History of Operations Research in the United States Army

Volume III: 1973–1995

Charles R. Shrader

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For those who served, 1973–1995

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Foreword

The period from 1973 to 1995 was one of the most challenging eras in the history of the United States Army. The last quarter of the twentieth century saw the reorganization and revitalization of the Army following the long and debilitating war in Vietnam and the reorientation of the Army toward the defense of Western Europe against a potential attack by the Soviet Union and its allies. At the same time, the Army had to deal with ever-accelerating changes in technology and fundamental changes in the international security environment. New weapons, new organizations, and new doctrine as well as new training methods were required to meet the rapidly changing defense environment. The success of the Army's efforts in meeting these challenges was seen in the rapid defeat of Iraqi forces in operations Desert Shield and Desert Storm in 1990–1991. Following that stunning 100-hour victory and the end of the Cold War, marked by the collapse of the Soviet Union in the early 1990s, the Army turned to coping with the challenges of a much different security environment under conditions of severely restrained resources. That the Army was so successful in its efforts was due in large part to the assistance provided to Army decision makers by the Army analytical community, which supplied a disciplined means of dealing with the uncertainties of a rapidly evolving situation.

In this final volume of the history of operations research (OR) in the United States Army, Dr. Charles R. Shrader identifies, describes, and evaluates the ideas, people, organizations, and events that influenced the development of OR in the Army from the end of the Vietnam War in 1973 to the mid-1990s. Using official documents, studies, and publications as well as interviews with key personnel and a wide range of books and articles, Dr. Shrader clearly and concisely outlines the evolution of the Army analytical community during the period and describes the impact of the 1973 STEADFAST reorganization of the Army, the changes in organization and management affecting the Army operations research/systems analysis (ORSA) program, the evolution of the principal Army analytical organizations, and the role played by Army analysts in developing the new weapons, organizations, doctrine, and training that made possible the rapid defeat of Iraq in 1991, victory in the Cold War, and effective adjustment to the challenges of the "new world order."

This volume completes our three-volume history of operations research in the United States Army from 1942 to 1995. Of course, the story continues, and the post-1995 period will in time find its own chronicler. But in the three volumes he has written, Dr. Shrader has laid a solid foundation for any subsequent history of the Army analytical community. All three volumes are highly recommended for study by members of the Army analytical community and by civilian leaders, military commanders, and staff officers at all levels who are interested in Army management, the decision-making process, the adaptation of science to military affairs, and the evolution of U.S. Army weaponry, organization, and doctrine.

WALTER W. HOLLIS
Deputy Under Secretary of the Army
for Operations Research, 1980–2006
March 2007

Preface

As the distinguished former Deputy Under Secretary of the Army for Operations Research Walter W. Hollis notes in his foreword to this volume, the period from 1973 to 1995 was one of the most challenging eras in the history of the United States Army. In an era of rapidly changing technology, sudden shifts in the threats facing the United States, and the need (particularly toward the end of the period) to operate on "short rations," Army leaders faced a number of complex and difficult decisions. Their ability to efficiently sort out the alternatives and find an effective solution was due in no small part to the support provided by Army ORSA managers and analysts. By 1995, the value of such support was clear to almost every Army leader, and few of them would have thought to tackle a problem without the aid of a modern-day "OP Annie" (operations analyst). This, the third and final volume of the history of ORSA in the Army from 1942 to 1995, covers the momentous events of the last quarter of the twentieth century and attempts to tell the story of when, where, and how the members of the Army analytical community supported Army decision makers and how the Army analytical community itself grew and evolved between 1973 and 1995.

The volume begins with a brief discussion of the changing defense environment and an overview of the Army analytical community as it existed in 1973 and the challenges it faced in the period 1973–1995, a period in which Army leaders turned from the Vietnam War to refocus on the threat of the Soviet Union and the Warsaw Pact in Europe and which was marked by the revitalization of the Army and the development of new weapons, new organizations, new doctrine, and new training methods to meet changing needs. The rather unexpected collapse of the Soviet Union in 1991 marked the beginning of a new period in which the threats to American security were broader and in many ways more complex. At the same time, the end of the Cold War and the emergence of the "new world order" brought about significant changes in domestic conditions affecting our military forces, as Congress and the people demanded a reallocation of national resources from defense expenditures toward other pressing needs. As a result, the Army and the other services entered a period of constrained manpower and budgets that demanded complex and difficult decisions on the part of Army leaders.

Chapter Two contains a brief discussion of the high-level management of the Army ORSA program from 1973 to 1995, beginning with a synopsis of the STEADFAST reorganization of the Army in 1973 and its impact on the Army analytical community. The role played by senior Army civilian and military leaders, the deputy under secretary of the Army for operations research, and the principals of the Army Staff are covered in some detail, as are the sequential reviews and studies of the Army's analytical programs, the management of resources for those programs, and the ways in which the Army analytical community interacted with the Office of the Secretary of Defense, the Joint Chiefs of Staff, the other services, the ORSA organizations of allied countries, and ORSA professional organizations.

Chapter Three is an overview of the state of the Army analytical community in general during the period under consideration. The ORSA elements of the Army Secretariat and Staff and of the major Army commands, as well as the Army Study Program itself, are reviewed in some depth. We then turn to look at each of the so-called Big Four Army analytical agencies: the Army Materiel Systems Analysis Activity (AMSAA); the Operational Test and Evaluation Agency/Command (OTEA/OPTEC); the TRADOC Analysis Command/Center (TRAC) and its predecessors; and the Concepts Analysis Agency (CAA). Chapters Four through Seven address each of the Big Four in turn and provide glimpses of the origins, missions and functions, organization, leadership, personnel resources, budget resources, work programs, and achievements of each agency in the period from 1973 to 1995. In Chapter Eight, the threads are drawn back together in a discussion of the role played by the Army analytical community in the stunning victory of United States and Coalition forces over Iraqi forces in the Persian Gulf War of 1990–1991. The volume ends with a brief assessment of the achievements of the Army analytical community over the entire period, from 1942 to 1995.

Throughout this volume, I have tried to identify, describe, and evaluate the ideas, people, organizations, and events that influenced the development of ORSA in the Army from the end of the Vietnam War in 1973 to the mid-1990s. I have covered the changes in organization and management affecting the Army ORSA program, the evolution of the principal Army analytical organizations, and the role played by Army analysts in developing the new weapons, organizations, doctrine, and training that made possible victory in the Cold War, the rapid defeat of Iraqi forces in 1991, and the transition to a "new world order." Not every idea, every event, or every hero has received their due, but I have tried to describe fairly what I saw as the most important elements of the story. Only the reader can judge the degree to which I have failed or succeeded.

As was the case with Volume I and Volume II of this history, the complexity of the story and the gaps in the available documentation ensure that some omissions and imperfections will appear. The responsibility for those is mine alone. As ever, I am grateful for the assistance I have received from many sources, especially the contributions of Eugene (Gene) P. Visco and Brian R. McEnany, whose comments and suggestions have made this a much better work. The comments, suggestions, and actions on my behalf by E. B. Vandiver III and Michael F. Bauman have also been most helpful, and I remain indebted to James T. Hooper of SAIC for his support. I have also benefited from the assistance of many members and former members of the military analytical community, including Robert Sheldon, Michael Garrambone, Arend (Pete) Reid, Thomas Rheinlander, Eric Grove, and others. James Malley was particularly helpful in providing information on the ORSA cells in United States Army, Europe. And last but by no means least, my wife, Carole, deserves continued thanks for her patience and support.

CHARLES R. SHRADER
Carlisle, Pennsylvania
March 2007

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History of Operations Research in the United States Army

CHAPTER ONE

Introduction: The Changing Defense Environment and Army ORSA, 1973–1995

To the sounds of a South Vietnamese Army artillery salute and a Sousa march, the last United States Army infantry battalion in Vietnam—the 3d Battalion, 21st Infantry—stood down on 11 August 1972.[1] That same month, Battery B, 3d Battalion, 82d Artillery fired the last U.S. artillery round in Vietnam.[2] Five and a half months later, on 23 January 1973, President Richard M. Nixon announced the signing of a peace agreement between the Americans and the South Vietnamese on one side and the North Vietnamese and Viet Cong on the other, and a cease-fire went into effect four days later.[3] By 28 February, the last U.S. advisers had been withdrawn, and the following month all remaining U.S. forces left Vietnam save for a small number of military personnel in the Office of the Defense Attaché in Saigon and those assigned to the Four Party Joint Military Commission tasked to oversee the cease-fire. On 29 March 1973, Headquarters, United States Army Vietnam/Military Assistance Command, Vietnam, was disestablished. The long Vietnam War was finally over for the United States, and the attention of the American people and government quickly turned to other matters.

The ensuing twenty-two years, from 1973 to 1995, were marked by rapid, complex, and dramatic changes in the international and domestic political and social environment, in science and technology, and in the resources available for national defense, all of which had a profound influence on the weapons, organization, tactical doctrine, and strategy of the United States Army. The two decades after the end of the Vietnam War can be divided into two distinct periods. From 1973 to 1991, the Army focused on the recovery and reinvigoration of an army worn down and demoralized by the long counterinsurgency struggle in Southeast Asia and on the reorganization and reorientation necessary to meet the primary perceived threat—an attack by Soviet and Warsaw Pact forces in Europe. The fall of the Berlin Wall in November 1989, the reunification of Germany in October 1990, and the disintegration of the Soviet Union in December 1991 left the United States as the sole world superpower, but new threats to American national security began to emerge in the Middle East and Southwest Asia. Accordingly, the second period, from 1991 to 1995, saw yet another reorientation of Army organization and doctrine to meet the emerging threats of regional conflict, militant Islamic fundamentalism, and global terrorism.

By 1973, the Army analytical community had proven itself in three major conflicts since 1942. It was thus called upon to facilitate the Army's recovery from Vietnam and to help reshape an army that had all but disintegrated under the combined pressures of the continued global threat of the Soviet Union, rapidly developing technology, and the loss of confidence and focus resulting from the long and contentious war in Vietnam. The task was complex and arduous, but in the end the efforts of Army leaders, planners, trainers, and analysts working together produced the most formidable army ever seen, one capable of defeating decisively the world's fourth-largest army in a matter of hours. In meeting that challenge, Army operations research/systems analysis (ORSA) managers and analysts yet again applied their skills to assist military decision makers in the reorganization, reorientation, and revitalization of the United States Army. How they met the challenge can be seen in the development and contributions of the Army analytical community at the Headquarters, Department of the Army (HQDA), and Army Staff level, in the major Army commands, and indeed throughout the Army between 1973 and 1995. Their success in meeting the complex challenges of the period was demonstrated fully in the conduct and outcome of the first Gulf War (operations Desert Shield and Desert Storm) in 1990–1991. Throughout the period under consideration, the art and science of ORSA itself continued to advance and to change its focus as required by the emergence of new techniques and methods, new tools, and new requirements. Thus, by 1995, Army ORSA reached full maturity and had long since become an essential element of Army management and planning, weapons development and acquisition, test and evaluation, the development of organization and force structure, and the development of tactical doctrine and strategy.

The Defense Environment, 1973–1995

Many Army leaders and planners hoped that the end of the Vietnam War would bring a period of renewed stability in the defense environment, a stability that would permit the Army to revive itself and to focus on the traditional Cold War threat of an aggressive and expansive Soviet Union. Those hopes proved to be unfounded. A number of factors, notably the changing international security environment (the threat), rapidly evolving military technology, and severe resource constraints combined to create a dynamic situation that required constant and continuous adaptation of the Army to meet the many challenges of defending our national interests.

In terms of the changing defense environment, the two decades after the Vietnam War can be divided into two periods. The first, characterized by a focus on defending against the Soviet threat in Europe, can be called the "end of the Cold War"; it stretched from the end of the Vietnam War in March 1973 until the collapse of the Soviet Union in December 1991. The second, characterized by the emergence of the United States as the sole world superpower, a variety of new threats from regional conflicts, the rise of Islamic fundamentalism, and the threat of worldwide terrorism, can be called the "new world order." It began with the disintegration of the Soviet Union in December 1991 and continues today. In fact, the transition from one period to the next was not clear-cut. Already by the late 1980s, it was clear that the Soviet empire was in crisis and that new threats to American national security were emerging. And throughout the period, military technology continued to evolve rapidly and the resources available for national defense were generally constrained.

The End of the Cold War, 1973–1991

The period from March 1973 to December 1991 began with relative stability and a high degree of certainty regarding the global security environment.[4] The principal threat to U.S. national security interests seemed to be the continued Cold War with the Soviet Union and, in particular, the prospect of a Soviet-led attack involving both conventional and nuclear weapons against our NATO (North Atlantic Treaty Organization) allies in Western Europe. Accordingly, as the Vietnam War drew to a close, Army leaders and planners refocused on the Soviet threat in Europe. Their perception was that while the United States had been preoccupied in Southeast Asia, the Soviet Union had made significant progress in developing new military technology and improving Soviet military forces, albeit at a high cost to the Soviet economy and social fabric. They also perceived that the Soviets continued to have a good deal of success in fomenting problems and supporting successful military coups in Africa, South and Southwest Asia, and Latin America.

Upon taking office in January 1969, the Nixon administration continued the Kennedy-Johnson strategy of "flexible response," which called for the capability to face and defeat a wide range of threats, from all-out nuclear war to counterinsurgency and counterterrorism. However, President Nixon and his national security adviser, Dr. Henry A. Kissinger, recognized that the Vietnam War had demonstrated the limits of U.S. power and initiated a policy of détente with both China and the Soviet Union and reduction of U.S. global commitments to a level consistent with U.S. capabilities. The so-called Nixon Doctrine pledged to continue to honor U.S. treaty obligations, to continue to protect our allies against Soviet nuclear blackmail, and to provide economic and military assistance, but not necessarily U.S. troops, to countries threatened by Communist subversion.

The centerpiece of the Nixon Doctrine was the principle of equilibrium and an effort to achieve stability in the U.S. relationship with the Soviet Union. That effort had a significant diplomatic component. In the late 1960s, the Soviet Union achieved strategic nuclear parity with the United States. In order to prevent an all-out arms race, the United States and the Soviet Union began a series of Strategic Arms Limitation Talks (SALT) in late 1969 that eventually produced a series of agreements in 1972. At the same time, U.S. observers perceived a buildup of Soviet conventional forces in Central Europe that posed a serious threat to U.S. forces and to the security of our NATO allies. In view of the Soviet advantages in proximity to any potential European battlefield, manpower, and conventional weapons, the U.S. Army faced the problem of how to employ the available NATO forces to maximum effect. Thus, beginning in May 1972, negotiations were undertaken to arrange Mutual and Balanced Force Reductions (MBFR) in Europe. In 1972, the United States and the Soviet Union also signed a Treaty on Limitations of Anti-Ballistic Missiles, and on 10 April 1972, the United States signed a convention prohibiting the production, stockpiling, and deployment of biological weapons and toxins. The United States subsequently shut down the production of, and research on offensive uses of, both chemical and biological weapons. The practical effect of that decision was to further reduce the means available to the U.S. Army to offset superior Soviet manpower resources.

As part of the effort to implement the Nixon Doctrine and to counterbalance the global influence of the Soviet Union, President Nixon also initiated a number of initiatives in U.S. Asian policy. The Vietnamization of the war in Vietnam and the search for an honorable termination of that conflict were the first steps in this policy. The most striking aspect of President Nixon's Asian policy was the rapprochement with the People's Republic of China. The first steps were taken in 1969, and by February 1972, President Nixon was able to make a formal state visit to Peking (now Beijing). The normalization of U.S. relations with Communist China was an attempt to take advantage of tensions in the Sino-Soviet relationship and to provide the United States with additional leverage in our dealings with the Soviet Union. The rapprochement with China also permitted the United States to shift from a "two and a half war" strategy to a "one and a half war" strategy and to draw down other U.S. forces in Asia—for example, in Korea.

With respect to Army organization and doctrine, counterinsurgency and "nation building" seemed to be forgotten after 1973 as the Army refocused on the armor-heavy forces required to defend against the Soviet Union in a conventional or limited nuclear war in Europe.[5] As General Maxwell R. Thurman, a former Army vice chief of staff and former commander of both the U.S. Army Training and Doctrine Command and United States Southern Command, told his readers in July 1991, the efforts of the Army during the 1970s and 1980s focused on five "major thrusts or vectors": (1) the implementation of a total force policy; (2) the end of the draft and the transition to an all-volunteer army; (3) a reformation of Army operational doctrine; (4) a transformation in Army training methods; and (5) a vigorous program for the modernization of Army weapons and other equipment.[6]

The total force policy called for the use of National Guard brigades to "round out" the existing active Army divisions and the use of combat support and combat service support troops from the Army Reserve to augment the active Army in the event of deployment.[7] The all-volunteer Army concept was implemented in the early 1970s, but the Army struggled to meet recruitment and retention goals until congressional legislation in the early 1980s provided increased incentives in terms of increased pay and educational benefits. The doctrinal reformation was a central activity of the Army throughout the period.[8] The "active defense" oriented on Europe emerged in 1975, but was replaced in 1982 with the AirLand Battle concept that focused on offensive operations on a global scale. In June 1991, a new doctrine of AirLand Operations was promulgated. Each successive doctrinal concept incorporated elements designed to increase the agility, depth, initiative, and synchronization of Army forces as well as the generation of overwhelming combat power in order to terminate hostilities quickly and with as few casualties as possible on either side.[9] The transformation of Army training during the period was based on creation of the

National Training Center at Fort Irwin, California; the Joint Readiness Training Center for light forces at Fort Polk, Louisiana; and the Combat Center at Hohenfels, Germany. The new training doctrine emphasized force-on-force free-play exercises, the use of highly trained opposing forces, rigorous after-action reviews, and the widespread use of advanced simulation techniques. And finally, the Army's weapons and equipment modernization program in the 1970s and 1980s focused on the so-called Big Five items essential to the AirLand Battle doctrine: the M1A1 Abrams tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot air defense missile system. A sixth system, the multiple-launch rocket system (MLRS), was also a priority.

Even as U.S. Army leaders focused their attention on the Soviet threat in Europe, the shape of future security challenges began to emerge. Of particular influence on the development of Army weapons, organization, and tactical doctrine during the 1970s and 1980s was the Yom Kippur War of 1973. Although fought in the Middle East between Israel and its Arab opponents, principally Egypt and Syria, the Yom Kippur War was thought to have particular relevance to the conduct of a potential NATO–Warsaw Pact war in Europe, involving as it did an emphasis on fighting outnumbered and winning, intense armor and counterarmor battles, deep penetrations, and extensive use of antitank missiles, close air support, and rapid battlefield mobility. U.S. Army leaders and planners closely studied the lessons of the Yom Kippur War and were greatly impressed by "the lethality and destructiveness of the modern battlefield."[10] Subsequently, they sought to incorporate those lessons into evolving Army weapons, organization, and doctrine. U.S. Army forces continued to be structured to fight a large conventional war against the Warsaw Pact in Europe, but there were also renewed efforts to adapt the armed helicopter; smart weapons; improved command, control, communications, and intelligence (C3I); and mobility to the European battlefield.

Another early indicator of changes in the international defense environment came in 1979–1980. The Iranian hostage crisis, which began with the seizure of the U.S. Embassy in Tehran in November 1979 and the ensuing debacle at "Desert One" in April 1980, made it clear that new threats to U.S. national security interests were emerging. The terrorist bombing of the U.S. Marine Corps barracks in Beirut, Lebanon, on 23 October 1983, and the U.S. intervention in Grenada in Operation URGENT FURY two days later were also harbingers of things to come. In December 1989–January 1990, U.S. forces deployed from the continental United States (CONUS) under the command of the United States Southern Command conducted Operation JUST CAUSE to overthrow and capture the Panamanian dictator Manuel Noriega and install a legally elected government. Operation JUST CAUSE influenced subsequent joint warfighting and simultaneous-attack doctrines, and foreshadowed the coming importance of rapid deployment on a global basis.[11]

The test of the efficacy of Army reforms in force structure, manpower management, training, doctrinal development, and modernization came not as expected on the plains of Central Europe but in the Middle East in August 1990, when the Iraqi forces of Saddam Hussein invaded and subjugated Kuwait. The Iraqi aggression precipitated an international response led by the United States that culminated in a U.S.-led buildup of forces in Saudi Arabia (Operation DESERT SHIELD) and the forceful ejection of Iraqi forces from Kuwait in Operation DESERT STORM in January–February 1991. As General Thurman wrote, the stunning, quick victory of coalition forces in Operation DESERT STORM

> was not the result of a seven-month conflict, or a 44-day air campaign, nor even a successful 100-hour ground campaign. Rather, the victory was a result of visionary changes begun in the 1970s by the Army leadership assisted by countless numbers of men and women through the intervening years.[12]

To a certain degree, the attention devoted to events in the Persian Gulf region between August 1990 and February 1991 masked the fundamental shifts in the international security environment taking place in Eastern Europe. Those shifts ushered in a new and much more unstable era.

Emergence of the New World Order, 1989–1991

Between 1989 and 1991, the global strategic equation was transformed by the dissolution of the Soviet empire. The failed Soviet intervention in Afghanistan in the late 1980s revealed cracks in the Soviet empire, and the demands of the Soviet satellites in Eastern

Europe for national independence led to free elections in Poland under the aegis of the Solidarity movement in June 1989; the fall of the Berlin Wall in November 1989 and the consequent collapse of the East German regime and the unification of Germany in October 1990; and the end of Communist domination in Hungary, Czechoslovakia, Rumania, and Bulgaria by the end of 1989. At the same time, the long-term stresses of competing economically and militarily with the West and the buildup of U.S. forces in the 1980s further weakened the Soviet Union. Under the combined weight of these pressures, the Soviet Union disintegrated with stupefying rapidity in December 1991. Following a failed coup by Soviet hard-liners against the Gorbachev regime, the leaders of Russia, Ukraine, and Belarus met in Brest on 8 December 1991 and declared that "the U.S.S.R., as a subject of international law and a geopolitical reality, is ceasing its existence."[13] With that declaration, the Soviet Union—and with it the Cold War—came to an end.

Three months before the final collapse of the Soviet Union, Dr. David S. C. Chu, then director of program analysis and evaluation in the Office of the Secretary of Defense (OSD), noted that a new era was in the offing. In the September 1991 issue of *Phalanx* he wrote:

> We now face . . . a somewhat different situation that presents new, and still evolving, challenges for us to confront. I think that there are at least a half dozen major developments related directly to recent events (which therefore are quite new in character), and some developments that have been building for a considerable period of time."[14]

The characteristics of the new era cited by Dr. Chu included:

1. A change in American perceptions of the threat posed by the Soviet Union;
2. The realization that the United States and the Soviet Union were not the only countries with access to modern technology and the resources to create weapon systems that might pose a serious threat to future U.S. military operations;
3. A sharp decline in the resources available to the Department of Defense and "sharply increased fiscal limits" placed upon the department;
4. The "coming of age" of so-called high-technology systems;
5. Significant changes in the political situation in the Middle East; and
6. Changes in attitudes toward strategic nuclear weapons.[15]

The momentous events of 1991—Operation Desert Storm and the disintegration of the Soviet Union in particular—had a profound impact on the subsequent development of U.S. security policy and military posture. The breakup of the Warsaw Pact, the reunification of Germany, the collapse of Soviet Communism, and the dissolution of the Soviet Union reduced the massive threat to NATO and led to unilateral reductions by non-U.S. NATO allies. For the United States, the evaporation of the Soviet threat seemed to offer a chance to reduce defense expenditures by transforming a larger, forward-deployed force into a smaller, more mobile power projection Army taking full advantage of the latest developments in military technology.[16] At the same time, the first Gulf War had also provoked greater emphasis on joint and combined operations, precision-guided munitions, the application of advanced information technology, and the creation of smaller, more mobile, and more agile combat forces. Even as the threat of the Soviet Union declined and the lessons of Operation Desert Storm were being absorbed, the rise of Islamic fundamentalism and the accompanying threat of global terrorism as well as the emergence and intensification of regional conflicts in Central America, Haiti, Somalia, Bosnia, and elsewhere marked yet another characteristic of the period to follow and prompted a renewed interest in Special Operations forces, peacekeeping, nation building, and operations other than war. Nevertheless, the new world order after 1991 left the United States as the sole superpower and seemed to offer new opportunities for the United States to act with greater freedom to support national independence and democratic institutions around the world.

The end of the Cold War and the rise of new threats to American interests clearly required a new post–Cold War strategy based on forces tailored to the new requirements. In fact, a new American strategic policy had already been enunciated by President George H. W. Bush in an address at the Aspen Institute on 2 August 1990, in which he noted that the new strategy should emphasize "regional conflicts and crisis response in contrast to the Cold War emphasis on defense against massed Soviet/Pact forces," and that the new criterion of success would be the ability to "apply 'decisive force' to win swiftly and minimize casualties."[17]

President Bush's new strategic policy was articulated by the adoption of a new strategic concept for

NATO at the November 1991 meeting of the NATO heads of state in Rome.[18] The old NATO strategy had been oriented toward the Soviet Union and the Warsaw Pact, and emphasized defensive warfighting; the concept of flexible response and deterrence based on a wide range of military capabilities, including nuclear weapons; and a forward defense, including the protection of all NATO territory. The guiding principles of the new NATO strategy recognized a diverse and "multidirectional" threat; collective defense characterized by the formation of multinational forces; war prevention involving political action before military action; an operational concept emphasizing counterconcentration of military forces; and smaller military forces with greater reliance on reserves and the time necessary to activate them.[19]

In some respects, the U.S. armed forces were slow to accept the realities of the changing national security environment, but gradually steps were taken to restructure American military forces to address the new conditions and to accommodate the new national security strategy outlined by President Bush and the NATO heads of state. The U.S. armed forces were restructured to focus on missions of strategic deterrence, crisis response, and reconstitution. Nuclear weapons and armor-heavy conventional forces were increasingly seen as inappropriate for the types of conflicts in which we expected to engage, and the focus shifted to the creation of a leaner, more lethal, more deployable Army capable of conducting integrated joint operations in a wide variety of environments. In the early 1990s, the requirement for ready expeditionary forces came to the fore as resource constraints dictated less forward deployment and greater reliance on the rapid deployment of forces from the continental United States. This new, leaner, more deployable Army relied on the selective call-up of reserve components to flesh out a reduced-strength standing army with much of its combat support and combat service support strength in the Army Reserve and National Guard or contracted out to civilian firms. The resulting Army was intended to be "smaller but more lethal, versatile, and deployable," and Army materiel priorities shifted "from procurement of new, advanced systems to research and development programs aimed at maintaining the Army's technological edge."[20]

Writing in July 1991, General Maxwell R. Thurman noted that the Army agenda for the 1990s was quite similar to that for the period 1973–1991, with a concentration on manpower issues, including maintaining the strength of the National Guard and Army Reserve; improvements in Army training; doctrinal development; and the procurement of advanced military technology.[21] In his view,

> contingency operations with power projection from CONUS-based forces will be the baseline for future doctrine wherein Europe is but the most demanding contingency. These operations will be characterized by quick response focused on early resolution and minimum casualties on both sides consistent with safeguarding the lives of American fighting personnel.[22]

The Rapid Growth of Military Technology, 1973–1995

Since 1945, the pace of basic science and applied technology has accelerated rapidly. Each new basic scientific discovery has been quickly followed by some practical application of the basic scientific principle. Among the many and varied technological advances since 1945 have been innovations in such diverse fields as nuclear physics (nuclear power plants); communications and electronics (the semiconductor, the microchip, miniaturization, the high-speed digital computer, and the cellular telephone); new materials (new metallic alloys and plastics); space science (rocketry, earth-orbiting satellites, and space-exploration vehicles); medicine and the biological sciences (virology, immunology, magnetic resonance imaging, organ transplants, and mapping of the human genome); and the earth sciences (ecological management, weather forecasting, and understanding of natural phenomena such as earthquakes, volcanic eruptions, and tsunamis). Almost all of these technological innovations have had military applications as well. As a consequence, the pace of military technology also increased dramatically in the late twentieth century, more so because many of the basic scientific advances worked together to produce a synergistic effect. For example, "smart" weapons were made possible by the development of electronic miniaturization, high-speed digital computers, and perfection of the global positioning system (GPS), which itself depended on the combination of new technology in the fields of communications, electronics, satellites, and the earth sciences.

Until World War II, the United States Army was not particularly quick to adopt new military technology—the failure to adopt a repeating rifle until the end of the nineteenth century being but one example. However, since 1945, American military leaders have been eager to adapt the latest scientific and technological advances to military purposes, and for most of the past sixty years, the United States has led the way. In large part, the emphasis placed by the U.S. armed forces on keeping up with the rapid pace of military technology stems from a desire to substitute advanced technology for limited manpower and a traditional reluctance to mobilize American manpower and subject our soldiers, sailors, airmen, and marines to the risks of combat.

The Army's adaptation of new technology was somewhat neglected during the long slog in Vietnam against an elusive enemy armed with rather simple weaponry. In 1973, it seemed that the Soviet Union, our principal opponent, had gained a decided advantage in developing and fielding new weapons and equipment. Consequently, after the end of the Vietnam War, Army leaders gave a high priority to developing new weapons and equipment based on the latest scientific advances and to fielding that new military technology as rapidly as possible. Thus, advances in military technology drove the Army's modernization programs after 1973. During the first period, 1973–1991, the focus was on the so-called Big Five and the multiple-launch rocket system (MLRS), but the supporting systems were not neglected, and significant advances were made in technology related to C3I, logistics, and other areas. The Big Five plus MLRS were fielded prior to Operation Desert Storm in 1991, and the success of Army efforts to modernize was amply demonstrated in that conflict. Coalition forces—U.S. forces in particular—dominated the battlefield with "stealth" technology, cruise missiles and other smart weapons, improved tanks and armored fighting vehicles, advanced artillery cannon and rocket systems, new air defense missile systems, and highly advanced C3I systems based on high-speed digital computers. The practical effect of having introduced these systems was superior battlefield control, mobility, flexibility, speed of maneuver, accuracy, and lethality.

Following the first Gulf War, the focus shifted to further improvements of the Big Five and the development of new systems. In July 1991, General Maxwell R. Thurman proposed that future efforts should focus on seven new systems for the 1990s: the Block II Abrams tank and an equally improved Bradley infantry fighting vehicle; the line-of-sight antitank missile (LOSAT); the fiber-optic guided missile (FOG-M); the Army tactical missile system (ATACMS) Block II longer-range missile (in large quantities); the Comanche light helicopter; a vastly improved antitactical ballistic missile; and identification-friend-or-foe (IFF) equipment, the last being a requirement clearly identified during Operation Desert Storm.[23]

Despite fears of Soviet dominance in science and military technology, in the end the superiority of American science and engineering, coupled with the inherent strength of the U.S. economy, ensured that the U.S. armed forces were unsurpassed. By 1995, the Russian Federation, the heir of the Soviet Union, was no longer a contender in the military technology race, and no other nation came close to matching the U.S. technological lead or the national resources dedicated to maintaining that lead. But the costs were high.

Constrained Resources, 1973–1995

The third major factor influencing the shape of the United States Army in the post-Vietnam period was the desire of American political leaders to reduce the resources of money and manpower dedicated to national defense. That desire was a reflection of the fact that the last quarter of the twentieth century and the opening years of the twenty-first century were generally a time of economic retrenchment worldwide. Inflation, unemployment, and rising welfare costs affected national economies worldwide; in many regions, armed conflict, famine, and general social chaos further increased the pressure on national economic resources.[24]

Budgetary Constraints

Economic and political considerations ensured that U.S. defense budgets would decline after 1973. At the height of the Vietnam War in fiscal year (FY) 1968, U.S. defense outlays represented 9.4 percent of our gross domestic product (GDP), but by FY 1973, the percentage had fallen to 5.5 percent of GDP.[25] Defense outlays rose again during the first six years of the Reagan administration, peaking at 6.2 percent of GDP in FY 1986 before declining again to only 3.7 percent of GDP in FY 1995.[26]

The constraints on the U.S. defense budget after 1973 are not so obvious when viewed in terms of the annual budget authority for the Army expressed in current dollars.[27] The annual Army budget authority amounted to some $25,407,000,000 at the height of the Vietnam War in FY 1968.[28] By FY 1973 it had declined to $21,048,000,000; it rose steadily (in current dollars) thereafter, reaching $91,825,000,000 in FY 1991, then dropped to $63,268,000,000 in FY 1995.[29] Although the rise in Army budget authority after FY 1973 is dramatic expressed in current dollars, real growth year to year was much less impressive. In the twenty-three fiscal years from 1973 to 1995, real growth took place in only ten fiscal years and was negative in the remaining thirteen fiscal years.[30]

Long before the last Army combat troops left Vietnam in 1973, it was clear that the post-Vietnam Army would be a much smaller force operating in an environment of significantly reduced military budgets and rapidly escalating costs for military weapons systems. Such an environment demanded careful management of resources, and "waste" and "fat in the military system" became favorite targets of congressional and media critics.[31] The coming resource constraints were signaled by the Nixon administration, which took office in January 1969; over the next decade, the Army and other services faced rather austere budgets. In the 1980s, however, President Ronald W. Reagan initiated a military buildup that significantly increased U.S. military spending until 1986, when defense budgets again started to decline and the U.S. armed forces entered yet another period of budgetary austerity.

Assistant Secretary of Defense (Program Analysis and Evaluation) Leonard Sullivan Jr. announced the new era of budgetary constraint in a keynote address to the fifty-eighth Military Operations Research Symposium (MORS) at Annapolis, Maryland, in June 1990. He noted:

> We are headed into a period of transition. . . . It is clear to me that spending for defense is going to drop—plummet might be better—to a lower limit somewhere between 4% and 3% of GNP [gross national product]. That will result in a military force of no more than one million active duty personnel and half a million reserve component personnel—half the current size. We will vastly reduce our forward deployed forces, and our worldwide logistics infrastructure as well.[32]

Sullivan was, of course, correct. With the collapse of the Soviet Union and the end of the Cold War in December 1991, pressure to reduce the defense budget again became a major factor as Congress, the media, and some sectors of the American public sought to lower the deficit and to realize an elusive "peace bonus" from the presumably lowered threat to the United States and consequent lessening of need for military equipment and ready forces. The "peace dividend," it was hoped, could be used to meet other urgent needs, such as public funding of infrastructure repair, health care, education, and the like.

In part, the renewed interest in frugality was a reaction to the deficit spending on military capabilities of the Reagan administration in the 1980s, but James S. Tritten has noted that the major impetus for the 1990–1991 review of America's role in the world, and the new national security strategy adopted as a result, came from a recognition by U.S. political leaders that the level of resources devoted to defense in the 1980s could no longer be sustained.[33] In any event, the demand for a peace dividend and consequent budget cutbacks put increased pressure on Army leaders to "make do" with even fewer resources than before. As Secretary of the Army Togo D. West Jr. and Army Chief of Staff General Gordon R. Sullivan pointed out the following in their FY 1996 Army Posture Statement:

> More than any single factor, resources affect the Army's capabilities, readiness, and effectiveness. . . . The Army's total obligation authority has declined 36 per cent since fiscal year 1989. Not only have total resources declined, but the Army's share of the Department of Defense budget has also declined over the same period. During the period of these reductions, operational deployments increased 300 per cent.[34]

The FY 1993 defense budget submitted to Congress by President William J. Clinton was designed to support the new national security strategy and included requests for only some $63.3 billion in total obligation authority for the Army.[35] The new strategy emphasized responding to regional contingencies and sought to structure U.S. armed forces for missions of "strategic deterrence and defense, forward presence, crisis response, and reconstitution."[36] The FY 1993 defense budget thus called for an Army at the end of FY 1993 that would be "smaller but more lethal, versatile, and deployable" with full funding of training to maintain readiness and a shift in priority from the procurement of new, advanced weapons systems to basic research and development programs "aimed at maintaining the Army's technological edge."[37]

Manpower Constraints

The constrained defense budgets during the period 1973–1995 directly affected the manpower available to the armed forces. From a Vietnam War peak of some 1,570,000 men and women in 1968, Army active-duty strength fell to 801,000 in FY 1973 and reached a post-Vietnam nadir of 758,000 in 1979.[38] Army active-duty strength peaked again at 781,000 in FY 1985–FY 1987 during the Reagan buildup but began a steady decline thereafter, reaching 751,000 in FY 1990 and then falling to 509,000 in FY 1995, the lowest level since FY 1940.[39] The strength of the Army's reserve components rose from 772,378 officers and soldiers in FY 1979 to 1,070,266 during the Reagan years (FY 1987) but then declined to about 437,000 in FY 1990 and 375,000 in FY 1995.[40] Similarly, the Army's civilian workforce peaked in FY 1969 at 531,000, declined to 406,000 in FY 1973, and reached a post-Vietnam nadir of 359,000 in FY 1979.[41] Civilian strength rose again during the Reagan era to 418,000 in FY 1987, before beginning a steady decline to 267,000 by FY 1995.[42]

In December 1972, the secretary of defense suspended draft calls for January–June 1973, six months before the legal expiration of the draft on 30 June 1973.[43] At the end of FY 1973, the Army had only 801,000 active-duty officers and soldiers in thirteen divisions, the lowest since FY 1950.[44] Of the thirteen active divisions, four and one-third divisions were stationed in Europe, one division in Korea, two-thirds of a division in Hawaii, and seven divisions in the continental United States, plus brigade-sized elements in Alaska, Panama, and Berlin.[45] As the author of the 1973 Department of the Army Historical Summary (DAHSUM) noted: "The Army contracted to postwar strength, reached the zero-draft phase line, moved well along toward all-volunteer status, and in general converted from wartime to peacetime operation."[46] It thus became possible to "stabilize training, education, assignment, leadership, expenditures, and morale, among other things" and to correct organizational weaknesses brought about by the long war in Vietnam and thus move toward the development of a fully trained, well-disciplined, thoroughly professional Army.[47]

In 1974, the Army initiated a program to create three additional combat divisions to bring the total to sixteen; in order to do so, combat support forces were cut and headquarters were eliminated. The National Guard and Army Reserve were also called upon to provide brigades to "round out" the active divisions in time of crisis. All three divisions were activated in 1975 and became operational in 1976. Thus, in FY 1976, the U.S. armed forces included 2,081,000 men and women and constituted the third-largest armed force in the world. The active Army numbered 779,000 (of whom 198,000 were in West Germany and 33,000 were in Korea); the Army National Guard numbered 405,000; and the Army Reserve numbered 225,000. There were 198,000 soldiers in West Germany and 33,000 in Korea.[48] The Army had 8,930 tanks, 5,000 artillery pieces, 11,000 aircraft (more than the Air Force's 9,400), but only about half the divisions were fit for armored high-intensity war.[49]

The size of the Army increased slightly (from 772,000 in FY 1980 to 781,000 in FY 1987) during the Reagan era but began to decline again after 1987. The Gulf War in 1990–1991 brought a temporary spike, but with the introduction of the new world order and the new U.S. security strategy in 1991, all three elements of Army manpower (active Army, reserve components, and civilians) began a steady decline and the bases of Army planning shifted. After Operation Desert Storm, Army planners focused on "the reduced threat of a massive, short-warning land war in Europe" and "the rapidly growing Third World threat."[50] Plans thus called for cuts in the active forces by 17 percent and in the National Guard and Army Reserve by 24 percent in the period 1992–1996.[51]

The FY 1992 defense budget marked "the beginning of the Department of Defense's comprehensive six-year plan to restructure its forces in the face of a changing global security environment."[52] The FY 1992 budget included plans to reduce by 1995 the number of Army divisions from eighteen to twelve; the number of Navy battle force ships from 545 to 451, and the number of aircraft carriers from fourteen to nine; the Marine Corps from 194,000 to 177,000; the number of active Air Force tactical fighter wings from twenty-four to fifteen, and the number of strategic bombers from 268 to 181; and overall DOD outlays to 3.6 percent of GNP; and active-duty DOD personnel to 1,653,000 (down 24 percent from 1,151,000 in FY 1987).[53] President Clinton's FY 1993 defense budget continued the reductions in force: the active Army was scheduled to reach a strength of 598,900 by the end of FY 1993; the Army National Guard would be reduced to 383,100; the Army Reserve to 257,500; and the Army civilian workforce to 309,420.[54] The active Army strength goal for FY 1995 was set at 520,000 officers and soldiers.[55]

The downsizing of the Army in the early 1990s was reflected in the tremendous reduction in the U.S. Army in Europe between September 1990 and September 1995.[56] During that period, the Army cut the number of combat battalions in Europe by 76 percent, from 147 to 36. The number of Army installations declined from 858 in 1990 to 275 in 1996 to support a remaining force of 65,000. As of 1 February 1995, 506 installations had been fully closed and 39 had been partially closed, and the overall Army population in Europe had decreased by nearly 70 percent between September 1990 and September 1995. At the end of the five-year period, the Army had moved out of Europe some 148,000 soldiers, 192,400 family members, 54,760 privately owned automobiles, 44,400 pets, and 592,000 long tons of personal property.

The FY 1995 Army was much smaller than that of FY 1973, but it was a leaner, more lethal, and more mobile force. As Secretary West and General Sullivan explained:

> America's Army today is smaller than the force that won the Cold War and Desert Storm—but it is not simply a smaller Cold War army. With 541,000 active component soldiers, 280,000 Army civilians, 396,928 soldiers in the National Guard, and 259,856 Army reservists at the beginning of fiscal year 1995, America's Army is a formidable force, capable of a wide range of operations virtually anywhere in the world. The Army's force structure has also changed. Since 1989, the Army has inactivated one corps, two armored cavalry regiments, six active component divisions, two National Guard divisions, and a variety of support units in both the active and reserve components. With four active corps, 12 active component divisions, and eight National Guard divisions, today's Army is regionally oriented, rapidly deployable, and capable of protecting US interests worldwide.[57]

The changing international security environment, domestic political and economic constraints, and rapid advances in military technology during the period 1973–1995 imposed upon the United States Army a need for constant improvement and adaptation in weaponry and other equipment, organization, and tactical and strategic doctrine. During the period 1973–1991, the Army refocused on the Soviet threat in Europe, restructured itself, and developed new equipment, tactical doctrine, and training methods in an environment of generally constrained budgets and manpower resources. With the fall of the Soviet Union in 1991, the Army again shifted its focus to develop equipment, organizations, and doctrine more suitable for dealing with regional conflicts and the threat of Islamic fundamentalism and global terrorism. The process of adapting to rapid and complex change was one in which the Army analytical community was prepared to play an important role. ORSA techniques were particularly well suited to helping decision makers find the optimum mix of capabilities required to meet the various new challenges and to prioritize the challenges themselves.

Army ORSA, 1973–1995: An Overview

A Solid Foundation

In the three decades after operations research was first introduced in the Army, Army ORSA managers and analysts repeatedly proved the value of their methods in many ways and gained the acceptance—grudging in some cases, to be sure—of the civilian and uniformed decision makers they sought to assist. Speaking at the thirteenth Army Operations Research Symposium (AORS XIII) in October 1974, Dr. Hugh M. Cole, a former Operations Research Office (ORO) manager and a former vice president of the Research Analysis Corporation (RAC), summarized the development of Army ORSA since 1948. He noted that during the period 1948–1962 the creation of NATO and the Korean War caused the Army "to turn more actively to its new OR capability, to seek to use it, and to understand it."[58] In general, he said:

> The US Army made a truly remarkable and generally successful effort to shed its features of a World War II fighting force and enter the Atomic Era with minimal hesitation and delay. For the most part this transition was prompted by the new demands of the Army's role in NATO: a theater in which Army OR was consciously and successfully employed. I conclude, therefore, that Army OR must be given a full share of credit for the post-WW II modernization of the US Army.[59]

Dr. Cole summarized the principal features of Army ORSA from 1962 to 1972: the replacement of ORO by RAC in 1961 and RAC's subsequent demise in 1972; Secretary of Defense Robert S. McNamara's preference for "facts" over "experienced military judgment" in defense decision making; the growth of Army ORSA during the McNamara era, despite suffering from "guilt by association" with the arrogant "Whiz Kids" in OSD; the contribution made by ORSA techniques and Army ORSA analysts to the deliberations of the Howze Board and the development of the armed helicopter and air assault concept in the 1960s; and the many and varied contributions of Army ORSA analysts to the conduct of the long war in Vietnam.[60]

In his address, Dr. Cole also pointed out that

> OR has been an Army tool for a quarter of a century and needs to be used—not defended. . . . Two wars have been fought and two major military interventions on foreign soil have occurred in these years; none of the major weapons in the hands of Regular Army divisions at the beginning of this period are "standard issue" today; the Army has had ten Chiefs of Staff; if we average a tour of duty in the Pentagon as three years, the Army has had eight successive generations of planners and operators in the General Staff and Major Commands—and more likely twelve generations. Also, during these twenty-five years, the Army OR community has been addressed on occasions such as this by 257 Senior Officers and civil servants of which number 23% forcibly expressed the opinion that OR was useless, 22% believed that it had some value, and 55% had no opinion.[61]

He went on to say that

> despite much intellectual wheel spinning, the OR community in and for the Army was in general agreement as to mission and methods (this despite the continuing battle between those who wanted Army OR organized outside of the regular Army structure and those who wished to bring it inside and make it a subordinate part of the existing Army civilian structure).[62]

Dr. Cole concluded his remarks at AORS XIII by stating:

> At the end of a quarter of a century, Army OR, I believe, has the potential of playing a role far more important than at any time in its first twenty-five years. We need to accentuate the positive . . . the Army should make a commitment (a) to sustain a viable, cohesive and prestigious OR community (no matter where currently it may be found or what its antecedents were; (b) to employ this capability in a rational, consistent, continuous and optimistic manner with priority application on those problem areas where the national stakes are the highest and where the future of the United States Army is most in question.[63]

Dr. Cole's generally positive view of Army ORSA's past contributions was echoed by Daniel F. McDonald, the vice president for technical programs at the BDM Corporation, when he told attendees at AORS XVI in 1977:

> Army operations research has been leading the way during the last 35 years. We are also fortunate because at the senior levels of Army management the need for our services is clearly perceived, our activities are enthusiastically supported, and our solutions to problems are eagerly looked for. . . . So we have, in those who are charting the course of the future of the Army, men who see a continuing, essential role for our activities in operations research.[64]

However, contemporary assessments of Army ORSA in the early 1970s were not all sweetness and light. With respect to the increase in reliance on ORSA during the 1960s cited by Hugh Cole, Abraham Golub noted at AORS XIII in 1974 that

> the net results of this surge of activity under the banner of "ORSA" can be summarized in three brief statements:
> 1. The number of people who could claim ORSA experience and ORSA qualification on their resumes had multiplied to unprecedented levels.
> 2. There was a great deal of work done that ranged from marginal to simply bad.
> 3. Criticism of the newly enlarged "ORSA Community" mounted to the point where even congressional leaders and the president-elect got on the bandwagon.[65]

Golub also noted that

> it's fairly clear how some of these attitudes developed. In the decade of the sixties, under the combined influence of Secretary McNamara's support, Dr. Enthoven's publicity, and expanding budgets, "ORSA Activity" simply mushroomed. From my various vantage points in Aberdeen, in

> the Army Secretariat and the DA Staff, I watched all this happen with mounting concern over the general lack of what might best be called "Quality Control." Now, I don't mean to say that everything that was done in that era was bad, but it seemed like every job shop in the country could get a piece of the action by simply advocating a "Systems Approach" to any problem.[66]

In his keynote address at AORS XVI, Seth Bonder noted his impression that "the Army OR community suffers a credibility gap in the eyes of its military leaders . . . the work we do is accepted for legislated reasons but not particularly respected or deemed necessary for the good of the Army."[67] This negative view of Army ORSA lasted well into the twenty-first century. Writing in the *Boston Globe* in 2004, Virginia Postrel opined:

> O.R. started as a way of bringing scientific thinking to the complex problems of warfare. . . . But O.R. didn't live up to its postwar hype, its implicit promise to "solve everything." Militarily, it could attack certain tactical problems but, as the Vietnam War illustrated, O.R. wasn't the right tool for addressing strategic issues of where, or why, to fight. . . . By the 1970s, the Vietnam War had made O.R.'s military applications and Pentagon funding suspect in universities.[68]

But on the whole, the general assessment of Army ORSA's utility and contributions followed that of David C. Hardison, then the deputy under secretary of the Army for operations research (DUSA [OR]), in his banquet address at AORS XXI in October 1982, when he concluded by stating:

> I'm positive that we've come a long way, and that we do not look bad in comparison with others. It's time to stop flagellating and proceed proudly and confidently. . . . I am confident that you are just as committed as I to make the next advance, whatever its size, whatever its direction, or whatever its popularity.[69]

The Army Analytical Community, June 1973

Although there had been some consolidation along functional lines as a result of the Army reorganization of 1962, the Army analytical community as it existed in June 1973 on the eve of the implementation of the STEADFAST reorganization was much the same as it had been during the 1960s.[70] The most notable exception was the absence of a primary Army ORSA contractor with a special relationship such as that which had been enjoyed by ORO and RAC during the period 1948–1972. By the early 1970s, budget constraints—coupled with complaints from private industry, increasing congressional criticism, and growing dissatisfaction among Army leaders—led to the demise of the Army's Federally Funded Research and Development Centers (FFRDCs). RAC, then the Army's principal ORSA contractor, was sold to the General Research Corporation in September 1972, and its special relationship with the Army, which had existed since the formation of ORO in 1948, was severed. The Human Resources Research Office (HumRRO) became a private company, and the Center for Research in Social Systems (CRESS), the successor to the Special Operations Research Office (SORO), was also shut down. Thus, by the fall of 1972, all four of the Army's FFRDCs had been eliminated and their functions assumed, if at all, by in-house Army analysis agencies.[71] The Army continued to use independent contractors, and some Air Force–sponsored FFRDCs, to perform ORSA tasks, but after mid-1972, the Army relied primarily on its newly created in-house ORSA capabilities.

The structure of the Army analytical community as it existed prior to the implementation of the STEADFAST reorganization plan consisted of a number of autonomous elements. At HQDA level, the Office of the Deputy Under Secretary of the Army for Operations Research provided policy guidance and general oversight. Various ORSA elements in the Office of the Army Chief of Staff (OCSA) provided specialized support for the chief of staff and oversaw the Army Study Program. There were also small ORSA elements in most of the principal Army Staff sections as well as a number of HQDA staff support and field operating agencies, notably the Strategy and Tactics Analysis Group (STAG), which supported the HQDA deputy chief of staff for operations and plans (DCSOPS) with simulations and war-gaming; the Engineer Studies Center (ESC), which supported the Army Corps of Engineers with studies and analyses; and the Strategic Studies Institute (SSI) at the Army War College, which conducted studies and analyses at the strategic policy level. The Army chief of research and development (CRD) also played an important role in management of Army ORSA elements and the conduct of Army studies and analyses generally.

At the major command level, the Army Materiel Systems Analysis Activity (AMSAA) supported the

Army Materiel Command (AMC), and many of the AMC subordinate commands had their own small ORSA teams. The Combat Developments Command (CDC) had long been supported by the Combat Operations Research Group (CORG), a contract operation, and had headquarters staff elements focused on ORSA matters. The subordinate elements of CDC, particularly the Combat Developments Experimentation Command (CDEC) at Fort Ord, California, had its own ORSA elements, principally contracted, to assist in the development, test, and evaluation process. The other major commands, such as the United States Army, Europe (USAREUR), had only small, dedicated ORSA elements or none at all.

Each of the existing Army ORSA elements was responsible to its immediate commander (or HQDA principal staff officer) and acted autonomously. The DUSA (OR) did attempt to set general policy for all Army ORSA elements but did not exercise direct control over any of the Army ORSA elements in the Army Staff or at lower echelons. Each of the existing Army ORSA elements also had authorizations for both uniformed and civilian ORSA managers and analysts. The uniformed (officer) personnel were selected and managed through the Army ORSA Officer Specialty Program (Specialty Code 49) run by the HQDA deputy chief of staff for personnel (DCSPER) and the Army Military Personnel Center. The civilians were managed by the United States Civil Service and Army civilian personnel managers under Career Field 1515. In all, fewer than 1,200 managers and analysts were involved in Army ORSA programs.[72]

Challenges for Army ORSA, 1973–1995

The theme of AORS X, held at Durham, North Carolina, in May 1971, was "The Challenge to Military OR in the 70's," and a number of senior ORSA specialists addressed the attendees on that theme. Among the speakers, Dr. Clive G. Whittenbury, a RAC vice president, told his listeners that

> challenges to military OR in the seventies will often be synonymous with challenges to the military. Some of the traditional support and help from civilian institutions, including universities, individuals, foundations, have come into jeopardy, although we are moving into a time when this help will be needed most. However in the OR community you have technical qualifications, you have experience which tracks with your own, you have understanding, sympathy and an attitude that your problems are consequential; but most important you have a motivation alongside this problem-solving capability which could go a long way to helping meet this challenge to the Army of the 70's.[73]

At the same conference, Donald N. Fredericksen, assistant director for land warfare in the Office of the Director of Defense Research and Engineering, told attendees that the "emphasis and reliance on military operations research applied to land warfare by top-level decision makers could increase in the next decade," mainly due to highly constrained defense budgets, the increasing costs of manpower, the increased emphasis on tactical warfare systems and capabilities to support the policy of building a credible, conventional deterrent in Europe, and recent advances in computer technology and the methodology of ORSA itself, which improved the rapidity and quality of military operations research.[74]

In point of fact, the challenges faced by the Army analytical community in the period 1973–1995 were twofold: external and internal. First, there were the many challenges of supporting the Army in an era of changing geopolitical conditions, rapid technological advance, and fiscal restraint. Second, a number of internal issues concerning funding, manpower, organization, and technical matters challenged the Army analytical community as an Army organizational entity and as a profession.

The External Challenges

The principal external challenge faced by the Army ORSA community during the period 1973–1995 was, as always, how to most effectively help Army decision makers deal with the problems posed by a dynamic geopolitical environment, rapid technological change, and constrained resources. In general, the efforts of Army ORSA managers and analysts to meet this challenge fell into five main areas: operations and doctrinal development, manpower and personnel, force structure, the materiel development and acquisition process, and training.

In the period immediately following the Vietnam War, from 1973 to 1989, the Army OR community underwent a significant expansion in both size and the level and pace of its activities as Army ORSA analysts applied their skills to helping the Army refocus weapons development, organization, and doctrine on the Soviet threat in Europe and deal with the issues created by new military technology and the declining defense budget.[75] Numerous commentators proposed various ways in which the Army ORSA community could best serve the Army in this period of intense activity. For example, in his keynote address to AORS XIV in 1975, General John R. Deane Jr., then commander of AMC, suggested a number of ways in which OR, used correctly, might be useful:

- O.R. can help the Army provide better systems for combat.
- O.R. can help isolate key problem areas and provide a quantitative basis for evaluating alternative approaches to solutions.
- O.R. can provide a common language to bridge the gap between the R&D and operational communities.
- O.R. can assist in the evaluation of alternative tactics and system deployment.
- O.R. can ensure that the difference between R&D performance estimates and actual performance of materiel in the field is minimized.
- O.R. can provide a systematic and organized approach to learning from combat and real experience, through combat data collection, model verification, and application of data to new systems—for example, aircraft survivability.[76]

As the process of change quickened toward the end of the 1980s, it became readily apparent that the Army, and with it Army ORSA, was about to enter a new era. In an address at the Concepts Analysis Agency study directors' luncheon in December 1988, John A. Riente, then technical adviser to the DA DCSOPS, noted that "the Army must continue to press to make needed improvements in the areas that contribute most to warfighting," as outlined by Army Chief of Staff General Carl E. Vuono.[77] He noted:

> Today's environment is fraught with a changing superpower relationship; a great concern for our economy, especially the federal deficit; growing Soviet military capabilities; and with threats outside the Atlantic Alliance growing in complexity and capability. This strategic environment places a high premium on developing Army forces that provide our warfighting combatant commanders the necessary capability and flexibility to fight and defend United States interests, citizens and territory.[78]

The changing defense environment brought with it new challenges for the Army ORSA community. For example, Leonard Sullivan suggested to attendees at the fifty-eighth MORS in June 1990 that there were eight areas in which Army ORSA analysts might be of great assistance. They were (1) coping with the unknown; (2) low-intensity warfare vs. high-intensity crime; (3) the urban battlefield; (4) lower-intensity warfare force design; (5) jumpstarting less ready reserve components; (6) national mobilization potential; (7) conventional arms control measures; and (8) defense acquisition excesses.[79] And writing just before the incursion of U.S. forces in Panama in 1989 and the Iraqi invasion of Kuwait in 1990, General Thurman, then commander of the U.S. Army Training and Doctrine Command, noted that

> as important as ORSA is to the Army now, it will become even more important in the near future. The bottom line is we need quality results. We must have thoughtful insights that are supported by logic, analysis, and data, and, in the end, competent military judgment—not just a report full of numbers. "Analysis that counts" is the bridge that links our warfighting challenges to sound, affordable solutions for the future battlefield.[80]

The new era brought on by the collapse of the Soviet Union and the end of the Cold War in the early 1990s posed even greater challenges to the Army ORSA community. During the 1970s and 1980s, the problem had been one of dealing with the improvement of existing doctrines and processes; in the 1990s, Army ORSA managers and analysts faced the problem of developing entirely new doctrines and processes suited to meet the fundamental changes in the defense environment. As E. B. Vandiver III, the director of the Concepts Analysis Agency, told attendees at the fifty-ninth MORS in 1991, Army analysts could expect the evolving U.S. defense posture to bring with it "declining resources leading to harder choices; changing emphasis leading to different requirements; increased jointness; and more regionally oriented planning."[81]

The new issues requiring the attention of Army ORSA analysts after 1991 were many and complex. Among the more important and more pressing issues for analysis were "political/military interactions, a variety of scenarios and variations within scenarios, force expansion, increased lethality and maneuver speed (to compensate for reduced force size), role of space, high technology applications, and distributed training concepts."[82]

In the September 1991 issue of *Phalanx*, Walter W. Hollis, the DUSA (OR), summarized the comments of panelists at a session of the fifty-ninth MORS who reviewed the challenges Army ORSA analysts faced in the changed strategic environment that followed the first Gulf War.[83] One of the panelists, Col. Raoul Alcala, noted that Army Chief of Staff General Carl Vuono had established a set of imperatives—quality people; forward-looking doctrine; continuous modernization; robust force structure; tough, realistic training; and leader development—all of which needed the support of Army ORSA analysts to "actively shape our future rather than waiting to see what the future may have in store."[84] The imperatives established by General Vuono corresponded to the five principal areas on which the Army ORSA community had focused since 1973: operations and doctrinal development, manpower and personnel, force structure, the materiel development and acquisition process, and training and leader development. These five areas continued to be the focus of Army ORSA efforts after 1991.

Senior Army leaders and Army ORSA personnel agreed that the principal focus of their efforts during the period 1973–1995 should be on improving Army operations and developing effective tactical and operational doctrine. As early as 1971, Clive Whittenbury signaled the importance of dealing with issues of immediate concern to commanders in the field when he told attendees at AORS X that

> one of the most challenging problems to OR will continue to be the analysis of close combat or its possible replacement in terms of the purpose of the participants, measures of their success, how they achieve success and how the terrain and other environmental characteristics influence the whole operation, in general and in high resolution with all its subtleties.[85]

In 1974, Abe Golub noted that the analysis of current operations was likely to become an important activity in the future, with greater emphasis on issues of survivability, net assessment, operational testing, decision risk analysis, night combat, urban combat, and the use of "red teams."[86]

The views of senior Army commanders were provided by General William E. DePuy, then the commander of TRADOC, in his welcoming address to the participants in AORS XV in October 1976:

> First, I believe we are just emerging—thank God—from a period in which the process of weapons systems acquisition was regarded as more important than the product. The analytical community must share the responsibility for that tragic state of affairs.
>
> We have institutionalized the development, testing, evaluation, and analysis aspects of weapons systems acquisition until there is an institutional bias toward prolonging and complicating the process rather than changing and simplifying it.
>
> Second, and stemming from the first, we must only use complex, expensive, time-consuming analysis when really tough choices confront us which are not obvious on simple inspection and through the use of eighth grade arithmetic . . . we should only go to that level of complexity which is absolutely required.
>
> Third, it seems to me we spend more time and money on the manipulation of bad data than the accumulation of good data.
>
> Last, we have not yet surmounted the formidable problem of representing the effects of night, poor visibility, smoke, or suppression in our models, although some progress has been made on suppression.[87]

That theme was reinforced by General Walter T. Kerwin Jr., then the Army's vice chief of staff, at AORS XVI in 1977. General Kerwin stated:

> The issues I have raised this morning reflect, in the main, operational concerns of field commanders. You Army analysts have, for a long time, focused primarily on the acquisition process for materiel. You must now look beyond force effectiveness based upon materiel performance. The Army of the 80's needs good analysis techniques to assist the field commander with his need to increase productivity, and particularly, force readiness. I challenge you to rise to the occasion.[88]

Seth Bonder, the president of Vector Research, Inc., elaborated further on the need for operational analysis in his keynote address at AORS XVI, when he stated:

> I think the time is right to shift the emphasis of OR activity from the long-range planning issue of "what is needed for the future" to address the more operational one of "how to use what we have." That is, we should focus our efforts on research on operations rather than systems analysis.[89]

Based on his perceptions of the changing military environment, Bonder went on to recommend that over the next ten to fifteen years Army ORSA analysts needed to focus on operational topics such as maneuver unit tactics; fire support procedures (the use of artillery, helicopters, and close air support); the organization of and procedures for C3I, electronic warfare, and communications; nuclear doctrine; and logistics policies.[90] In summary, he stated:

> I have suggested a change in the direction of Army OR for the next decade—a change that would provide more focus on operational studies to determine effective ways to employ the current and forthcoming generation of new Army systems. It should involve field measurement, experimentation, and simulation technology synergistically to analyze and create tactics and procedures for improved operations. I am not suggesting a complete reduction in systems analysis activities such as COEAs [Cost and Operational Effectiveness Analyses] and long range force structure studies, but rather a shift to increasing emphasis of research on operations over the next 2–3 years in preparation for such work in the 1980s.[91]

The urgency of the need for ORSA assistance in the development of new operational doctrine was heightened by the first Gulf War and the new strategic environment following the collapse of the Soviet Union. As General Paul F. Gorman wrote in the June 1992 issue of *Phalanx*, the success of Army operations in Grenada, Panama, and above all in Desert Storm created "expectations concerning the timing and precision of future combat that will be almost certainly be difficult, if not impossible to meet."[92] At the same time, General Gorman saw "new opportunities of operations research, unfettered by the enumerated realities of the NATO–Warsaw Pact confrontation."[93] And only a few months earlier in the March 1991 issue of *Phalanx*, James J. Tritten wrote:

> The operations analysis and political science communities will need to cooperate like they never have before. The need for analysis of the old, massive, short-term (14-day) mobilization has diminished. The military operations analysis community needs to reorient itself to measurements of reconstitution where the timelines are measured in months and years and not days or weeks.
>
> New planning scenarios need to be created and wargames need to be conducted to help us study the lessons of wars and campaigns yet to be fought. An artificial history can be written of alternative forces so that the military can better advise their political leadership on the most suitable course of actions for decisions they should make today. Gaming, naturally, is no substitute for solid analysis. Gaming, however, can provide new insight and can supplement more traditional methods of dealing with alternative futures. Perhaps the time has come even to game jointly with the USSR the de-escalation of crises.
>
> Strategic warning, decision making, non-NATO battlefields (ashore and at sea), manpower and personnel planning, resource allocation, test and evaluation, combat models, and gaming and simulation are all areas that will need fundamental readjustment due to the new international security environment.[94]

Manpower and personnel issues were also an important consideration throughout the period in question. In 1974, Paul D. Phillips, the deputy assistant secretary of the Army for manpower and reserve affairs, argued that such matters should have a higher priority for ORSA effort than even operations and doctrinal development.[95] He pointed out that Secretary of the Army Howard H. Callaway spent between 65 and 70 percent of his time working on people-related matters, and he called for increased Army ORSA analysis aimed a "making the all-volunteer Army an unqualified success."[96]

In fact, the end of the Vietnam War as well as the end of the draft in June 1973 and the creation of an all-volunteer Army solved a number of serious political and morale problems, but those events also created a number of significant personnel management problems for the Army, problems that ORSA analysts were able to address.[97] For example, matching a vacant seat at an Army service school with a qualified student became a very difficult task.[98] There were also issues such as recruitment and retention and the worldwide assignment of personnel in an increasing variety of technical specialties. Such matters lent themselves naturally to solutions arrived at by the application of ORSA techniques.

Issues of future force structure were closely allied with the issues surrounding the improvement of operations and the development of doctrine as well as with issues surrounding available manpower. Army ORSA analysts had the tools necessary to design and run simulations and war games that could test and compare various force structure options. As a consequence, few force structure decisions were made after 1973 without a thorough ORSA analysis.

Army ORSA analysts had long played a key role in the materiel development and acquisition process, including test and evaluation, and they continued to be a valued part of the process during the period

1973–1995. Daniel F. McDonald, the vice president for technical programs of the BDM Corporation, addressed the matter at AORS XVI, stating:

> It is fair to say that much of the operations research—the modeling and analysis activities—has, during the last 15 years, been directed toward the materiel acquisition process. This was the area where there was a clear need and where quick gains could be made. The OR methodology, with the technology boost provided by the parallel advances in computer sciences, developed new and powerful ways to conduct weapon systems effectiveness analyses.[99]

ORSA support to the Army materiel development and acquisition process became even more important in an era of reduced defense budgets. In 1975, Under Secretary of the Army Norman R. Augustine told attendees at AORS XIV that

> spending constraints for defense, in real dollars, are becoming tighter by the year. If we elect to spread our resources over a wide variety of promising systems, we will possess a broad technological base but an eggshell-thin defense. If we expend all our funds on one "sure-fire" system or family of systems, we are reverting to the Maginot Line mentality and are vulnerable to the other guy's breakthroughs. We need help with the big picture, and Operational Analysts must aid us in deciding on which squares we should put our chips.[100]

A large number of new systems were developed between 1973 and 1995 for which ORSA support was essential. Among the many weapons systems fielded during the period were the Big Five and the multiple-launch rocket system, and new technologies, such as fiber optics, lasers, and precision-guided munitions, were adapted to Army needs.[101] As Lawrence W. Woodruff, the deputy under secretary of defense for research and engineering (strategic and theater nuclear forces), wrote in the March 1988 issue of *Phalanx*:

> The lasting strength of today's modernization is our military's ability to stay a step ahead of the Soviets' continually evolving and responding threat. Operations Research Systems Analysis (ORSA) is the key to planning the next moves—research on the plausible range of threat capabilities, and research analysis to discriminate various technical operations for modernizing strategic systems. . . . Operations research is key to formulating our response. . . . In the final "analysis," operations research is fundamental to our ability to make sound decisions on weapon system acquisition, and therefore it has a critical role in our national security strategy.[102]

ORSA methods were also key to the testing and evaluation process, which was a major part of the overall Army materiel development process. Such methods had long been a central element of the Army's testing and evaluation of new systems, and they became even more important when Congress mandated that each service have an independent means of conducting the necessary field testing and evaluation.

The use of ORSA methods to improve Army training and leader development had been a reality since the creation of ORO in 1948. As the Army adopted new and more complex weapons systems, the need for ORSA assistance in designing and evaluating Army training methods and results became even more pronounced. As General Gorman noted in June 1992:

> Arguably, most of the advances in weapons and tactics during the past half-century depended upon Operations Research, or were advantaged by OR during development. One exciting development of the last quarter-century has been the growing influence of OR on training techniques and training equipment that makes contemporary US training a close approximation of actual combat, and enables experiential learning that obviates costly instruction under fire.[103]

In addition to the five main areas, there were also a number of other topics and issues with which Army ORSA analysts were well equipped to cope. Seth Bonder, for one, suggested that Army ORSA analysts should address such topics as management information systems and the analysis of research and development management.[104] In 1974, Abe Golub mentioned urban combat, increased reliance on field testing, the logistical implications of new materiel systems, night combat, survivability, and risk analysis.[105] And in his remarks in the September 1991 issue of *Phalanx*, soon after the first Gulf War, David Chu noted two areas to which Army ORSA analysts should devote their attention and skills:

> First, doing mission-area analyses for what we think are the important future missions and, second, doing campaign analyses. These have been neglected in recent years. . . . The biggest challenge in front of us is to resurrect these tools, to reinvigorate these tools, and to use these tools to help answer the basic "why" question. Why are these systems needed? Why are these military forces important, and what role do we expect them to play? Why do we expect them to play that role in the very different world that we confront in the decade ahead of us?[106]

The Internal Challenges

Between 1973 and 1995, the Army ORSA community also faced a number of internal challenges. In the first instance, Army ORSA managers and analysts had to deal with factors affecting the Army as a whole: the changing geopolitical environment and consequent changing missions, rapidly advancing technology, and budgetary constraints. In addition, there were important questions of how Army ORSA was to be organized, where the necessary qualified managers and analysts were to be found, and what priorities should be established for their work. There were also technical issues arising from the constantly advancing field of ORSA itself and the rapidly improving state of auxiliary services such as high-speed digital computers.

Perhaps the most pressing issue was the fundamental question of whether or not Army ORSA would continue to be a valued part of the decision-making process. On taking office in 1969, the Nixon administration made clear its intention to reduce the importance of ORSA in the Department of Defense and to return more of the decision-making authority and responsibility to the country's military leaders.[107] At the same time, the use of ORSA contractors, such as RAC, came under attack in Congress, and the FFRDCs were phased out. In the end, the decision was made to continue the use of ORSA methods to support Army decision making, with the emphasis placed on using in-house ORSA capabilities.

The constraints in the defense budget after 1973 had a decided impact on Army ORSA organizations. Personnel authorizations, the number of studies conducted, and the time and manpower that could be devoted to particular areas were all affected. Abe Golub, then the technical adviser to the DA DCSOPS, addressed the impact of reduced defense budgets on the Army ORSA community in a presentation to the attendees at AORS XIII in 1974:

> Certainly the most prominent and the most critical trend impacting on Military O. R. is the decreasing defense budget. In actual purchasing power it is lower than at any time in the past quarter-century. . . . This trend impacts on Army Operations Research in two principal ways: First, ORSA activity will have to continue to adapt to reduced funding, and second, the reduced funds to support new R&D starts on weapons systems and maintenance of a reasonably structured Army will require a much better analytical batting average than every before.
>
> The continuing trend toward fewer dollars to support Army Operations Research means that fewer tasks and studies can be undertaken. That will force use to be more critical and selective in choosing which one to fund. From the standpoint of quality, however, it should enable us to concentrate our best resources on the fewer but very important studies . . . we will shortly be entering an era of near-zero contractual effort.[108]

Golub went on to note:

> The defense budget, and indeed the social climate with regard to defense spending, will inescapably impact on our profession, the dimensions of the work we do and the environment in which we work. I'm afraid we are in for an extended period of belt-tightening; our work must be much more selective and a lot "smarter."[109]

At the same symposium, Golub also summarized the other trends impacting on Army ORSA. He told his audience:

> There has been a significant trend toward consolidating Army ORSA activities within the Army with a corresponding reduction in the use of outside contractors. Contractual efforts will enter a near-zero era.
>
> One of the primary reasons this is possible is the sizable growth over the past six years of ORSA-qualified Army officers. They are beginning and will continue to enter the group of General Officers.
>
> There is a definite trend toward standardization of scenarios, models and analytical methods.
>
> The quality, quantity and health of the ORSA Community [are] generally good. We need no control mechanism to insure professional performance—we have become self-disciplining and self-regulating.[110]

Working more selectively and smarter, as Abe Golub suggested, meant adopting a number of measures to focus the available Army ORSA resources on the most pressing problems. Golub listed for his listeners at AORS XIII some of the steps that would have to be taken if Army ORSA were to continue to provide essential services to the Army. Among them were the following:

- Define the type of services we are providing
- Purge the analytic quacks and earn greater credibility
- Sharpen up the procedures and techniques we now take for granted
- Use military operations research resources more efficiently; especially computer
- Remove obstacles to innovation in ORSA

- Develop a code of ethics to be applied to contractor organizations
- Adapt to change in the Defense environment and declining Defense funding
- Develop a hierarchy of models with varying levels of resolution
- Develop a disciplined set of measures of effectiveness applicable to Army systems
- Gain a better understanding of the ways in which night operations differ from day operations
- Structure a better framework and methods for storage and retrieval of the accumulated body of ORSA work and knowledge.[111]

Implementing the changes recommended by Abe Golub required a great deal of effort. A few years later, Seth Bonder warned that such change would require strong guidance by the DUSA (OR) and other senior Army ORSA managers and would require significant changes in administration and behavior, such as:

- A moderation of the legislated advocacy requirement to conduct a large number of COEA and COEA-like studies each year.
- Design of a specific integrated program to perform the research on operations and designation of an Army organization of operations researchers to initiate the transition activities.
- Invitation by the operational forces (initially those in Europe) for the OR community to work with them and the provision of financial resources to do so, and
- A reassociation of the Army OR community with the OR and scientific communities at large. That is, I think there should be a conscious effort to again involve the intellectual resources of academia and research organizations with Army operations research.[112]

Bonder went on to warn that failure to implement needed changes might result in the demise of Army ORSA, but he also noted that the "potential professional benefits and payoffs to the Army" of such changes were high, and that "the opportunity to revitalize the Army OR scientific profession is at hand."[113]

During the immediate post-Vietnam period, from 1973 to 1991, Army ORSA changed in response to changing Army needs. Army ORSA analysts continued to play a significant role in the restructuring of the Army throughout the period; but, as Seth Bonder has pointed out, Army ORSA managers and analysts alike "recognized early on that analyses would be more difficult to perform because of changes in the Cold War era," particularly tighter budgets, the new requirements for determining what constituted "decisive force," and the need to minimize casualties.[114] Even greater challenges for Army ORSA resulted from the demise of the Soviet Union and the end of the Cold War in the early 1990s. The shift in U.S. strategic policy from forward deployment and forward defense in Europe to a smaller Army projecting its power from the continental United States, with concomitant changes in operational doctrine and force structure, altered Army leaders' expectations and produced demands for "more flexibility (many scenarios and issues); more sophistication (particularly for involvement of political contexts); more comprehensiveness (to recognize all relevant considerations); and more efficiency (resulting from reductions in analysis forces)."[115]

Army ORSA itself was changed by the demands of the new situation after 1991. In the Cold War era, studies were often long term (one to two years) and involved large groups of (fifteen to twenty) analysts, but in the post–Cold War era ORSA projects typically became two- to three-month affairs conducted by small teams of four to five analysts in order to meet the needs of a much shortened decision-making process.[116] There was also increased emphasis on high-level policy-type analysis, such as the force structure needed to meet a given element of the National Military Strategy, global stationing policy, and the trade-offs between major elements of warfighting capability (for example, force structure vs. modernization, or pre-positioning vs. rapid deployment).[117] More and more Army analyses dealt with joint and coalition operations and assets, focused on the theater level, and considered multiple theaters of operation and multiple scenarios.[118]

Conclusion

Speaking at the Concepts Analysis Agency's annual study directors' luncheon in December 1988, John Riente, then technical adviser to the DA DCSOPS, told his listeners that opportunities for Army ORSA analysts to help the Army and the nation were unlimited and that the challenge for them was "to provide us with the analytic tools necessary to help us pull all of these together into a comprehensive strategy that will enable the Army to field the most agile, lethal, survivable and cost-effective family of systems."[119] He went on to say:

> Your analyses will guide the next several generations of Army modernization and optimize our ability to integrate all areas that contribute combat power. You have the opportunity to shape the way the Army prepares for the future and to help develop a disciplined and affordable evolution to the future. Despite the fact that you sometimes feel that we are not using your work, make no mistake about it: we depend on you to provide the quality analysis we need. I know that we are in good hands.[120]

Despite the progress made since 1942, in 1973 much work remained to be done if Army ORSA assets were to be used most effectively to assist the Army as a whole.[121] Chief among the tasks that needed to be done was to ensure that decision makers at all levels gained a full understanding of capabilities and limitations of OR and its products, and that analysts guarded against "overestimating their capabilities lest their credibility be tarnished by unsound conclusions and recommendations . . . against presenting themselves as the all-knowing and infallible possessors of the solutions to all the Army's problems."[122] The bottom line was expressed by Under Secretary of the Army Norman R. Augustine, speaking at AORS XIV in 1975, when he remarked:

> The 1,250 civilian and military practitioners of your profession [OR] in the Army are the bridge between our experiences and lessons of the past, with which we are altogether too comfortable, and the new realities of change due to advancing technology, which may well decide whether we continue to exist after the next war.[123]

As the following chapters will show, the Army analytical community would prove that it was more than equal to the challenges ahead.

Chapter One Notes

1 Richard K. Kolb, "The Gimlets' Last Patrol," *Vietnam*, February 1991, available at http://members.tripod. com/~msg_fisher/gimlets1.html (accessed 18 November 2005).

2 See http://www.landscaper.net/artyunits.htm (accessed 18 November 2005).

3 On the events marking the end of the Vietnam War, see, inter alia, *Department of the Army Historical Summary, Fiscal Year 1972*, edited by William Gardner Bell (Washington, D.C.: Center of Military History, U.S. Army, 1974), pp. 1–2, 30–31, 191; and *Department of the Army Historical Summary, Fiscal Year 1973*, edited by William Gardner Bell and Karl E. Cocke (Washington, D.C.: Center of Military History, 1977), pp. 3–10, 184–85. All Department of the Army annual historical summaries are cited hereafter as (Fiscal Year) DAHSUM.

4 Seth Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," *Operations Research* 50, no. 1 (January–February 2002): 30.

5 In fact, the lessons of Vietnam had been absorbed quite well, and while counterinsurgency and nation building were indeed eclipsed by the renewed interest in a possible conventional war in Europe, important developments continued to be made in the organizations and doctrine for so-called low-intensity warfare. In the course of the 1970s and 1980s, the Army Special Forces were recognized as a formal branch of the Army; the John F. Kennedy Special Warfare Center and School were established at Fort Bragg, North Carolina; a Joint Low Intensity Conflict study was published; and U.S. special operating forces were augmented by the establishment of Delta Force (Special Forces Operating Detachment-D, a commando and counterterrorist force), Task Force-160 (an Army aviation unit specializing in special operations), and the 3d Special Forces Group. These forces were employed on several occasions, notably in Central America (El Salvador, Nicaragua, and Honduras).

6 General (USA Ret.) Maxwell R. Thurman, *Today's Victories and Tomorrow's Army*, AUSA-ILW Landpower Essay No. 91–3 (Arlington, Va.: Institute for Land Warfare, Association of the United States Army, July 1991), pp. 1–3.

7 The total force policy intentionally called for the reduction of active Army combat support and combat service support forces to such a degree that the Army would be incapable of conducting any overseas deployment without a substantial call-up of reserve forces, a step that presumably would require the explicit support of Congress and the American people.

8 There is an especially rich literature on the development of Army doctrine in the period 1973–1995. See, in particular, U.S. Army Training and Doctrine Command, Military History Office, *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command, 1973–1998* (Fort Monroe, Va.: Military History Office, U.S. Army Training and Doctrine Command, 1998); U.S. Army Training and Doctrine Command, Military History Office, *Transforming the Army: TRADOC's First Thirty Years, 1973–2003* (Fort Monroe, Va.: Military History Office, U.S. Army Training and Doctrine Command, 2003); John L. Romjue, *The Army of Excellence: The Development of the 1980s Army* (Fort Monroe, Va.: Office of the Command Historian, U.S. Army Training and Doctrine Command, 1993); and Glen R. Hawkins and James Jay Carafano, *Prelude to Army XXI: U.S. Army Division Design Initiatives and Experiments, 1917–1995* (Washington, D.C.: Center of Military History, U.S. Army, 1997). For the post-1991 period, see, inter alia, John L. Romjue, *American Army Doctrine for the Post–Cold War* (Fort Monroe, Va.: Military History Office, U.S. Army Training and Doctrine Command, 1997).

9 Thurman, *Today's Victories and Tomorrow's Army*, p. 2.

10 William C. Baldwin, *The Engineer Studies Center and Army Analysis: A History of the U.S. Army Engineer Studies Center, 1943–1982* (Fort Belvoir, Va.: Engineer Studies Center, U.S. Army Corps of Engineers, 1985), p. 165.

11 Romjue, *American Army Doctrine for the Post–Cold War*, p. 23.

12 Thurman, *Today's Victories and Tomorrow's Army*, p. 1.

13 Association of the United States Army, Institute of Land Warfare, *Our Changing World: A Global Assessment, 1991* (Arlington, Va.: Institute of Land Warfare, Association of the United States Army, March 1992), p. 57.

14 David S. C. Chu, "World Change and Military Operations Research: The View from OSD," *Phalanx* 24, no. 3 (September 1991): 10.

15 Ibid., pp. 10–12 passim.

16 TRADOC Military History Office, *Prepare the Army for War*, pp. 2–3.

17 Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," p. 30; James J. Tritten, "A New National Security Strategy," *Phalanx* 24, no. 1 (March 1991): 11.

18 *Our Changing World: A Global Assessment*, 1991, p. 3.

19 Ibid.

20 "Army Budget Supports New Strategy," *Army Logistician*, PB 700–92–3 (May–June 1992): 40.

21 Thurman, *Today's Victories and Tomorrow's Army*, p. 8.

22 Ibid., p. 6.

23 Ibid., p. 7.

24 *Our Changing World: A Global Assessment*, 1991, p. 1.

25 U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2005* (Washington, D.C.: Office of the Under Secretary of Defense [Comptroller], U.S. Department of Defense, March 2004), pp. 216–17, Table 7–7 (Defense Shares of Economic and Budgetary Aggregates).

26 Ibid.

27 Budget authority (BA) represents the amount authorized by Congress each year and does not equal either total obligation authority (which includes carryovers from previous fiscal years) or expenditures (outlays). Current dollars represent amounts not adjusted for inflation over time.

28 *National Defense Budget Estimates for FY 2005*, p. 124, Table 6–10 (Department of Defense BA by Service).

29 Ibid., pp.124, 126, Table 6–10.

30 Ibid., pp. 168–70, Table 6–19 (Army BA by Title).

31 Baldwin, *The Engineer Studies Center and Army Analysis*, p. 165.

32 Leonard Sullivan Jr., "Off-Keynote Address—The Changing Analytical Landscape," fifty-eighth Military Operations Research Symposium (MORS), Annapolis, Maryland, June 1990, *Phalanx* 23, no. 3 (September 1990): 3.

33 Tritten, "A New National Security Strategy," p. 11. James S. Tritten was a MORS vice president at the time his article was written.

34 The Honorable Togo D. West Jr. and General Gordon R. Sullivan, *A Statement on the Posture of the United States Army Fiscal Year 1996 Presented to the Committees and Subcommittees of the United States Senate and the House of Representatives, First Session, 104th Congress* (Washington, D.C.: Congressional Activities Division, Office of the Chief of Staff, Army, February 1995), p. 31 (cited hereafter as *Army Posture Statement FY 1996*).

35 "Army Budget Supports New Strategy," p. 40.

36 Ibid.

37 Ibid.

38 *National Defense Budget Estimates for FY 2005*, pp. 212–13, Table 7–5 (Department of Defense Manpower).

39 Ibid.

40 FY 1979–FY 1989 figures from U.S. Department of Defense, Washington Headquarters Services, Directorate of Information Operations and Reports, *Department of Defense Selected Manpower Statistics Fiscal Year 1989* (Washington, D.C.: Directorate of Information Operations and Reports, Washington Headquarters Services, U.S. Department of Defense, [1989]), p. 204, Table 5–2 (Reserve Strength Trends by Reserve Component). Totals include both Ready Reserve (Selected Reserve plus Inactive Ready Reserve and Inactive National Guard) and Standby Reserve. FY 1979–FY 1989 figures from the Association of the United States Army, Institute for Land Warfare, *FY 2006 Army Budget: An Analysis* (Arlington, Va.: Institute for Land Warfare, Association of the United States Army, September 2005), pp. 53–54, Figures 7 and 8.

41 *National Defense Budget Estimates for FY 2005*, pp. 212–13, Table 7–5.

42 Ibid.

43 1973 DAHSUM, p. 5.

44 *National Defense Budget Estimates for FY 2005*, pp. 212–13, Table 7–5. There were also eight divisions and twenty-one combat brigades in the reserve components (see 1973 DAHSUM, p. 8).

45 1973 DAHSUM, p. 8.

46 Ibid., p. 84.

47 Ibid., pp. 84–85.

48 *National Defense Budget Estimates for FY 2005*, pp. 212–13, Table 7–5; Paolo E. Coletta, *The United States Navy and Defense Unification, 1947–1953* (Newark, Del.: University of Delaware Press, 1981), p. 495.

49 Coletta, *The United States Navy and Defense Unification, 1947–1953*, p. 495.

50 "A View of the FY '92–'93 Defense Budget," *Retired Officer Magazine*, April 1991, p. 17.

51 Eric Schmitt, in *New York Times*, 26 May 1991.

52 "A View of the FY '92–'93 Defense Budget," p. 17.

53 Ibid.

54 "Army Budget Supports New Strategy," *Army Logistician*, PB 700–92–3 (May–June 1992), p. 40.

55 Thurman, *Today's Victories and Tomorrow's Army*, p. 4.

56 The statistical data that follow are from "Downsizing the Army in Europe," *Stars and Stripes* (European Edition), Wednesday, 29 March 1995, p. 4.

57 *Army Posture Statement FY 1996*, p. 4.

58 Hugh M. Cole, "The Impact of ORSA on the US Army—Historical Overview," in U.S. Army Concepts Analysis Agency (USACAA), *Proceedings of the Thirteenth Annual United States Army Operations Research Symposium (AORS XIII), 29 October–1 November 1974, Fort Lee, Virginia, Volume I* (Bethesda, Md.: USACAA, 1974), p. 8.

59 Ibid., p. 10.

60 Ibid., pp. 11–13. All of these events are discussed in detail in Volume II.

61 Ibid., pp. 1–2.

62 Ibid., p. 6.

63 Ibid., pp. 13–14.

64 Daniel F. McDonald, "The Next Ten Years in Army Operations Research," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Sixteenth Annual US Army Operations Research Symposium (AORS XVI), Fort Lee, Virginia, 12–14 October 1977, Volume I* (Bethesda, Md.: USACAA, 1977), p. 44.

65 Abraham Golub, "Present & Future ORSA Trends—A Forecast for the US Army," in *Proceedings . . . AORS XIII, Volume I*, p. 16.

66 Ibid., pp. 15–16.

67 Seth Bonder, "Keynote Address—Changing Army OR," in *Final Proceedings . . . AORS XVI, Volume I*, p. 2. Bonder was the president of Vector Research, Inc.

68 Virginia Postrel, "Operation Everything," *Boston* (Mass.) *Globe*, 27 Jun 04, p. 2. Virginia Postrel was an economic columnist for the *New York Times*.

69 David C. Hardison, "Banquet Speech," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twenty-First Annual US Army Operations Research Symposium (AORS XXI), Fort Lee, Virginia, 6–7 October 1982, Volume I* (Bethesda, Md.: USACAA, 1982), p. 2-349.

70 The evolution of the Army analytical community from 1962 to 1972 is discussed in detail in Volume II.

71 U.S. Congress, Office of Technology Assessment, *A History of the Department of Defense Federally Funded Research and Development Centers* (Washington, D.C.: Government Printing Office, July 1995), p. 32. The fourth Army FFRDC, the Army Mathematics Center at the University of Wisconsin, had already been shut down. The bulk of RAC's work was taken over by the newly established (January 1973) Concepts Analysis Agency.

72 The number was around 1,250 in 1975. See Norman R. Augustine, "Comments," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Fourteenth Annual United States Army Operations Research Symposium (AORS XIV), 17 November–20 November, Fort Lee, Virginia, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1975), p. 17.

73 Clive G. Whittenbury, "Challenges in Military OR in the 70's," in U.S. Army Research Office-Durham, *Proceedings of the [10th] United States Army Operations Research Symposium: "The Next Decade," 26–28 May 1971, Durham, North Carolina* (Durham, N.C.: U.S. Army Research Office-Durham, 1971), p. 170. For other remarks on the theme, see the Conclusion to Volume II.

74 Donald N. Fredericksen, "Challenges in Military OR in the 70's," in *Proceedings . . . AORS X*, p. 177.

75 Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," p. 28.

76 General John R. Deane Jr., "Keynote Address," in *Final Proceedings . . . AORS XIV, Volume I*, pp. 4–5.

77 John A. Riente, "The Opportunity for Analysis Today," *Phalanx* 23, no. 2 (June 1990): 6.

78 Ibid., p. 5.

79 Sullivan, "Off-Keynote Address—The Changing Analytical Landscape," pp. 4–5.

80 General Maxwell R. Thurman, "Analysis Counts," *Phalanx* 22, no. 1 (March 1989): 8.

81 Quoted in Walter W. Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," *Phalanx* 24, no. 3 (September 1991): 7.

82 Comment of John A. Riente at the fifty-ninth MORS summarized in Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," p. 7.

83 Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," pp. 1, 7–9. The panel included Hollis and Col. Raoul Alcala, chief, Army chief of staff's Analysis and Initiatives Group; Brig. Gen. Richard Tragemann, commander, TRAC; Keith Myers, director, AMSAA; E. B. Vandiver III, director, CAA; and John Riente, technical adviser to the Army DCSOPS.

84 Summarized in Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," p. 7.

85 Whittenbury, "Challenges in Military OR in the 70's," p. 170.

86 Golub, "Present & Future ORSA Trends," pp. 22, 24.

87 General William E. DePuy, "Welcome Address," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Fifteenth Annual United States Army Operations Research Symposium (AORS XV), 26–29 October 1976, Fort Lee, Virginia, Volume I* (Bethesda, Md.: USACAA, 1976), pp. 21–22. Col. Max Noah delivered General DePuy's remarks.

88 General Walter T. Kerwin Jr., "Remarks," in *Final Proceedings . . . AORS XVI, Volume I*, p. 35.

89 Bonder, "Keynote Address—Changing Army OR," p. 4.

90 Ibid., pp. 6–20 passim.

91 Ibid., p. 22.

92 General (USA Ret.) Paul F. Gorman, "Future War? Future Victory?" *Phalanx* 25, no. 2 (June 1992): 7.

93 Ibid., p. 6.

94 Tritten, "A New National Security Strategy," p. 13.

95 Paul D. Phillips, "ORSA Help in Managing the All Volunteer Army," in *Proceedings . . . AORS XIII, Volume I*, p. 26.

96 Ibid.

97 Ibid., pp. 26–27.

98 Ibid., p. 27.

99 McDonald, "The Next Ten Years in Army Operations Research," p. 45.

100 Augustine, "Comments," p. 20.

101 Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," p. 28.

102 Lawrence W. Woodruff, "Operations Research and Strategic R&D Planning," *Phalanx* 21, no. 1 (March 1988): 3–4.

103 Gorman, "Future War? Future Victory?" p. 7.

104 Bonder, "Keynote Address—Changing Army OR," pp. 22, 24.

105 Golub, "Present & Future ORSA Trends," p. 23.

106 Chu, "World Change and Military Operations Research," p. 12.

107 Golub, "Present & Future ORSA Trends," p. 15.

108 Ibid., p. 19.

109 Ibid., p. 24.

110 Ibid.

111 Ibid., pp. 17–18.

112 Bonder, "Keynote Address—Changing Army OR," p. 24.

113 Ibid.

114 Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," p. 30.

115 Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," p. 8.

116 Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," p. 30.

117 Ibid.

118 Ibid.

119 Riente, "The Opportunity for Analysis Today," p. 6.

120 Ibid.

121 Lt. Col. Larry R. Tinberg, *Operations Research and the US Army* (Carlisle Barracks, Pa.: U.S. Army War College, 7 April 1983), pp. 19–20.

122 Ibid., p. 20.

123 Augustine, "Comments," p. 17.

CHAPTER TWO

High-Level Management of the Army ORSA Program 1973–1995

Between 1973 and 1995, the United States Army underwent substantial changes in missions, organization, and the assignment of roles and functions, all within the context of generally constrained budget and manpower resources. By the beginning of fiscal year (FY) 1973, the organizational structure and assignment of responsibilities for the management of the Army operations research/systems analysis (ORSA) program were well established. While the implementation of the Army reorganization under Operation STEADFAST in 1972–1973 did affect the ORSA program in Headquarters, Department of the Army (HQDA) staff support and field operating agencies, and in the major commands, the top-level management of the ORSA program remained essentially unchanged from 1973 to 1995, although some important modifications regarding Army Staff roles and functions with respect to the ORSA program were made as a result of the reorganization of the Army Staff in 1974. Throughout the period, the regulatory basis for the Army ORSA program remained *Army Regulation (AR) 5–5: MANAGEMENT—Army Studies and Analyses*, a new edition of which was published on 15 October 1981 and remained in effect until 30 June 1996. The deputy under secretary of the Army for operations research (DUSA [OR]) was the principal HQDA figure responsible for establishing policy and overseeing the ORSA program. As a result of the 1974 Army Staff reorganization, the positions of assistant vice chief of staff of the Army (AVCSA), assistant chief of staff for force development (ACSFOR), and chief of research and development (CRD), all of which played important roles in the higher-level management of Army ORSA, were eliminated and their functions were transferred to other staff agencies. A new Army Staff element, the Office of the Director of the Army Staff (ODAS), absorbed many of the functions of the former AVCSA, and the deputy chief of staff for operations and plans (DCSOPS) also assumed greater responsibilities with respect to Army ORSA activities.

Between 1973 and 1995 there were five major reviews of the state and direction of the Army Study System (TASS) and thus of the Army ORSA program that was closely tied to it. Conducted for the most part under the aegis of the DUSA (OR), these reviews assessed the effectiveness of the programs in question and made recommendations for their improvement. Of particular importance were the 1978–1979 Review of Army Analysis (RAA) and the 1985 Review of Army Analysis Extended (RAAEX), which assessed the implementation of the earlier RAA.

Throughout the period, the management of resources of money and personnel associated with the Army ORSA program continued as a high priority activity at HQDA. The restrictions on resources of all types available to the Army between 1973 and 1995 constrained spending on Army ORSA and limited the number of both military and civilian ORSA analysts and managers. Although there were few major structural changes in the Army ORSA Officer Specialty Program, some modifications were made to accommodate budget restrictions and other factors impacting the program. Meanwhile, a good deal of effort was expended to improve the management of Army civilian ORSA analysts and managers.

Led by the DUSA (OR), Army ORSA personnel at every level participated actively in efforts to make their work known and to maintain close contacts with their counterparts in the military operations research community at home and abroad. The very important series of Army Operations Research Symposia as well as contacts with the Office of the Secretary of Defense (OSD), the Office of the Joint Chiefs of Staff (OJCS), the other services, allied nations, academia, and professional organizations, such as the Military Operations Research Society, were continued and expanded.

Although constantly refined and improved, the higher-level management of Army ORSA remained essentially unchanged in structure between 1973 and 1995 but proved to be entirely adequate to its purpose, facilitating the growth and improving the effectiveness of the overall Army ORSA program at every level. The result was something of a "golden age" for Army ORSA, an era in which both its influence and contribution to the Army were significant.

The STEADFAST Reorganization of 1972–1973

The first major step in restructuring the United States Army to meet the challenges of the last quarter of the twentieth century was the STEADFAST reorganization of 1972–1973, which created the basic structure still retained by the Army today.[1] Operation (or Project) STEADFAST aimed at streamlining the Army for greater efficiency and coherence and resulted in the establishment of two new Army major commands, the United States Army Training and Doctrine Command (TRADOC) and the United States Army Forces Command (FORSCOM). The old United States Continental Army Command (CONARC) and the United States Army Combat Developments Command (CDC) were eliminated and their missions were assumed by TRADOC and FORSCOM. With respect to the Army ORSA program, the STEADFAST reorganization continued the process of consolidating Army ORSA activities along functional lines that began with the 1962 Army reorganization and the creation of CDC and the United States Army Materiel Command (AMC). The general outline of the Army ORSA structure created in 1972–1973 remains relatively unchanged today. Under the aegis of STEADFAST, the newly created TRADOC consolidated the ORSA elements of CONARC and CDC into a new integrated TRADOC analysis organization; a new United States Army Concepts Analysis Agency (CAA) assumed the functions of the old Strategy and Tactics Analysis Group (STAG); and a new test and evaluation organization, the United States Army Operational Test and Evaluation Agency (OTEA), was created. All three new organizations made extensive use of ORSA techniques for studies, analyses, and simulations.

The Origins of STEADFAST

Well before the last U.S. troops left Vietnam in March 1973, Army leaders had decided that a thorough reorganization of the Army was needed to incorporate the "marked changes in organizational and managerial situations" that had occurred since the 1962 Army reorganization and to improve Army performance in such key areas as the management of money and personnel, the development of weapons and doctrine, and training.[2] The major factors indicating a need for reorganization included:

> The need to improve the fighting forces versus the support units; the need to do more with fewer people and less money; the increased dependence of the Army on its reserve components; the requirement to maintain the highest readiness of active and reserve units; the congressional—and Defense Department—directed need to improve the process of developing, testing, and acquiring new equipment and materiel; and the need to improve the soldier's morale and espirit through improvements in health care and personnel management.[3]

The Vietnam War had revealed many cracks in the Army's overall structure and suggested several modifications that might lead to greater efficiency and effectiveness, but demands and recommendations for reform had been forthcoming from various sources since the 1962 Army reorganization.[4] As the author of the definitive history of Operation STEADFAST wrote:

> Thus, by 1969, the time cycle for soul-searching, self-criticism, and management improvement was again imminent at the Department of the Army and Department of Defense levels. . . . In an era of dwindling manpower

> resources and enforced economies in operations, it was almost inevitable that study groups would be inaugurated at both the Department of the Army level and at the level of the U.S. Continental Army Command with their resultant drastic proposals for reorganization.[5]

The recommendations of the bipartisan Blue Ribbon Defense Panel appointed by President Richard M. Nixon in 1969 and headed by Gilbert H. Fitzhugh, chairman of the board of the Metropolitan Life Insurance Company, were delivered to Secretary of Defense Melvin R. Laird on 1 July 1970. Senior Army leaders, notably Army Vice Chief of Staff General Bruce Palmer Jr., were critical of the panel's recommendations with respect to the Army.[6] In any event, Army Chief of Staff General William C. Westmoreland had already taken action to generate an internal study of Army organization by appointing an ad hoc study group within the Force Planning Analysis Directorate of the Office of the Assistant Vice Chief of Staff (OAVCSA) headed by Lt. Gen. William E. DePuy.[7] During the summer of 1969, Lt. Col. Winthrop Whipple Jr., an operations analyst, and Lt. Col. John V. Foley, a cost accountant, studied Army organization with an eye to needed changes. Their finished report, entitled *Pilot Study on DA Organization*, was not disseminated but did prompt General Westmoreland to go forward with a more formal study of the problem. On 30 September 1969, he appointed Maj. Gen. David S. Parker as chairman of a special review panel on Department of the Army organization.[8] Over the next two years, the so-called Parker Panel studied the organization, roles, and functions of CONARC, CDC, AMC, the numbered armies in the continental United States, the Military District of Washington, the Army Staff, and the Class II activities reporting to the Army Staff. A number of significant recommendations were included in the panel's final report in March 1971.[9]

The work of the Parker Panel aroused substantial discussion among Army leaders and led directly to the decision by the Army chief of staff to undertake a thorough reorganization of the Army's subordinate commands, and by the end of 1971 there was consensus at the upper levels of the Army leadership that such a major reorganization of the Army was not only necessary but inevitable.[10] Meanwhile, General DePuy and a small group of staff officers drawn from the Office of the Coordinator of Army Studies and other elements of OAVCSA had developed a basic concept and plan for Army reorganization in the form of a series of butcher-paper charts kept in General DePuy's office safe. In late January 1972, the concept and plan were briefed and approved up through the secretary of defense.[11] The CDC commander, Lt. Gen. John Norton, did not object to the proposed reorganization, but General Ralph E. Haines Jr., the CONARC commander, had many reservations and set his staff to devising their own reorganization plan in an effort to exercise some control over the unfolding events. The CONARC STEADFAST Study Group, as it was called, provided General Haines with "ammunition" for his meeting with General Westmoreland on 16 February 1972 to reclama the DePuy plan. At that meeting General Haines successfully argued several points, notably the need to delay the implementation of the reorganization plan one year until 1 July 1973.

Having heard out General Haines, in the first week of March 1972, General Westmoreland selected Maj. Gen. James G. Kalergis, then the deputy commanding general for logistical support of AMC, to be the DA project manager for reorganization (DA-PMR). General Kalergis met with General Westmoreland on 8 March and was given three missions: "to write the reorganization directive; to validate the requirement to reorganize; and to supervise the implementation phase of the reorganization."[12] Two days later General Kalergis met with Secretary of the Army Robert F. Froehlke, and on 24 April 1972, Secretary Froehlke approved the official "DA Charter for the Project Manager for Reorganization" and the Office of the Project Manager for Reorganization was established in the Office of the Chief of Staff of the Army (OCSA) to manage planning and implementation for a reorganization that would "modernize, reorient, and streamline the Army's organization within the continental United States . . . [and] improve readiness, training, the materiel and equipment acquisition process, and the quality and responsiveness of management."[13]

The STEADFAST Reorganization Directive

The general concept of the reorganization, already laid out by General DePuy and his team, was clear from the start, although there was a good deal of "horse trading" among the principal players before a final plan was adopted. From General Kalergis' perspective, the project required the accomplishment of six major actions.[14] The first two involved reassignment of the roles and functions of CONARC and CDC and the disestablishment of those two organizations. The third was the establishment of a United States Army Forces Command (FORSCOM) to which all Army combat forces in the continental United States would be assigned. The fourth was the establishment of a United States Army Training and Doctrine Command (TRADOC), which would be responsible for all training, doctrinal development, and combat developments. The fifth and sixth major actions were the establishment of two DA field operating agencies: an independent Operational Test and Evaluation Agency (OTEA) to conduct tests and evaluate materiel and a Concepts and Analysis Agency (CAA) to provide an in-house capability for analysis of force development concepts, operational plans, and major weapons systems requirements. In addition, the STEADFAST concept included a number of other measures such as possible elimination of one headquarters echelon (the CONUS numbered army headquarters) between DA and the major tactical commands and installations in CONUS, an increase in the responsibilities and clout of installation commanders, and the creation of several other new commands and agencies.

General Kalergis' first task was to write a DA Reorganization Directive to provide authority for initiating the detailed planning, validating the requirement for reorganization, assigning responsibilities, outlining channels of communication, and establishing a tentative schedule and mileposts for the project.[15] Among the factors that had to be taken into account in preparing the Reorganization Directive and its underlying concept was the fact that "the Army would be smaller, people costs would increase, greater reliance would be placed on the Reserve Components, and the need for decentralization would increase."[16]

The Reorganization Directive prescribed that the DA-PMR had full authority to carry out the necessary planning and coordination for implementing changes directed by the secretary of the Army and was the single DA point of contact for all actions pertaining to the reorganization. However, detailed planning, coordination, and implementation were to be carried out by designated executive agents. The commanding general of CONARC (General Haines) was made responsible for establishing both FORSCOM and TRADOC, for transferring the functions of CONARC to the new commands, and for overseeing the disestablishment of CONARC. The commanding general of CDC (General Norton) was made responsible for transferring the functions of his command to the newly formed TRADOC and for overseeing the disestablishment of CDC. The DA assistant chief of staff for force development (Lt. Gen. R. R. Williams until October 1972, and then Lt. Gen. Elmer H. Almquist) was made responsible for establishing the two new field operating agencies, OTEA and CAA.

Implementation of the STEADFAST Reorganization

The STEADFAST Reorganization Directive prescribed the roles and missions of the new commands and agencies that were to be created, and on 8 February 1972, broad guidance was issued regarding the reorganization of CONARC, the numbered continental armies, and CDC. The STEADFAST Outline Plan was submitted on 5 May 1972, and a Detailed Plan followed on 20 July 1972.[17] The plan was approved at the highest levels, and on 11 January 1973, Secretary Froehlke and the new Army Chief of Staff, General Creighton W. Abrams, announced "a series of major actions to modernize and streamline the Army's organization within the continental United States—the most sweeping organization since 1962."[18] A final revision of the Detailed Plan was issued on 28 February 1973.[19] In accordance with the 28 February Revised Detailed Plan, CDC was to become a subordinate element of CONARC on 1 March 1973, the new FORSCOM and TRADOC were to become official DA major commands on 1 July 1973, and between 1 July and 1 October 1973 FORSCOM and TRADOC were to gradually absorb the functions and command responsibilities of CONARC, which would then be disestablished on 31 December 1973.[20]

With respect to Army ORSA, the most significant changes of Operation STEADFAST were the creation of the Training and Doctrine Command, the Operational Test and Evaluation Agency, and the Concepts Analysis Agency. Each of the new organizations was to have a substantial ORSA element and thus would be a major contributor to the overall Army ORSA program. On the other hand, FORSCOM, Health Services Command, and the other new commands and agencies created by Operation STEADFAST—with the exception of the new Military Personnel Center (MILPERCEN)—were destined to have small ORSA contingents or none at all, and thus they did not assume prominent positions in the Army analytical community.[21]

On 1 March 1973, HQ CONARC established a provisional HQ CONARC/TRADOC at Fort Monroe, Virginia, and three new integrating centers were created to coordinate the combat developments effort: the Combined Arms Center at Fort Leavenworth, Kansas; the Logistics Center at Fort Lee, Virginia; and the Administration and Personnel Center at Fort Benjamin Harrison, Indiana.[22] All of the Army service schools and training centers formerly assigned to CONARC became subordinate commands of TRADOC. The various CDC elements were then reassigned to the new headquarters, one of the three integrating centers, or an appropriate Army school. HQ TRADOC was officially established at Fort Monroe on 1 July 1973, with a strength of some 180,000 military personnel (22 percent of the active force) and some 49,000 civilian employees.[23] The specific missions assigned to TRADOC were to:

> a. Act as the principal agent of the DA in developing, managing and supervising the training of individuals of the active Army and Reserve components.
>
> b. Act as the principal agent of the DA in formulating and documenting concepts, doctrine, materiel requirements, and organizations for the US Army.
>
> c. Develop plans and programs for the introduction of new systems into the Army and develop appropriate training and doctrinal literature.
>
> d. Command subordinate commands, installations, and activities as may be assigned by Headquarters, Department of the Army.
>
> e. Provide base operations and other support through subordinate installation commanders to Department of the Army, Department of Defense, or other Government activities which are tenants of or are satellited on TRADOC installations.[24]

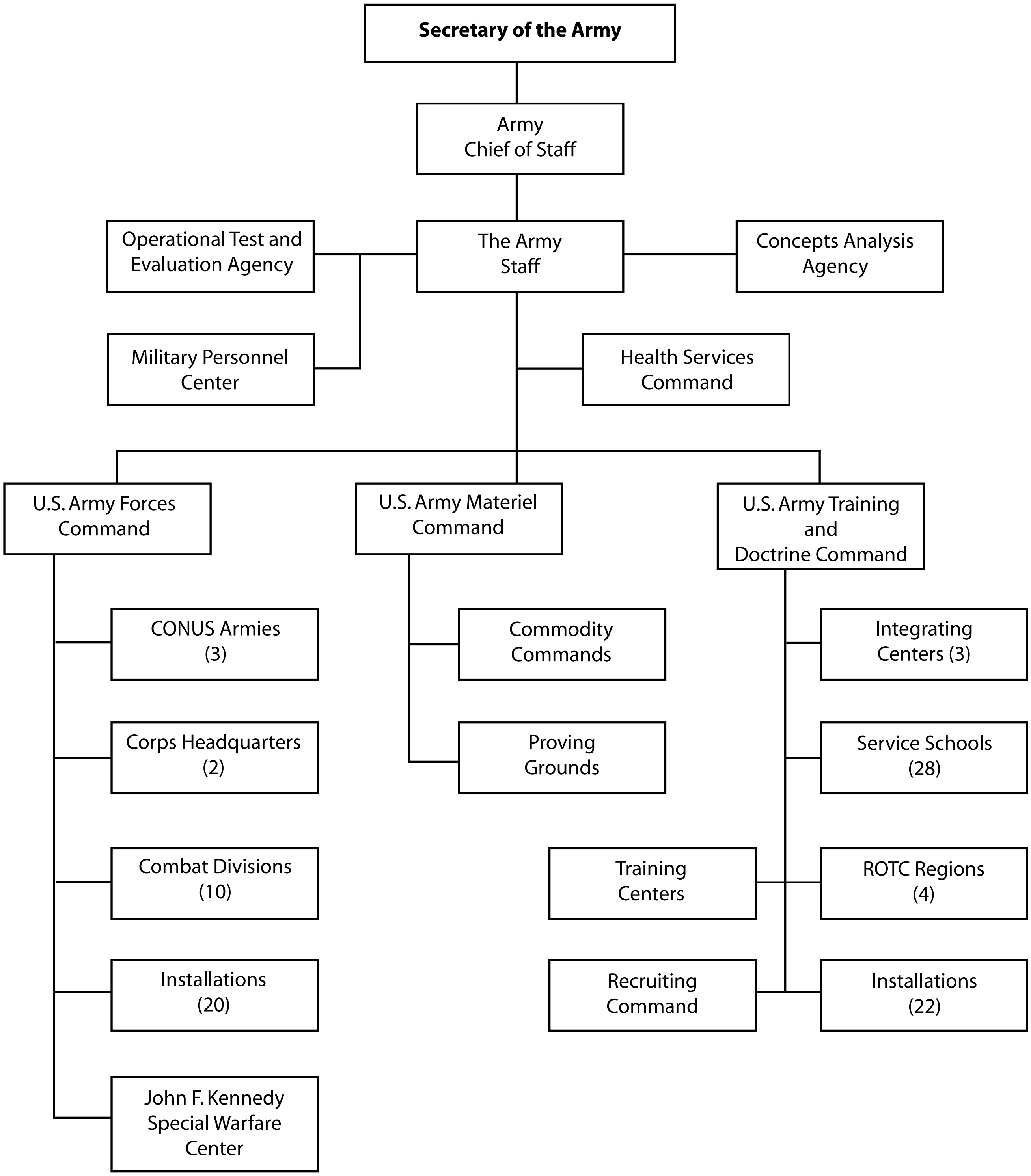
The commander of TRADOC was also charged with developing and approving training procedures for unit training, managing the Reserve Officers Training Corps (ROTC) and National Defense Cadet Corps programs, exercising operational control over all U.S. Army Reserve training divisions and centers, and operating the U.S. Army Recruiting Command (USAREC).[25]

The ORSA elements of CDC and CONARC were absorbed and reorganized by TRADOC, thereby creating an integrated ORSA organization dealing with Army organization, doctrine, and training. However, the two new Army field operating agencies established as part of the 1973 reorganization—the Operational Test and Evaluation Agency (OTEA) and the Concepts and Analysis Agency (CAA)—had an even more direct and profound impact on Army ORSA by adding two major elements to the Army analytical community.[26] OTEA became active at Fort Belvoir, Virginia, on 25 September 1972, its establishment having been accelerated to accommodate congressional mandates for the creation of an independent test and evaluation element in each of the armed services. OTEA's mission was to plan for and conduct tests for all major and selected nonmajor systems required in the materiel acquisition process. CAA was established in Bethesda, Maryland, on 15 January 1973, with a nucleus from the former Strategy and Tactics Analysis Group (STAG), which was then discontinued. Whereas STAG had supported only the DA DCSOPS, CAA was to support the entire Army Staff by conducting simulations, war games, studies, and analyses connected with force design and development, the introduction of new equipment, and operational doctrine and planning.

Post-STEADFAST Structure of the Army

The major changes in Army organization under Operation STEADFAST were completed by 1975, and in general, the Army structure created under STEADFAST remains the same today.[27] Figure 2–1 shows the organization of the Army following the STEADFAST reorganization. With respect to the Army ORSA program, the STEADFAST reorganization of 1972–1973 continued the process of consolidation of Army ORSA elements along functional lines and established the organizational milieu in which the Army analytical community would function for decades to come.

Figure 2–1—Army Organization after the 1973 STEADFAST Reorganization



Source: See, inter alia, Moenk, *Operation STEADFAST Historical Summary*, pp. 34–35, Chart 5 (Proposed Organization for Department of the Army); p. 83, Chart 8 (U.S. Army Force Command); and pp. 88–89, Chart 11 (U.S. Army Training and Doctrine Command); Revised STEADFAST Detailed Plan, Incl 1, p. 12, Figure 6 (TRADOC Organization) and p. 20, Figure 14, (Forces Command Organization).

The Regulatory Basis of Army ORSA

Strictly speaking, in 1973 there was no "Army ORSA Program" as such.[28] For all practical purposes, the Army ORSA program was an integral part of the Army Study System (TASS) and operated in accordance with the regulations governing TASS. Policy, procedures, and responsibilities for TASS were prescribed by Army regulations (ARs) and other official DA publications supplemented by corresponding regulations at lower echelons. Some aspects of the Army ORSA program, for example the selection, training, and management of officers as ORSA specialists, were covered by specific policies and regulations.

The principal Army regulation governing TASS (and thus the Army ORSA program) was *AR 1–5*, which was superseded in the early 1970s by *AR 5–5*.[29] *AR 5–5* was revised in 1977, and a new DA pamphlet (DA Pam 5–5) was published in response to DOD Directive 5010.22, dated 22 November 1976, which was aimed at improving DOD study management and interservice coordination.[30] The 5 July 1977 revision of *AR 5–5* also incorporated findings and recommendations from the U.S. Army Engineer Studies Group's August 1976 study entitled "Results and Use of Army Studies" and completed Army implementation of DOD Directive 5010.22.[31] However, a new edition of *AR 5–5* was published on 15 October 1981 to implement changes generated by the 1978–1979 Review of Army Analysis and remained in effect until 30 June 1996.[32] As its predecessors had done, the 15 October 1981 edition of *AR 5–5* defined terms and prescribed policies, responsibilities, and procedures for the management of Army studies and analyses (and ORSA).

Several other Army regulations also had a direct bearing on TASS and the Army ORSA program. *AR 10–5* assigned basic functions to various persons and offices.[33] *AR 1–110* dealt with the contracting of ORSA work, and *AR 70–20* covered the work done for the Army by the Research Analysis Corporation until its dissolution in 1973.[34] *AR 70–8* covered operations research in special fields such as "human factors," and the selection, training, assignment, and career management of Army officer ORSA specialists were governed by *AR 614–139*.[35] Of particular importance was *AR 71–9*, which prescribed policy and procedures for the conduct of the Cost and Operational Effectiveness Analyses (COEAs) mandated by Congress for each new piece of equipment.[36] During the 1970s and 1980s, COEAs were to absorb much of the Army's ORSA effort.

The Role of the Deputy Under Secretary of the Army (Operations Research)

The focal point for high-level management of the Army ORSA program from 1973 to 1995 was the Office of the Deputy Under Secretary of the Army for Operations Research (ODUSA [OR]). The position of DUSA (OR) was established initially in early 1964 as the special assistant for operations research in the Office of the Assistant Secretary of the Army for Financial Management as part of the Army's response to the McNamara reforms of the early 1960s and the demands for validated data emanating from OSD.[37] In January 1968, the position was officially designated as the deputy under secretary of the Army for operations research. Throughout the period, the Office of the DUSA (OR) remained generally unchanged with respect to size and organization, but the distribution of functions, including ORSA-related functions, did change from time to time as the Secretariat and Army Staff were reorganized for greater efficiency and effectiveness.

Responsibilities and Functions

In general terms, the responsibilities of the DUSA (OR) were to provide policy guidance and oversight for ORSA activities within the Army to meet the needs of the secretary of the Army and the Department of Defense (DOD). The October 1973 DA staffing charts further defined those responsibilities as:

1. Establishing policy guidance for OR;
2. Monitoring Department of the Army OR activities;
3. Exercising responsibility for operational test and evaluation policies in coordination with the Assistant Secretary of the Army for Research and Development;
4. Initiating studies of interest to the Secretariat and serving as the DA point of contact for similar activities in OSD; and

5. Conducting, reviewing, and/or monitoring studies, experiments, and analytical reports basic to justification of Army requirements and programs.[38]

As a result of the 1974 reorganization of the Army Staff, the DUSA (OR) assumed responsibility for management of the Army Study System, and the 1 April 1975 edition of *AR 10–5* stated:

> The Deputy Under Secretary of the Army (Operations Research) is responsible for the formulation of policies and recommendations in the areas of operations research and systems analysis, and for the Army Study Program. He advises on all significant aspects of—
>
> a. Application of operations research to—
>
> (1) Weapons systems.
>
> (2) Research and development.
>
> (3) Test, evaluation, and field experimentation.
>
> (4) Force structuring.
>
> (5) Logistics.
>
> (6) Readiness.
>
> (7) The planning, programming, and budgeting cycle.
>
> (8) Systems acquisition review committees (ASARC/DSARC) matters.
>
> (9) Net threat and technical assessments.
>
> b. The Army Study Program.[39]

HQDA General Order No. 12, dated 30 June 1978, changed those functions slightly, adding responsibility for guiding the Army Officer Operations Research Education Program.[40] The functions and responsibilities assigned to the DUSA (OR) changed somewhat over time but remained essentially the same in 1995 as in 1978, although several functions were added as a result of reorganizations and the emergence of new programs and requirements.[41]

Three Deputy Under Secretaries of the Army (Operations Research)

There have been only three incumbents in the position of deputy under secretary of the Army (operations research). The first was Dr. Wilbur B. Payne, who was selected as the special assistant for operations research in 1964 and became the DUSA (OR) in January 1968. Dr. Payne chose to leave the position in November 1975 to organize and lead the new TRADOC analysis organization. He was replaced by David C. Hardison, who left in August 1980 to take a position in the Office of the Secretary of Defense. Hardison was followed on 14 December 1980 by Walter W. Hollis, who served in the position until June 2006.

Wilbur B. Payne

In 1964, Dr. Wilbur B. Payne, then an analyst in the Systems Analysis Office in OSD under Alain C. Enthoven, was chosen to be the special assistant for operations research in the Office of the Assistant Secretary of the Army for Financial Management.[42] In January 1968, he became the first deputy under secretary of the Army for operations research. He served as the DUSA (OR) until November 1975 when he was lured to White Sands Missile Range in New Mexico by General DePuy to head the newly established U.S. Army Training and Doctrine Command Systems Analysis Activity (TRASANA). He subsequently consolidated the several TRADOC analysis organizations into the capstone TRADOC Operations Research Activity (TORA), the forerunner of the present TRADOC Analysis Command (TRAC) at Fort Leavenworth, Kansas. Long interested in problems of Army air defense, Dr. Payne was later director of the Special Study Group for Forward Area Air Defense from 1986 until his retirement in 1987.

Dr. Payne, who died at El Paso, Texas, on 17 August 1990, is widely revered as the dominant figure of the middle period of Army ORSA history, from the 1960s through the 1980s, and he was a worthy successor to such early Army ORSA leaders as W. Barton Leach and Ellis A. Johnson.[43] Dr. Payne was particularly noted for his leadership of study groups tasked to sort out difficult development problems. Thus, he headed the Infantry Fighting Vehicle/Cavalry Fighting Vehicle (IFV/CFV) Special Study in 1978 to revive the floundering IFV/CFV program, and he also led the 1985 special study on the Forward Area Air Defense System II (FAADS II), which recommended what to do following termination of the failed Sergeant York program.[44] As both an analyst and a manager of analysts, he made major contributions to the discipline and to the Army ORSA program, and he received numerous honors for his work, including election as a fellow of the Military Operations Research Society (MORS) and the 1987 MORS Vance R. Wanner Award. As his long-time colleague, Daniel C. Willard, noted in his memorial essay on Payne, "Si monumentum requiris, circumspice."[45]

David C. Hardison

David C. Hardison became the DUSA (OR) in November 1975. He brought to the position many years of experience in the development of weapons systems and high-level management of the Army research, development, test, and evaluation process. Hardison served as the DUSA (OR) until August 1980, when he left to head the Tactical Warfare Program in the Office of the Under Secretary of Defense for Research, Development, and Acquisition. He subsequently served for two years as the director of the U.S. Army Concepts Analysis Agency. He retired from public service in 1984 and later worked as a consultant on defense matters.

David Caleb Hardison was born in Arapahoe, North Carolina, on 10 April 1927.[46] He grew up and was schooled in Arapahoe, and briefly attended Atlantic Christian College (now Barton College) in Wilson, North Carolina, before enlisting in the Navy at the end of World War II. He served from April 1945 to May 1946 in the Pacific theater.[47] Upon being mustered out in 1946, Hardison returned to Atlantic Christian College where he earned a B.A. degree in mathematics in 1949. He then attended graduate school at Duke University and received his M.A. in mathematics from Duke in 1951. He also graduated from the National War College in 1972 and received a master's degree in international affairs from George Washington University the same year.

Hardison first became involved in the Army ORSA program in 1952 when he took a position as a weapons systems analyst at the Ordnance Research Laboratory, part of the U.S. Army Ballistics Research Laboratories (BRL) at Aberdeen Proving Ground, Maryland.[48] While at BRL, he conducted a number of important studies, including a seminal study of tank engagements in Europe in World War II, and participated in the extensive program of field experimentation in tank gun ballistics conducted at Camp (now Fort) Irwin, California, in the 1950s.[49] He rose to become chief of the Armor/Antiarmor Systems Branch and remained at BRL until 1964, when he became the science adviser to the commanding general, U.S. Army Combat Developments Command (CDC), at Fort Belvoir, Virginia. There he continued his interest in armored vehicles and antiarmor missile systems. His work was instrumental in the abandonment of the inadequate DART missile system and in the development and adoption of the TOW antitank missile, still used extensively by U.S. and many foreign armies today. He also worked on the development of Army helicopter systems, notably the UH–60 Black Hawk helicopter.

The Combat Developments Command was melded into the new U.S. Army Training and Doctrine Command in the 1973 STEADFAST reorganization of the Army. Hardison chose not to follow the remnants of CDC to Fort Monroe, Virginia, and in the fall of 1972 he was asked by Lt. Gen. William C. Gribble Jr., then the Army's chief of research and development, to take a post as the "analytical fireman" in the Office of the Chief of Research and Development (OCRD).[50] There he became immersed in the Army's planning, programming, and budgeting system (PPBS) but continued to be deeply involved in the development of Army weapons systems, notably the mechanized infantry combat vehicle (MICV), the M16 rifle, the SAM-D (Patriot) surface-to-air missile system, and the multiple-launch rocket system (MLRS). He also led the 1973 BATTLEKING study that sought to improve Army artillery systems and led to the development of MLRS, the Army tactical missile system (ATACMS), sense-and-destroy armor munitions (SADARM), the battery computer system (BCS), and the fire support team vehicle (FISTV), as well as the AQUILA remotely piloted vehicle and the Copperhead homing shell.

In November 1975, Hardison left ODCSRDA to become the DUSA (OR). There he continued to focus on the development of new weapons systems for the Army, a process he was able to influence through his membership on the Army Systems Acquisition Review Committee and the Select Committee. He played a key role in the decision by Secretary of the Army Martin R. Hoffman to abandon plans to produce the MICV and to continue work on what came to be the M2/M3 Bradley infantry fighting vehicle.[51] He also continued to promote the widespread use of the TOW antiarmor guided missile. Hardison also worked to improve the internal organization and operations of the Office of the DUSA (OR). He instituted a relatively flat organizational structure in which all assigned professional ORSA personnel, both military and civilian, including himself, were actively involved in studies and analyses. Hardison also headed the 1978–1979 Review of Army Analysis, a comprehensive study of the strengths and weaknesses of the Army analytical community at that time.

In 1980, Hardison chose to leave the DUSA (OR) position and became the director of tactical warfare programs in the Office of the Under Secretary of Defense for Research, Development, and Acquisition, where he worked closely with Walter B. LaBerge, who had earlier been the under secretary of the Army. By that time, Hardison sensed the need to leave government service and provide a greater measure of financial security for his family. He planned to retire in 1982, but the Army's vice chief of staff, General John W. Vessey Jr., persuaded him to accept one more tough assignment, the directorship of the Concepts Analysis Agency (CAA). He somewhat reluctantly accepted the challenge and took over as the first civilian director of CAA in December 1980.

Located in Bethesda, Maryland, CAA was a product of the 1973 STEADFAST reorganization and had absorbed the missions, personnel, and other assets and liabilities of the former Strategy and Tactics Analysis Group (STAG). Over the years, STAG/CAA had become somewhat stagnant and top-heavy, and Hardison worked diligently to motivate personnel, improve working conditions and computer support, and increase productivity. Then, having set his own schedule, Hardison retired from public service on 1 October 1984 and subsequently worked for some years as a consultant for defense industries and government agencies. He was for several years a member of the Army Science Board, served as a consultant for the Defense Science Board, and consulted for the Institute for Defense Analyses and the RAND Corporation.

In the course of a long and productive career in Army weapons systems developments and ORSA, Hardison was personally involved in the development of what came to be called the Big Five, the family of weapons systems with which the U.S. Army won Operation DESERT STORM and which continue to be the basis of Army combat power in the twenty-first century.[52] He also contributed significantly to the decision to develop a number of other important systems, including the TOW antitank missile, the AH–64 Apache attack helicopter, the SERGEANT YORK air defense system, the HMMWV (high-mobility, multipurpose wheeled vehicle, or "Humvee") tactical utility vehicle family, and various advanced munitions. He also influenced the decision to abandon those systems, such as the DART missile and the MICV, which were inadequate.

Hardison was frequently recognized for his outstanding technical contributions and effective management skills. In 1963 he earned the DA Research and Development Achievement Award and the following year accepted the Kent Award, the highest award for technical achievement in ballistics. He was awarded the DA Meritorious Civilian Service Award in 1965, and the DA Exceptional Civilian Service Award, the Army's highest award for civilians, four times (1968, 1977, 1979, and 1980). In 1982 he received the DOD Meritorious Civilian Service Award, and in 1983 he garnered the Presidential Distinguished Senior Executive Award, the highest rank conferred by the president on individuals in the federal Senior Executive Service.

Walter W. Hollis

On 14 December 1980, Walter W. Hollis became the third DUSA (OR), and he continued to serve in that position until June 2006. He, too, came from the weapons development community and brought with him extensive experience in the Army test and evaluation process, models and simulations, and the development and recognition of Army ORSA personnel, both military and civilians. Under his leadership, the ODUSA (OR) assumed greater responsibilities in overseeing the test, evaluation, and acquisition processes.

Walter Winslow Hollis was born in Braintree, Massachusetts, 13 November 1926, and grew up in Waltham, Massachusetts.[53] Following Army service in World War II as a sergeant in the Chemical Warfare Service assigned to the 2d Infantry Division, he attended Northeastern University, from which he received a B.S. degree in physics and mathematics in 1949. He then taught at Northeastern University and attended graduate classes at Boston University until he entered the civil service in 1951 as an optical engineer at Frankford Arsenal in Philadelphia, where he remained in a series of progressively more responsible positions for seventeen years (1951–1968). In 1968 he moved to Fort Ord, California, to serve as the scientific adviser to the commanding general of the U.S. Army Combat Developments Experimentation Command from 1968 to 1972. Following attendance at the National War College in 1972–1973, he became the scientific adviser to the commander of the newly created U.S. Army Operational Test and Evaluation Agency (OTEA) in Falls Church, Virginia, where he served from 1973 to 1980. He became the DUSA (OR) on 14 December 1980. He earned a master's degree in international relations from George Washington University and received many international, U.S. government, and national-level awards and honors. The MORS Army sponsor from 1980 to 2006, he was elected a fellow of MORS in 1995.[54]

As noted in his MORS biography, Hollis' tenure as DUSA (OR) was marked by his positive impact on the Army in such areas as test and evaluation, modeling and simulation, acquisition reform, and keeping the Army abreast of emerging science and technology.[55] He oversaw the implementation of three major consolidations efforts: development of the "Integrated Process for Developmental and Operational Test and Evaluation"; execution of a consolidation of Army materiel evaluation; and a consolidation of Army testing.[56] He was also instrumental in developing the VISION 21 theme of Army reduction, restructuring, and revitalization and personally oversaw two of the most important aspects of the VISION 21 process: the independent activities-based costing analysis and the Require Test and Evaluation Capabilities Analysis.[57] As the author of his MORS biography wrote:

> Mr. Hollis' persistence in demanding thorough and realistic operational testing of crucial combat systems was in a large part responsible for the confidence our soldiers were able to place in the capability of the M1 tank, the Bradley Fighting Vehicle, the Army Tactical Missile System, and Patriot II during Desert Storm and Operation Iraqi Freedom.[58]

Hollis led the 1985 Review of Army Analysis Extended, which assessed the progress made in the implementation of the recommendations of the 1978–1979 Review of Army Analysis. He also took a keen interest in Army use of models and simulations and established the Army Models and Simulation Office to oversee Army investments in models and simulations, a move that resulted in substantial cost savings.[59]

During his tenure as the DUSA (OR), Hollis demonstrated concern for the recruitment and development of Army analysts both military and civilian. He constantly encouraged younger Army ORSA analysts and managers to grow in their profession and provided developmental opportunities for West Point cadets participating in the U.S. Military Academy Summer Work Program and established an annual ORSA fellowship in his office.[60] Hollis also sponsored a number of initiatives to recognize the contribution of Army ORSA managers and analysts over the years. In 1991 he established the Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis.[61] He also established the Army Operations Research/Systems Analysis (ORSA) Hall of Fame in March 2004.[62] Located at the Army Materiel Systems Analysis Activity at Aberdeen Proving Ground, Maryland, the Army ORSA Hall of Fame honors distinguished contributors to the Army ORSA program. The first ORSA Hall of Fame inductees were announced in October 2004 and included Dr. Wilbur B. Payne, Dr. Joseph Sperrazza, General Maxwell R. Thurman, and Hunter M. Woodall Jr. In more than fifty years of federal service, Hollis himself garnered many significant honors and awards, including two awards of the Presidential Meritorious Executive Award, a Presidential Distinguished Executive Award, a DOD Distinguished Civilian Service Award, and four DA Exceptional Civilian Service Awards.[63]

Other Notable ODUSA (OR) Personalities

Several other individuals well known in military ORSA circles served in the ODUSA (OR) over the years. Dr. Daniel C. Willard had a long tenure, beginning with Wilbur Payne in 1964. A physicist by training (Yale and Massachusetts Institute of Technology [MIT]), he taught physics at Swarthmore College and Virginia Polytechnic Institute before learning ORSA on the job at the Research Analysis Corporation.[64] Another distinguished Army ORSA manager, Abraham Golub, became the assistant DUSA (OR) in early 1968.[65] Another long-time

ODUSA (OR) stalwart was Hunter M. Woodall Jr., who replaced Abe Golub as assistant DUSA (OR) in early 1970. He began his career in analysis and testing with the Combat Operations Research Group (CORG) in the late 1950s, was chief of test and experimentation at CORG from 1962 to 1965, and was deeply involved in the test and evaluation of airmobility concepts.[66] In 1970, Woodall became the assistant DUSA (OR) with responsibilities focused on Army analysis. Beginning in 1980, and for ten years until his retirement from federal service in 1990, he was the DA research, development, and acquisition analysis officer in the Office of the Assistant Secretary of the Army for Acquisition and Logistics, where he was responsible for policy and oversight of analysis and testing in the research and development process. He was inducted into the Army ORSA Hall of Fame in 2005.

Another prominent Army ORSA personality who served in the ODUSA (OR) was Eugene P. Visco.[67] Gene Visco began his career as a member of the Army analytical community at Dugway Proving Ground, Utah, in 1951. In 1956 he joined the Operations Research Office as an analyst. He remained at ORO (and its successor, the Research Analysis Corporation) until 1966, when he went to CORG. He led the Mechanized and Armor Combat Operations in Vietnam (MACOV) study team in 1967 and then left CORG in 1968 to work in private industry and other government agencies until 1981, when he became a supervisory operations analyst and deputy director of the Army Study Program Management Office (SPMO) in the Office of the Chief of Staff of the Army. In 1987 he moved to the ODUSA (OR), where he served as a supervisory operations analyst and for seven years as director of the SPMO and then the U.S. Army Model Improvement and Study Management Agency (MISMA) before retiring from government service in 1997. He participated in many important studies and analyses, and at the behest of the DUSA (OR) he planned and conducted a series of oral history interviews with senior Army ORSA personnel that provide important insights on the Army ORSA program. Visco was also particularly active in national and international organizations and meetings of ORSA professionals and was elected a fellow of the Military Operations Research Society.

Another well-known Army ORSA manager, Joann H. Langston, also served in the ODUSA (OR) and other Army ORSA positions.[68] Early in her career, Langston was an operations research analyst at CORG, Operations Research Inc., and the Applied Physics Laboratory at Johns Hopkins University. In 1981 she was selected as the director of SPMO and director of contracted advisory and assistance services, Management Directorate, OCSA, where she served until 1988. She then occupied the Army chair at the Defense Systems Management College (1988–1990) and served as the Army's competition advocate general (1990–1995) before becoming the director of MISMA in 1995. She remained in that position until 1998, when she took the Army chair at the Defense Acquisition University. In 2001 Langston joined the ODUSA (OR) as the director of special projects and served in that position until 2003 when she left to join the Army Contracting Agency.

Evolution of the Office of the DUSA (OR), 1973–1995

The position of special assistant for operations research in the Office of the Assistant Secretary of the Army for Financial Management was created in 1964 specifically to coordinate the Army response to the data-related demands of Secretary of Defense Robert S. McNamara and the "Whiz Kids" in OSD. Thus, the focus of the special assistant's attention was upward rather than downward. As time went on, however, his successor, the DUSA (OR), accumulated responsibilities for policy guidance and higher-level management of the Army ORSA program even as the problem that the office was created to address—OSD's thirst for detailed data—abated. As the focus of Army attention changed, so to did the focus of activities in the ODUSA (OR).

On the whole, the basic missions, organization, and personnel authorizations of the ODUSA (OR) changed very little between 1973 and 1995. From time to time, specific responsibilities and functions were added to or taken away, the principal addition being the requirement to oversee the Army Study System, a responsibility inherited by the DUSA (OR) upon the elimination of the Office of the Assistant Vice Chief of Staff in 1974. Day-to-day management of TASS remained with the Study Management Office in the Management Directorate, OCSA. The

1979 RAA study group recommended enhancement of that office, which as the Army Study Program Management Agency continued to manage TASS until passage of the Defense Reorganization Act of 1986, at which time it became a field operating agency of the Office of the Under Secretary of the Army with operational control delegated to the DUSA (OR).[69]

The 1979 RAA study group also recommended the establishment of an Army Model Committee to oversee the development of the growing number of complex models and simulations used by the Army, and such a committee was subsequently created under the direction of the DUSA (OR). At the same time, the Army Model Improvement Program (AMIP) was established under the provisions of *AR 5–11* and responsibility for its management was delegated to the commander, TRADOC, as executive agent. Implementation of the AMIP was directed in April 1980, and the Army Model Improvement Management Office (AMMO) was set up at Fort Leavenworth, Kansas, to manage the program. On 15 August 1989, the Army Study Program Management Agency was redesignated and combined with AMMO to form the U.S. Army Model Improvement and Study Management Agency (MISMA), a field operating agency of the under secretary of the Army with operational control exercised by the DUSA (OR).[70]

As interest in streamlining and improving the efficiency of the Army acquisition process increased in the late 1980s and early 1990s, the DUSA (OR) picked up additional responsibilities in the test and evaluation and materiel acquisition areas. On the whole, the additions and subtractions to the DUSA (OR)'s mission list were relatively minor and did not require substantial changes in personnel or organization. From time to time, there were also proposals to do away with the ODUSA (OR) altogether, but they all came to naught.

The ODUSA (OR) began as a small office and remained small throughout the period under consideration. In April 1975, the personnel authorization of the office was two military and nine civilian personnel, and when David C. Hardison became the DUSA (OR) in November 1975, the office consisted of two civilian super-grade executives (the deputy under secretary himself and the assistant deputy under secretary), a colonel as military assistant, a half-dozen relatively senior military and civilian analysts, and a small (three- or four-person) administrative staff of civilians and enlisted personnel.[71] The personnel authorizations for the ODUSA (OR) did change from time to time, but the size of the office remained generally in the range of six to nine professional analysts.

Throughout the period under consideration, the internal organization of the ODUSA (OR) also remained much the same. In general, it was relatively "flat." Although each of the military and civilian analysts was assigned to cover a specific area, they tended to be assigned to specific projects on an ad hoc basis. Under David Hardison, at least, all the senior management and analytical personnel, including Hardison himself, participated actively in the conduct of studies and analyses and there was consequently very little "hierarchy."[72]

Each of the three successive incumbents as deputy under secretary of the Army (operations research) brought to the office his own interests, experience, and management style, which, when combined with the changing focus of Army needs and interests, led to changes in the focus of the office and different emphases in its activities. Wilbur B. Payne became the special assistant for OR in 1964 and then the DUSA (OR) in 1968. By all accounts, he was a brilliant but somewhat eccentric and laid-back manager, more concerned with the product than with internal management of the office. Payne, who had been an analyst with ORO and in OSD prior to becoming the DUSA (OR), had grown up professionally in what might be called the "classic" OR pattern, with primary emphasis on the development and use of new scientific (mathematical) techniques to aid decision makers in finding solutions to operational problems. He also served as DUSA (OR) during the McNamara and Vietnam War era and perforce was concerned with managing the Army's response to OSD demands for verified data and with implementation of the new McNamara management system, the planning, programming, and budgeting system (PPBS). Thus, the ODUSA (OR) during Payne's tenure was somewhat loosely organized and managed and focused on coordination of Army data and analyses, implementation of PPBS, and the application of ORSA techniques to both management and operational problems.

David C. Hardison came to the ODUSA (OR) after a substantial career in the Army's weapons systems development arena and had long experience in the definition of requirements for Army weapons systems and the design and development of those systems. His managerial style was more formal than that of Payne, and he was much more concerned with the efficient organization of the office and its level of productivity. Hardison served as DUSA (OR) during the critical early period of the Army's recovery from the Vietnam War, a period characterized by intense focus on the development of new weapons systems needed to defeat the Soviet Union in a conventional war in Central Europe. Consequently, under Hardison management of the office was tightened and focused on helping Army leaders to decide what the Army's requirements were for weapons systems and what systems would best meet the Army's needs.

The third DUSA (OR), Walter W. Hollis, took office in 1980. Like Hardison, he too began as a "bench scientist" and had long experience in the Army's weapons systems development field, with particular emphasis on the test and evaluation of proposed systems. Hollis' management style was perhaps the most "traditional" of the three, neither as loose as that of Payne nor as strict as that of Hardison. By the time Hollis became the DUSA (OR), the basic decisions on what new weapons systems were to be developed by the Army in the post-Vietnam era had been made, and development of the Big Five was well under way. At that point, the focus shifted to the testing and evaluation of those new systems and improvement of the materiel acquisition process. At the same time, the Army's use of modeling and simulations was growing at an accelerated pace and required greater attention. Thus, under Walter Hollis' leadership the ODUSA (OR) gradually came to focus more and more on questions of testing and evaluation, on the materiel acquisition process, and on the management of the Army's inventory of models and simulations and less on basic OR methodology, weapons systems requirements, or operational questions.

Although the focus and "character" of the Office of the Deputy Under Secretary of the Army (Operations Research) changed with each new incumbent and with changes in the focus of Army interests, the office remained throughout the period 1973–1995 the wellspring of policy guidance and leadership for the Army analytical community and the principal advocate for the maintenance of a substantial and vibrant Army ORSA program in an era of fiscal retrenchment and changing national priorities. The ODUSA (OR) continuously reviewed the Army's needs for ORSA and the degree to which the Army analytical community was meeting those needs. Led by the DUSA (OR), comprehensive reviews of the Army ORSA program in 1979, 1985, 1989, and 1991 led to increased efficiency and productivity and the correction of inadequacies. Although the Army analytical community was decentralized, the ODUSA (OR) provided an essential focal point for Army ORSA activities and thus ensured the continued participation of Army ORSA managers and analysts in the important decisions affecting the Army and national security.

Criticism of the ODUSA (OR)

The management of the Army Study System—and consequently of the Army ORSA program—was under constant review, and from time to time the Office of the Deputy Under Secretary of the Army (Operations Research) was criticized for its performance in handling one or another aspect of TASS and Army ORSA activities. The most serious challenge arose in the late 1970s with publication of the 1978–1979 Review of Army Analysis (RAA). As part of the RAA, which was led by David C. Hardison, the U.S. Army Engineer Studies Center (ESC) was tasked to do a substudy on the management of TASS. Completed in October 1978 and included as Appendix F to the RAA final report, the ESC study, entitled "Managing the Army Study Program for Effectiveness," was aimed at ascertaining "those management of OR/S&A [i.e., Operations Research/Studies and Analyses] functions best performed at the Secretariat/HQDA level and the best organizational structure to support them."[73] The ESC team conducted a "wide-ranging management analysis" that considered "the classic management functions of planning, organizing, staffing, directing, controlling, coordinating, and evaluating."[74] The recommendation of the team was for the creation of a management cell at HQDA to carry out all TASS management functions under the direction of a two-star general who would report to the director of the Army Staff.[75] In the view of the ESC study group, the consolidation of study management responsibility in a single HQDA cell would free up resources, particularly analytical personnel. Specifically, the team proposed that out of a total of 146 identified analyst/management spaces in HQDA, twenty could be "saved," including seven from ODUSA (OR); three from the Directorate of Management, Office of the Chief of Staff, Army (OCSA); six from the Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS); two from the Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA); one from the Office of the Deputy Chief of Staff for Logistics (ODCSLOG); and one from the Office of the Deputy Chief of Staff for Personnel (ODCSPER).[76]

The ESC study group was broadly critical of the role of the ODUSA (OR) with respect to TASS. In Tab B (Analysis of Responsibilities, Functions, and Roles of Secretariat/HQDA OR/S&A-Related Elements), and especially in Tab C (Special Topic—Past, Present, and Future of ODUSA [OR]), the ESC team questioned the need for continuance of the ODUSA (OR) in the form it then held. They noted that during the early 1970s, the trend toward centralized management of studies and analyses had been reversed and organizations such as the Systems Analysis Directorate in OSD and OAVCSA had been disestablished but that the ODUSA (OR) had remained unchanged and thus was no longer properly aligned with the functions that needed to be performed. The ESC team also noted: "For reasons best known to the DUSA (OR), exercise of this responsibility has been incomplete. In particular, the establishment of objectives and plans and the overall direction have been cursory."[77] They then went on to state:

> When viewed in isolation, the ODUSA (OR) appears to be performing desirable, useful, and necessary functions. As part of a larger DA Staff/OSD organization, however, the ODUSA (OR) appears to be both an enigma and an anachronism. It appears to be performing some functions that should more logically be performed by others. For example, detailed model development and data generation should probably not be performed at all within ODUSA (OR). Also, participation as members of an almost infinite number of SAGs [Study Advisory Groups] should probably be left to representatives from subordinate elements.[78]

The ESC study group's main criticism of the role played by the ODUSA (OR) in the Army Study System was that

> study activity including study program management should be mainstream to the Army decisionmaking processes that studies support. However, the ODUSA (OR) is not mainstream in the sense of PPBS and the decisionmaking that characterizes that Staff side of the house. Hence, the study system responsibility of the DUSA (OR) appears to be misplaced.[79]

They also noted that

> one informal function the DUSA (OR) is credited with performing is that of overwatching study technical matters and advising the SA on operations research or S&A-related matters. It is not at all clear why operations research or the S&A activities are so uniquely important as to require a DUSA . . . there appears to be no overriding need for the retention of ODUSA (OR).[80]

Finally, the ESC team concluded by stating:

> If the new S&A management organization proposed in this report is adopted, what role should the DUSA (OR) play in that organization? The answer is probably none. This report recommends the transfer of all formally assigned S&A management responsibilities from DUSA (OR) to the new S&A management cell. Except for any informal/unwritten functions the ODUSA (OR) might perform, that office could probably be disestablished.[81]

As it turned out, the S&A management cell recommended by the ESC study group was rejected by Army leaders and the ODUSA (OR) continued to perform its functions with respect to Army studies and analyses essentially unchanged for the next twenty years and more despite occasional complaints regarding the need for such an office, the focus of its activities, and its productivity.

The Role of the Army Staff

Prior to the 1974 reorganization of the Army Staff, the DUSA (OR), the principal DA General Staff officers, and the ORSA specialists under their direction focused for the most part on meeting the requirements for integrated data and analyses imposed on the Army Secretariat and Staff by OSD. The DA General Staff principals concentrated on studies conducted within HQDA, and their concern with the management of Army-wide ORSA programs was marginal.[82] However, several elements of the Army Staff did play important roles in managing ORSA resources and activities Army-wide.

The director of studies in OCSA; the deputy chief of staff for military operations (DCSOPS); the chief of research and development (CRD); and, after February 1967, the assistant vice chief of staff (AVCSA) were the traditional focal points on the Army Staff for the management of the Army ORSA program. The director of studies supervised TASS; the DCSOPS oversaw the Strategy and Tactics Analysis Group (STAG); and the CRD was responsible for overseeing the Army Research Office (ARO) and contracts with Army ORSA contractors, such as the Research Analysis Corporation. After the establishment of the Office of the Assistant Vice Chief of Staff (OAVCSA) on 16 February 1967, the AVCSA became the principal DA Staff officer promoting and coordinating ORSA activities on the Army Staff and to some extent Army-wide. Lt. Gen. William E. DePuy, who served as AVCSA from March 1969 to March 1973, was particularly active in that regard. Despite increased centralization of Army ORSA management in the Secretariat and OCSA during the 1960s, the DCSOPS, the CRD, and other Army Staff elements continued to play a prominent role in the overall management of Army ORSA activities until the 20 May 1974 Army Staff reorganization.

The 1974 Reorganization of the Army Staff

As part of the 1973 STEADFAST reorganization, Army leaders evaluated the requirements and management practices of the Army Staff and its staff support agencies and concluded that there was a need to streamline the Army Staff and eliminate layering and other inefficiencies.[83] On 5 October 1973, the secretary of defense ordered a study of the manpower requirements of DOD management headquarters to determine the effect of reductions of 10, 20, or 30 percent, and directed each of the services "to analyze the impact of manpower cuts within the headquarters on the management of the staff."[84] Accordingly, in November 1973 the Army Chief of Staff, General Creighton W. Abrams Jr., directed that the Army Staff should be reorganized to:

1. establish clear responsibility in the five key functions requiring departmental management, that is, people, dollars, plans, materiel acquisition, and logistics;
2. remove operational tasks from the Army staff so that the staff could concentrate on establishing Army policy;
3. improve direction and control;
4. eliminate fragmentation of functional responsibilities;
5. remove layering through broader spheres of control;
6. make better use of the management abilities of the U.S. Army Materiel Command, the U.S. Army Forces Command, and the U.S. Army Training and Doctrine Command; and
7. achieve manpower and dollar savings for transfer to combat forces.[85]

General Abrams' intent was to reduce the number of Army Staff agencies reporting to him and to reduce the Army Staff by some 800 spaces with most of the "saved" military spaces to be transferred to combat units.[86]

While planning for the staff reorganization was in progress, a survey was taken of members of the Army Staff and their perception of the proposed changes.[87] Some 70 percent of the 47 individuals surveyed said without hesitation that the reorganization was a good idea.[88] Even general officers in those Army Staff elements proposed for elimination—notably the Office of the Chief of Research and Development (OCRD) and the Office of the Assistant Chief of Staff for Force Development (OACSFOR)—were generally positive about the proposal, and the only substantial negative comments focused on materiel acquisition and logistical matters.[89] Many respondents praised in particular the proposed disestablishment of the positions of AVCSA and ACSFOR.[90]

On 4 March 1974, Secretary of the Army Robert F. Froehlke announced the so-called Abrams Reorganization, effective 20 May 1974, the first major change in the organization of the Army Staff since 1962.[91] The principal actions were the elimination of the CRD, the ACSFOR, the assistant chief of staff for communications-electronics, the provost marshal general, and the Office of Reserve Components.[92] The offices of the assistant vice chief of staff and of the secretary of the general staff were combined to form a new Office of the Director of the Army Staff (ODAS), and many of the functions of the old CRD were assumed by a new deputy chief of staff for research, development, and acquisition (DCSRDA), formed in December 1974.[93] The other principal DA Staff offices were continued with only relatively minor changes, although some changes were made in the functions assigned to the various HQDA staff support and field operating agencies.[94]

The management of the Army Study System and the Army ORSA program were changed significantly by the disestablishment of OAVCSA, OCRD, and OACSFOR and the redistribution of their functions to other DA Staff agencies. The functions formerly assigned to the director of management in OCSA, to the AVCSA, and to the CRD were transferred to the newly established DAS, other DA Staff offices, or to one or another of the HQDA staff support or field operating agencies. The organization of the Army Staff subsequent to the 1974 reorganization is shown in Figure 2–2.

The 1974 reorganization resulted in a significant decrease in the number of military and civilian personnel assigned to the Army Staff, and the personnel spaces saved by the reorganization were presumably used to increase the fighting strength of the Army.[95] From 9,600 personnel (2,983 military and 6,617 civilian) in January 1969, the total authorized strength of the Army Staff declined by more than 50 percent by June 1974 to 4,719 personnel (1,898 military and 2,821 civilian).[96] By May 1974, some 571 positions had been eliminated and another 216 transferred to field operating agencies or commands.[97]

Role of the Director of the Army Staff

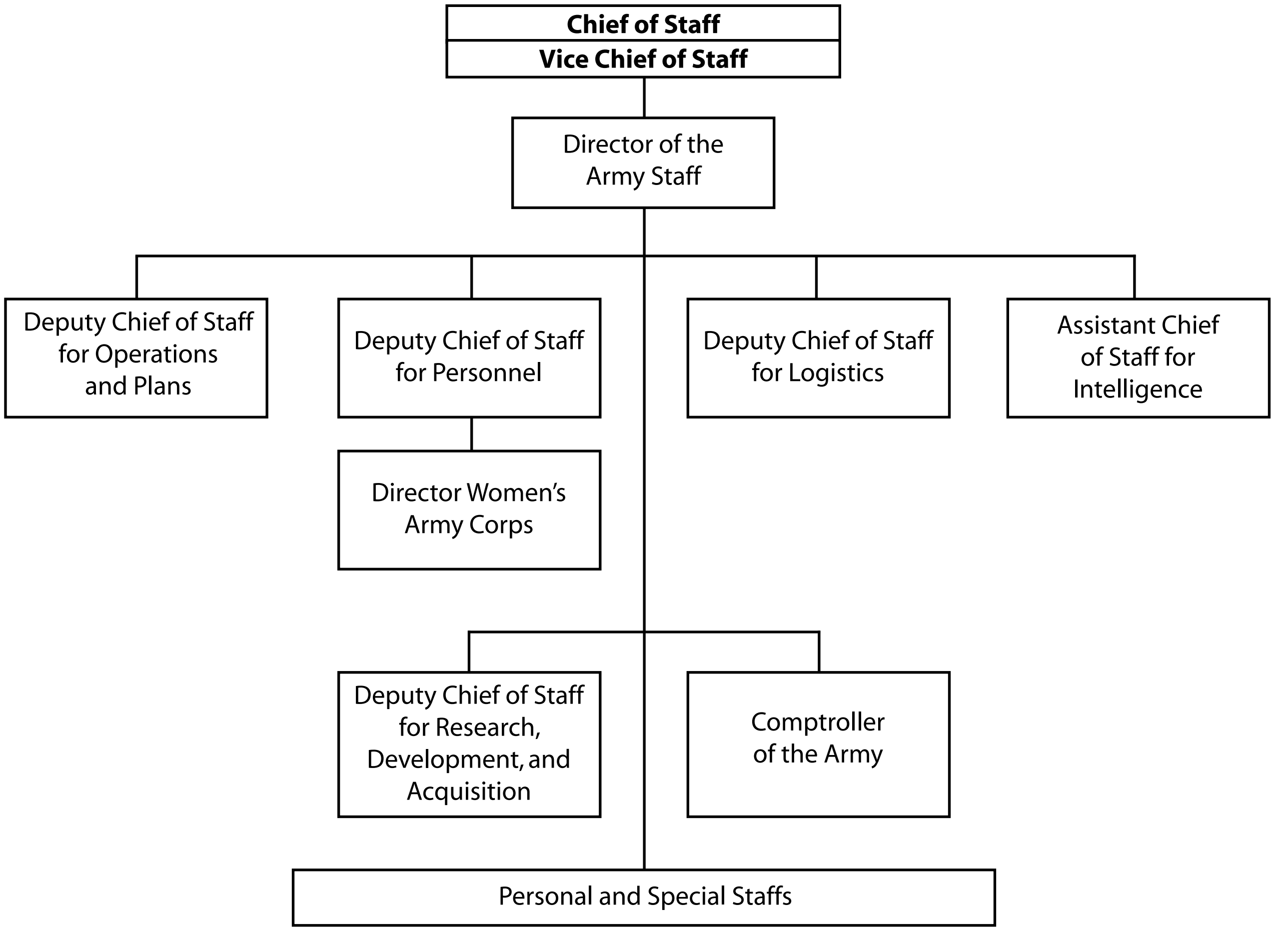
From 1967 to 1974, the assistant vice chief of staff played an important role in the management of the Army ORSA program. Many of the functions of the AVCSA were assumed by the newly created director of the Army Staff (DAS) after 1974, notably the responsibility for day-to-day management of the Army Study System. The position of DAS had first been recommended in the OSD Project 80 Study of 1961, but the office was not established until 1974.[98] The primary function of the DAS, a lieutenant general, was to manage the day-to-day routine of the Army Staff. He was responsible to the chief of staff and the vice chief of staff for "guiding and integrating Army Staff efforts in all Army matters and coordinating the activities of all agencies reporting to the Chief of Staff, Army," and he also served as chairman of the Select Committee (SELCOM) and a member of the General Staff Council and Army Policy Council.[99]

The DAS also supervised the directorates of management (DM), director of management information systems (DMIS), and director of program analysis and evaluation (PA&E), all of which formerly reported directly to the chief of staff. The management directorate was responsible for studying command relationships, conducting internal reviews of Army management, managing the Army Staff, and making recommendations for changes.[100] The director of management was also charged with acting as "the principal advisor to CSA on management of Army studies and as the coordinator for execution of Army Study Program."[101] The specific duties of the director of management with respect to Army studies were as follows:

(7) Establishes policy and guidance on review and analysis.
(8) Provides the principal advisor to the CSA on Army studies, and establishes policy and guidance for the Army Study Program.
(9) Develops Study Planning guidance for Army studies and analyses programs as part of Army guidance and provides the program functional manager in all PPBS activities related to Army studies.
(10) Reviews study programs and related research and analytical projects for balance and mutuality of purpose in addressing Army problems.
(11) Coordinates the study program and HQDA resource allocation for the US Army Concepts Analysis Agency (USACAA), including "lines of credit" for analytical support of HQDA at USACAA.
(12) Insures that right problems are studied, quality of effort is improved, and productive use is made of beneficial results.[102]

The Study Program Management Office (SPMO), formerly the Study Management Office in OCSA, fulfilled the responsibilities of the DAS and the director of management with respect to TASS. The SPMO was redesignated the Study Program Management Agency (SPMA) in 1979, and in 1986 it became a field operating agency of the Office of the Under Secretary of the Army with operational control delegated to the DUSA (OR). At that time, the agency consisted of four to five civilian analysts and two to three military analysts, each of whom was focused on a particular weapons system.[103] As noted above, SPMA was redesignated and combined with the Army Model Management Office in August 1989 to form the U.S. Army Model Improvement and Study Management Agency (MISMA), a field operating agency of the under secretary of the Army with operational control exercised by the DUSA (OR). MISMA was subsequently disestablished in FY 1998 and responsibility for TASS was passed to the Study Program Office set up in the ODUSA (OR), where it remained until the 2001 HQDA reorganization, when it was transferred to the newly established Office of the Army G–8.

FIGURE 2–2—ORGANIZATION OF THE ARMY STAFF AFTER 20 MAY 1974



Source: U.S. Department of the Army, *Organization and Functions of the Army Staff* (Washington, D.C.: Office of the Adjutant General, HQDA, 10 May 1974), p. 1-2.

Note: This was a one-time publication to outline the organization and functions resulting from the 1974 Army Staff reorganization. It was superseded by *AR 10–5*, 1 April 1975 (and later editions thereof). The Special Staff included the adjutant general, surgeon general, judge advocate general, chief of engineers, chief of chaplains, chief of information, chief of the National Guard Bureau, and chief of the Army Reserve. The Personal Staff included the inspector general and auditor general, and for certain purposes, the chief of information, chief of chaplains, judge advocate general, and the director of the Women's Army Corps. For definitions of the various elements of the Army Staff and the functions they performed, see *Organization and Functions of the Army Staff*, pp. 1-3 to 1-5.

Role of the Deputy Chief of Staff for Research, Development, and Acquisition

Prior to the 1974 Army Staff reorganization, the chief of research and development (CRD) played a central role in the management of the Army ORSA program, but the CRD had begun to lose his ORSA management functions even before 1974.[104] During FY 1972, the Office of the Chief of Research and Development (OCRD) "continued to disengage from contract operations research study management" as congressional reductions in funding of contract studies declined and plans crystallized for the sale of the Research Analysis Corporation and termination of its status as a Federal Contract Research Center (FCRC).[105] In the last quarter of FY 1972, the Army Study Advisory Committee concurred in the transfer of responsibility for staffing and monitoring OR studies from OCRD to "the respective agency sponsors within the Army

Staff," and OCRD negotiated a draft support agreement with the Army Materiel Command (AMC) for the transfer of responsibility for contracting OR studies from OCRD to AMC's Harry Diamond Laboratories (HDL).[106] The agreement was implemented in FY 1973 and thenceforth HDL was responsible for procuring and monitoring contracts to support research and development (R&D) studies under the guidance of the coordinator of Army studies in OAVCSA, and, after 1974, the Study Program Management Office, Directorate of Management, ODAS. The Research Directorate of OCRD was reorganized in FY 1973 and its personnel authorization was reduced by 50 percent from 114 to 56.[107] At the same time, the U.S. Army Research Office at HQDA level was eliminated, and the Army Research Office in Durham, North Carolina (ARO-D) was redesignated as the U.S. Army Research Office (ARO).[108]

With the 1974 Army Staff reorganization, the new Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA) absorbed many of the functions of OCRD as well as some functions previously performed by the ODCSLOG.[109] However, the DCSRDA retained few of the CRD's ORSA management responsibilities, although the Army Research Directorate and Office of the DA Chief Scientist within ODCSRDA did provide the principal scientific adviser to the secretary of the Army, the assistant secretary of the Army for research and development, and the chief of staff; directed the activities of the Army Scientific Advisory Panel; formulated and recommended DA guidance and policy "for all basic research, exploratory research, and nonsystems advanced development in support of the DA technology base"; formulated, justified, and defended "the basic research plans, programs, and budget [(except for basic research in the behavioral, social, environmental, and life sciences assigned to other agencies])"; and represented HQDA on various panels, committees, and working groups.[110] However, responsibility for overseeing the human resources R&D program was transferred from OCRD to ODCSPER and responsibility for overseeing Army environmental sciences and environmental quality R&D programs was transferred to the Office of the Chief of Engineers.[111]

Role of the Deputy Chief of Staff for Operations and Plans

Before the STEADFAST reorganization of 1973 and the subsequent reorganization of the Army Staff in 1974, the deputy chief of staff for military operations (DCSOPS) played only a relatively minor role in the Army-wide management of the ORSA program. He oversaw the Strategic Studies Institute at the Army War College and the Strategy and Tactics Analysis Group and had some oversight of the use of models and simulations and other ORSA-related matters. After 1974, however, the deputy chief of staff for military operations, renamed the deputy chief of staff for operations and plans (DCSOPS), was given many of the functions of the former ACSFOR as well as staff supervision of the newly created Concepts Analysis Agency.[112] Thereafter, the DCSOPS was responsible for development and coordination of the strategic studies program and for force development–related models.[113] In addition, the assistant DCSOPS (ADCSOPS) was made the chairman of the Operations Research/Systems Analysis Program Consultant Board; the DCSOPS Technical Analysis Office exercised quality control over models, war games, simulations, and other analytical techniques; the DCSOPS Studies Coordination Office developed and coordinated the strategic studies program to support strategy formulation, problem analysis, and development of Army plans; and the Strategy and Security Assistance Directorate oversaw the Army War College and the Strategic Studies Institute.[114] The DCSOPS also became the HQDA proponent for Officer Personnel Management System (OPMS) Specialty 49—ORSA.[115]

Role of Other Principal Army Staff Officers

Both before and after the 1974 Army Staff reorganization, the other principals of the Army General Staff and Special Staffs normally played only peripheral roles in the Army-wide management of ORSA activities. Generally, their role was to sit on the various committees and councils concerned with Army studies or ORSA matters and to supervise staff support or field operating agencies that employed ORSA methods.[116] For example, the deputy chief of staff for personnel (DCSPER) oversaw the U.S. Army Research Institute for Behavioral and Social Sciences and was responsible for administration of the Army ORSA Officer Specialist (SC 49) Program.[117] The deputy chief of staff for logistics (DCSLOG) had some responsibility for overseeing the conduct of logistical studies and analyses but there was no senior analyst in ODCSLOG to "oversee logistics analysis, provide direction on appropriate goals and tools for analysis, and insure the utility of analysis."[118] However, after May 1974, the Logistics Studies Steering Group (LSSG), formerly the Logistics System Steering Group, reviewed proposed logistical studies, identified possible duplications, and selected studies to be included in the Army's Logistics System Master Plan.[119] A Logistics Models Working Group assisted the LSSG in managing logistics studies by "insuring that maximum use was made of existing logistics models and that duplication in the development of new models was avoided."[120] The assistant chief of staff for intelligence also supervised the conduct of intelligence-related studies and analyses.

The principals of the Special Staff also played a minor role. After 1974, the comptroller of the Army remained responsible for cost and economic analyses.[121] The chief of engineers was responsible for "centralized management of the Chief of Engineers research and development program including activities of the assigned laboratories," for formulating and recommending "guidance and policy on the basic research program of DA in the environmental sciences," and for supervision of the U.S. Army Engineer Studies Group (ESG).[122] The 1974 reorganization also resulted in some changes among those SSAs and FOAs supervised by the Army Staff. As already noted, CAA (a staff support agency) came under the DCSOPS, and OTEA (a field operating agency) reported directly to the chief of staff.[123]

Subsequent Reorganizations of the Army Staff

By 1975, both the Army Staff and OSD acknowledged that the staff reorganization had been successful and that the Army Staff had greatly improved due to streamlining and a decrease in staff layering.[124] The Army Staff and its supporting agencies had been reduced to 5,547 people, the lowest level since the Korean War, and some 3,525 spaces had been transferred from HQDA field operating agencies to combat units.[125] In general, there were no striking changes in the organization of the Army Staff between 1974 and 1985, although several changes in the Army Secretariat and Staff were made. The last major change in the organization of the Army Staff organization during the period 1973–1995 came as a result of the Department of Defense Reorganization Act of 1986 (Public Law 99–433), sometimes called the Goldwater-Nichols Reorganization Act of 1986.[126] The act required changes in the headquarters staffs of the military departments; clarified the roles of the service secretaries and chiefs of staff; imposed reductions on the overall number of personnel assigned to staff billets, including the number of general officers; placed a ceiling on the number of active duty officers on the departmental staffs; and required full integration of the Secretariat and Military (General) Staff of each of the services, especially in the areas of acquisitions, auditing, comptrollership and financial management, information management, research and development, legislative affairs, public affairs, and inspector general activities.

Under the provisions of Goldwater-Nichols, the total number of DA military and civilian employees assigned or detailed to permanent duty with the Army Secretariat and Army Staff was limited to 3,105, of which not more than 1,865 could be Army officers on the Active Duty List. The principal impact of the act with respect to TASS and Army ORSA program was that it designated the under secretary of the Army as the Army acquisition executive and thereby increased emphasis in the DUSA (OR) on acquisition matters; combined the Office of the Assistant Secretary of the Army for Research, Development, and Acquisition with the Office of the Deputy Chief of Staff for Research, Development, and Acquisition and the Office of the Assistant Secretary of the Army for Financial Management with the Office of the Comptroller of the Army; and the assistant chief of staff for intelligence (ACSI) became the deputy chief of staff for intelligence (DCSINT). In most other respects, the 1986 reorganization had little or no impact on TASS or the Army ORSA program.

Reviews of Army Analysis

During the 1960s there were several comprehensive and productive studies of the Army Study System and of Army ORSA activities. The 1964 Bonesteel study, the 1966 Army Study Advisory Committee study, and the 1969 evaluation of TASS led to significant changes in the Army analytical community, including the expansion of in-house capabilities, the establishment of an ORSA training and utilization program for Army officers, and other positive changes.[127] The period 1973–1995 was one of even more constrained resources for all Army activities. Consequently, TASS and the Army ORSA program remained in a constant state of review, adjustment, and improvement. There were no less than five major reviews of the Army's studies and analysis programs during the period, and although none of them resulted in drastic changes, they did serve to correct obvious faults and to improve overall efficiency and effectiveness as well as "customer" satisfaction.

The 1976 Engineer Studies Group Study

In 1976, the U.S. Army Engineer Studies Group (ESG) was tasked by the director of management, OCSA, to assess "the results, uses, and benefits of Army studies."[128] The ESG team, led by Lyle G. Suprise (project director) and Elton H. Underwood (assistant project director) and including all the ESG managers and analysts, evaluated the results, uses, and benefits of a sample of 145 Army studies selected from among 462 studies completed or terminated during FY 1974 and FY 1975.[129] Data were gathered by means of questionnaires completed by study sponsors and users and from examination of other study documents, and the ESG study group came to a number of conclusions and recommendations for improvement of TASS.

The focus of the ESG study was on "the extent to which individual studies achieve stated goals and objectives."[130] The specific objectives were to:

> a. Determine the immediate, residual, and derivative impacts of studies evaluated. Evaluate the cost effectiveness of individual studies that have resulted in tangible benefits.
>
> b. Identify common characteristics/attributes of successful studies. Identify common causes for study failure. Draw inferences from success and failure and make recommendations regarding study efforts and resources.
>
> c. Affirm the validity and usage of available data bases . . . during the development and execution of study efforts. Review existing procedures to determine if study information is being disseminated adequately to preclude duplicating study effort.
>
> d. Contribute to a better understanding of the relative cost effectiveness of in-house and contract studies. Obtain insights into the range of resource levels the Army should commit to and within the study program.
>
> e. Develop criteria for use in evaluating the merits of study proposals.[131]

In general, the ESG study group found that

> overall, the TASS appears to be in better administrative health than its critics have led us to believe. Within agency/command programs, customer satisfactions and demand for studies are high. Studies and analyses were found to be initiated and accomplished in line with applicable directives and regulations. However, there appear to be opportunities for substantial improvement. The study system itself appears to be in a continuous state of change. Even as this study was in progress, revisions to study regulations were being staffed and administrative changes were being made anticipating approval of the revisions. Study program managers, particularly at staff agency/MACOM level appear to have reasonable control of the admittedly imperfect study programs. It is apparent that the reports and approval procedures embodied in TASS have resulted in more thought and care being given to allocation of study resources. The issues addressed by the hundreds of studies always underway range from very narrow functional problems to the most complex planning and policy issues affecting the entire Army and DOD.[132]

With respect to the sample of 145 studies conducted or terminated in FY 1974 and FY 1975, the ESG study group found that approximately 26 percent of the Army Staff studies and 45 percent of the major command (MACOM) studies were conducted in order to meet requirements levied by higher headquarters.[133] The study group also found that although 85 percent of the studies considered achieved most or all of their objectives in the view of the sponsors, users, and study agencies, 45 percent failed to achieve one or more of their objectives.[134] The most frequent causes of failure to meet objectives were too many objectives; trying to structure a non-stable, poorly defined activity; changing roles, missions, and organization of the Army Staff and/or MACOMs during the conduct of the study; changes within the sponsoring organization or study agency; and the inability of methodology to solve the problem.[135] Of those studies that achieved one or more of their objectives, the ESG study group found that 45 percent were used as direct input to a decision or problem; 18 percent were used as input to a planning process; 15 percent were used as input to another study or study phase; 14 percent were used as reference data and planning factors; and 8 percent were not used at all.[136] The study group concluded that

> achieving objectives is not a guarantee that study results will be used. Study results are more likely to be used if: the study management principals are the same from inception to implementation; if the results do not require acquisition of large amounts of new data in order to be effective; if appropriate authorities take approval actions expeditiously; and if the results are delivered on time.[137]

The recommendations of the ESG study group with respect to improvements in TASS were:

> a. Do not now radically change the manner in which individual study programs are developed but revamp the SPG [Study Planning Guidance] to reflect key issues and to distinguish between important and less important priority areas.
>
> b. Study proposals should be evaluated to insure that:
>
> (1) The problem and purpose are clearly defined.
>
> (2) The need, expected results, and *user* are identified.
>
> (3) There are a manageable number of objectives combined with consistent scope and resource estimate.
>
> (4) There is assurance of high-level sponsor interest and a specified sponsor management mechanism (i.e., steering/advising group or manager).
>
> c. The problem of action officer and study advisory group turbulence needs to be resolved. Top management should, as a matter of policy, be sure that individuals assigned to these positions expect to be available for the duration of the study.
>
> d. Executives and commanders need to become more involved early—when the need for a study is established. It may be advisable to establish a threshold above which they must personally approve study undertakings.
>
> e. Results, uses, and benefits data must be recorded for future program evaluation purposes before all people involved in the study execution and implementation have departed. The implementation plan should have a provision for gathering information necessary to a comprehensive and valid approval of results and use.
>
> f. Publish, at least quarterly, a list of all studies completed or terminated during the period.
>
> g. Institute a simple newsletter disseminating items of interest to the study community.
>
> h. Resource levels should be keyed to actual identified need rather than arbitrary level of effort. Cutbacks in the short run can be absorbed with least loss of benefits by:
>
> (1) Curtailing large-scale model and simulation efforts.
>
> (2) Curtailing broad methods and standardization projects.
>
> (3) Selectively reducing contract support.[138]

Many of the ESG study group recommendations were approved and implemented.

1978–1979 Review of Army Analysis

The most influential of the five reviews of Army studies and analysis conducted between 1973 and 1995 was the 1978–1979 Review of Army Analysis (RAA).[139] The 1976 ESG study focused rather narrowly on the benefits of TASS and how the Army studies were used, but RAA attempted to provide a comprehensive overview of nearly all aspects of TASS and the Army analytical community in general.

By 1978, the need for a special review of the Army's organization and structure for the conduct of analysis was manifest. Five years had passed since the 1973 STEADFAST reorganization and the consequent reorganization of the Army analytical community without an assessment of whether or not the Army's analytical organizations were functioning as intended. Moreover, some criticism of the quality and credibility of Army analysis was beginning to emerge. Among the criticisms were allegations that

> (1) Several cost and operational effectiveness analyses have required second efforts.
>
> (2) Cost and schedule projections of acquisition programs have not been uniformly accurate.
>
> (3) Performance of hardware item systems often has not been analyzed in a sufficiently representative set of battlefield conditions.
>
> (4) Quality and value of some of the human resources related studies have been marginal.
>
> (5) Obvious alternatives to significant proposed changes to Army organizations . . . have not been analyzed well.

(6) Alternatives to major force structure change proposals, such as conversion of light divisions to heavy divisions, apparently have not been analyzed well.[140]

Critics also pointed to the "highly decentralized management of Army analysis resources" as a reason for "analysts not working on the most fruitful problems."[141] Such critics saw the obvious solution as greater centralized management of the Army analytical community.[142] The declining support of Congress for funding contracts for Army studies was also a factor.

Following discussions between the Under Secretary of the Army, Dr. Walter B. LaBerge, and the Army DCSOPS, Lt. Gen. Edward C. Meyer, on 11 July 1978, Under Secretary LaBerge issued a study directive for "a basic review of our Army analysis resources, organizations, and procedures" that should produce "specific recommendations for improvement of Army analysis" and be completed by 1 October 1978.[143] Responsibility for the review was assigned to the DCSOPS, and a Special Study Group was formed under the direction of David C. Hardison, the DUSA (OR). In addition to Hardison, the Special Study Group included E. B. Vandiver III (then technical adviser to the DCSOPS) as deputy director and ten senior DA civilians and field grade officers representing the various MACOMs, Army Staff sections, and principal Army ORSA organizations.[144] The Concepts Analysis Agency provided support personnel. The Special Study Group convened on 25 July and finished its work on 29 September 1978. Six months of staffing, review, and decision making ensued before the final RAA report was issued in April 1979.

The research approach adopted by the Special Study Group had four general steps: (1) definition of the Army analytical community; (2) definition of a concept of what Army analysis should be; (3) description of what the Army analysis community currently is and does, to include perceptions, facts, and the Special Study Group assessment of these; and (4) comparison of the current practices with the conceptual or idealized practices to develop findings and objectives/solutions/actions for improvements.[145]

The data required to fulfill the Special Study Group's mission was obtained through interviewing more than one hundred "knowledgeable individuals," a detailed questionnaire administered to seventy-four Army organizational elements in order to inventory the Army's analytical resources, and specialized investigation of selected topics, including:

> The status of manpower and personnel studies in the Army; an in-depth review of how the Army study program is assembled and justified; an examination of the current organizational arrangement of Army analysis resources; the current utilization of military analysts (SC 49); and an exploration of budget strategies.[146]

As part of its deliberations, the RAA study group devised a concept of Army analysis that posited a system with six levels in descending order of scope, as shown in Table 2–1.

The concept of Army analysis proposed by the RAA study group was adopted and became a useful means for describing the focus of studies and analyses and their assignment to one or another of the organizations comprising the Army analytical community.

Perhaps the most controversial part of the 1978–1979 RAA was the supporting study on management of TASS done by the Engineer Studies Center (ESC) and included as Appendix F ("Managing the Army Study Program for Effectiveness") in Volume II of the final RAA report. As has already been noted, the ESC substudy severely criticized the performance of the DUSA (OR) and the higher-level management of TASS and went so far as to recommend that ODUSA (OR) be disestablished and a new Army Study Council be set up to manage TASS. The ESC proposal was rejected, and it probably came as no surprise when the Select Committee (SELCOM) approved the recommendation of the RAA study group that the ESC be restricted to "engineer-peculiar" studies in the future.[147]

In Chapter 15 of their report, the RAA Special Study Group recommended that some thirty-nine separate actions be taken to improve the Army analytical community.[148] The Joint Select Committee (Augmented) then met on 22 March 1979 and approved the "central thrust, philosophy and goals of the study" as well as all study recommendations "except those related to the proposed Army Study Council and the numbers of, and transfers of personnel resources," which were deferred pending review by the director of management and the DAS.[149] The Joint SELCOM (Augmented) also decided that: (1) the SELCOM would review and approve study guidance and programs (*vice* the rejected Army Study Council); (2) CAA would be assigned to the DAS to provide analytical support for the entire

Table 2–1—Concept of Army Analysis—System Levels

Level	*Description*	*Principal Element Responsible*
6	Total Army	Concepts Analysis Agency (CAA)
5	Theater Force	CAA
4	Major Organization (Brigade, Division, and Corps)	Combined Arms Operations Research Activity (CAORA)
3	Vertically Integrated Functional Systems (Air Defense, Intelligence, Fire Support, etc.)	TRADOC Systems Analysis Activity (TRASANA)
2	Combined Arms and Support Battle Group (Company Team, Battalion Task Force)	TRASANA
1	Item System (Tank, Helicopter, Howitzer, etc.)	Army Materiel Systems Analysis Activity (AMSAA)

Source: RAA I, p. 3-2, Table 3-1 (System Levels), and p. 3-16, Table 3-2 (Key Analytical Organizations).

Army Staff and would have an enlarged mission and resources; (3) the analytical capability of CACDA would be increased; (4) a Study Program Coordination Committee would be established as a subcommittee of the SELCOM; (5) SPMO would be enlarged with a civilian super grade chief; (6) the DAS would recommend the sources of analytical spaces needed to satisfy the ODCSPER requirement for nine analysts at the Army War College and eighteen in ODCSPER; and (7) the DAS would review the role and resources of ESC, which would be focused in the future on support of engineer-peculiar studies.[150]

1985 Review of Army Analysis Extended

By 1984, most of the approved recommendations of the 1978–1979 Review of Army Analysis had been implemented. On 5 June 1984, in a memorandum for the DAS, the Under Secretary of the Army, James R. Ambrose, noted that "because analysis is so important to our work, I believe its health should be reviewed periodically" and proposed yet another review of the Army analytical community that would extend the original RAA to include those areas not covered in the 1979 report: testing and evaluation, intelligence studies, costing studies, and vulnerability/lethality studies.[151] OCSA was designated as the study sponsor, and the DUSA (OR) and the technical adviser to the DCSOPS were designated as the study codirectors.[152] The codirectors were charged with furnishing the final recommendations of the study to the chief of staff and under secretary of the Army by 1 October 1984, with a final report to follow.[153] The "Terms of Reference" issued on 2 July 1984, stated that the purpose of Review of Army Analysis Extended (RAAEX) was "to further improve the contribution made by analysis to illumination of issues of interest to the Army and to the solution of Army problems building upon the improvements initiated with the Review of Army Analysis conducted in 1978."[154] The objectives of the review were stated as follows:

> a. Assess the extent to which the actions taken as a consequence of the prior review have improved the contribution made by analysis to illumination of issues of interest to the Army and to the solution of Army problems.
>
> b. Identify practicable actions which would improve the following:
>
> (1) Problems Selected for Study and Analysis—The Army analysis community should work mainly on important issues in need of illumination and on problems whose solutions would be of high benefit to the Army.
>
> (2) Quality of Work—Army analyses should be pertinent, consistent, valid, and credible.
>
> (3) Productivity—Army analyses should be efficiently conducted and resources should be at least adequate to minimal needs.
>
> (4) Organizational Arrangements—The Army analysis community and supporting activities should be organized to facilitate efficient

conduct of an integrated program of studies, to provide proper guidance and control of studies and analyses, to encourage coordination of related study activities and to minimize analysis gaps and needless overlaps.

(5) Support to the Army in the Field—The Army analysis community should provide support to the functions of training, planning, and operations.[155]

The "Terms of Reference" also prescribed the scope of RAAEX and defined the overall task to be performed—"to assess the Army's current analysis system and its uses and to propose specific improvements in policy, procedure, programs, and organizations"—as well as sixteen specific tasks.[156]

Pursuant to the tasking letter and "Terms of Reference," the RAAEX study team assembled on 9 July 1984 to review the study purpose and objectives and to develop the study approach. Research activities began one week later. The team consisted of twenty-one members led by the codirectors, Walter W. Hollis (the DUSA-OR) and E. B. Vandiver III (the technical adviser to the DCSOPS).[157] Team members represented ODUSA (OR); the Office of the Director of Management, OCSA; the principal Army Staff sections; HQ TRADOC; HQ AMC; the Military District of Washington; and the principal Army analysis agencies (CAA, AMSAA, OTEA, TORA [TRADOC Operations Research Activity], ARI [Army Research Institute], and LEA [Logistics Evaluation Agency]).

The approach adopted by the RAAEX study team was to assign the various tasks to individuals or small (one- to three-person) committees, which operated more or less independently.[158] Periodic in-process reviews were conducted to review progress, receive feedback from the study group, and receive guidance from the study leaders. The collection of data for the study was accomplished primarily by means of questionnaire addressed to Army analysis activities, and the two study codirectors also interviewed senior officers and producers of analysis.

In general, the findings of the RAAEX study group were that

> the activities comprising the Army analysis community are properly assigned and missioned. Information on unsatisfied demand would indicate that more resources are needed; however, this is a finding that could probably be derived from a detailed examination of any function in the Army. This study has interpreted the unsatisfied demand as an indication of the usefulness of the community to the Army, and has, to the extent possible, sought improvements that do not require substantial additional resources. It should be noted though that the numbers of people available to do the work and, to a lesser extent, the statutory limitations on levels of remuneration of those personnel do have a negative impact on the strength, quality and responsiveness of Army analysis.[159]

Based on their findings, the study group recommended a number of actions to improve the functioning of the Army analytical community.[160] The general thrust of the action recommendations were grouped into five categories as follows:

STUDY PROGRAM MANAGEMENT

- Clarify definitions of studies and analysis with provisions for appropriate degrees of management
- Better define major Army issues to address in the Army Study Program and achieve better program balance

STUDY AND MODEL INTEGRATION

- Develop a top down driven Army-wide mission area analysis process to provide greater horizontal and vertical integration of force and combat developments
- Reaffirm commitment to the hierarchy of models and the Army Model Improvement Program

QUALITY OF ANALYSIS

- Improve policy and procedures for assuring quality of Army analysis
- Emphasize analysis research efforts to provide for growth in future capability
- Improvement management of the professional development of military and civilian operations research analysts

FUNCTIONAL SUPPORT

- Increase analysis support to the Army in the field
- Increase capability for conducting analysis of manpower and personnel issues
- Increase capability for conducting analysis of logistics issues

ANALYSIS INTERFACES

- Increase interaction with analysis activities external to the Army
- Increase integration of testing and analysis
- Strengthen interface between cost analysis and other Army analysis

- Improve procedures for providing essential vulnerability and lethality input data.[161]

With respect to its task of assessing the contribution made by the 1978–1979 RAA, the RAAEX study group found that all but two of the thirty-nine approved recommendations of RAA had been implemented and that the overall effect of RAA had been "highly beneficial."[162] They specifically cited:

> The new generation of combat and support simulations being developed under the Army Model Improvement Program and the general usefulness of the concept of a hierarchy of integrated models; improvements in CAA support to HQDA; expansion in analysis capability at the TRADOC Combined Arms Center; increased emphasis on quality control programs and professional development programs; and better accounting for the resources associated with the Army Study Program.[163]

The RAAEX study team also recognized the efficacy of the general concept of analysis enunciated by the RAA study group, noting that it "has served to sharpen the focus of analytical agencies, and has served as a unifying mechanism for the Army's geographically and organizationally dispersed analytical community and has fostered coordination and cooperation within the community."[164]

The RAAEX study team completed its work on 31 August 1984, and its final report was published in March 1985 following review and approval by the Joint SELCOM (Augmented) on 1 February 1985.[165] The Joint SELCOM (Augmented) approved most of the RAAEX study group recommendations, but ten items were approved on a conditional basis or assigned for further study, and three items were disapproved: (1) making the Army Model Management Office a HQDA field operating agency reporting to the DCSOPS; (2) co-location of the Army Model Management Office with the Concepts Analysis Agency; and (3) assignment of the Army Research Institute to the DAS.[166]

1989 Army Management Review

In the summer of 1989, the Army undertook a comprehensive review of Army management under the chairmanship of John S. Doyle Jr. and Lt. Gen. John J. Yeosock. As part of that review, the DUSA (OR) was asked to examine three issues: (1) consolidation of Army test and evaluation organizations; (2) consolidation of Army analytic organizations; and (3) transition of test centers to government-owned, contractor-operated (GOCO) status.[167]

To accomplish his assigned tasks, Hollis assembled a team of test, evaluation, and analysis experts to provide him with advice and to frame the positions of the various headquarters and agencies involved. The team members acted as individuals rather than representatives of their command/agency, and the recommendations made to the chairmen of the Army Management Review Task Force (AMRTF) were essentially those of Hollis.[168] Hollis' report to AMRTF was submitted on 15 August 1989 and contained a wealth of data, including personnel strengths and costs, regarding the state of the Army test and evaluation and analytical community at that time. Three alternatives were presented regarding the consolidation of Army test and evaluation organizations and three alternatives were presented regarding the consolidation of Army analytical organizations. The report forwarded to the AMRTF co-chairmen contained four recommendations regarding the three assigned issues. The recommendations were to:

1. Create from the resources of the Test and Evaluation Command (TECOM), Test and Experimentation Command (TEXCOM), Operational Test and Evaluation Agency (OTEA), and other smaller elements, an Army Test Command which would report to the commanding general, AMC, and have the mission of "executing the testing, technical and operational, required in support of the acquisition process and such other testing as is required in support of the Army role as executive agent for chemical munitions, small arms ammunition, production acceptance testing, stock pile surveillance testing, etc."[169]

2. Create from the resources of the Army Materiel Systems Analysis Activity (AMSAA), the evaluation resources of OTEA, the assessment element of TECOM, and the Integrated Logistics Support Division of LEA, an Army Evaluation and Analysis Agency (AEAA) with the mission of "preparing the Army's independent assessments and evaluations of the results of testing of systems under acquisition."[170]

3. Retain the existing Army analytical agencies with some realignment of functions and assets across agencies and reductions in the TRADOC Analysis Command (TRAC).[171]

4. Develop a plan to convert the mission of Jefferson Proving Ground to a GOCO operation at Yuma

> Proving Ground when that mission is transferred to Yuma Proving Ground under the Base Closure Act and to use the experience of that conversion as the basis for "further decisions regarding the expansion to the GOCO concept of operation within the Army Test Command."[172]

In general, the recommendations made by the DUSA (OR) to the AMRTF were approved and adopted. On 15 November 1990, OTEA was redesignated the U.S. Army Operational Test and Evaluation Command (OPTEC) and absorbed TEXCOM, formerly a TRADOC organization. The Army Evaluation and Analysis Agency was also formed under the staff supervision of the DUSA (OR). Only minor changes were made in the missions, organization, and resources of the various Army analytical agencies: AMSAA was retained as a separate AMC agency, TRADOC analysis responsibilities and resources were reduced somewhat, and there was some cross-leveling of personnel among the various organizations.

"Army Analysis Requirements for the Nineties" (AAR 90) and the Vanguard Study

In March 1990, Lt. Gen. Gordon R. Sullivan, then the DA DCSOPS, asked the DUSA (OR) to again review the organization and resourcing of the Army analytical community.[173] Hollis subsequently chartered a study entitled "Army Analysis Requirements for the Nineties" (AAR 90), which was performed by John A. Riente (technical adviser to the DCSOPS), Daniel Shedlowski (deputy director for strategic analysis, CAA), and Michael F. Bauman (deputy commander, TRAC).[174] The changes in the Army analytical community proposed by Riente, Shedlowski, and Bauman in their October 1990 study report were subsequently incorporated into the recommendations of the Project Vanguard study group, and, after some further refinement at the direction of the Army's vice chief of staff, were implemented in September 1991.[175]

Both the AAR 90 study and the Vanguard study focused on the eight principal Army analytical organizations: CAA, TRAC, AMSAA, LEA, ESC, the Strategic Studies Institute (SSI), the Cost and Economic Analysis Center (CEAC), and the RAND Arroyo Center.[176] The stated goal of Project Vanguard was to identify alternative analytical organizations that meet the future needs of core processes at reduced resource levels with high-quality products using the best available analytical tools.[177] To that end, the Vanguard study group developed a concept for "four Centers of Excellence for Army analysis and two functional organizations providing functional area analysis," which was projected to result in an overall reduction in manpower of 25 percent.[178] The four Centers of Excellence were to be the following:

(1) **RAND Arroyo Center** – to conduct analysis that supports assessment of policy and broad strategic issues.

(2) **Strategic/Force Evaluation Center** – to conduct analysis that supports force planning and assessments of strategic concepts and broad military options, supports Cost and Operational Effectiveness Analysis (COEA), supports crisis actions and deliberate planning and provides logistics and personnel study support to HQDA.

(3) **Force Integration Analysis Center** – to conduct analysis that supports the Concept- Based Requirements System (CBRS), supports COEA's, conducts force design studies that support force development and provides training studies to support the force integration process.

(4) **Systems Analysis Center** – to conduct system analysis support, supports COEA's, provides independent materiel evaluations, and an authoritative source for system performance data.[179]

The two functional organizations proposed by the Vanguard study group were to be the following:

(1) **Cost and Economic Analysis Center** – to develop independent cost estimates for major systems, force cost estimates, operational & support (O&S) cost factors and supports resource allocation.

(2) **COEA Integrating Activity** – to integrate all the support provided by the Centers of Excellence for COEA's.[180]

To achieve the goal of establishing the four new Centers of Excellence and two functional area analytical organizations, the Vanguard study group proposed to shuffle the Army's existing analytical resources to:

1. Reduce and redesignate CAA as a DCSOPS FOA to be called the Strategic and Force Evaluation Center to which would be attached

for administration a fifteen-man staff support activity to conduct COEA integration reporting to the DCSOPS;

2. Reduce and redesignate TRAC as a TRADOC FOA to be called the Force Integration Analysis Center "to conduct analysis for combat, training, doctrine, and force design/development across the spectrum of conflict";
3. Reduce and redesignate AMSAA as an AMC FOA to be called the Systems Analysis Center "to conduct analysis and provide quantitative information and data that contributes to Army/AMC decision making on weapons, logistics systems and resource management";
4. Reduce CEAC, the mission and functions of which would be unchanged;
5. Eliminate LEA, a FOA of DCSLOG, and transfer its functions of logistics force analysis to the Strategic Force Evaluation Center;
6. Reduce the RAND Arroyo Center, the Army's sole Federally Funded Research and Development Center (FFRDC) for policy and strategy, to sixty professional staff-years of effort; and
7. Eliminate ESC, a FOA of the Office of the Chief of Engineers.[181]

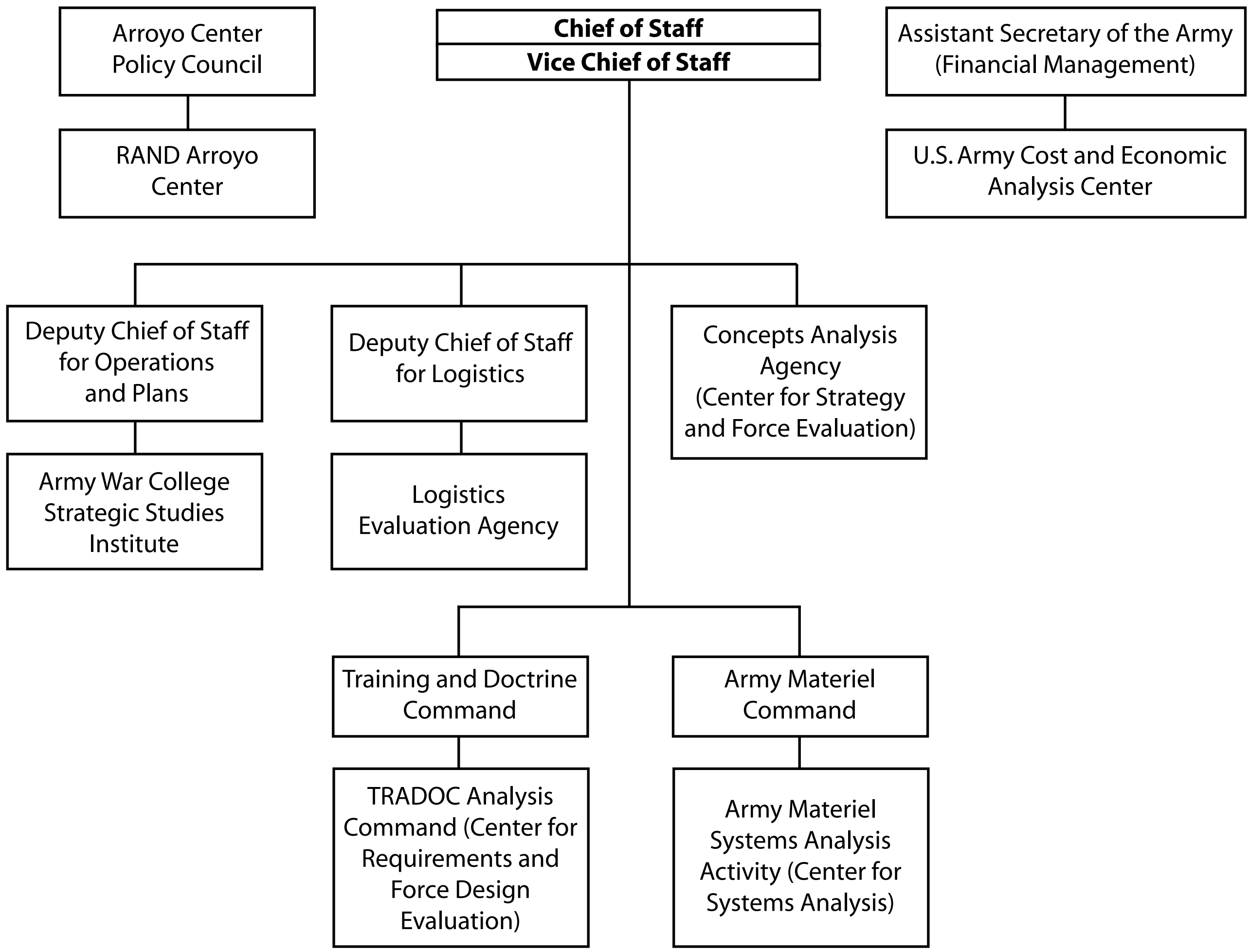
Following considerable discussion among key Army Staff principals, the MACOM commanders, and the directors of the various Army analytical organizations, the plan for restructuring the Army analytical organizations was briefed to the Army vice chief of staff, then General Gordon R. Sullivan, on 1 February 1991.[182] General Sullivan directed that plans for implementation of the reorganization be prepared, and on 23 September 1991, the newly appointed (June 1991) vice chief of staff, General Dennis J. Reimer, issued instructions for the restructuring and realignment of Army analytical agencies.[183] Although the AAR 90 and the VANGUARD study groups both recommended rather radical reorganization of the Army's analytical organizations, in the end only relatively minor adjustments in missions, organization, and resource allocations were made. In his message implementing the changes, General Reimer noted:

> Army will institutionalize concept of centers of excellence for its key in-house analysis capabilities. Centers will maintain Army's leadership within Department of Defense for methods and models to conduct studies, especially those involving airland operations, requirements, and capabilities. Centers will leverage opportunities for improving quality and efficiency.[184]

In essence, the Army adopted the Center of Excellence proposals of the VANGUARD study group but without the formal redesignations, reorganizations, and wholesale personnel shifts of the VANGUARD recommendations. CAA was retained as a staff support agency of the Army chief of staff reporting to the DAS, was designated as the Army's Center for Strategy and Force Evaluation, and was charged with conducting studies to assess strategy, strategic concepts, and broad military options as well as to evaluate readiness, capabilities, and requirements for current, programmed, and future forces.[185] Similarly, TRAC was designated as the Army's Center for Requirements and Force Design Evaluation and was charged with conducting studies to support the Army's Concept-Based Requirements System, force design and structure, battlefield requirements, and Army training strategy. AMSAA remained a separate element of AMC and was designated as the Army's Center for Systems Analysis—"the authoritative Army source for systems performance assessments and data"—and was charged with providing systems analysis and independent materiel evaluations. SSI was not merged with CAA but remained an element of the Army War College, its research program to be coordinated by the DA DCSOPS. CEAC remained a field operating agency of the assistant secretary of the Army (financial management) without change of mission. LEA also remained subordinate to the DCSLOG, who was charged to "ensure coordination of logistics implications of CAA's assessment of OPLANs [Operations Plans] and CONPLANs [Contingency Plans] with related activities at USALEA." Support for the RAND Arroyo Center was established at 100 professional staff years per year for the period FY 1992–FY 1997. In addition, as recommended in the VANGUARD study, ESC was disestablished.[186] The COEA Integration Agency proposed by the VANGUARD study group as a staff support agency of the DCSOPS was not formed.[187] The 1991 restructuring and realignment of the principal Army analysis organization resulted in the structure shown in Figure 2–3.

General Reimer's implementation message also established manpower levels for each of the

Figure 2–3—Army Analysis Agencies after 23 September 1991



Source: DAMO-ZDS Information Paper, Figure 2 (Restructured and Realigned Army Analysis Agencies—HQDA Implementation Concept).

organizations mentioned with a view to achieving savings by "streamlining process for cost and operational effectiveness analysis, minimizing overhead structure, and maximizing efficiency."[188] The suggested levels of total civilian plus military manpower to be achieved by the end of FY 1993 were the following: CAA, 230 personnel; TRAC, 500 personnel; and AMSAA, 475 personnel.[189]

Subsequent Reviews

Of course, comprehensive reviews of the Army analytical community continued after 1995. In February 1996, the Army vice chief of staff requested that the DUSA (OR), aided by CAA, examine the option of making CAA the sole source of analysis support to HQDA by assuming control of contracting for HQDA analytical support and of the Army's Federally Funded Research and Development Centers, including the RAND Arroyo Center.[190] The study, conducted by Daniel Shedlowski (CAA), as team director, and Vernon M. Bettencourt Jr. (ODUSA [OR]), Steven Siegel (CAA), and Jeffrey Hall (CAA), reviewed the organization, functions, and resources of CAA, MISMA, LEA, ARI, and other HQDA staff support and field operating agencies. A more comprehensive review was included in the "Revolution in Analytical Affairs—XXI" initiative begun in 1997.[191] That study, sponsored by the DUSA (OR) and conducted by Daniel J. Shedlowski (CAA), David J. Shaffer (AMSAA), and Margaret Fratzel

(TRAC), sought "to determine what revolutionary changes are needed in the Army analysis community" to meet "the analytical demands of its analysis customers in a decision environment of increased and changing demands and under the constraints of reduced resources."[192] The principal recommendations of the study team were:

> (1) Analytical agencies accelerate the trend of strategic partnering and fully embrace the strategic partnering concept with selected customers; (2) As the concept matures, expand strategic partnering to include alliances with contractors, FFRDCs, and other analytical agencies, refine the organizational concept of the parent organization to provide support of the concept and formally recognize the importance of the roles of the analysts serving as strategic partners; (3) Focus on information technology initiatives that can be leveraged to support the strategic partner concept and quick turn-around capability.[193]

Impact of the Five Major Reviews

The five major reviews of Army analytical organizations conducted between 1973 and 1995 resulted in a number of relatively minor changes in the structure of the Army analysis community, some cross-leveling of resources, and some improvements in the overall efficiency and effectiveness of the Army ORSA program. Only one Army analytical organization, the Engineer Studies Center, was actually eliminated, and no new analytical organizations were created. Throughout the period, the various Army analytical organizations strived continuously to improve their internal efficiency and effectiveness. Overall, the changes made as a result of the five studies conducted between 1973 and 1995 served to focus the work of the existing analytical agencies and to strengthen their ability to carry out their assigned missions.

Management of Resources for Army Studies and Analyses

In general, the period 1973–1995 was one of constrained resources, particularly after 1979 when Congress severely cut back funding for contract research, but the funds and manpower allocated to the Army analytical community appear to have been sufficient for its needs. In his keynote address to the thirtieth MORS in 1981, the former DUSA (OR), Wilbur B. Payne noted that

> in the period between 1949 and 1962, the defense expenditures on military operations research increased about tenfold. Although I can't prove it, I suspect that it has increased at least a factor of five in the past decade and probably more. In-house or on contract, as near as I can compute it, the current level of effort of the Army supports about 1,500 professional man-years per year. . . . [*re* the number of organizations] the estimate that emerged would still be one of steady growth with a doubling period of about 10 years.[194]

When asked specifically about the sufficiency of money and manpower during the period, none of the high-level Army ORSA managers interviewed acknowledged any serious shortfalls and dismissed the question with the comment, "It was not a problem."[195]

Although there was some centralized, high-level coordination of the resources dedicated to the Army Study System, and the DUSA (OR) provided policy and guidance governing the overall conduct of the Army ORSA program, the management of the resources of money and personnel required to conduct Army studies and analyses was decentralized. Elements of the Army Secretariat and the Army Staff planned, programmed, and budgeted for those study and analysis activities under their direct control and the MACOMs did the same. Thus, resources for the operation of CAA were managed by the DCSOPS (later the DAS), of AMSAA by HQ AMC, and of TRAC by HQ TRADOC. There were two principal exceptions to this decentralized management process. First, the Study Program Management Office in the Office of the DAS centrally managed the money for contract studies related to Research, Development, Test, and Evaluation. Second, the DCSPER in coordination with the DUSA (OR) centrally managed funding and personnel allocations for the Army ORSA Officer Specialty Program.

Funding of Army Studies and Analyses

As is the case with earlier periods, the costs of running the Army's analytical organizations during the period 1973–1995 are difficult to ascertain with any degree of thoroughness or accuracy.[196] Little comprehensive cost data seems to have survived—at least it is not readily accessible—and the decentralized process of funding the Army Study System, of which Army ORSA activities were only a part, makes the problem even more difficult. For the most part, only a few "snapshots" are available, connected with the conduct of one or another of the five reviews of the Army analytical community conducted during the period.

With few exceptions, Army studies and analyses, both in-house and contract, were normally funded by the Military Pay and Allowances, Army (MPA) appropriations; Operations and Maintenance, Army (OMA), appropriations; and Research, Development, Test, and Evaluation (RDTE) appropriations.[197] Funds for Army studies and analyses were programmed and budgeted as part of the normal Army programming and budgeting process. Requirements were presented, defended, and included in the programs and budget requests of successively higher echelons, and the Study Program Management Office provided information on approved contract studies to program directors for use in the development of the budget.[198]

The August 1976 Engineer Studies Group review of Army studies attempted to analyze the costs associated with the 462 Army studies completed or terminated during FY 1974–FY 1975.[199] Of the total, in-house studies accounted for about two-thirds of the studies performed but less than two-thirds of the total costs.[200] For the 462 studies, the in-house costs were $68,160,000 and contract costs were $38,938,300, for a total of $107,098,300.[201] The ESG study team also found that the "average" cost for each in-house study was $223,500 (4.47 professional man-years) and $248,000 for each contract study, for a combined average cost of $231,800 for each of the 462 studies completed or terminated in FY 1974–FY 1975.[202] They also found that roughly one-third of the studies in their sample had a low rate of return on the resources invested, that "large-scale model/method/standardization developments are very expensive and risky ventures," that "low return on study resource investment is associated with discontinuities in study management (changes in actions officers, sponsor representatives, Study Advisory Group principals, or in the study agency)," and that "a very long or phased study was found to be a prime candidate for a low-return rating."[203] The data provided by the ESG study was limited to the 462 studies completed or terminated in FY 1974 and FY 1975 and thus cannot be used to either measure the overall adequacy of study resources or make general conclusions regarding the overall studies and analysis program from 1973 to 1995.

The most thorough assessment of the costs of the Army analytical community undertaken during the period under consideration was that associated with the 1978–1979 Review of Army Analysis. The RAA study group not only reviewed the budget process as it existed in 1978 and the impact of restrictions on contract studies imposed by the 95th Congress but also provided a detailed description of the FY 1978 expenditures and FY 1979 funding requests for Army analytical activities and laid out a budget strategy for the future.[204] As shown in Table 2–2, the RAA study group estimate of the total cost of Army analytical activities in FY 1978 was about $139 million, of which about $128 million (92 percent) were direct costs and about $11 million (8 percent) were indirect costs.[205] As shown in Table 2–3, about $115 million (83 percent) of the costs were for in-house analytical activities and about $24 million (17 percent) were for contract activities. The distribution of direct costs by budget category was the following: Military Pay and Allowances, Army (MPA), about $19 million (14 percent); Operations and Maintenance, Army (OMA), about $54 million (41 percent); and Research, Development, Test, and Evaluation (RDTE), about $56 million (45 percent).[206] With respect to Tables 2–2 and 2–3, note that data for two major Army users of ORSA, the Operational Test and Evaluation Agency (OTEA) and the Cost and Economic Analysis Center (CEAC), are missing. Despite their shortcomings, the two tables present a snapshot of Army studies and analysis expenditures that is representative for the entire period 1973–1995 in terms of the proportionate distribution.

As shown in Table 2–4, the total FY 1979 funding request for Army studies and analysis amounted to some $143 million, of which MPA funding represented abut $20 million, OMA funding represented about $57 million, and RDTE funding about $67 million.[207] The distribution of the total Army funding request by method of performance was $107,956,000 in-house, $7,296,000 OMA contract, and $27,829,000 RDTE contract. Congress decremented the appropriation requested by some $8,988,000 in the authorization bill and by some $19,264,000 in the appropriation bill. Customer funding accounted for another $8,796,000 in Army studies and analysis funding.

Table 2–2—Estimated Cost of Army Studies and Analysis for FY 1978
(Thousands of Dollars)

		Source of Funds				
			Direct			
Organization	*Total Cost*	*Indirect*	*Total*	*MPA*	*OMA*	*RDTE*
HQDA	7,355	0	7,355	1,530	2,495	3,330
HQDA SSA and FOA	41,079	2,148	38,931	5,580	14,060	19,291
TRADOC	37,908	760	37,148	9,935	24,019	3,194
DARCOM	52,193	7,958	44,235	1,370	12,855	30,010
Other MACOMs	480	0	480	240	240	0
Army TOTAL	139,015	10,866	128,149	18,655	53,669	55,825

Source: RAA II, app. D, pp. D-I-19 to D-I-22.
Note: Table 2–2 is a corrected and abbreviated form of the original estimate for FY 1979.

Table 2–3—FY 1978 Army Studies and Analysis Funding by Method of Performance
(Thousands of Dollars)

		Method of Performance		
			Contract	
Organization	*Total Funding*	*In-House*	*OMA*	*RDTE*
Headquarters, Department of the Army	7,355	3,025	1,000	3,330
Staff Support Agency (SSA) and Field Operating Agency (FOA)	41,079	31,427	576	9,076
Training and Doctrine Command (TRADOC)	37,908	32,747	2,661	2,500
United States Army Materiel Development and Readiness Command (DARCOM)	52,193	47,037	558	4,598
Other Major Commands	480	480	0	0
Army TOTAL	139,015	114,716	4,795	19,504

Source: RAA II, app. D, p. D-I-22.

The cost data included in the 1978–1979 RAA are unsurpassed for thoroughness. Subsequent reviews of the Army analytical community contained only scattered and limited cost data. For example, in laying out the alternatives for reorganization of the Army test and evaluation and analytical agencies in his report to the Army Management Review Task Force in 1990, the DUSA (OR) cited the then current and projected payroll costs for various Army analytical agencies as shown in Table 2–5.

In his 13 November 1991 briefing for AORS XXX on the results of the restructuring and realignment of Army analytical agencies, John Riente, the technical adviser to the DCSOPS, noted that as of 1990 there had been an overall 15–20 percent decline in the resources allocated to Army analysis since 1970.[208] Resources for CAA had declined by 25 percent during the period, for TRAC by 15 percent, and for Army FFRDCs (i.e., the Arroyo Center) by 50 percent. Only for AMSAA did the resources increase (by 50 percent) between 1970 and 1990. Riente also noted that in FY 1990, the cost of operating selected Army in-house and FFRDC analysis organizations were some $95.7

Table 2–4—Funding Request, Appropriation, and Method of Performance for FY 1979 Army Studies and Analysis (Selected Elements) (Thousands of Dollars)

Organization	*Funding Request*	*Appropriation*		
		MPA	*OMA*	*RDTE*
Deputy Under Secretary of the Army for Operations Research	335	55	280	0
Office of the Army Chief of Staff, Study Program Management Office	130	60	70	0
Concepts Analysis Agency	8,803	2,845	5,958	0
Strategic Studies Institute	1,557	830	727	0
Logistics Evaluation Agency	3,516	100	3,416	0
Engineer Studies Center	1,747	225	1,522	0
Combined Army Combat Developments Activity	5,152	1,605	3,547	0
TRADOC Systems Analysis Activity	8,667	810	7,857	0
Army Materiel Systems Analysis Activity	14,892	465	1,929	12,498
TOTAL (Selected Elements)	44,799	6,995	25,306	12,498
Army TOTAL	143,081	19,515	56,646	66,920

Source: RAA II, app. G. Table G-I-1.

million, as shown in Table 2–6. He also noted that 75 percent of the professional staff years (PSYs) and 67 percent of the dollar costs were associated with in-house analysis activities, while contract and FFRDC analysis activities accounted for 25 percent of the PSYs and 33 percent of the dollar costs.[209]

The Management of Army ORSA Personnel

The decision taken by Army leaders in the mid-1960s to increase the Army's in-house ORSA capabilities led to an increase in the number of both military and civilian ORSA specialists and managers and to improvements in their education and training.[210] The August 1966 report of the Army Study Advisory Committee on the Army's ORSA personnel requirements set forth in some detail the existing management of both military and civilian ORSA personnel and proposed a number of changes and improvements. The Army Study Advisory Committee's recommendation that the Army establish a formal program for the recruitment, development, and career management of Army officers qualified as ORSA specialists or executives was realized with the creation of the ORSA Officer Specialty Program in March 1967. Thereafter, the Army had a systematic program for the management of Army officer ORSA assets, and as time went on the program continued to be refined. In the late 1960s positive steps were also taken to improve Army management of civilian ORSA assets. By 1973, both the military and civilian programs were functioning well and provided the Army with a substantially improved means of managing its in-house ORSA personnel.

To advise Army leaders on both military and civilian ORSA personnel matters, an ORSA Program Consultant Board was created in 1974 under the chairmanship of the assistant DCSOPS (ADCSOPS).[211]In 1985, the ORSA Program Consultant Board became the Joint Civilian and Military ORSA Advisory Committee.[212] Cochaired by the Officer Personnel Management System (OPMS) Functional Area (FA) 49 Personnel Proponent (in turn, the DCSOPS; the commanding general, Combined Arms Center; and the commanding general, TRADOC) and the functional chief's representative (FCR) for the Engineers and Scientists Career Program 16 Series 1515 Subprogram (the director, AMSAA), the committee met twice a year to provide guidance on topics of interest to the Army ORSA community. The chief of the FA 49 Proponency Office and the FCR were

TABLE 2–5—PAYROLL COSTS OF PRINCIPAL ARMY ANALYSIS ORGANIZATIONS, FY 1990–FY 1995 (MILLIONS OF DOLLARS)

	Fiscal Year						
							Total
Agency	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1991–1995*
Concepts Analysis Agency	16	15.4	15.97	16.21	16.46	16.46	80.5
TRADOC Analysis Command/Center	28	28	28	28	28	28	140
TRADOC (Other)	—	1.44	1.44	1.44	1.44	1.44	7.20
Army Materiel Systems Analysis Activity	34.8	35.59	44.1	44.2	44.2	44.2	212.294
Logistics Evaluation Agency	7.0	5.57	5.80	5.94	6.00	6.00	29.31
Cost and Economic Analysis Center	9.0	8.58	8.71	8.85	8.98	8.98	44.1
Engineer Studies Center	4.0	3.84	3.84	3.84	3.84	3.84	19.2
TOTAL	> 98.8	98.42	107.86	108.48	108.92	108.92	532.6071

Source: Memo, Hollis for Doyle and Yeosock, 15 Aug 89, sub: Army Management Review, Encl 4 (Analysis Initiative Report), p. 4-11, and Encl 1, p. 1–7 (pp. 4-28 to 4-34 of Encl 4).

Note: Both OMA and RDTE costs are included. TRAC figures also include $22.5 million in GF 208018 funds and $5.5 million in Training 814772 funds in FY 1990. Data not available for TRADOC (Other) costs in FY 1990.

designated as recording secretaries of the committee, the members of which eventually included the DUSA (OR); the deputy assistant secretary of the Army for cost and economics; the Army G–8, deputy G–6, and a representative of the G–3; the director of program analysis and evaluation (PA&E), OCSA; the directors of CAA, TRAC, and AMSAA; and the commander, U.S. Army Test and Evaluation Command.

The 1966 Army Study Advisory Committee study group projected that by 1970 the Army's requirements for military and civilian ORSA personnel would be some 375 officer and 600 civilian "specialists" and some 1,470 military and civilian "executives."[213] By the time of the Review of Army Analysis in 1978, the Army had some 2,803 ORSA professionals authorized, distributed as shown in Table 2–7.[214] The 1985 RAAEX study group found that the number of authorized ORSA positions had dropped slightly to 2,686 (918 military and 1,768 civilian).[215] Most of the authorized spaces were in AMC (953), TRADOC (899), HQDA (152), and the SSAs/FOAs supporting HQDA (268).[216] The RAAEX study group also found that qualified SC 49 officers and Series 1515 civilians represented only about 49 percent of the persons reported to be doing studies and analyses. Military and civilian personnel who were not qualified ORSA specialists performed most of the studies and analyses, particularly in the TRADOC functional centers and schools.[217]

In August 1989, the DUSA (OR) reported to the Army Management Review Task Force that the projected FY 1990 Army ORSA personnel authorizations for the six principal Army analytical organizations (CAA, TRAC, AMSAA, LEA, CEAC, and ESC) would total some 420 military and 1,311 civilians and that the projected authorized end strength for Army ORSA personnel in the same organizations, for FY 1991 through FY 1995, would be roughly 420 military and 1,308 civilians.[218] Two years later, in his presentation to AORS XXX on the 1991 restructuring and realignment of Army analytical agencies, John Riente listed the FY 1990 personnel authorizations for the six selected Army analytical organizations plus the RAND Arroyo Center as shown in Table 2–8. He also provided details of the distribution of Army analysts by analysis category as shown in Table 2–9.

By 1978 the principal issue was no longer the numbers of trained ORSA personnel available to the Army; the focus had shifted to the quality of

Table 2–6—Cost for Army Base Line Analysis Organizations, FY 1990

Organization	*Cost (Millions of Dollars)*
Concepts Analysis Agency	13.4
TRADOC Analysis Center	26.1
Army Materiel Systems Analysis Activity	26.4
Cost and Economic Analysis Center	4.0
Engineer Studies Center	3.4
Strategic Studies Institute	.9
RAND Arroyo Center	21.5
TOTAL, Selected Organizations	95.7

Source: Riente slides for AORS XXX presentation, Slide 7 (Baseline Organizations).

Note: In-house costs reflect operating budgets, not total costs.

those personnel, the perception being that improvements were necessary in certain organizations. Consequently, both the 1978–1979 RAA and the 1985 RAAEX examined in detail the issue of Army ORSA personnel qualifications. The RAA study group found that among the Army ORSA personnel assigned in FY 1978, the average number of years of professional experience was 10.6 and the average GS grade equivalent was 12.5.[219] While 99 percent of the military analysts and 94 percent of the civilian analysts had a four-year college degree, only 68 percent of the military analysts and 51 percent of the civilian analysts had a master's degree or higher.[220] Of those analysts who held advanced degrees, 37 percent had been earned in operations research, mathematics, statistics, or economics; 31 percent in the physical and experimental sciences or engineering; and 32 percent in business, the social sciences, or other fields.[221] The RAA study group also found that nearly 40 percent of the civilians and 25 percent of the military had been in federal service less than ten years, while only 15 percent of the civilians and less than 10 percent of the military had more than twenty-five years of service.[222] They also found it "especially bothersome that almost half of the civilians have not enrolled in a course for over 5 years while over one-fourth—27 percent—have not taken a course in over 10 years."[223] The obvious conclusion was that more emphasis was needed on continuing professional growth, especially for civilian analysts.

To correct the perceived inadequacies in the quality of available ORSA professionals, the RAA study group made four recommendations:

a. *Recruit to Voids*. When staff vacancies occur, analysis agencies should seek first rate candidates having relevant advanced degrees, and strong efforts should be made to insure proper balance of skills within each agency.

b. *Continue Education*. The analysis world is changing. Each analysis organization should encourage each member of its professional staff to continue to grow and maintain currency of knowledge. To the extent permitted by policies and fund availability, agencies should assist the staffs by helping with the costs of continuing education.

c. *Establish Local Self-Help Practices*. Each of the analysis organizations being staffed by professionals has a high potential for and should explore "bootstrap" practices which can be very beneficial to members of its analysis staff. Internal courses, seminars, colloquia, and invited guest speaker programs are but a few of the possibilities.

d. *Support Intern Programs*. A well managed intern program is perhaps the most satisfactory way to insure an inflow of young analyst talent. Each analytical organization should participate in an intern program either by support of a local program or, in the case of smaller activities, by cooperative programs with larger organizations such as TRASANA and AMSAA which do train interns.[224]

In 1985, the RAAEX study group reviewed the status of the four recommendations made by the RAA study group and found that while guidance on achieving the four recommendations had been published in a July 1981 guidance letter and included in DA Pam 5–5, little had been done to implement the RAA recommendations in any meaningful manner. Difficulties in the Army personnel system had limited action to fill available vacancies with first-rate candidates possessing the necessary advanced degrees and to ensure a proper balance of skills within each analytical agency; no Army-wide policies and procedures for promoting continuing education among Army ORSA personnel or for enhancing internal training opportunities had been forthcoming; and only limited progress had been made in establishing effective internship programs in Army analytical organizations.[225]

Table 2–7—Distribution of Army ORSA Personnel Authorizations, FY 1978

Organization	*Total Personnel Authorized*	*Professional Personnel* *Total Authorized*	*Total Assigned* *Civilian*	*Military*
Headquarters, Department of the Army (HQDA)	123	90	23	61
HQDA Staff Support Agency and Field Operating Agency	958	708	460	170
Training and Doctrine Command	1,193	924	407	331
U.S. Army Materiel Development and Readiness Command	1,248	978	842	64
Other Major Commands	136	103	55	42
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D, pp. D-I-2 to D-I-5. "Total Personnel Authorized" includes clerical and other administrative personnel. This table is an abbreviation and correction of the original.

Note: Two major users of Army ORSA personnel, OTEA and CEAC, are not represented. Of the total number of Army ORSA professionals assigned in FY 1978, about 80 percent were analysts and 20 percent were managers and supervisors (RAA II, app. D, p. D-II-1).

Table 2–8—ORSA Personnel, Selected Army Analysis Organizations, FY 1990

Organization	*Military* *Number*	*Percent*	*Civilian* *Number*	*Percent*
Concepts Analysis Agency	101	37	162	63
TRADOC Analysis Center	249	38	433	62
Army Materiel Systems Analysis Activity	29	6	465	94
Cost and Economic Analysis Center	6	6	86	94
Engineer Study Center	5	8	58	92
Strategic Studies Institute	15	47	17	53
RAND Arroyo Center	6	5	120	95
TOTAL, Selected Organizations	411	24	1,341	76

Source: Riente slides for AORS XXX presentation, Slide 7 (Baseline Organizations) and Slide 15 (Military/Civilian Balance).

On the other hand, the RAAEX study group found that many areas were in good shape:

- Fully funded programs are adequate and growing
- Educational programs at NPG [Naval Postgraduate School] are excellent
- Intern programs at Kansas University and other universities further develop skills
- ALMC [U.S. Army Logistics Management College] continuing education program refreshes skills[226]

The Army ORSA Officer Specialty Program

In October 1974, Abraham Golub, then the technical adviser to the DCSOPS, told attendees at AORS XIII that

> one of the major developments of the past few years . . . is the increase in the number of "Green Suiters"—officers who are ORSA trained and qualified. Prior to 1968 there was only a handful of Army officers with ORSA credentials. Scattered as thinly as they were among the

Table 2–9—Distribution of Army Analysts by Analysis Category, FY 1990

Category	*Percent*	*CAA*	*TRAC*	*AMSAA*	*ESC*	*Arroyo*
Strategy and Policy	4	5	0	0	0	24
Force Analysis	25	122	190	0	10	24
System Evaluation	25	0	0	347	0	0
Cost and Operational Effectiveness Analysis	6	0	70	0	0	20
PPBS Cost/Benefit	3	25	20	0	0	0
Functional Area	22	25	200	22	36	27
Cost Analysis	7	2	10	9	0	3
Modeling	8	20	60	22	3	10
TOTAL	100	199	550	400	49	108
Administration and Overhead		64	122	94	14	0

Source: Riente slides for AORS XXX presentation, Slide 13 (Resource Allocation [FY90]—Distribution of Analysts to Analysis Categories).

Note: Also, twenty-five analysts assigned to the Strategic Studies Institute worked on strategy and policy issues, and seventy analysts assigned to the Cost and Economic Analysis Center worked on cost analysis issues.

> Army Staff and major commands, they could do little except review other people's work. Today there are nearly 600 Army officers on active duty with graduate degrees in Operations Research, and more are being trained each year. With this kind of talent to add to the civilian resources, it is not surprising that organizations like CAA and TRADOC are beginning to produce quality work. My own observation is that the ORSA trained Army officer brings his own special enthusiasm and specialized knowledge of the military which effectively complements the civilian's longer experience and continuity.[227]

By 1978, about 30 percent of the Army's ORSA personnel were officers holding OPMS Specialty Code 49—Operations Research/Systems Analysis.[228] The selection, training, assignment, and career management of officers holding SC 49 were centrally managed by the U.S. Army Military Personnel Center in accordance with *AR 614–139*.[229] The DUSA (OR) was responsible for providing policy and guidance for the program, and the DCSOPS was designated as the HQDA proponent OPMS Specialty 49.[230] Proponency for SC 49 was transferred to TRADOC in April 1982.[231] Thereafter, the deputy commanding general of TRADOC (i.e., the commander of the Combined Arms Center at Fort Leavenworth, Kansas) served as the FA 49 Personnel Proponent, and the commander of the Combined Arms Operations Research Activity (CAORA; later TRAC) was his executive agent and oversaw the operation of a small proponency office. The RAAEX study group characterized the proponency for SC 49 as "active, informative, and making further improvements."[232] With the reorganization of TRADOC on 3 October 1986, the commanding general of TRADOC became the FA 49 Proponent vice the CAC commander, and the commander of TRAC remained the executive agent.

Under OPMS, Army officers were normally assigned two specialties, a primary specialty awarded upon entry on active duty and associated with the officer's basic branch and an alternate specialty in some specialized area usually assigned during the eighth year of service and designated an "advanced entry" specialty. SC 49 was an "advanced entry" specialty, and only a few officers held it as a primary specialty.[233] Ideally, officers rotated assignments between their primary and alternate specialties, but a number of factors served to preclude that in all but a few cases. To ensure that sufficient numbers of qualified personnel were available to fill authorized requirements, Army personnel managers normally sought to maintain an asset/requirement ratio of 3:1.

OPMS was reorganized in 1985 and many positions requiring certain specialties, including FA 49, were divided into two categories: those requiring functional expertise and normally filled by a qualified

FA 49 officer and those requiring lesser specialist skills. The latter was predominantly branch-related and was filled by officers awarded the new Additional Skill Identifier 4B recommended by the RAAEX study group.[234] In 1987, the DCSPER approved the implementation of an "areas of concentration" (AOC) concept for FA 49 officers. Under the AOC concept, each officer assigned to FA 49 would be given one or more AOC designators based on their training and experience. The seven approved designators were:

- 49A—General, including ORSA instructors and military assistants to the DUSA (OR)
- 49B—Concentration in personnel matters
- 49C—Concentration in combat operations and weapons systems analysis
- 49D—Concentration in planning, programming, and resource management
- 49E—Concentration on test and evaluation matters
- 49X—Newly designated or untrained
- 49W—ORSA training completed but no AOC-producing assignment yet completed

The qualification requirements for the various OPMS specialties were contained in *AR 611–101*. For SC 49 officers, the qualifications required were:

(1) Must have an academic background and/or experience in ORSA, economics, systems engineering, systems analysis, mathematics, logic, management, or possess a degree in engineering, physical science, or business when supported by a quantitative analytical background such as linear and dynamic programming, inventory theory, mathematical models, probability theory, queuing theory, statistical analysis, stochastic processes, and ADP.

(2) Must have accomplished one of the following:

a. One year experience or formal on-the-job training in ORSA.

b. Completed an appropriate short course in ORSA such as the ORSA Executive Course at USALMC.[235]

The principal means of educating officers in ORSA was attendance at civilian graduate schools. From FY 1974 through FY 1977, the ORSA specialty averaged thirty-seven slots per year for attendance at graduate school, and in FY 1978 the number was fifty-nine.[236] As of 1987, most Army ORSA officers attended graduate degree programs at the Naval Postgraduate School, the Air Force Institute of Technology, Georgia Tech, the University of California at Berkeley, or Texas A&M University.[237] Generally, their work led to award of the master's degree, although a few officers were selected to pursue a doctorate.

Before 1977, the principal available option for formal in-house military schooling in ORSA was the three-week ORSA Executive Course at the Army Logistics Management College (ALMC) in Fort Lee, Virginia, which was designed to provide managers with an appreciation of ORSA techniques and capabilities.[238] After 1977, the Army developed a number of ORSA training courses at ALMC, and by 1987, there were several options, the most important of which was the fourteen-week Operations Research/Systems Analysis Military Applications Course I (OR/SA MAC I), which provided initial entry training in ORSA and gave prospective Army analysts a basic understanding of the military applications of ORSA methods.[239] ALMC also offered a two-week refresher course, the Operations Research/Systems Analysis Military Applications Course II (OR/SA MAC II), and a short (normally three- to five-day) Operations Research/Systems Analysis Continuing Education Program (OR/SA CEP) to assist Army ORSA personnel to remain up-to-date on new developments or to cover subjects that they may have missed or that had changed significantly.[240] In 1989, ALMC and the FA 49 Proponency Office initiated a new three-week ORSA Military Skills Development Course to train non-FA 49 officers and qualify them for award of ASI 4B.[241] ALMC also offered a number of other short courses, such as one on the effective presentation of ORSA study results.

In accordance with the recommendations made by the RAA study group, many of the Army analytical agencies initiated in-house professional development programs designed to provide continuing education and training in ORSA methods using seminars, colloquiums, guest speakers, and cooperative arrangements with nearby universities.[242] Many of these programs paid tuition and fees and could be credited toward advanced degrees in ORSA. The ALMC courses and the in-house professional development programs sponsored by the various Army analytical agencies were opened to civilian as well as military ORSA specialists.

On the whole, Army ORSA officers were well trained, educated, and managed, but there were never enough SC 49–qualified officers to meet the Army's verified needs.[243] The RAA study group identified 1,616 officers assigned SC 49, of whom 100 percent had undergraduate degrees, 79 percent had master's degrees, 75 percent were graduates of the Command and General Staff College (or equivalent), and 23 percent were graduates of a senior service college.[244] At that time (1978), there were validated requirements for only 732 ORSA officer positions, 44.4 percent of which were in TRADOC.[245] Despite the fact that there were more than twice as many qualified ORSA officers as there were validated positions, more than 25 percent of all ORSA positions were unfilled. Given 1,616 qualified officers, 732 validated positions, and a resulting asset/requirement ratio of 2.2:1, the expected fill rate should have been 0.92.[246] However, the actual fill rate in FY 1978 was only 0.74, and for TRADOC the problem was even greater, a fill rate of only 0.54.[247]

The conclusions of the RAA study group in the area of "Acquisition/Production of Analysts" were:

(1) The graduate degree method of training analysts is not available to all officers assigned the specialty.

(2) Quotas have not been sufficient to send all designees to graduate school.

(3) Graduate programs vary widely with no standard core curriculum established.

(4) There is minimal in-house capability to provide continuing specialty education/training.[248]

And with respect to the "Distribution of Assets" the study group found that

(1) There is no control exercised by any but the using activity on designating the specialty or series for positions. It is believed that some positions have been designated SC 49 in order to enhance the chances of having top quality officers assigned.

(2) Many positions which are designated ORSA require minimal ORSA skills. There is currently no means or activities for insuring that assigned officers have these skills without requesting an ORSA officer.

(3) The Army has not been able to fill all requirements for ORSA officers.[249]

The RAA study group thus recommended that the authorized SC 49 positions in TRADOC schools be filled and that plans be developed for improving the quantity and utilization of SC 49 officers.[250] This required that improved procedures for determining requirements, qualifications, and utilization of SC 49 officers be developed and that a program be set up to improve the fill of SC 49 officer positions in the Army analytical community, particularly at the TRADOC schools. ODCSPER revised the Officer Distribution Plan (ODP) by March 1980, and although not supported by the revised ODP, the fill at TRADOC schools was somewhat improved.[251]

In 1981 and again in 1982, representatives of U.S. Army Military Personnel Center briefed attendees at AORS XX and XXI on the status of the Army ORSA Officer Specialist Program.[252] In his 1981 presentation, Maj. John D. French noted that in FY 1980 the Army had more requirements for qualified ORSA officers than it had qualified officers.[253] There were some 1,686 qualified ORSA officers in the grades of captain through colonel to fill some 815 requirements, an asset/requirement ratio of 2.07.[254] The ORSA officers available in FY 1980 were well educated: 100 percent were college graduates and 76 percent held a master's degree or higher.[255] Some 93.3 percent of the captains were advanced course graduates, 66.5 percent of the majors and lieutenant colonels were Command and General Staff College graduates, and 28.1 percent of the lieutenant colonels and colonels were senior service college graduates, all percentages being well above the OPM average.[256]

The following year Major French's colleague, Maj. J. Doesburg, reviewed the same statistical categories. In FY 1981 there were some 1,715 qualified ORSA officers in the grades of captain through colonel to fill some 1,025 authorized positions, an asset/requirement ratio of only 1.67.[257] Again, some 93.5 percent of the captains were advanced course graduates, 67.1 percent of the majors and lieutenant colonels were Command and General Staff College graduates, and 25.8 percent of the lieutenant colonels and colonels were senior service college graduates, all percentages still being well above the OPM average.[258]

In 1985, the RAAEX study group made a thorough scrub of SC 49 ODP authorizations and the number of SC 49 officers assigned to the principal Army analytical agencies. The results were as shown in Table 2–10. The study group found that the average SC 49 fill of ODP for all organizations reviewed was 79 percent, varying from a low of 50 percent in AMSAA and CAORA to a high of 133 percent in the AMC subordinate command systems analysis offices.[259] They also found that, with the exception of the integrating centers, the fill in TRADOC was particularly low: 50 percent for CAORA, 64 percent for TRASANA, and 69 percent for the functional centers and schools.[260]

As of June 1987, there were about 2,000 qualified ORSA officers available to fill about 881 authorized positions, an asset/requirement ratio of 2.27:1.[261] In April 1991, there were 1,986 trained ORSA officers to fill 943 authorized active-duty positions, an asset/requirement ratio of only 2.1:1, and, given other demands, the fill rate was only about 81 percent.[262] And as of FY 1992 there were some 2,600 qualified ORSA officers to fill some 999 authorized ORSA positions, an asset/requirement ratio of only 2.6:1 vs. the "standard" of 3:1.[263]

In 1978, the RAA study group identified 581 SC 49–qualified officers distributed by grade as follows: major generals, 1; brigadier generals, 0; colonels, 54; lieutenant colonels, 183; majors, 175; captains, 138; first lieutenants, 20; and second lieutenants, 10.[264] By 1986, the total number had grown to 890 officers distributed by grade and assignment, as shown in Table 2–11.

In some respects the period 1973–1995 would later be regarded as "the good old days" of the Army ORSA Officer Program. After 1995, Army force reductions, changes in Army personnel management policies, the pressures of repeated overseas assignments in the Balkans, Afghanistan, and Iraq, and other factors served to enervate the program to a certain degree. All of the senior Army ORSA executives interviewed for this study in 2005 and 2006 expressed concern about the state of the program and its prospects for the future.[265] In an article published in *Military Review* in late 2004, the Army G–8, Lt. Gen. David F. Melcher, and Lt. Col. John G. Ferrari noted that

> since World War II, the military operations research analyst has been critical to the military's operational and institutional success. During the past decade, however, changes to the ORSA career field and a migration of the specialty from the operational Army to the institutional Army have reduced ORSA's opportunities to directly support the operational commander.[266]

Nevertheless, General Melcher and Colonel Ferrari were optimistic and noted that over 10 percent of the Army's FA 49 positions in the institutional Army were in the process of moving to the operational Army, thereby reversing the long-standing trend in the other direction.[267] Those changes, they wrote, were based on insights gained by Army deployments in Bosnia, Kosovo, and Iraq, which demonstrated that "an embedded analytical cell with G3 and G5 plans is needed to provide rigorous analysis that is operationally relevant, reaching across the entire battle staff through the staff and planning groups."[268] In the end, the need for a cadre of well-qualified ORSA officer specialists remains as critical today as in 1973.

Army Civilian ORSA Personnel Management

In 1973, most Department of Army civilian employees were managed in accordance with the rules on recruitment, qualifications, assignments, career development, pay and benefits, and other personnel matters set down by the United States Civil Service Commission and administered by the Office of Personnel Management. But unlike the centralized system managed by MILPERCEN for officers holding SC 49, the system for management of the Army's civilian ORSA specialists was decentralized with most important decisions regarding authorizations, hiring, job assignment, and professional development made at the local agency or command level. Most of the Army's civilian ORSA specialists were managed under Career Program 16 (CP 16) (Engineers and Scientists—Non-Construction), the functional chief of which was the commanding general of AMC.[269] Under CP 16, ORSA specialist positions were included in Series 1515 (OR Analyst), which included:

> All classes of positions the duties of which are to administer, direct, supervise, or perform professional and scientific work drawing on mathematical, statistical, and other scientific methods and techniques common to mathematics, engineering, and physical, biological, and social sciences.[270]

Pursuant to the recommendations of the RAAEX study group, in 1985 the commanding general of AMC in his role as functional chief of CP 16 appointed his deputy for management and analysis, Marie B. Acton, as the functional chief's representative (FCR) and thus the Army proponent for civilian OR analysts in the

Table 2–10—Distribution of SC 49 Personnel by Organization (Authorized, ODP Supported, and Assigned)

Organization	*Authorized*	*ODP Supported*	*Assigned*
HQDA Staff Support and Field Operating Agencies			
Concepts Analysis Agency	60	51	57
Logistics Evaluation Agency	2	2	2
Engineer Studies Center	1	1	1
Training and Doctrine Command			
TRADOC Systems Analysis Activity	38	36	23
Combined Arms Operations Research Activity	42	38	19
Integrating Centers	24	18	23
Functional Centers and Schools	128	94	65
Army Material Command			
Army Materiel Systems Analysis Activity	6	4	2
AMC Subordinate Command Systems Analysis Offices	7	3	4
TOTAL	308	247	196

Source: RAAEX II, p. 8-15, Table (SC 49 Personnel [Auth/ODP/On Hand]).

CP 16 Series 1515 (OR Analyst).[271] As the functional proponent for civilian ORSA analysts, Acton managed the Army Career Program Office for Operations Research and oversaw all matters pertaining to the education and career development of Army civilian ORSA personnel, including administration of the Army ORSA Fellowship Program, a program for the exchange of civilian analysts among Army analytical agencies, internship programs, in-service training and education, special award programs, and similar matters.[272]

Marie Acton's successor as FCR was Michael Sandusky, the deputy chief of staff for program analysis and evaluation, HQ AMC, who took over upon the retirement of Acton in early 1988.[273] In July 1988, Series 1515 was broken out from CP 16 (Engineers and Scientists—Non-Construction) and became a separate career subprogram, and at the same time those cost analysis specialists in CP 16 Series 1515 were transferred to CP 11 (Comptroller).[274] In a 7 July 1988 memorandum, the DCSPER directed that TRAC and AMC be given joint proponency for the 1515 subprogram.[275] Subsequently, the AMC commander designated the director of AMSAA to serve as the FCR for Subprogram 1515 and to sit as co-chairman of the Joint Civilian and Military ORSA Advisory Committee.

In 1988, the Office of Personnel Management revived its study of the qualification and classification standards for the GS–1515 (Operations Research) series abandoned in 1983.[276] Under an arrangement with OPM, HQ AMC took the lead on the study, and a study team with four permanent members (two ORSA analysts, one personnel management specialist, and a secretary) was established in August 1988 and was charged with producing a new occupational standard for the 1515 (OR Analyst) series, which had not been revised since 1967.[277]

Although the commanding general of AMC was the functional chief for DA civilian ORSA specialists in CP 16, most of the Army's positions requiring trained civilian ORSA specialists were not in AMC but rather were spread throughout the Army. Some Army analytical organizations, such as AMSAA and TRASANA, were staffed almost exclusively by civilians; others, for example the TRADOC schools, had mostly military analysts; and some, such as CAA and CACDA, had a mix of military and civilian

Table 2–11—Assignment of SC 49 Officers, CY 1986

Organization	*Captain*	*Major*	*Lieutenant Colonel*	*Colonel*	*Total*
Army Staff	5	39	59	17	120
DOD Agencies	2	7	19	15	43
U.S. Army, Europe	5	12	4	1	22
U.S. Army Forces Command	7	8	3	1	19
Joint Activities	4	11	16	4	35
U.S. Marine Corps	14	5	2	0	21
U.S. Army Recruiting Command	11	17	3	1	32
Training and Doctrine Command	192	106	37	8	343
Army Materiel Command	43	17	6	4	70
Other	20	100	47	18	185
TOTAL	303	322	196	69	890

Source: U.S. Department of the Army, *Department of the Army Pamphlet 600–3–49: Functional Area 49—Operations Research/Systems Analysis* [Washington, D.C.: HQDA, 1 August 1987], p. 5).

personnel.[278] In 1966, the ASAC raised the question of whether or not the AMC commander should continue to be the functional chief for ORSA and concluded that the matter required further study by the DCSPER with the goal of "insuring the best possible management of DA civilian OR/SA 'specialists' and 'executives' to meet the Army's needs."[279] In fact, no changes were made.

In 1972, there were 679 Army civilian ORSA managers and analysts, and over the next five years the number increased to 1,197.[280] The RAA study group found that in FY 1978 there were some 1,692 Army ORSA civilian professionals on the books, ranging in grade from GS–5 (fourteen individuals) to GS–18 (six individuals).[281] Only about 742 (44 percent) of them were being managed under CP 16 Series 1515.[282] By FY 1983, the number of civilian ORSA specialists had declined to only 881, and at that time the Army had 1,038 authorizations, distributed among the principal Army analytical organizations as shown in Table 2–12.[283] The number of assigned civilian ORSA specialists declined a bit thereafter. For example, in 2006 the number of personnel in CP 16 Subprogram 1515 was only 749 (305 in TRADOC, 267 in AMC, and 177 in other organizations).[284]

On the whole, the Army's civilian ORSA specialists were somewhat less well educated and less well managed than their military counterparts. The RAAEX study group focused on individual career management of Army civilian ORSA personnel, particularly with respect to education, training, and career progression, and their findings regarding the management of Army civilian ORSA personnel were that

> the E&S field numbers almost 20,000 and by size alone is almost not manageable. It certainly prohibits attention to individuals.
>
> Presently the entry requirements for GS-1515 are extremely broad. This represents a problem in that some of the people qualified in the career field have weak analytic backgrounds when compared with counterparts who have strong backgrounds in math or other analytic disciplines.
>
> The 1515 career field encompasses personnel who are managed under the comptroller and specialize in cost analysis. This is a two way street for opportunities in that the comptroller managed 1515's are a small group and eligible for the excellent graduate program the comptroller runs with Syracuse University. In the other side, there is a general feeling that ORSA 1515's are more capable of competing for cost analysis jobs than comptroller 1515's are able to compete for ORSA 1515 slots.
>
> To some extent a perception exists that GS-1515 along with other civilian career fields are limited by the adverse cost of mobility. Personnel in other regions view 1515's in the MDW area as having many more advancement

> opportunities than their counterparts in other locations but the same individuals do not generally seek assignments in the Washington area because of the high cost of initially moving into the area.
>
> Since 1515's are managed as part of the much larger E&S career field much of the counseling is done by the career manager at local command or activity. Although many of these individuals do an excellent job and are extremely dedicated, there is clearly a lack of uniformity in the counseling and career guidance that is given.
>
> Presently job announcements at the higher grade levels are made public through the DARCOM Announcement Distribution System (DADS). Although fairly thorough, this system is still somewhat dependent on each individual's initiative to get into the DADS program and keep his information current.
>
> At the intermediate level, there are very limited opportunities for exposure to advanced military education. For example at present only one civilian, who happens to be a GS-1515, is able to attend Command and General Staff College.
>
> At the entry level the education opportunities are even more limited. Basic training for entry level people is not uniform and very little additional education is available.[285]

The RAAEX study group went on to note that OPM was taking steps to remedy many of the problems stated in the findings, and that the Army Civilian Training, Education and Development System was "an attempt to establish a planned progression of training and professional development for interns, intermediate managers and senior civilians" and would "establish the essential skills and knowledge needed at each level and more importantly provide education opportunities to achieve those skills."[286] Based on their findings, the RAAEX study group's recommendations with respect to the management of Army civilian ORSA personnel were:

> In order to improve the present management of 1515's it seems prudent to break the ORSA 1515's out from under the Career Management within Engineering and Scientists program. E & S is simply too large. The diversity of disciplines as well as the number within the E & S field prohibits providing individual attention to specific disciplines like operations research.
>
> The establishment of a separate functional chief for GS-1515, along the lines of the comparable SC 49 proponent appears to be a logical step toward refining the standards and training for GS-1515. Director, AMSAA is a prudent choice for this function.
>
> The ACTEDS program is a good start in trying to discipline the training and education of interns through SES. In order to determine if it can actually achieve its goals the funding requests need to be supported.
>
> Entry standards for the GS-1515 need to be reevaluated. Army should request OSD to pursue with OPM completing its now inactive study on this matter.[287]

In July and August 1986, Marie B. Acton, the FCR for civilian OR analysts, led an Army-wide survey of DA civilians in Series 1515.[288] Some 666 out of 1,490 Army civilian ORSA specialists (nearly 45 percent) responded to the questionnaire dealing with such matters as their academic background, their sources of career counseling, individual development plans, training, and reasons for leaving or staying in federal service. Among the shortfalls identified were the needs for management/supervisory development for women, a standardized intern program, management emphasis on training and career development, and a formal mentoring/guidance program. In August 1987, a similar survey was made among former and current Army OR interns, fifty-seven of whom responded (twenty-nine former and twenty-eight current interns).[289] Some 68 percent of the respondents had a bachelor's degree and 25 percent had a master's degree, mathematics being the most common field of study. Only 15 percent of the respondents had attended the ALMC career intern orientation class, and only 25 percent of them had attended an orientation by ORSA career professionals.

Among the other initiatives taken by Marie Acton during her term as the FCR for Series 1515 was the Army ORSA Fellowship Program, which began on a test basis in FY 1985 and consisted of two to four developmental assignments rotated among the various Army analytical agencies for the purpose of providing participants with "exposure to Army decision makers as well as experience with new OR methodologies and techniques."[290] She also initiated efforts to increase the "greening" of Army civilian analysts through a wide variety of activities designed to familiarize them with the Army and its worldwide operations. Included in the "greening" effort were such formal developmental opportunities as attendance for selected personnel at the Army Management Staff College and the Combined Arms and Services Staff School as well as participation in the Army ORSA Fellowship Program and assignments to the European and Korean ORSA cells.[291]

Table 2–12—Distribution of 1515 Personnel, FY 1983

Organization	*Authorized*	*Assigned*	*Percent Fill*
HQDA Staff Support and Field Operating Agencies			
Concepts Analysis Agency	81	72	89
Logistics Evaluation Agency	5	5	100
Engineer Studies Center	11	9	82
Army Research Institute	8	6	75
Training and Doctrine Command			
TRADOC Systems Analysis Agency	180	174	97
Combined Arms OR Activity	66	52	79
Integrating Centers	75	71	95
Functional Centers and Schools	120	99	83
Army Materiel Command			
Army Materiel Systems Analysis Activity	300	218	73
AMC Subordinate Command Systems Analysis Offices	192	175	91
TOTAL	1,038	881	85

Source: RAAEX II, p. 8-21, Table, and p. 8-25, Table.

The Subject Matter Expert Return to Field (SMERF) Program initiated by the U.S. Army Communications and Electronics Command at Fort Monmouth, New Jersey, was typical of the efforts to familiarize civilian ORSA personnel with the "real" Army. SMERF participants, including item managers, engineers, and quality assurance specialists, participated in field exercises at Fort Hood, Texas, and gained firsthand experience in the use of the systems that they developed.[292] In FY 1989, the Army also initiated a formal graduate-level training program in ORSA for selected DA civilian employees.[293] Known as the Advanced Studies Program for Operations Research Analysts, the program was initially funded at a level of three students for one year of graduate education. Students were competitively selected for participation.

As a result of the changes made after 1973, by 1995, the management of the Army's civilian ORSA specialists had become somewhat more centralized. Great strides had been taken to improve educational opportunities, career counseling and planning, career progression, and other matters of interest to those DA civilian personnel in CP 16 Subprogram 1515 (OR Analyst), and consequently the Army's civilian ORSA managers and analysts were being more carefully managed, with greater satisfaction for all concerned.

External Interfaces of the Army ORSA Program

Even before the creation of the Operations Research Office in 1948, Army ORSA personnel from the most senior to the most junior participated actively in efforts to make known their work and to exchange ideas among themselves and with their colleagues outside the Army. After 1962, one of the principal venues for such interchange was the annual Army Operations Research Symposium. A variety of other means were also employed to maintain contacts with ORSA elements in OSD, OJCS, the other services, and friendly governments as well as to participate in the activities of the various professional societies such as the Operations Research Society of America and the Military Operations Research Society. After 1968, the deputy under secretary of the Army (operations research) took the lead in such activities. Although not specifically addressed in the documents prescribing his official responsibilities, over time the DUSA (OR) assumed the role as the principal point of contact between the Army ORSA program and ORSA programs in DOD, the official military ORSA programs in other countries, and the national and international ORSA professional organizations.

The Army Operations Research Symposia

Prior to the 1974 Army Staff reorganization, the chief of research and development was responsible for the annual Army Operations Research Symposium (AORS).[294] The annual meeting was hosted by various commands, and the Army Research Office-Durham (ARO-D) managed the details and produced the symposium proceedings. The DCSOPS assumed responsibility for AORS in 1974, and his responsibilities were later formalized in *Chief of Staff Regulation (CSR) No. 1–29*, which prescribed policies and responsibilities for the sponsorship of AORS and formally established AORS as an annual event to "foster communication, exchange information, and recognize high-quality work within the Army analytical community."[295] Per *CSR 1–29*, the DCSOPS was assigned overall responsibility and was to designate the annual sponsor, furnish guidance, and coordinate with the DUSA (OR).[296] In 1974, the DCSOPS delegated responsibility for managing the annual meeting and for producing the symposium proceedings to CAA, and since 1974, the annual sponsorship of AORS has rotated among the principal Army ORSA organizations (AMSAA, OTEA/OPTEC/ATEC, TRAC, and CAA).

AORS has been held annually since 1962 with the sole exception of AORS XXIX in 1990, which was canceled due to the support requirements for Operation Desert Shield.[297] Since 1974, AORS has been held at Fort Lee, Virginia, and has been hosted and supported by the Army Logistics Management Center and the U.S. Army Quartermaster School and Center and Fort Lee (later the U.S. Army Combined Arms Support Command and Fort Lee). About 200 Army ORSA analysts and managers attend each year, and a smaller number of ORSA personnel from OSD, OJCS, the other services, allied ORSA establishments, and academia are invited to the annual two-day conference as well.[298]

The basic format of AORS has changed little over the years, although the annual focus of the symposium has changed with the waxing and waning of Army interest in various topics. For example, in 1978, David C. Hardison, then the DUSA (OR), called for more work in AORS presentations on "the analysis of operational employment options, strategic options, chemical/nuclear considerations, etc.," noting that "overall, the conference was too much oriented toward materiel systems analysis/operations research on item level systems."[299] At AORS XX in 1981, the new DUSA (OR), Walter W. Hollis, noted: "As I see it, we have an AORS to provide a forum for the presentation of work by our young analysts and to provide an informal opportunity for review of test work by their peers and seniors. AORS is, then, for our people."[300] The following year, Hardison again spoke and noted that it was "terribly important that Army analysts stand on the shoulders of other analysts—important that we share tools as we work new problems which differ in details of substance but have similar mathematical form."[301] And at AORS XXII in 1983, Hardison argued that "the hallway opportunities [i.e., informal discussions] are perhaps the greatest payoff of the whole symposium."[302] The importance of AORS was amply demonstrated by an anecdote told by Hollis in his keynote address at AORS XXII. After recognizing the allied guests in attendance, he stated:

> I want you all to know that the AORS is a timely and very highly regarded symposium in the Soviet Union. Not long ago, the *Washington Post* published an article that indicated an agent of the Soviet Union had been apprehended in the process of trying to buy a copy of the symposium proceedings from last year for which I think he was willing to pay the price of $500.00. . . . Let me assure you that ACSI approved the release of the symposium proceedings to the FBI for the purpose of apprehending the culprit.[303]

Relationships with Office of the Secretary of Defense and Office of the Joint Chiefs of Staff

The 1978–1979 RAA did not address the question of the interface of Army ORSA activities with DOD or other analysis activities external to the Army. However, the 1985 RAAEX did examine such contacts in some depth and arrived at several findings regarding the interface of the Army ORSA program with ORSA activities in OSD, OJCS, the other services, and allied nations.[304] The RAAEX study group found that the Army had "extensive analysis interfaces with multiple OSD elements," and that the principal OSD element with which the Army ORSA program interacted was the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation (OASD-PAE), specifically those OASD-PAE elements dealing with land forces, mobility forces, regional forces, and to a lesser degree strategic forces.[305] Army ORSA managers also interacted with the Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics, with the director of net assessment, and with the Tactical Warfare Programs element of the Office of the Director of Under Secretary of Defense for Research and Engineering. The only major problem area in Army–OSD ORSA relationships was the "adversary relationship" and "atmosphere of animosity, distrust and secretiveness," which had developed over several years between Army analysis activities and the OSD-PAE Land Forces Division.[306] The RAAEX study group recommended the continuation of good relationships between Army ORSA elements and OASD-PAE and that the bad relationship between Army ORSA elements and OASD-PAE Land Forces Division "not be allowed to obscure or detract from the helpful relationships between the Army and all other elements of OSD."[307] They also recommended the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME) as a model for technical multiservice programs.[308]

With respect to the OJCS, the RAAEX study group was less complimentary. It found that although the Army had "extensive service capability" to support the Modern Aids to Planning (MAP) project, there was no formal service role for the Army in that project.[309] It also found that there was "insufficient effort to ensure consistency between OJCS theater-level models and Army models at the same level."[310] The MAP project was a 1982 initiative of General John W. Vessey Jr., chairman of the Joint Chiefs of Staff from 1982 to 1985. Its aim was "the development and fielding of analytical techniques to support operational planning by the unified commands."[311] The RAAEX study group found that although the Army had no formal role in the project, there had been "extensive informal participation and some funding support by the Army," and that CAA and the Army War College were supporting a U.S. Readiness Command–sponsored contract with Jet Propulsion Laboratory to develop a joint theater-level simulation.[312] However, the study group recognized that

> under the current MAP arrangements there is a serious mis-match between responsibilities and capabilities. The command with development responsibility has limited in-house development capabilities and is forced to rely on contractors: the services, which have substantial in-house development capabilities, have no formal role in the project. An obvious remedy is to assign a formal development role to the services in support of OJCS. This role could encompass technical guidance and assistance to the project. Service development of models to be used in the MAP would also assist in ensuring consistency between analytical planning aids developed for the Unified Commands and those developed unilaterally by the services. Further, to adequately support the program in the field the Service Component Command will need increased analysis capabilities to interact with the analysis groups to be formed in the headquarters of the Unified Commands.[313]

Accordingly, the RAAEX study group recommended the creation of an advisory body composed of senior analysts from the services to provide technical guidance and ensure coordination with similar or related service efforts and that the services should play a formal role in the development and testing of analytical techniques that would ultimately be exported to the Unified Commands.[314] They also recommended greater sharing of models, data, and experience among the Army and OJCS elements conducting war games of theater-level campaigns in order to eliminate unnecessary inconsistencies.

Relationships with the Other Services

The RAAEX study group noted that there were considerable differences in how the Army and the Air Force conducted analyses and that the dispersed Air Force ORSA organization did not provide a central point of contact on the Air Force Staff equivalent to the Army's Study Program Management Office and DUSA (OR) and thus "the study-doing elements of the two headquarters do not align well organizationally."[315] Even so, they cited the efforts of the Army's Training and Doctrine Command to secure Air Force participation in Army combat developments studies and found that there were many opportunities for joint Army–Air Force analyses and joint testing.[316] Noting the need for "mechanisms for identifying specific joint study and test needs and providing taskings" and for "mechanisms for conducting joint studies and tests," the RAAEX study group concluded that: "The Army and the Air Force have a long history of cooperation in studies although this has mainly consisted of input data and advisory services rather than true joint studies," and went on to recommend that the existing Army–Air Force Memorandum of Agreement be revised to more explicitly address "mechanisms for conducting joint studies on a continuing basis" and that a joint analysis activity should be established at the TRADOC Combined Arms Center at Fort Leavenworth, Kansas.[317]

With respect to the Navy, the RAAEX study group noted that

> there is very little interface between Navy (including the Marine Corps) and Army analytical activities. . . . The potential exists for greater interface and the possibility of joint or parallel studies and the possibility of sharing models and data. In the training arena some interface already exists between Army analysis activities and the Naval War College, but there is potential for wider ranging and higher level cooperation.[318]

As with the Army–Air Force relationship, the study group saw a need for a "mechanism for identifying areas of coordination and cooperation in analysis" and for "effective coordination and cooperation in conducting analysis."[319] They thus recommended that: "HQ DA explore with the Navy headquarters the possibility of an agreement to formalize coordination and cooperation on analyses of issues of mutual interest."[320] Of course, the Army already cooperated with the Navy in the training of ORSA analysts and managers. From 1965, Army officers attended the OR program of instruction at the Naval Postgraduate School (NPS) in Monterey, California, and the Operations Analysis (360) curriculum at NPS was jointly sponsored by the Navy and the Army's FA 49 Proponency Office.[321] Army officers also served on the NPS ORSA program faculty.

Relationships with U.S. Allies

The first DUSA (OR), Dr. Wilbur B. Payne, was particularly active in the series of American-British-Canadian-Australian (ABCA) conferences on ORSA, coordinated often with ORSA leaders in the NATO countries, and worked with the Germans on a study of the Patriot missile system as a replacement for the Nike-Hercules missile, studies on defense of the Central Region, land mines, and the BATTLEFIELD 90 study on tactical force structures and weapons systems requirements.[322] His successors continued and improved upon those relationships.

With respect to the Army interface with ORSA activities in allied countries, the RAAEX study group found that there were "extensive interfaces with analysis organizations of major allies," and that those interfaces were a "very productive and useful activity."[323] The study group stated that those extensive and useful relationships were developed over time through multinational agreements, such as the Quadripartite Panel on Army Operational Research, and bilateral agreements.[324] U.S. Army ORSA leaders constantly sought new ways of working with Great Britain, Canada, and Australia, and there was a regular combined review of U.S./U.K. studies.[325] The relationship with the major British analysis organizations (the Royal Army Research and Development Establishment and the Defense Operational Analysis Establishment) and with the German Ministry of Defense's Department of Studies and Exercises was rated especially strong, and efforts in the mid-1980s to develop a relationship with French analysis organizations were also noted.[326] The NATO operations research effort as it existed in 1984 was outlined by G. H. Dimon Jr.[327] NATO had once sponsored a series of OR symposia and had an advisory panel on operational research but terminated them for a supposed lack of funds, although Ronald Shepherd of the British Army Operational Research Group at West Byfleet revived the symposia as the International Symposia on Military Operational Research at the Royal Military College of Science in Shrivenham.[328]

In the mid-1970s, OSD proposed that a bilateral conference on studies and analysis be held by the United States and the Republic of Korea, and the Army was appointed by OSD to oversee the effort.[329] The DUSA (OR) was assigned responsibility for the endeavor and was tasked to develop, oversee, and conduct the seminar. In 1978, David C. Hardison, then the DUSA (OR), met with the president of the Korea Institute for Defense Analyses (KIDA) to discuss appropriate ways for the two countries to promote academic exchanges and research cooperation. The result was the first U.S.-ROK [Republic of Korea] Defense Analysis Seminar (DAS) held in September 1979. A second meeting was held in 1983 and every two years thereafter. In 1985, the RAAEX study group recognized that the relationship with KIDA was developing well and that the potential existed for joint U.S.-ROK studies.[330] The U.S. delegation to the U.S.-ROK Defense Analysis Seminar has been composed of representatives from across the DOD as well as the contractor and academic communities.[331] At DAS-11, held on 29 April–2 May 2002, in Seoul, there were more than 280 ROK visitors and fifty-two ROK and U.S. presentations.[332] The seminar has served the purpose of fostering "international discussions of analysis pertinent to current ROK-U.S. issues," and the benefits to both countries have grown over the years.[333] Today, the DUSA (OR) and KIDA remain the joint sponsors.

Army ORSA leaders also developed a first-rate relationship with their counterparts in Japan. The first Japan-U.S. Operations Research Seminar (JUORS) was held on 16–19 September 1986 at Camp Ichigaya Staff College in Tokyo.[334] The symposium was jointly sponsored by the Japan Defense Agency; commander, U.S. Forces, Japan; and U.S. commander in chief, Pacific Command, and was attended by some eighty-five U.S. and Japanese ORSA personnel representing twelve U.S. and six Japanese defense organizations. The success of JOURS-1 led to the event's becoming a recurring one.

The 1985 RAAEX study group noted that, "we have enjoyed greater success in conducting joint studies with our allies than with our sister services."[335] Their recommendation that "current cooperative analysis activities with Allies, both under international agreements and bi-laterally, be encouraged to continue and be expanded as interests and capabilities allow," has largely been fulfilled.[336]

Relationships with Professional Organizations

Since the early 1950s, members of the Army analytical community have participated in the activities of the various professional ORSA organizations in the United States and abroad and have played an important role in their leadership. Ellis A. Johnson, the director of ORO, and Thornton L. Page, an ORO division chief, were among the founders of the Operations Research Society of America (ORSA) in 1952.[337] Many members of the Army analytical community have been members of ORSA over the years, and several Army ORSA leaders have served in key positions in that organization.

Army ORSA personnel have also been active in the Military Operations Research Symposium/Society (MORS). The first Military Operations Research Symposium was held in August 1957 at the Corona Naval Ordnance Laboratory, Corona, California, under the sponsorship of the Office of Naval Research-Pasadena.[338] The MORS became nationally oriented and joint service in 1961, and in 1964, the Office of Naval Research-Washington assumed responsibility for the annual event. In April 1966, the Military Operations Research Society was incorporated and took over management of the annual symposium. MORS is a professional society incorporated under Virginia law and publishes a quarterly newsletter, *Phalanx*, and a refereed journal, *Military Operations Research*. MORS had no members in the usual sense until 1989; now anyone who attends a MORS symposium is automatically a member for three years and may request extension. There are no dues. MORS is managed by a thirty-member board of directors and an executive council consisting of a president, president-elect, three elected vice presidents, an immediate past president, and an executive vice president. MORS' classified symposia and other meetings are sponsored by high-ranking officials of OSD, the JCS, and the four services. For example, the DUSA (OR) is the Army sponsor for MORS, and between 1980 and 2006, Walter W. Hollis actively supported the organization's aims and prodded MORS to conduct special-issue workshops.[339]

The stated goals of MORS are the following:

- To enhance the quality and usefulness of classified and unclassified military operations research, the Society endeavors to—
  - Understand and encourage responsiveness to the needs of the user of military operations research.
  - Provide opportunities for professional interchange.
  - Educate members on new techniques and approaches to analysis.
  - Provide peer critique of classified and unclassified analyses.
  - Inform and advise decision makers on the potential use of military operations research.
  - Encourage conduct consistent with high professional and ethical standards.
  - Recognize outstanding contributions to military operations research.

- Assist in the accession and development of career analysts.
- Strive for a membership which is representative of the military operations research community.
- Preserve the heritage of military operations research.
- Preserve the role of MORS as a leader in the analytical community.
- Encourage the use of operations research in support of current military operations.[340]

The argument has been that MORS enhances the quality of military operations research in several ways, including monitoring quality in a classified environment, facilitating better cooperation and increased efficiency with in the military operations research community, educating, and recognizing superior achievements.[341] The close relationship of the Army analytical community with MORS is confirmed by the fact that no fewer than eighteen members of the Army analytical community—or persons closely connected with it—have served as president of MORS since 1965, including the first five MORS presidents. Among them are Lewis Leake (1965–1966), Howard M. Berger (1966–1967), Arthur Stein (1967–1968), John Honig (1968–1969), Seth Bonder (1969–1970), Ken Yudowitch (1972–1973), John K. Walker, Jr. (1974–1975), Marion R. Bryson (1975–1976), Amoretta (Amie) M. Hoeber (1981–1982), Richard E. Garvey Jr. (1986–1987), Mary G. B. Pace (1990–1991), Vernon M. Bettencourt Jr. (1991–1992), E. B. Vandiver III (1992–1993), Gregory S. Parnell (1993–1994), Brian R. McEnany (1994–1995), Frederick E. Hartman (1996–1997), Willie J. McFadden II (2003–2004), and Andrew G. Loerch (2004–2005).[342] Similarly, at least seventeen one-time members of the Army analytical community have been elected MORS fellows. They include John K. Walker Jr. (1989), Marion R. Bryson (1990), Wilbur B. Payne (1990), Eugene P. Visco (1990), Lewis Leake (1991), Arthur Stein (1991), George Schecter (1992), Seth Bonder (1994), Richard E. Garvey (1993), Walter W. Hollis (1995), E. B. Vandiver III (1996), Gregory S. Parnell (1997), Vernon M. Bettencourt Jr. (1998), Brian R. McEnany (1999), Frederick E. Hartman (2000), Mary G. B. Pace (2002), and Michael F. Bauman (2004).[343]

Conclusion

In many respects the period 1973–1995 was indeed the "golden age" of Army ORSA. Despite serious reductions in the resources of money and manpower imposed by a parsimonious Congress and competing Army priorities, Army ORSA prospered. Following the changes occasioned by the STEADFAST reorganization of the Army in 1973 and the reorganization of the Army Staff in 1974, the organization of the Army analytical community stabilized in the form it retains today. Minor changes in mission, structure, and resource allocations were made, but on the whole the community continued to mature at a steady pace.

After 1974, the top-level management of the Army ORSA program remained stable. The deputy under secretary of the Army (operations research) provided central policy and guidance, the Army Staff administered important ORSA programs, and the Army analytical community as a whole was well led and well coordinated. It should be noted that the Army ORSA program was by no means a fully centralized, hierarchical system. Although over time, there was a trend toward centralized policy and centralized control of some aspects in the ODUSA (OR) and in the Army Staff, the ORSA elements in each major command reported to their respective commander and not to any higher echelon. This continued a system instituted in the earliest days of ORSA in the Army.

As time went on, many of the minor problems and inadequacies of the Army ORSA program as it existed in 1973 were fixed, duplication of effort was decreased, and resource management was substantially improved. As one commentator noted in 1983, operations research was

> well ensconced in the structure of the US Army. While the preponderance of analysts lie in the higher echelons the impact of their efforts will be felt more and more throughout the entire Army . . . their contributions to the decision making process have been instrumental in getting the best product for the dollar and reducing the likelihood of large errors.[344]

Despite the great progress made after 1973, a number of troublesome issues remained, some of which were still unaddressed or unresolved by 1995. In its 1979 report, the Review of Army Analysis study group listed the strengths and weaknesses of the Army studies and analysis community and its products as perceived by experienced Army ORSA personnel.[345] Data were collected from some one hundred individuals in OSD, the Army, the other services, and industry through the use of personal interviews, questionnaires, and group sessions.[346] As stated in the Review of Army Analysis report, "the main thrust of the Review of Army Analysis was to seek ways to improve the community,"—thus, the number of perceived weaknesses exceeded the number of perceived strengths by a considerable margin.[347]

As the RAA study group acknowledged, not all of the perceived strengths and weaknesses were borne out by the facts.[348] In any event, once implemented, the recommendations of the 1978–1979 Review of Army Analysis, the 1985 Review of Army Analysis Extended, and the other studies of the Army analytical community conducted during the period served to correct many of the perceived weaknesses. Greater centralized management of the Army Study System was instituted and the topics studied were better focused to meet Army needs; the construction and use of models was brought under control; communications among the various elements of the Army analytical community were greatly improved; the selection, training, and management of Army civilian ORSA personnel were improved, resulting in a better civilian workforce; the Arroyo Center was established to meet the need for a "first-rate think house"; the scope of studies and analyses was extended into relatively ignored areas like logistics, personnel, and training; efforts were made to streamline and focus the presentation of completed studies; and many other issues were addressed. Even so, some problems remained intractable, particularly under the existing conditions of constrained resources. On the whole, however, between 1973 and 1995 the higher-level managers of the Army ORSA program were very successful in their efforts to improve the structure, productivity, and effectiveness of the Army analytical community. The fruits of their efforts would be seen in contributions made by Army ORSA elements to the reformation and recovery of the Army after 1973 and its preparation for the stunning victory in Operation Desert Storm in 1991.

Chapter Two Notes

1 The key aspects of the STEADFAST reorganization are summarized in *Department of the Army Historical Summary, Fiscal Year 1972*, edited by William Gardner Bell (Washington, D.C.: Center of Military History, 1974), and in *Department of the Army Historical Summary, Fiscal Year 1973*, edited by William Gardner Bell and Karl E. Cocke (Washington, D.C.: Center of Military History, 1977). Upon second occurrence, all annual Department of the Army historical summaries are cited hereafter as "[Fiscal Year] DAHSUM." For a comprehensive history of STEADFAST, see Jean R. Moenk, *Operation STEADFAST Historical Summary: A History of the Reorganization of the U.S. Continental Army Command (1972–1973)* (Fort McPherson, Ga./Fort Monroe, Va.: Historical Office, Office of the Deputy Chief of Staff for Operations, U.S. Army Forces Command/Historical Office, Office of the Chief of Staff, U.S. Army Training and Doctrine Command, [1974]). Of particular interest for its "insider" look at the reorganization planning process is Maj. James A. Bowden, *Operation STEADFAST: The United States Army Reorganizes Itself*, Student Paper (Quantico, Va.: U.S. Marine Corps Command and Staff College, April 1985), p. 19 (available at http://www. globalsecurity. org/military/library/report/1985/BJA.htm, accessed 2 February 2006). The following description of the STEADFAST reorganization is based primarily on Moenk, Bowden, and the 1972 and 1973 DAHSUMs.

2 1972 DAHSUM, p. 191.

3 Francis T. Julia, Jr., *Army Staff Reorganization, 1903–1985* (Washington, D.C.: Government Printing Office for Analysis Branch, Center of Military History, 1987), p. 35.

4 1973 DAHSUM, p. 5; Moenk, *Operation STEADFAST Historical Summary*, p. i.

5 Moenk, *Operation STEADFAST Historical Summary*, p. 1.

6 Bowden, *Operation STEADFAST: The United States Army Reorganizes Itself*, p. 19. N.B.: Page numbers given here for the Bowden study may not agree with those of the original document due to the formatting of the document on the Internet site.

7 Ibid., p. 20. Lt. Gen. William E. DePuy was to be the driving force behind the 1972–1973 reorganization.

8 On the formation, conduct, and results of the Parker Panel, see Bowden, *Operation STEADFAST: The United States Army Reorganizes Itself*, pp. 22–75.

9 U.S. Department of the Army Special Review Panel on Department of the Army Organization, *Report of the Special Review Panel on DA Organization*, 2 vols. (Washington, D.C.: HQDA, 1 March 1971).

10 Moenk, *Operation STEADFAST Historical Summary*, pp. i–ii, 29; 1973 DAHSUM, p. 44.

11 The ensuing events are described in detail in Bowden, *Operation STEADFAST: The United States Army Reorganizes Itself*, p. 75 et seq.

12 Bowden, *Operation STEADFAST: The United States Army Reorganizes Itself*, p. 45.

13 Ibid., p. 46; 1972 DAHSUM, p. 115; 1973 DAHSUM, p. 44.

14 Moenk, *Operation STEADFAST Historical Summary*, p. 47.

15 Ibid.

16 1973 DAHSUM, pp. 44–45.

17 Ltr, U.S. Continental Army Command (CS-SSG-STEADFAST) to Chief of Staff Army (DACS-MR), Fort Monroe, Va., 28 Feb 73, sub: Revision of STEADFAST Detailed Plan, 20 Jul 1972, Incl 1 (Executive Summary), p.1 (cited hereafter as Revised STEADFAST Detailed Plan).

18 1973 DAHSUM, p. 45.

19 Revised STEADFAST Detailed Plan, Incl 1, p. 1.

20 Ibid. The third major Army command, the U.S. Army Materiel Command (AMC), established in 1962 and responsible for the design, development, procurement, distribution, and wholesale support of materiel, continued unchanged save for certain minor functional and geographical consolidations (see 1973 DAHSUM, p. 46).

21 MILPERCEN was established in Alexandria, Virginia, on 15 January 1973 and absorbed functions previously assigned to the DCSPER,

the Adjutant General's Office, and the Office of Personnel Operations, including the assignment, career planning, counseling, and related functions for all Army officer and enlisted personnel. MILPERCEN played an important role in the Army ORSA program by managing the Army ORSA Officer Specialty Program (see 1973 DAHSUM, p. 47).

[22] 1973 DAHSUM, p. 46; Revised STEADFAST Detailed Plan, Incl 1 (Executive Summary), pp. 3–4.

[23] 1973 DAHSUM, pp. 45–46.

[24] Ibid.

[25] Moenk, *Operation STEADFAST Historical Summary*, p. 48. Four new regional headquarters (at Fort Bragg, North Carolina; Fort Knox, Kentucky; Fort Riley, Kansas; and Fort Lewis, Washington) were established to assist in managing the ROTC program (Revised STEADFAST Detailed Plan, Incl pp. 1–2).

[26] The establishment and evolution of both organizations between 1972 and 1995 are discussed in greater detail in Chapters Five and Seven, below.

[27] Although minor changes have been made from time to time since 1973, no significant changes were made until 1985. Thus, the STEADFAST structure remained in place longer than any since that created by General Pershing in 1921 (see Julia, *Army Staff Reorganization, 1903–1985*, p. 41).

[28] The term "Army ORSA Program" as used here designates all of the elements pertaining to the organization, management, and products of Army ORSA personnel.

[29] See U.S. Department of the Army, *Army Regulation No. 1–5: MANAGEMENT—Army Study System* (Washington, D.C.: HQDA, various dates); and *Army Regulation No. 5–5: MANAGEMENT—Army Studies and Analyses* (Washington, D.C.: HQDA, various dates).

[30] Karl E. Cocke, and others, compilers, *Department of the Army Historical Summary, Fiscal Year 1976* (Washington, D.C.: Center of Military History, 1977), p. 24; U.S. Department of Defense, Deputy Under Secretary of Defense for Research and Engineering, *DOD Directive 5010.22: The Management and Conduct of Studies and Analyses* (Washington, D.C.: Deputy Under Secretary of Defense for Research and Engineering, 22 November 1976); U.S. Department of the Army, *Army Regulation No. 5–5: MANAGEMENT—Army Studies and Analyses* (Washington, D.C.: HQDA, 5 July 1977); *Department of the Army Pamphlet No. 5–5: MANAGEMENT—Guidance for Army Study Sponsors, Sponsor's Study Directors, Study Advisor Groups, and Contracting Officer Representatives* (Washington, D.C.: HQDA, 1 November 1996 and earlier editions).

[31] Karl E. Cocke and others, compilers, and Rae Panella, ed., *Department of the Army Historical Summary, Fiscal Year 1977* (Washington, D.C.: Center of Military History, 1979), p. 27.

[32] See U.S. Department of the Army, *Army Regulation No. 5–5: MANAGEMENT—Army Studies and Analyses* (Washington, D.C.: HQDA, 15 October 1981); *Army Regulation No. 5–5: MANAGEMENT—Army Studies and Analyses* (Washington, D.C.: HQDA, 30 June 1996).

[33] U.S. Department of the Army, *Army Regulation No. 10–5: ORGANIZATION AND FUNCTIONS—Department of the Army* (Washington, D.C.: HQDA, 1 April 1975 and later editions).

[34] U.S. Department of the Army, *Army Regulation No. 1–110: ADMINISTRATION—Contracting for Management Advisory Services and Operations Research Studies and Projects* (Washington, D.C.: HQDA, 28 June 1961 and later editions); *Army Regulation No. 70–20: RESEARCH AND DEVELOPMENT—Operations Research Projects and Studies Conducted by Research Analysis Corporation* (Washington, D.C.: HQDA, 27 August 1962 and later editions).

[35] U.S. Department of the Army, *Army Regulation No. 70–8: RESEARCH AND DEVELOPMENT—Human Factors and Non-Materiel Special Operations Research* (Washington, D.C.: HQDA, 6 March 1967 and later editions); *Army Regulation No. 614–139: ASSIGNMENTS, DETAILS, AND TRANSFERS—Operations Research/Systems Analysis Officer Program* (Washington, D.C.: HQDA, 6 March 1967 and later editions).

[36] U.S. Department of the Army, *Army Regulation No. 71–9: FORCE DEVELOPMENT—Materiel Objectives and Requirements* (Washington, D.C.: HQDA, 20 February 1987 and other editions).

[37] The origins and early history of the ODUSA (OR), 1964–1973, are discussed in Volume II, Chapter Three.

[38] U.S. Department of the Army, *Organization and Staffing Charts of the Office, Secretary of the Army* (Washington, D.C.: HQDA, October 1973), Chart 4 (Office of the Under Secretary of the Army).

[39] *AR 10–5*, 1 April 1975, par. 2–13.

[40] U.S. Department of the Army, General Order No. 12, 30 June 1978, par. 11e (reproduced in U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume II: Appendices C-M* [Washington, D.C.: U.S. Department of the Army Special Study Group, April 1979], app. F [Substudy on Managing the Army Study Program], Tab C, p. F-41 [cited hereafter as RAA II]). The changes were incorporated in the 1 December 1980 edition of *AR 10–5*. Similarly, the 15 October 1981 edition of *AR 5–5* (par. 4–2) prescribed simply that the "DUSA (OR) is responsible to the Secretary of the Army for the Army Study Program, for study policy formulation, and for program direction of OR/SA activities of the Army."

[41] The current (February 2006) mission statement of the ODUSA (OR) includes "(1) Managing the Army Study Program, the Model Improvement Program, and the Simulation Technology Program; (2) Establishing policy for operations research and systems analysis activities for Department of the Army analytical support services; (3) Supporting the Army Systems Acquisition Review Council/Defense Acquisition Board, and similar systems acquisition review committees; (4) Providing policy and program direction for the Army Officer Operations Research Education Program; (5) Approving test-related documentation for the Department of the Army and forwarding it to the Office of the Secretary of Defense; (6) Serving as principal Department of the Army interface with the Director, Defense Research and Engineering, and the Director, Defense Operational Test and Evaluation; (7) Providing policy and oversight for Army Contracted Advisory and Assistance Services," available at http://www.odusa-OR.army.mil (accessed 11 February 2006).

[42] There is no formal published biography of Dr. Payne, but see the brief biographical sketch in Volume II, Chapter Three; and Eugene P. Visco, "Ellis A. Johnson and Wilbur B. Payne, FS: Two Unsung (Relatively) Pioneers," *Military Operations Research* 9, no. 4 (2004): 67–72.

[43] Eugene P. Visco, "An Appreciation of Wilbur Payne," *Phalanx* 23, no. 3 (September 1990): 34; Daniel C. Willard, "In Memoriam of Wilbur B. Payne, 1926–1990," *Phalanx* 23, no. 3 (September 1990): 35.

[44] Willard, "In Memoriam of Wilbur B. Payne, 1926–1990," p. 35.

[45] Ibid. The Latin tag means "If you seek his monument, look around you."

[46] There is no published biography of David C. Hardison. The brief description of his life and career here is based on biographical materials provided to the author by Hardison and in David C. Hardison, *Oral History Interview with Dr. Charles R. Shrader, 21 February 2006*, U.S. Army War College/U.S. Army Military History Institute Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2006).

[47] Hardison enlisted in the Navy for training as a naval aviator, but the sharp reduction in the need for naval aviators at the end of the war resulted in his serving as a seaman on Saipan in the Marianas instead.

[48] Ballistics Research Laboratories was the forerunner of the Weapons Systems Laboratory, which ultimately became the U.S. Army Materiel Systems Analysis Activity (AMSAA).

[49] David C. Hardison, *Data on W.W. II Tank Engagements Involving the U.S. Third and Fourth Armored Divisions* (Aberdeen Proving Ground, Md.: U.S. Army Ballistics Research Laboratories, 1954). The data assembled by Hardison was subsequently used as the basis for development of the M60 and M1 ABRAMS series of U.S. Army tanks.

[50] The Office of the Chief of Research and Development (OCRD) was reorganized as the Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA) as part of the 1974 Army

Staff reorganization. Hardison was originally assigned as the deputy director of plans and programs, OCRD, but he served temporarily in several other positions in OCRD/ODCSRDA and ended up as the analysis adviser to the DCSRDA.

[51] The Army Systems Acquisition Review Committee was prepared to put the mechanized infantry combat vehicle into production, but Hardison persuaded Secretary Hoffman that the faults of the MICV should preclude its adoption. Among those faults were an unreliable transmission, a cramped one-man turret, and an inadequate 20-mm. machine gun, all of which defects were corrected in the Bradley, now the Army's standard infantry fighting vehicle.

[52] The Big Five were the M1A1 Abrams tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot air defense missile system.

[53] Basic biographical information on Hollis may be found in Walter W. Hollis, *First Oral History Interview with Dr. Charles R. Shrader, 2 September 2004*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2005). A second interview contains material on Hollis' term as DUSA (OR): Walter W. Hollis, *Second Oral History Interview with Dr. Charles R. Shrader, 28 November 2005*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2006). Additional biographical material may be found in Hollis' MORS biography (available from the MORS office in Alexandria, Virginia).

[54] "New Fellow on Campus: MORS Selects Walter W. Hollis," *Phalanx* 28, no. 3 (September 1995): 5.

[55] MORS Hollis biography, p. 3.

[56] Ibid. Consolidation of the Army's evaluation organizations saved some ninety-five personnel spaces and some $12 million while significantly improving support to acquisition decision makers.

[57] Ibid.

[58] Ibid., p. 4.

[59] Ibid.

[60] On 4 May 1995, the United States Military Academy announced the establishment of an annual award in honor of Hollis. Sponsored by the USMA Operations Research Center of Excellence, the Hollis Award recognizes excellence in military operations research by cadets or cadet/faculty teams. See "U.S. Military Academy Announces Hollis Award," *Phalanx* 28, no. 3 (September 1995): 7.

[61] The award was originally established as the Department of the Army Systems Analysis Award, but at the urging of Hollis, Secretary of the Army John O. Marsh Jr., changed the name of the award in 1991 to honor Dr. Payne. The award is presented each year in two categories. One acknowledges the best individual analysis done during the past year and one acknowledges the best group analysis done during the same period.

[62] Patricia J. Cook, "First Induction of Army ORSA Hall of Fame," *Phalanx* 38, no. 2 (June 2005): 29.

[63] MORS Hollis biography, p. 5.

[64] Toborg Associates, Inc., *Joint Services Conference on the Uses of History for Analysis and Military Planning, April 28–30, 1987, National Defense University, Washington, D.C.* (Washington, D.C.: Torborg Associates, Inc., 1987), app. C (Biographical Sketches), p. C-15.

[65] On Golub's activities in ODUSA (OR) and other Army ORSA assignments, see Volume II.

[66] Cook, "First Induction of Army ORSA Hall of Fame," p. 30.

[67] The sources of biographical information on Eugene P. Visco include *Eugene P. Visco Resume, 2004* (copy provided to the author by Visco); Eugene P. Visco, "Military Operations Research Society Oral History Project Interview of Eugene P. Visco, FS," *Military Operations Research* 6, no. 2 (2001), pp. 67–82; and Eugene P. Visco, *First Oral History Interview with Dr. Charles R. Shrader, 17 November 2004*, and *Second Oral History Interview with Dr. Charles R. Shrader, 24 June 2005*, both from the USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, forthcoming).

[68] Biographical information for Langston is derived from her official biography available at http://www.aca-nrhq.army.mil/directors_profile.htm. As of March 2006, Langston was the director, Army Contracting Agency-Northern Region, at Fort Monroe, Virginia.

[69] In 1986, the Study Program Management Agency consisted of four to five civilian analysts and two to three military analysts, each of whom was focused on a particular weapons system.

[70] U.S. Department of the Army, *General Orders No. 36: United States Army Model Improvement and Study Management Agency* (Washington, D.C.: HQDA, 27 July 1989). See also U.S. Department of the Army, *Army Regulation No. 5–11: MANAGEMENT—Management of Army Models and Simulations* (Washington, D.C.: HQDA, 1 February 2005). The Model Improvement and Study Management Agency (MISMA) was subsequently abolished at the beginning of FY 1998 and the models/simulations and study management functions were again separated. The Army Models and Simulation Office (AMSO) was established within the Office of the DA DCSOPS, and the Study Program Office was set up in the ODUSA (OR), where it remained until the 2001 HQDA reorganization, when it was transferred to the newly established Office of the Army G–8. In both cases, the DUSA (OR) retained responsibility for policy guidance and oversight. See, inter alia, Terese Sweet, "The G–8 Organization—Army Study Program Management Office (AMSPO)," available at http://www.g8.army.mil/organization new/aspmorg new.htm. AMIP and MISMA are discussed in greater detail in Chapter Three, below.

[71] Hardison, *Oral History Interview with Dr. Charles R. Shrader, 21 February 2006*. By the time of the 1978–1979 RAA, the total number of authorized personnel had been reduced to seven, and the number remained in that general range thereafter (see U.S. Department of the Army, *Organization and Staffing Charts of the Office, Secretary of the Army* [Washington, D.C.: HQDA, October 1975], Chart 4 [Office of the Under Secretary of the Army]; RAA II, app. F, Tab B, F-39, Figure B-1 [Possible Sources of Spaces to Build OR/S&A Management Cell]).

[72] Ibid.

[73] RAA II, app. F (Substudy on Managing the Army Study Program), p. F-viii.

[74] Ibid.

[75] Ibid., app. F, p. F-ix.

[76] Ibid., app. F, Tab B, p. F-39, Figure B-1 (Possible Sources of Space to Build OR/S&A Management Cell).

[77] Ibid., app. F, Tab B, p. F-37.

[78] Ibid., app. F, p. F-40.

[79] Ibid., app. F, p. F-44.

[80] Ibid.

[81] Ibid., app. F, p. F-45.

[82] The role of the Army Staff in the management of TASS and of the Army ORSA program from 1962 to 1973 is covered in Volume II, Chapter Three. Only the ORSA *management* role of key Army Staff members is considered here. The use of ORSA by the various staff elements is discussed in Chapter Three, below.

[83] 1974 DAHSUM, p. 35.

[84] Ibid., p. 39; Julia, *Army Staff Reorganization, 1903–1985*, p. 38.

[85] 1974 DAHSUM, p. 35.

[86] Terrence J. Gough, James E. Hewes Jr., and Edgar F. Raines Jr., *Office of the Deputy Chief of Staff for Operations and Plans, 1903–1983: Establishment—Evolution* (Washington, D.C.: Center of Military History, 1983), p. 31. In fact, the DCSOPS increased in size from 366 to 623 authorized military and civilian personnel spaces.

[87] Memo, U.S. Department of the Army, Office of the Chief of Staff (DSGS-SS, Maj. Dilworth) to Maj. Gen. Foster, Washington, 13 Feb 74, sub: Staff Perceptions of the Forthcoming Reorganization.

[88] Transmittal slip accompanying 13 Feb 74 memo, sub: Staff Perceptions of the Forthcoming Reorganization.

[89] Memo, 13 Feb 74, sub: Staff Perceptions of the Forthcoming Reorganization, pp. 1–5, 10–13, 15–16.

[90] The functions and responsibilities of both offices cut across traditional staff lines, and they were often perceived as meddling in matters properly assigned to one or another of the traditional General Staff elements.

[91] 1974 DAHSUM, pp. 35–36; Gough and others, *Office of the Deputy Chief of Staff for Operations and Plans, 1903–1983: Establishment—Evolution*, p. 31.

[92] 1974 DAHSUM, p. 36.

[93] Julia, *Army Staff Reorganization, 1903–1985*, p. 38.

[94] As stated in 1973 DAHSUM (page 48, note 1): "A field operating agency is concerned primarily with operational functions, although it may operate under the supervision of a specific staff agency. A staff support agency, on the other hand, directly supports the Army staff, usually with management information, analysis, or command and control support."

[95] Julia, *Army Staff Reorganization, 1903–1985*, p. 39.

[96] 1973 DAHSUM, p. 48.

[97] *Organization and Functions of the Army Staff*, p. 6-7.

[98] Julia, *Army Staff Reorganization, 1903–1985*, p. 39.

[99] *Organization and Functions of the Army Staff*, p. 1-7.

[100] 1974 DAHSUM, p. 36; Julia, *Army Staff Reorganization, 1903–1985*, p. 38.

[101] *Organization and Functions of the Army Staff*, p. 1-10.

[102] U.S. Department of the Army, *Army Regulation No. 10–5: ORGANIZATION AND FUNCTIONS—Department of the Army* (Washington, D.C.: HQDA, 1 December 1980), par. 2-20b. Paragraphs (1) to (6) dealt with other functions of the DAS unrelated to TASS.

[103] On the evolution of the SPMO, see Sweet, "The G–8 Organization—Army Study Program Management Office (AMSPO)."

[104] On the role of the CRD in Army ORSA program management, 1962–1973, see Volume II, Chapter Three.

[105] 1972 DAHSUM, pp. 167–68.

[106] Ibid., p. 168.

[107] 1973 DAHSUM, p. 160.

[108] Ibid., pp. 160–61.

[109] Julia, *Army Staff Reorganization, 1903–1985*, p. 38.

[110] *Organization and Functions of the Army Staff*, p. 1-45.

[111] 1974 DAHSUM, p. 126.

[112] Julia, *Army Staff Reorganization, 1903–1985*, p. 38; 1974 DAHSUM, p. 37.

[113] RAA II, app. F, Tab B, p. F-35.

[114] *Organization and Functions of the Army Staff*, pp. 1-14 to 1-24.

[115] *AR 10–5*, p. 1 December 1980, par. 2–24c.

[116] 1973 DAHSUM, p. 48. The terms Staff Support Agency (SSA) and Field Operating Agency (FOA) replaced the former designation of Class II activity.

[117] *Organization and Functions of the Army Staff*, p. 1-27.

[118] U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis Extended [RAAEX], Volume II: Task Reports* (Washington, D.C.: U.S. Department of the Army Special Study Group, HQDA, March 1985), pp. 13–14 (cited hereafter as RAAEX II). The subject of logistical analysis was discussed in depth in RAA and RAAEX. See below in this chapter and in Chapter Three.

[119] 1974 DAHSUM, p. 90.

[120] Karl E. Panella, comp., and Rae T. Panella, ed., *Department of the Army Historical Summary, Fiscal Year 1975* (Washington, D.C.: Center of Military History, 2000), p. 74.

[121] *Organization and Functions of the Army Staff*, pp. 1-48 to 1-51.

[122] Ibid., pp. 1-67, 2-13. The Engineer Strategic Studies Group (ESSG) became the Engineer Studies Group (ESG) in May 1974, and ESG in turn became the Engineer Studies Center (ESC) in November 1977.

[123] 1974 DAHSUM, p. 36.

[124] 1975 DAHSUM, p. 66; Julia, *Army Staff Reorganization, 1903–1985*, p. 39.

[125] 1975 DAHSUM, p. 66.

[126] Provisions of the 1986 DOD Reorganization Act are summarized in a fact sheet titled "Status of the Army Headquarters Reorganization, March 1967" (no author, n.p., n.d.). Copy in possession of the author. There was to be another major reorganization of the Army Staff in 2001 in which the principal General Staff officers were redesignated under the old G-staff system and a new G–8 was added to oversee Army programs, including the Army Study System.

[127] See U.S. Department of the Army, Office of the Chief of Staff, Director of Special Studies, *The Army Study System: A Staff Study by the Director of Special Studies, Office of the Chief of Staff, United States Army*, 3 vols. (Washington, D.C.: Director of Special Studies, Office of the Chief of Staff, HQDA, 18 May 1964) ["Bonesteel study"]; U.S. Department of the Army Study Advisory Committee (ASAC), *Army Study Advisory Committee Examination of the Army's Operations Research/Systems Analysis Personnel Requirements* (Washington, D.C.: Office of the Director of Special Studies, Office of the Chief of Staff, HQDA, 30 August 1966) ["ASAC study"]; and U.S. Department of the Army Committee to Evaluate the Army Study System, *Final Report of the Committee to Evaluate the Army Study System* (Washington, D.C.: HQDA, September 1969) ["DePuy study," or "ETASS"]. For greater detail on the 1960s studies, see Volume II, Chapters 4 and 5.

[128] U.S. Army Engineer Studies Group, *Final Report of Study: Results and Use of Army Studies* (Washington, D.C.: U.S. Army Engineer Studies Group, August 1976), p. 3.

[129] Ibid., p. viii.

[130] Ibid., p. vi.

[131] Ibid., p. vii.

[132] Ibid., pp. 3–4. The specific findings and conclusions are summarized on pages viii–ix.

[133] Ibid., p. 5.

[134] Ibid., p. 14.

[135] Ibid., pp. 14–15.

[136] Ibid., p. 17, Figure 7.

[137] Ibid., p. 18.

[138] Ibid., pp. ix–x.

[139] U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis*, 2 vols. (Washington, D.C.: Special Study Group, HQDA, April 1979). Volume I [cited as RAA I] contains the *Main Report* and Appendix A (Study Contributors) and Appendix B (References). Volume II [cited as RAA II] contains appendixes C (Perceptions), D (Data), E (Management of the Army Study System), F (Managing the Army Study Program for Effectiveness), G (Budget Strategy), H (Contract Support), I (Manpower/Personnel), J (Military Analysis), K (Models, Data, and Data Bases), L (Quality Assurance), and M (Study Directive). A useful synopsis of the study is provided in E. B. Vandiver III, "Review of Army Analysis," in *Final Proceedings of the Eighteenth Annual US Army Operations Research Symposium (AORS XVIII), Fort Lee, Virginia, 13–16 November 1979, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1979), pp. 9–44.

[140] RAA I, p. 1-2.

[141] Ibid.

[142] Vandiver, "Review of Army Analysis," p. 9.

[143] U.S. Department of the Army, Under Secretary of the Army, Memorandum for the Director of the Army Staff, Washington, 11 July 1978, sub: Review of Army Analysis (reproduced in RAA II, Appendix M [Study Directive]). The Terms of Reference that accompanied the Study Directive spelled out in detail the purpose and objectives of the study as well as its scope and the tasks to be performed. The overall task assigned was "to assess the Army's current analysis system and to propose specific improvements in policy, procedure, programs, and organizations." See also RAA I, p. 1-1.

[144] The members of the Special Study Group and the organizations that they represented are listed in RAA I, Appendix A (Study Contributors). Full-time representatives were provided by HQ TRADOC, HQ DARCOM, ODCSOPS, ODCSPER, OCOA, CAA, AMSAA, TRASANA, and the Combined Arms Combat Developments Activity (CACDA).

[145] RAA I, p. 1-3.

[146] Ibid., p. 1-4. The questionnaire had nine sections: Identification of Organization; Mission, Functions, and Organizational Structure; Personnel Resources; Facilities; Computers; Funds; Expected Work During FY 1979; Work Program Content–FY 1978; and Special Topics (see RAA II, Appendix D [Data], Annex I [Questionnaire]). The RAA did not examine testing, cost analysis, or threat analysis organizations (see Vandiver, "Review of Army Analysis," p. 10).

[147] U.S. Department of the Army, Office of the Chief of Staff (DACS-DMO), Memorandum for Record (MFR), Washington, 27 Mar 79, sub: Decisions at Meeting of Joint SELCOM (Augmented) on "Review of Army Analysis" Study [copy accompanying RAA I].

[148] Chapter 15 of RAA I is reproduced in its entirety in Appendix B.

[149] DACS-DMO MFR, 27 Mar 79, sub: Decisions at Meeting of Joint SELCOM (Augmented) on "Review of Army Analysis" Study.

[150] Ibid.

[151] U.S. Department of the Army, DACS-DMO, HQDA Ltr 5–84–1, Washington, 5 Sep 84, sub: Review of Army Analysis Extended, par. 3c. HQDA Letter 5–84–1 officially established the RAAEX study group, defined its composition, and assigned its responsibilities.

[152] Ibid., par. 4.

[153] Ibid., par. 5b(1). The RAAEX final report was published in two volumes. U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis Extended [RAAEX]*, 2 vols. (Washington, D.C.: Special Study Group, HQDA, March 1985). Volume I (cited as RAAEX I) contained the *Executive Summary*, and Volume II (cited as RAAEX II) contained the *Task Reports*.

[154] "Terms of Reference—Review of Army Analysis Extended (RAAEX)," 2 July 1984, par. 1 (reproduced in RAAEX II, app. B).

[155] Ibid., par. 2. Also stated in RAAEX I, p. 6.

[156] Ibid., pars. 3, 4. Although RAAEX examined those organizations not covered by the 1978–1979 RAA, the newly created Arroyo Center was excluded from consideration (see RAAEX I, p. 8). The sixteen tasks were "1. Definition of Studies and Analysis; 2. Implementation of 1978 Review of Army Analysis; 3. Program Focus; 4. Quality Assurance & Research; 5. Treatment of Countermeasures and Counter-Countermeasures; 6. Analytical Support of Functional Areas; 7. Acquisition and Training of Army Analysts; 8. Analysis Missions and Resources and AMIP; 9. Inter-Relationship of Analysis and Testing; 10. Inter-Relationship of Analysis and Intelligence; 11. Inter-Relationship of Analysis and Costing; 12. Manpower and Personnel Analysis; 13. Logistics Analysis; 14. Production of Vulnerability and Lethality Input Data; 15. Interface with External Analysis Activities; and 16. Analysis Support to the Army in the Field" (see RAAEX I, p. 10). The sixteen chapters of RAAEX II (*Task Reports*) correspond to the sixteen assigned tasks.

[157] The study team members are listed at RAAEX I, p. 16.

[158] On the RAAEX research approach, see RAAEX I, p. 14.

[159] RAAEX I, p. 22.

[160] The recommendations are described in RAAEX I, pp. 30–45.

[161] RAAEX I, pp. 26–29.

[162] Ibid., p. 24. The two recommendations not implemented were the development of vulnerability and lethality data (revisited in RAAEX) and the transfer of HQDA contract funds to CAA, which proved impractical for administrative reasons.

[163] Ibid. RAAEX study codirector Walter W. Hollis commented on the findings in "RAAEX Revisited," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twenty-Fourth Annual US Army Operations Research Symposium (AORS XXIV), Fort Lee, Virginia, 8–10 October 1985* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1985), pp. 1-9 to 1-12.

[164] Ibid.

[165] Ibid., p. 18; MFR,U.S. Department of the Army, Office of the Chief of Staff (DACS-DMO), Washington, 1 Mar 85, sub: Decisions at Meeting of Joint SELCOM on Review of Army Analysis Extended (RAAEX) Study, par. 1 (reproduced in RAAEX I).

[166] MFR, Joann H. Langston (Director, Study Program Management Office), Washington, 1 Mar 85, sub: Decisions at Meeting of Joint SELCOM on Review of Army Analysis Extended (RAAEX).

[167] Memo, Walter W. Hollis (DUSA-OR) for John S. Doyle Jr., and Lt. Gen. John J. Yeosock, Co-Chairmen, Army Management Review Task Force, Washington, 15 Aug 89, sub: Army Management Review, par. 2. The initial tasking was contained in Office of the Secretary of the Army (SAAM), Memorandum for Deputy Under Secretary of the Army (Operations Research), Washington, 18 July 1989, sub: Army Management Review, and refined in Office of the Secretary of the Army (SAAM), Memorandum for Deputy Under Secretary of the Army (Operations Research), Washington, 4 August 1989, sub: AMRTF Report Requirements. Hollis' memorandum was accompanied by eight enclosures that constituted his final report to the AMRTF. Enclosures 1–3 discussed alternatives for the consolidation of Army test and evaluation organizations, Enclosure 4 covered the consolidation of Army analytical organization, Enclosure 5 covered the government-owned/contractor-operated initiative, Enclosure 6 was the final briefing report, Enclosure 7 contained cost data, and Enclosure 8 included an assessment of the position of parties affected by the recommendations of the report.

[168] Ibid., par. 3. Hollis also established and consulted two panels composed of general officers and Senior Executive Service personnel to provide him with additional advice.

[169] Ibid., par. 5a.

[170] Ibid., par. 5b.

[171] Ibid., par. 5c.

[172] Ibid., par. 5d.

[173] U.S. Department of the Army, Office of the Deputy Chief of Staff for Operations and Plans (DAMO-ZDS), Cover Sheet, Washington, 15 Oct 90, sub: Meeting between VCSA and DUSA (OR) on 17 Oct regarding Reorganization of Army Analysis Agencies, par. 1. The cover sheet forwards Office of the Deputy Chief of Staff for Operations and Plans (DAMO-ZD); Memo thru Deputy Chief of Staff for Operations and Plans for Vice Chief of Staff, Army, Washington, 12 Oct 90, sub: Meeting with DUSA (OR), Hollis on 17 October to Discuss Reorganization of Army Analysis Agencies, with enclosures.

[174] Ibid. I have been unable to find a copy of the Riente-Shedlowski-Bauman study; therefore, the following account is based primarily on U.S. Department of the Army, VANGUARD Study Group, *Project VANGUARD Final Report: A Blueprint for the Future General Support Force* (Washington, D.C.: VANGUARD Study Group, HQDA, 15 December 1990), Chapter XII ("Restructure the Army Analysis Functions"). See also the slides used by Riente in his presentation on 13 November 1991 to AORS XXX (John A. Riente, "Restructuring and Realignment of Analysis Agencies," in *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium [AORS XXX], Fort Lee, Virginia, 12–14 November 1991, Volume I* [Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1991]).

[175] See Msg, DA DACS-ZB to MACOM Commanders and DA Staff Principals, Washington, 231256Z Sep 91, sub: Restructure and Realign Army Analysis Agencies—VCSA SENDS (a copy is included as an enclosure to U.S. Department of the Army, Office of the Deputy Chief of Staff for Operations and Plans [DAMO-ZD]; Memo thru Director of the Army Staff for Vice Chief of Staff, Army, Washington, 11 Sep 91, sub: Restructure and Realign Army Analysis Agencies—ACTION MEMORANDUM, and with the briefing slides for Riente's presentation to AORS XXX). In response to declining congressional appropriations, in 1989–1990 the Army undertook two important force structure studies. Project QUICKSILVER in late 1989 focused on the TOE [table of organization and equipment] Army and recommended a reduction of some 160,000 personnel as well as a reduction in TDA [table of distribution and allowances] units (HQDA, MACOMs, SSAs/FOAs, and installations) of some 40,000 soldiers and 57,000 civilian man-years by FY 1997. Project VANGUARD in 1990 focused on the TDA Army and reserve components and recommended a 20 percent decrease in HQDA, a significant downsizing of Army SSA/FOA, and the elimination of some 9,000 TDA enlisted personnel slots (see William Joe Webb and others, comps., and W. Scott Janes, ed., *Department of the Army Historical Summary, Fiscal Years 1990 and 1991* [Washington, D.C.: Center of Military History, 1997], p. 157). On implementation of the restructuring

and realignment, see U.S. Department of the Army, Office of the Deputy Chief of Staff for Operations and Plans (DAMO-ZDS), Cover Sheet, Washington, 11 Sep 91, sub: Restructure and Realign Army Analysis Agencies, par. 1 (forwarding DAMO-ZD Memo thru DAS for VCSA, Washington, 11 Sep 91, sub: Restructure and Realign Army Analysis Agencies—ACTION MEMORANDUM, with four enclosures).

176 *Project Vanguard Final Report*, pp. XII-1 and XII-2.

177 Ibid., p. XII-2.

178 Ibid., pp. XII-2, XII-4.

179 Ibid., pp. XII-2, XII-3.

180 Ibid., pp. XII-3, XII-4.

181 Ibid., pp. XII-4 to XII-11.

182 U.S. Department of the Army, Office of the Deputy Chief of Staff for Military Operations and Plans (DAMO-ZDS), Information Paper, Washington, 6 Sep 91, sub: Implementation of Recommendations for Restructuring and Realigning Army Analysis Agencies, par. 2 (copy enclosed with DCSOPS [DAMO-ZD] memorandum for VCSA, 11 Sep 91, sub: Restructure and Realign Army Analysis Agencies—ACTION MEMORANDUM).

183 The implementation directive was contained in DACS-ZB Msg 231256Z Sep 91.

184 DACS-ZB Msg 231256Z Sep 91, par. 2.

185 For implementation of the various recommendations of AAR 90 and Project Vanguard discussed below, see DACS-ZB Msg 231256Z Sep 91, par. 2, and DAMO-ZDS Information Paper, 6 Sep 91, par. 2b.

186 DAMO-ZDS Information Paper, 6 Sep 91, par. 2b(4). The decision to disestablish ESC was made by General Sullivan on 1 February 1991.

187 Ibid., par. 2b(5).

188 DACS-ZB Msg 231256Z Sep 91, par. 3.

189 Ibid.

190 U.S. Army Concepts Analysis Agency, *A Redesign Option for Improving HQDA Analysis Support: The Center for Army Analysis* (Fort Belvoir, Va.: U.S. Army Concepts Analysis Agency, 1996).

191 U.S. Army Center for Army Analysis, *Revolution in Analytical Affairs—XXI* (Fort Belvoir, Va.: U.S. Army Center for Army Analysis, May 2001).

192 Ibid., p. i.

193 Ibid., pp. i–ii.

194 Wilbur B. Payne, "The State of Military Operations Research," *Phalanx* 15, no. 1 (February 1982): 4.

195 See oral history interviews conducted by the author with Brian Barr, David C. Hardison, Walter W. Hollis, and E. B. Vandiver III, among others.

196 The costs of the Army ORSA program, 1962–1973, and the problems of compiling a comprehensive picture of the costs of Army analytical programs are discussed in Volume II, Chapter Five.

197 RAA II, app. G, p. G-3. Military personnel were paid out of the MPA appropriation and civilians were paid out of the OMA or RDTE appropriation according to the nature of their work.

198 Ibid., app. G, G-5.

199 *Results and Use of Army Studies*, pp. 6–12, 25–26, and app. A, pp. A-6 to A-14.

200 Ibid., p. 6. In-house studies accounted for 64 percent of the total and contract studies for 36 percent of the total (see *Results and Use of Army Studies*, p. 8).

201 Ibid., pp. 6 and A-8, Figure A-4 (Distribution of Studies by Cost [FY 74 and FY 75]). In-house costs were determined by multiplying the number of professional man-years (PMYs) expended times $50,000. The costs cited represent cumulative costs for the 462 studies completed or terminated in FY 1974–FY 1975 and thus do not represent the costs associated with any one fiscal year.

202 Ibid., p. 9.

203 Ibid., pp. 10–11.

204 See RAA II, app. G passim.

205 RAA II, app. D, p. D-I-22.

206 Ibid.

207 RAA II, app. G, Table G-I-1.

208 Riente slides for AORS XXX presentation, Slide 8 (Historical Perspective—Analysis Resources).

209 Ibid., Slide 17 (In-House/FFRDC/Contract Balance). Riente's best estimate for the total cost of Army contract studies and analysis activity was about $30–$40 million (see Slide 6 [Contract Dollars, 1 OCT 89–3 AUG 90]).

210 The management of Army ORSA personnel, both military and civilian, prior to 1973 is discussed in detail in Volume II, Chapter Four.

211 *Organization and Functions of the Army Staff*, pp. 1-14 to 1-24. See also "Charter—Operations Research/Systems Analysis (ORSA) Advisory Committee," available at http://www.amsaa.army.mil/ cp16/operat.htm (accessed 9 February 2006).

212 Marie B. Acton, "Army Operations Research Civilian Career Program Update—Army ORSA Fellowship Program," *Phalanx* 19, no. 1 (March 1986): 14. The first meeting of the committee was on 12–13 December 1985.

213 ASAC *Main Report*, ann. F, p. 2. See also ASAC *Main Report*, ann. C, Table C-1. The requirements stated here are rounded up and do not account for the mathematical errors in Table C-1.

214 RAA II, app. D, p. D-I-5.

215 RAAEX II, p. 8-34.

216 Ibid.

217 Ibid., p. 8-12. Some 81.6 percent of the persons doing combat developments and training studies and analyses in the TRADOC functional centers and schools were nonanalysts (see RAAEX II, p. 8-29).

218 Memo, Hollis for Doyle and Yeosock, 15 Aug 89, sub: Army Management Review, Encl 4 (Analysis Initiative Report), p. 4-11.

219 RAA I, p. 11-1, Table 11-1 (Fields of Education [percentage]); RAA II, app. D, p. D-I-5.

220 Ibid., p. 11-2, Table 11-2 (Percent of Professional Staff Having Education Shown).

221 Ibid., p. 11-1, Table 11-1; RAA II, app. D, p. D-I-5.

222 Ibid., p. 11-4

223 Ibid., p. 11-2.

224 Ibid., pp. 11-7, 11-10.

225 RAAEX II, pp. 2-58, 2-60 to 2-64.

226 Ibid., p. 7-5.

227 Abraham Golub, "Present & Future ORSA Trends—A Forecast for the US Army," in *Proceedings of the Thirteenth Annual United States Army Operations Research Symposium (AORS XIII), 29 October–1 November 1974, Fort Lee, Virginia, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1974), p. 20.

228 RAA II, app. J (Military Analysts), p. J-1. Prior to implementation of OPMS in 1975, military ORSA specialists were designated by Military Occupational Specialty Code 8700. The program for the management of Army ORSA officers established in 1967 was discontinued with the implementation of OPMS. Specialty Code (SC 49) was later changed to Functional Area 49 (FA 49).

229 U.S. Department of the Army, *Army Regulation No. 614–139: ASSIGNMENTS, DETAILS, AND TRANSFERS—Operations Research/Systems Analysis Officer Program* (Washington, D.C.: HQDA, 6 March 1967 and later editions). On 1 October 1987, the U.S. Army Military Personnel Center became the U.S. Total Army Personnel Agency (TAPA). TAPA was later absorbed into a new Human Resources Command (HRC). For a brief outline of the program, see *Department of the Army Pamphlet 600–3–49: Functional Area 49—Operations Research/Systems Analysis* (Washington, D.C.: HQDA, 1 August 1987).

230 HQDA General Order No. 12, 30 June 1978, par. 11; *AR 10–5*, 1 December 1980, par. 2-4d, 2-24c; *AR 5–5*, 15 October 1981, par. 4-2. The responsibility of the DUSA (OR) for FA 49 policy and guidance is retained in the current (2006) ODUSA (OR) mission statement at http://www.odusa-OR.army.mil (downloaded 11 February 2006).

231 RAAEX II, p. 2-26.

232 Ibid., p. 7-5.

[233] The provisions of OPMS pertaining to SC 49 are summarized in RAA I, Appendix J, pages J-1 and J-2.

[234] RAAEX II, p. 7-8. The RAAEX study group also noted: "All officers should be given at least some ORSA training early in their careers. The Officer Advanced Course is a logical place for such training."

[235] RAA II, app. J, p. J-2. The RAA study group noted that the qualification requirements were not strictly enforced.

[236] Ibid., app. J, p. J-9.

[237] DA Pam 600–3–49, p. 3.

[238] RAA II, app. J, p. J-2.

[239] DA Pam 600–3–49, p. 4. Initially there were just two OR/SA MAC I classes per year, each with about twenty students (see RAA II, Appendix J, pp. J-9 and J-10). As time went on, the number was steadily increased. For example, in 1987 the number went from four to six per year (see Brig. Gen. John D. Robinson, "Managing Development—FA49," *Phalanx* 20, no. 1 [March 1987]: 12), and by FY 1988 there were eight OR/SA MAC I classes per year.

[240] Ibid. The RAAEX study group expressed concern about the reluctance of commanders to release personnel for participation in the ALMC Continuing Education Program (see RAAEX II, p. 7-6).

[241] Brig. Gen. Robert T. Howard, "Getting Ahead," *Phalanx* 22, no. 3 (September 1989): 29. At that time there were 444 Army positions coded for ASI 4B but only 25 officers qualified for award of the ASI.

[242] DA Pam 600–3–49, p. 4. For example, CAA and AMSAA worked with George Washington University, TRAC-Fort Leavenworth with the University of Kansas, and TRAC-White Sands Missile Range with New Mexico State University.

[243] RAAEX II, p. 7-5.

[244] RAA II, app. J, pp. J-3, J-4.

[245] Ibid., p. J-5.

[246] Ibid., p. J-7.

[247] Ibid.

[248] Ibid., p. J-9.

[249] Ibid., p. J-11.

[250] RAA II, p. 2-26.

[251] Ibid.

[252] See Maj. John D. French, "Specialty 49 Demographics," in *Final Proceedings of the Twentieth Annual US Army Operations Research Symposium (AORS XX), Fort Lee, Virginia, 5–8 October 1981, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1981), pp. 33–43; and Maj. J. Doesburg, "Specialty 49 (Operations Research and Systems Analysis) Minimum Essential Demographics Briefing," in *Final Proceedings of the Twenty-First Annual US Army Operations Research Symposium (AORS XXI), Fort Lee, Virginia, 6–7 October 1982, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1982), pp. 2-283 to 2-300.

[253] French, "Specialty 49 Demographics," p. 37, Slide 6.

[254] Ibid., p. 36, Slide 5.

[255] Ibid., p. 41, Slide 13.

[256] Ibid., p. 40, Slide 11.

[257] Doesburg, "Specialty 49 (Operations Research and Systems Analysis) Minimum Essential Demographics Briefing," p. 2-291.

[258] Ibid., p. 2-297.

[259] RAAEX II, p. 8-18.

[260] Ibid.

[261] Brig. Gen. John D. Robinson, "Army ORSAs Active," *Phalanx* 20, no. 2 (June 1987): 27.

[262] Thomas P. Moore, "Collection of Wartime Data—Are Reserves the Solution?" *Phalanx* 25, no. 1 (March 1992): 21.

[263] Brig. Gen. Richard W. Tragemann, "ORSA 49—The Drawdown Puzzle," *Phalanx* 25, no. 1 (March 1992): 26.

[264] RAA II, app. D, p. D-II-1.

[265] See the oral history interviews conducted by the author with Brian Barr, David C. Hardison, Walter W. Hollis, and E. B. Vandiver III.

[266] Lt. Gen. David F. Melcher (USA Ret.) and Lt. Col. John G. Ferrari, "A View from the FA49 Foxhole: Operational Research and Systems Analysis," *Military Review* (November–December 2004): 2.

[267] Ibid., pp. 3–4.

[268] Ibid., p. 2.

[269] ASAC *Main Report*, app. 51 (Functional Chiefs - DAC Career Programs).

[270] "Job Description for Operations Research Series GS-015-0," from the *Civil Service Handbook of Occupational Titles and Definitions*, reproduced in ASAC *Main Report*, app. 29 (OR Job Description).

[271] Acton, "Army Operations Research Civilian Career Program Update—Army ORSA Fellowship Program," p. 14.

[272] For details of the activities of Acton as the FCR, see her periodic reports published in *Phalanx* between March 1986 and March 1988.

[273] Michael Sandusky, "Army Operations Research Career Program Update," *Phalanx* 21, no. 2 (June 1988): 22.

[274] Maj. David W. Harris, "Changing the Guard," *Phalanx* 21, no. 3 (September 1988): 24.

[275] Ibid.

[276] Sandusky, "Army Operations Research Career Program Update," *Phalanx* 22, no. 1 (March 1989): 10

[277] Ibid.

[278] RAA I, p. 11-7.

[279] ASAC *Main Report*, p. 21.

[280] "Employment Trends for Operations Research Analysts in the Federal Government," *Phalanx* 12, no. 1 (March 1979): 3. Data based on U.S. Office of Personnel Management Annual Occupational Survey.

[281] RAA II, app. D, p. D-II-1.

[282] Ibid., p. D-I-6.

[283] RAAEX II, p. 8-21, Table (1515 Personnel [AUTH/ON HAND]) and p. 8-25, Table (1515 Strength and Percent of Authorizations [FY 83]).

[284] See http://www.amsaa.army.milcp16/demogr.htm (accessed 18 March 2006). The chart at the website incorrectly gives the total number of persons in Subprogram 1515 at 849.

[285] Ibid., p. 7-10.

[286] Ibid., p. 7-12.

[287] Ibid., p. 7-14.

[288] Marie B. Acton, "Army Operations Research Career Program Update," *Phalanx* 20, no. 2 (June 1987): 26.

[289] Acton, "Operations Research Career Program Update," *Phalanx* 21, no. 1 (March 1988): 23.

[290] Acton, "Army Operations Research Civilian Career Program Update—Army ORSA Fellowship Program," p. 14; "Career Program Update," *Phalanx* 20 no. 1 (March 1987): 13; and "Army Operations Research Career Program Update," *Phalanx* 20 no. 4 (December 1987): 14.

[291] Action, "Greening for Army Civilians," *Phalanx* 20, no. 3 (September 1987): 24–25.

[292] Ibid., p. 25.

[293] Sandusky, "Army Operations Research Career Program Update," *Phalanx* 22, no. 1 (March 1989): 10; and "Army Operations Research Career Program Update," *Phalanx* 23, no. 1 (March 1990): 16.

[294] For a short history of AORS and a statement of its importance, see E. B. Vandiver III, "The US Army Operations Research Symposium," *Phalanx* 17, no 3 (September 1984): 4. Management of AORS by the CRD and ARO-D, 1962–1973, is covered in Volume II, Chapter Three.

[295] U.S. Department of the Army, Office of the Chief of Staff, *Chief of Staff Regulation No. 1–29: ADMINISTRATION—Army Operations Research Symposia* (Washington, D.C.: Office of the Chief of Staff, HQDA, 5 September 1989 and other editions).

[296] CSR 1–29, p. 1.

[297] A list of the dates, theme, and sponsor of each AORS from 1962 to 2007 is provided in Appendix A.

[298] Vandiver, "The US Army Operations Research Symposium," p. 4.

[299] David C. Hardison, "AORS XVII—Revisited," in *Final Proceedings of the Seventeenth Annual US Army Operations Research Symposium (AORS XVII), Fort Lee, Virginia, 6–9 November 1978,*

Volume I (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1978), pp. 138–39.

[300] Walter W. Hollis, "Keynote Address: Army Analysis—Is It Healthy?" in *Final Proceedings of the Twentieth Annual US Army Operations Research Symposium (AORS XX), Fort Lee, Virginia, 5–8 October 1981, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1981), p. 2.

[301] David C. Hardison, "Banquet Speech," in *Final Proceedings of the Twenty-First Annual US Army Operations Research Symposium (AORS XXI), Fort Lee, Virginia, 6–7 October 1982, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1982), p. 2-339.

[302] David C. Hardison, "Closing Remarks," in *Final Proceedings of the Twenty-Second Annual US Army Operations Research Symposium (AORS XXII), Fort Lee, Virginia, 3–5 October 1983* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1983), p. 2-24.

[303] Walter W. Hollis, "Keynote Address, AORS XXII," in *Final Proceedings . . . AORS XXII*, p. 2-7.

[304] See RAAEX II, ch. 15.

[305] Ibid., p. 15-18.

[306] Ibid.

[307] Ibid., p. 15-32.

[308] Ibid. The JTCG/ME was a program directed by the secretary of defense but funded in the Army budget. It developed data on munitions effectiveness and published the Joint Munitions Effectiveness Manuals (JMEMs) (see RAAEX II, pp. 15-20, 15-21).

[309] Ibid., p. 15-25.

[310] Ibid.

[311] Ibid., p. 15-6.

[312] Ibid.

[313] Ibid.

[314] Ibid., p. 15-26.

[315] Ibid., p. 15-12.

[316] Ibid., pp. 15-10, 15-14.

[317] Ibid., pp. 15-12, 15-25, 15-28.

[318] Ibid., p. 15-16.

[319] Ibid., p. 15-25. For a contemporary synopsis of the Navy's own ORSA program, see Admiral Ronald J. Hayes, "The OR Team Go to See," *Phalanx* 18, no. 2 (June 1985): 6–7. Admiral Hayes was then vice chief of naval operations.

[320] Ibid., p. 15-30.

[321] Peter Purdue, "Operations Research at the Naval Postgraduate School," *Phalanx* 21, no. 1 (March 1988): 11–12. See also Lt. Cdr. Robert Stemp, "MOR at NPS," *Phalanx* 24, no. 1 (March 1991): 13–15.

[322] Willard, "In Memoriam of Wilbur B. Payne, 1926–1990," p. 35.

[323] RAAEX II, p. 15-25.

[324] Ibid., p. 15-22.

[325] Walter W. Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," *Phalanx* 24, no. 3 (September 1991), p. 9.

[326] RAAEX II, p. 15-22.

[327] G. H. Dimon Jr., "Military O. R. in the NATO Organization," *Phalanx* 17, no. 1 (February 1984): 12, 18.

[328] Eugene P. Visco, Robert Sheldon, and Jack Marriott, "Military Operations Research Society Oral History Project Interview of Eugene P. Visco, FS," *Military Operations Research* 6, no. 2 (2001): 79.

[329] "History of the DAS [U.S.-ROK Defense Analysis Seminar]," available at http://www.odusa-or.army.mil/das/history.html (accessed 9 February 2006).

[330] RAAEX II, p. 15-22.

[331] A synopsis of DAS-4, held in Seoul in 1987, is provided in Lt. Col. Vernon M. Bettencourt Jr., "Defense Analysis in ROK," *Phalanx* 21, no. 2 (June 1988): 26. The forty-person U.S. delegation to DAS-4 was led by the DUSA (OR), Walter W. Hollis.

[332] "History of the DAS [U.S.-ROK Defense Analysis Seminar]."

[333] Ibid.

[334] Karl Eulenstein, "First Japan-U.S. Operations Research Seminar (JUORS-1)," *Phalanx* 20, no. 1 (March 1987): 20.

[335] RAAEX II, p. 15-22.

[336] Ibid., p. 15-34.

[337] See Volume I, Chapter Three.

[338] Military Operations Research Society, *The World of MORS—"OR Support for Tomorrow's Force"* (Alexandria, Va.: Military Operations Research Society, July 2003), p. 1.

[339] MORS biography of Hollis, p. 5; E. B. Vandiver, "Walt Hollis Celebrates Tenth Anniversary as DUSA (OR)," *Phalanx* 24, no. 1 (March 1991): 32.

[340] *The World of MORS—"OR Support for Tomorrow's Force,"* p. 1.

[341] Lt. Col. James N. Bexfield, "How MORS Enhances the Quality of Military Operations Research," *Phalanx* 18, no. 1 (March 1985): 4.

[342] "MORS Past Presidents," available at http://www.mors.org/wom/pastpresidents.htm (accessed 13 February 2006). I am indebted to Gene Visco, Brian McEnany, Bob Sheldon, and Bill Dunn for their help in identifying the Army ORSA connection of the various MORS past presidents.

[343] "MORS Fellows," available at http://www.mores.org/wom/fellows.htm (accessed 13 February 2006). Again, I am indebted to Gene Visco, Brian McEnany, Bob Sheldon, and Bill Dunn for their help.

[344] Lt. Col. Larry R. Tinberg, *Operations Research and the US Army*, Student Essay (Carlisle Barracks, Pa.: U.S. Army War College, 7 April 1983), p. 19.

[345] See RAA I, ch. 4; and RAA II, app. C (Perceptions).

[346] RAA II, app. C, p. C-1.

[347] RAA I, pp. 4-1 to 4-4. The list of strengths and weaknesses is reproduced in full in Appendix C below.

[348] Ibid., p. 4-5.

CHAPTER THREE

The Army Analytical Community, 1973–1995

The trend toward reducing contract studies and greater reliance on in-house analysis organizations, the 1973 STEADFAST reorganization of the Army, the 1974 reorganization of the Army Staff, and the subsequent evolution of technology, the threat, and Army organization and missions as well as a substantial decline in available resources reshaped the Army analytical community in the period 1973–1995.[1] The resulting system has been characterized as one of "decentralized tasking and execution."[2] During the period, the bulk of the Army's analytical assets were to be found in just two of the major commands—the United States Army Materiel Command (AMC), known from 1976 to 1985 as the United States Army Materiel Development and Readiness Command (DARCOM), and the United States Army Training and Doctrine Command (TRADOC)—and the two new Department of the Army staff support/field operating agencies created by the 1973 STEADFAST reorganization, which were the United States Army Operational Test and Evaluation Agency/Command (OTEA/OPTEC) and the United States Army Concepts Analysis Agency (CAA).

As of 1978, the Army's Materiel Development and Readiness Command employed about 37 percent of the Army's military and civilian professional ORSA analysts identified by the Review of Army Analysis (RAA) study group.[3] Most them were concentrated in the United States Army Materiel Systems Analysis Activity (AMSAA), established in 1968 at Aberdeen Proving Ground, Maryland. However, DARCOM also employed significant numbers of ORSA analysts in its headquarters, in its subordinate research and development and readiness commands, and in many of its other subordinate agencies. The Training and Doctrine Command, created as part of the 1973 STEADFAST reorganization, accounted for another 30 percent of the Army's ORSA assets.[4] The main TRADOC analysis elements were located at the TRADOC Systems Analysis Activity (TRASANA) at White Sands Missile Range in New Mexico; the three TRADOC integrating centers at Fort Leavenworth, Kansas, Fort Benjamin Harrison, Indiana, and Fort Lee, Virginia; and at the various Army service schools. In 1986–1987, most of the TRADOC analytical assets were consolidated under the aegis of the TRADOC Analysis Command/Center (TRAC), located at Fort Leavenworth.

Although the Army Secretariat and the Army Staff were concerned primarily with policy and overall management of the Army analytical community, both included small ORSA elements that conducted studies and analyses incident to fulfilling their responsibilities with regard to the Army's planning, programming, and budgeting system (PPBS) and other assigned functions. The bulk of the ORSA assets controlled by the Army Staff, however, resided in the several staff support agencies and field operating agencies (SSAs/FOAs). Only about 3 percent of the Army's ORSA assets were assigned to Headquarters, Department of the Army (HQDA), but another 26 percent were assigned to the various SSAs/FOAs.[5] Most of those assets were employed by the two new agencies created as part of the 1973 STEADFAST reorganization: the Operational Test and Evaluation Agency and the Concepts Analysis Agency. OTEA was created in response to congressional mandates for each of the services to establish an independent test and evaluation capability and focused on the testing and evaluation of individual weapons and equipment systems—tasks that traditionally had involved the use of ORSA techniques. CAA absorbed the mission and resources of the old Strategy and Tactics Analysis Group (STAG) and focused on the support of the deputy chief of staff for operations and plans and later the Army Staff as a whole by conducting studies, analyses, simulations, and war games pertaining to force structuring and operations at the theater level. The remainder of the Army's military and civilian ORSA personnel were assigned to one of the other major commands and agencies, notably the United States Army Intelligence and Security Command (USAISC), the United States Army Forces Command (FORSCOM), the United States Army, Europe (USAREUR), and the United States Army Communications Command, or to non-Army agencies, such as the Office of the Secretary of Defense (OSD) or the Office of the Joint Chiefs of Staff (OJCS).[6]

The disparate elements of the Army analytical community in the period 1973–1995 operated independently under the major command or Army Staff element to which they were assigned. However, they were all linked and coordinated through the Army Study Program (TASP), which listed and prioritized the studies and analyses to be conducted during each fiscal year. Initially, the annual work program of the various Army ORSA elements focused primarily on the development of new weapons and equipment, new organizations, new doctrine, and improved training methods. At the same time, a significant portion of the Army's analytical capability was directed toward the management of the Army and focused on PPBS and other aspects of program analysis and evaluation. For a time, the conduct of Cost and Operational Effectiveness Analyses was a principal activity of many Army ORSA analysts. Over time, the application of ORSA techniques to problems of force structuring and to the testing and evaluation of new weapons and equipment systems became increasingly important. Another major ORSA function that expanded over time was the design, maintenance, and operation of models, simulations, and war games.

The pattern of Army analytical organizations established by the 1973 STEADFAST reorganization and the subsequent 1974 reorganization of the Army Staff changed very little over the following two decades. A number of the key elements underwent internal reorganization and were renamed; some consolidation (particularly of test and evaluation agencies) occurred; and the resources allocated to each agency generally declined, but no major reorganization of the Army analytical community took place. However, four principal focal points of Army studies and analysis emerged. Known collectively as the "Big Four," they were the Army Materiel Systems Analysis Activity (AMSAA), the Operational Test and Evaluation Agency/Command, the Training and Doctrine Command Analysis Center, and the Concepts Analysis Agency.[7] As Abraham Golub, then the technical adviser to the deputy chief of staff for operations and plans, told attendees at Army Operations Research Symposium XIII in 1974:

> The establishment of the Concepts Analysis Agency, TRASANA in the Training and Doctrine Command, the Operational Test and Evaluation Agency, together with AMSAA consolidate many of our O. R. and test functions and responsibilities. These organizations will provide a much-strengthened in-house capability. The centralization of our in-house talent will give the Army the organizations which not only can manage and conduct large segments of the O. R. effort, but which can also act as the essential "Colleges" in which newcomers to the field can learn the trade.[8]

The Army Analytical Community, 1973–1995: An Overview

By the early 1970s, most of the Army's analytical work was under centralized control even though the use of ORSA techniques had spread widely throughout the Army and there were innumerable offices and agencies using such techniques but not formally identified as part of the Army analytical community.[9] Before the 1973 STEADFAST reorganization, the bulk of the Army's analytical resources were concentrated in two major commands—the Combat Developments Command and the Army Materiel Command—but as the 1978–1979 Review of Army Analysis (RAA) study group noted: "With the 1973 reorganization, a more dispersed approach to control of resources was introduced. There was a belief that studies and analysis should be viewed as an integral part of the decision-making process as opposed to a separate function."[10]

The identification of those elements that make up the Army analytical community has always been difficult. The RAA study group summed up the Army analytical community from a resource perspective as having three basic characteristics:

> It is dispersed throughout the Army; it includes a variety of organizations ranging from agencies which do nothing but studies and analysis [to] organizations (such as the operational commands) who have very little studies capabilities; and it is mainly an in-house function with only a small fraction of the resources being used to support contracts.[11]

The RAA study group thus defined the Army analytical community to include those agencies governed by *Army Regulation (AR) 5–5: The Army Study System*, that is, the ORSA elements in the Army Secretariat and Staff, in the various HQDA SSA/FOA (including the Concepts Analysis Agency and the Strategic Studies Institute at the Army War College), in TRADOC (TRASANA and at the TRADOC integrating centers and schools), in AMSAA and other DARCOM organizations, and in the other major commands and agencies.[12] After considerable discussion, the study group decided to exclude those Army analysts supporting the cost analysis, test and evaluation, and project manager's office programs. As they explained:

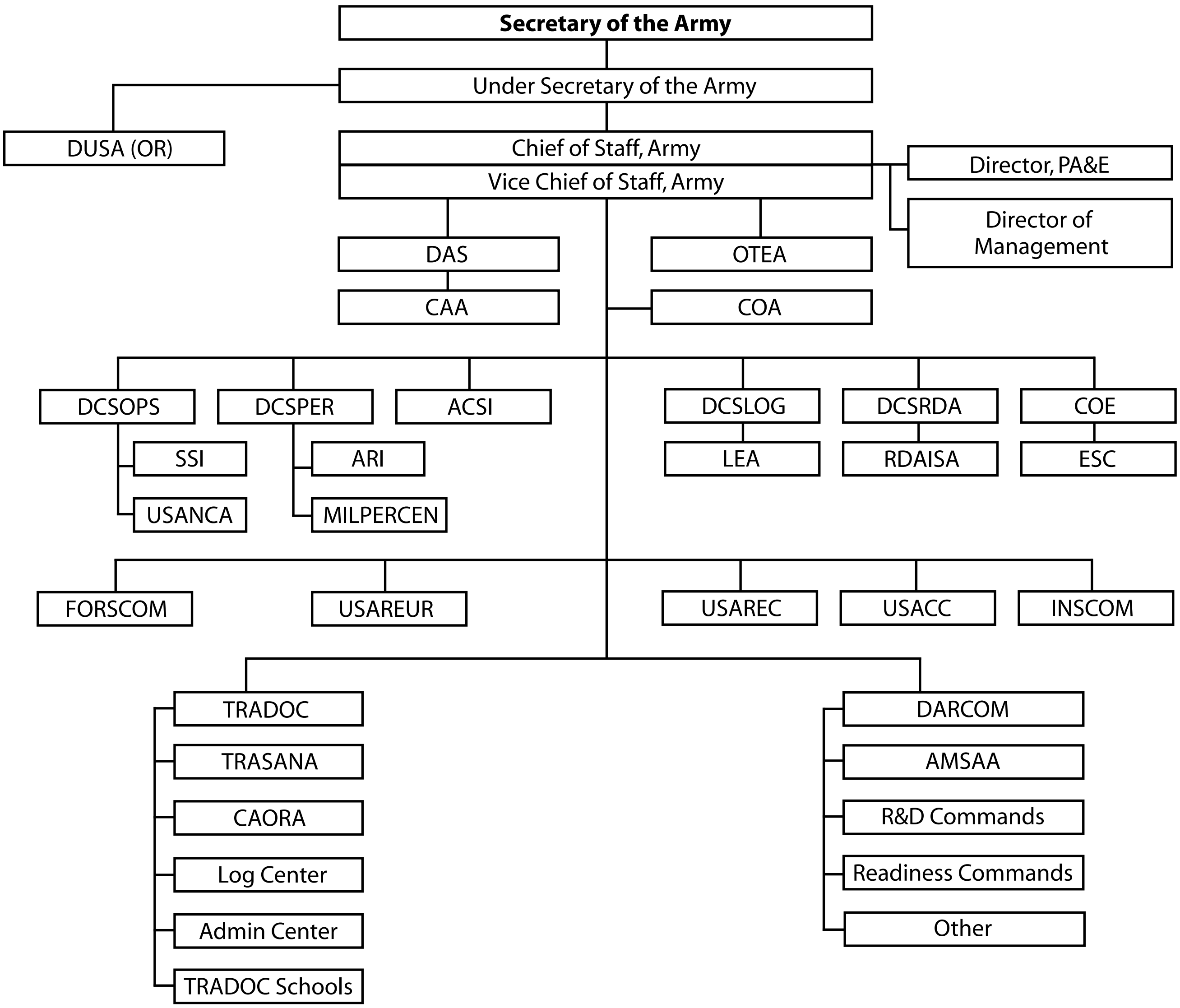
> Cost analysts usually are considered part of the financial management community rather than the studies community. The review team encountered some criticism of cost analysis within the Army, but had insufficient time to research the causes—it thus decided to exclude rather than include without corrective actions. (Selected information on cost analysis was obtained, however, and is available for later analysis if desired.) Exclusion of the analysts who work at TECOM, TCADA [*sic*, perhaps TCATA is intended], CDEC, OTEA, and the TRADOC Boards was based on the conclusion that it is questionable that their activities in test planning, data reduction, report preparation and similar activities is related to studies as much as it is to testing. The final exclusion—analysts who work in PM offices—was in a sense inadvertent. The work of these persons is not unlike that of the analysts who work in the DARCOM Commodity Commands, except that it is of a narrower scope. No data on the number of such persons was collected, but it is thought to be less than a few score.[13]

The 1978–1979 RAA study group identified some sixty-three separate Army organizations as part of the Army studies and analysis community. All of those organizations had authorizations for uniformed (SC 49) analysts and/or civilian (Series 1515) analysts, a total of 2,803 authorized professional ORSA personnel spaces, 2,455 of which were filled.[14] The organization and relationships of the sixty-three Army ORSA elements considered by the RAA study group (plus OTEA) are shown in Figure 3–1. The same basic structure was retained through 1995, although some elements were renamed, several were combined, a number of smaller elements were added, and the Army Staff agencies responsible for overseeing certain agencies were changed. For example, CAA and OTEA were established initially as an SSA and a FOA, respectively, under the assistant chief of staff for force development (ACSFOR). In 1974, OTEA became a FOA under the Office of the Army Chief of Staff (OCSA), and CAA became an SSA under the DCSOPS. In 1977, CAA became a FOA first under the DCSOPS and then in 1979 under the DAS. In 1990, OTEA was redesignated the United States Army Operational Test and Evaluation Command (OPTEC) and picked up test and evaluation responsibilities from TRADOC and other organizations. The Study Program Management Office, initially placed under the director of management, Office of the Army Chief of Staff, underwent several reorganizations and ended up under the DUSA (OR), who was also responsible for the Test and Evaluation Management Agency.

Another notable characteristic of the Army analytical community in the period 1973–1995 was the absence of a primary Army ORSA contractor, a role previously performed by the Operations Research Office and its successor, the Research Analysis Corporation (RAC). The Army continued to rely on private contractors to provide analytical services, but after the demise of RAC in 1973 and the subsequent disestablishment of the Army Mathematics Center, the Human Resources Research Office, and the Center for Research in the Social Sciences, there was no Army-sponsored Federally Funded Research and Development Center until the establishment of the Arroyo Center first at the California Institute of Technology and then in 1984 under the RAND Corporation.

The Army ORSA community was not in fact hierarchical. Each of its principal elements, and many of

Figure 3–1—The Army Studies and Analysis Community, 1979

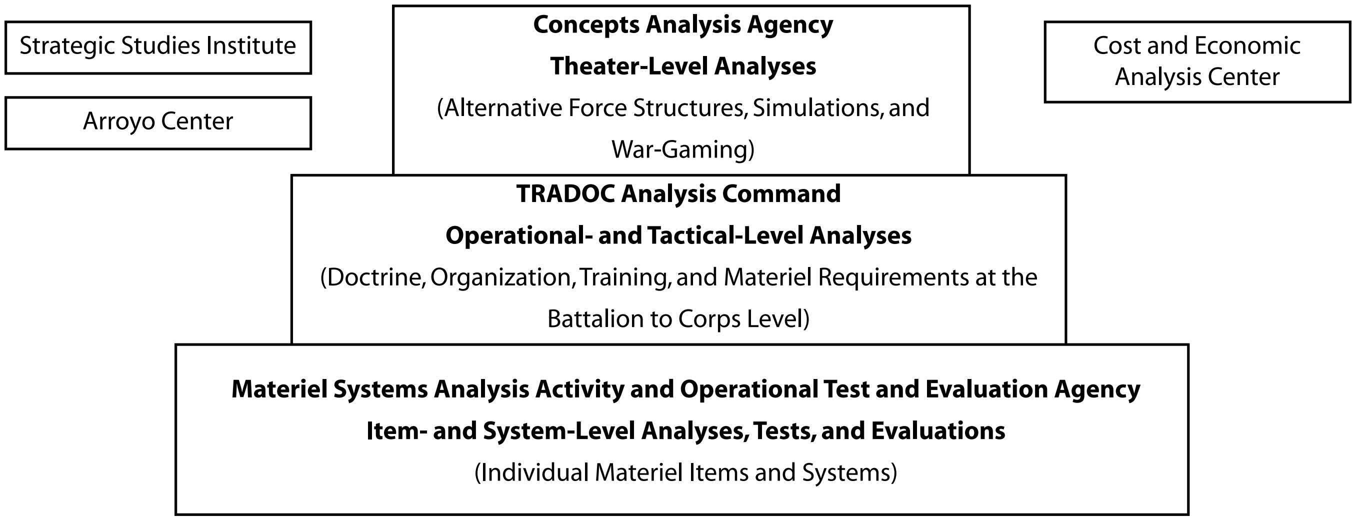


Source: RAA I, p. 2-8, Figure 2-5 (Locations of Army Studies and Analysis Resources).
Note: For abbreviations, see "Selected Abbreviations and Acronyms."

the smaller ones as well, operated independently under the major command or Army Staff element to which it was assigned. However, the community has often been conceptualized as a pyramid, as shown in Figure 3–2.[15] The analysis, test, and evaluation of individual items of materiel performed by AMSAA and OTEA provided basic data for the analysis, test, and evaluation of integrated materiel systems by those two agencies; for the development, test, and evaluation of integrated systems, organization, and doctrine by TRAC; and for the analysis of integrated theater-level systems by the Concepts Analysis Agency. Outside the main pyramid stood the Strategic Studies Institute, which performed studies and analyses of strategic issues; the Army's cost analysis community, focused in the Cost and Economic Analysis Center in the Office of the Comptroller of the Army; and, after 1984, the Arroyo Center, which focused on policy issues.

The resources of dollars and manpower dedicated to the operation of the Army analytical community as a whole have been described in Chapter Two above. Although the detailed figures needed to track Army ORSA resource allocations over the entire period 1973–1995 are not available, it appears that the peak

Figure 3–2—The Army ORSA Pyramid



commitment of funds was reached at about the time of the 1978–1979 Review of Army Analysis. The RAA study group used the estimated cost data for FY 1978 and noted that the core of the Army ORSA community operated on about $139,015,000, of which 92 percent ($128,149,000) was direct funding and 8 percent ($10,866,000) was indirect funding.[16] Some 83 percent ($114,716,000) was applied to in-house operations and 17 percent ($24,299,000) to contract operations.[17] Of the $128,149,000 in direct funding, 44 percent ($55,825,000) was funded by the Research, Development, Test and Evaluation (RDTE) appropriation; 42 percent ($53,669,000) by the Operations and Maintenance, Army (OMA), appropriation; and 14 percent ($18,655,000) by the Military Pay and Allowances, Army (MPA), appropriation.[18]

The number of authorized Army ORSA personnel also peaked about FY 1978. The RAA study group stated that the FY 1978 total authorization for Army professional ORSA personnel, both military and civilian, was 2,803 (3,658 including administrative personnel) with 2,455 professionals (1,783 civilians and 672 military) assigned.[19] By 1985, the number of authorized professionals had fallen to 2,686 (1,768 civilians and 918 military).[20] By FY 1990, the number of authorizations was down to about 1,752 (1,341 civilians and 411 military) in the principal Army analytical organizations.[21] The RAA study group also noted that in FY 1978 the Army's ORSA personnel resources were divided almost evenly among three groups (TRADOC, DARCOM, and all others), and within each of the three groups the bulk were found in one or two organizations with few ORSA personnel assets allocated to operational commands.[22] Within the Army Staff and its supporting organizations, over 60 percent of the assets were assigned to Concepts Analysis Agency and the Army Research Institute; within TRADOC, 203 of 738 personnel were assigned to TRASANA; and within DARCOM just over one-third of the assets were assigned to AMSAA. Less than 4 percent of the Army's total ORSA personnel were assigned to the other major commands.

Headquarters, Department of the Army

The 1978–1979 RAA study group identified eight organizational elements in the Army Secretariat and Army Staff with assigned ORSA responsibilities and professional ORSA personnel: the Office of the Deputy Under Secretary of the Army for Operations Research (ODUSA [OR]); the Study Management Office, Management Directorate, Office of the Army Chief of Staff (SMO, OCSA); the Program Analysis and Evaluation Directorate, Office of the Army Chief of Staff (PA&E, OCSA); the Human Analysis Team, Research and Studies Office, Office of the Deputy Chief of Staff for Personnel (RSO, ODCSPER); the Red Team, Office of the Assistant Chief of Staff for Intelligence (Red Team, OACSI); the Office of the Technical Advisor, Office of the Deputy Chief of Staff for Operations and Plans (Tech Adv, ODCSOPS);

Table 3–1—Distribution of HQDA ORSA Personnel, FY 1978

Organization	*Number of Personnel Authorized*	*Number of Professionals Authorized*	*Civilian Professionals Assigned*	*Military Professionals Assigned*
ODUSA (OR)	11	7	5	2
SMO, OCSA	4	3	1	2
PA&E, OCSA	62	45	4	38
RSO, ODCSPER	6	5	2	3
Red Team, OACSI	9	6	2	2
Tech Adv, ODCSOPS	9	7	4	3
SMO, ODCSLOG	1	1	1	0
SRAO/SciA, ODCSRDA	21	16	4	11
HQDA TOTAL	123	90	23	61
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D., p. D-I-2.
Note: "Number of Personnel Authorized" includes clerical and other administrative personnel.

the Study Management Office, Office of the Deputy Chief of Staff for Logistics (SMO, ODCSLOG); and System Review and Analysis Office and Scientific Advisor, Office of the Deputy Chief of Staff for Research, Development, and Acquisition (SRAO/Science Advisor, ODCSRADA).[23]

As of FY 1978, the eight analytical elements of the Army Secretariat and Army Staff were authorized a total of 123 personnel, of which ninety were ORSA professionals.[24] Nearly three-quarters (73 percent) of the assigned personnel (twenty-three civilian and sixty-one military) were military. The distribution of personnel among the eight offices is shown in Table 3–1.

As shown in Table 3–2, in FY 1978 the estimated funding for the eight HQDA offices was $7,355,000, about 5 percent of the estimated $139,015,000 allocated for Army studies and analyses in FY 1978.

Many of the Army ORSA personnel assigned to the eight HQDA offices listed were engaged in the formulation of policy for Army ORSA activities and in providing staff oversight of such activities. Such was the principal role of ODUSA (OR) and the Study Management Office in the Management Directorate, OCSA.[25] In a few cases, notably the Program Analysis and Evaluation Directorate in OCSA, the assigned ORSA professionals actually performed studies and analyses using ORSA techniques, mostly in connection with fulfilling Army responsibilities in the planning, programming, and budgeting area, notably by developing and applying various methodologies for prioritizing Army issues.[26] Among the achievements of PA&E, which had by far the largest authorization for professional ORSA analysts on the Army Staff (forty-five) and was also the most militarized (90 percent), was the development of PROBE, an automated system for managing budget and program issues.

ODCSPER used a variety of ORSA-related tools, such as COMPLIP, a linear program for estimating the military strength of a force. The focal point for analysis in ODCSPER was the Human Analysis Team in the Research and Studies Office. Both the RAA study group and the RAAEX study group found the studies and analysis capabilities of the ODCSPER to be inadequate and suggested a number of improvements.[27]

In their day-to-day work, many intelligence analysts used ORSA-related methods. Although the RAA study group identified the OACSI Red Team as having a definite ORSA capability, they did not address ORSA support for intelligence in detail. However, the RAAEX study group did.[28]

The technical adviser to the DCSOPS provided a limited study and analysis capability and assisted the DCSOPS in carrying out his responsibilities

Table 3–2—Estimated Cost of HQDA ORSA Activities for FY 1978
(Thousands of Dollars)

Organization	Total	Source of Funds MPA	Source of Funds OMA	Source of Funds RDTE	Method of Performance In-House	Method of Performance Contract
ODUSA (OR)	330	50	280	0	330	0
SMO, OCSA	4,455	55	1,070	3,330	125	4,330
PA&E, OCSA	1,325	925	400	0	1,325	0
RSO, ODCSPER	175	80	95	0	175	0
Red Team, OACSI	110	60	50	0	110	0
Tech Adv, ODCSOPS	305	85	220	0	305	0
SMO, ODCSLOG	50	0	50	0	50	0
SRAO/SciA, ODCSRDA	605	275	330	0	605	0
HQDA TOTAL	7,355	1,530	2,495	3,330	3,025	4,330
Army TOTAL	139,015	18,655	53,669	55,825	114,716	24,299

Source: RAA II, app. D, p. D-I-19.

as the HQDA proponent for OPMS Specialty 49 (Operations Research/Systems Analysis).[29] The assistant DCSOPS was chairman of the ORSA Program Consultant Board, and the Technical Analysis Office in ODCSOPS was responsible for quality control of Army models, war games, simulations, and other analytical techniques.[30]

ODCSLOG had a limited ORSA capability in its Study Management Office. The adequacy of Army logistics analysis capabilities was examined in some detail by the 1985 RAAEX study group, which recommended the addition of an SES-level ORSA analyst as technical adviser in ODCSLOG to "oversee logistics analysis, provide direction on appropriate goals and tools for analysis, and insure the utility of analysis"; assignment of responsibility for monitoring logistics analysis to an analyst in the ODUSA (OR); and improved guidance and coordination of logistics analysis.[31]

The System Review and Analysis Office (SRAO) in ODCSRADA prepared "broad materiel acquisition policy guidance" "and provided "independent review and analysis of materiel acquisition matters for the DCSRDA," and the chief scientist was the principal scientific adviser to senior Army leaders, provided guidance and oversight for all basic research, exploratory research, and non-systems advanced development.[32]

HQDA Staff Support and Field Operating Agencies

The RAA study group identified nine HQDA staff support agencies and field operating agencies (SSAs/FOAs) that were significantly involved in Army ORSA activities: the United States Army Research Institute for the Behavioral and Social Sciences (ARI, a DCSPER FOA); the United States Army Concepts Analysis Agency (CAA, a DCSOPS SSA); the United States Army Military Personnel Center (MILPERCEN, a DCSPER FOA); the United States Army Recruiting Command (USAREC, a DCSPER FOA); the Strategic Studies Institute (SSI, a DCSOPS FOA); the United States Army Nuclear and Chemical Agency (USANCA, a DCSOPS FOA); the Logistics Evaluation Agency (LEA, a DCSLOG SSA); the United States Army Research, Development, and Acquisition Information System Agency (RDAISA, a DCSRADA SSA); and the United States Army Engineer Studies Center (ESC, a Chief of Engineers SSA).[33]

As of FY 1978, the nine HQDA SSAs/FOAs identified by the RAA study group were authorized a total of 958 personnel, of which 708 were ORSA professionals.[34] Only about 25 percent of the assigned personnel (456 civilian and 174 military) were military. The distribution of personnel among the nine agencies in FY 1978 is shown in Table 3–3. By FY

Table 3–3—Distribution of HQDA SSA/FOA ORSA Personnel, FY 1978

Organization	*Number of Personnel Authorized*	*Number of Professionals Authorized*	*Civilian Professionals Assigned*	*Military Professionals Assigned*
ARI	371	263	224	17
CAA	299	215	94	91
MILPERCEN	82	69	31	17
USAREC	16	11	5	5
SSI	45	35	16	19
USANCA	17	14	4	10
LEA	20	15	12	3
RDAISA	55	50	48	0
ESC	53	36	26	8
SSA/FOA TOTAL	958	708	460	170
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D, p. D-I-2.
Note: "Number of Personnel Authorized" includes clerical and other administrative personnel.

1983, the number of civilian ORSA professionals authorized for the four principal HQDA SSA/FOA (ARI, CAA, LEA, and ESC) had risen to 1,038 with 881 on-hand, an 85 percent fill.[35] The bulk of them were in CAA (eighty-one authorized, seventy-two on hand).

Table 3–4 shows the estimated cost of HQDA SSA/FOA ORSA operations for FY 1978 by source of funding and method of performance. The estimated total cost of $41,079,000 represented roughly 30 percent of the total estimated Army expenditures on ORSA for FY 1978.[36]

In terms of both budget size and the number of professional personnel assigned, ARI was the largest of the HQDA SSA/FOA with an ORSA capability. On 20 May 1974, ARI was transferred from the chief of research and development to the DCSPER with 28 military and 149 civilian personnel.[37] The 1985 RAAEX study group found that ARI was conducting limited studies and analysis but that it was not assigned that mission and was not resourced to perform it.[38] Accordingly, the study group recommended that the ARI mission be expanded, the available analytical skill base realigned, and the agency be organized into separate departments for research and studies so as to make up for the Army's inadequate in-house capability to conduct personnel/manpower studies.[39] They also recommended that ARI be placed under the DAS to support the entire Army rather than just the DCSPER, but that recommendation was not implemented.[40] Although smaller than ARI, CAA, established in 1973 as part of the STEADFAST reorganization of the Army, was directly involved on a continuing basis with studies, analyses, models, simulations, and war games utilizing ORSA methods.[41] Initially, an SSA under the DCSOPS, CAA subsequently became a FOA, first under the DCSOPS and later under the DAS.

MILPERCEN was established as the Office of Personnel Operations (OPO), a Class II activity under the DCSPER, in July 1962.[42] OPO became MILPERCEN as part of the 1973 STEADFAST reorganization and subsequently operated as an FOA under the supervision of the DCSPER. USAREC also operated as an FOA under the DCSPER. USAREC analysts dealt with recruiting data to determine trends and assess the impact on the Army's ability to maintain the required level of personnel and skills. The USAREC Marketing Analysis Section consisted of five to seven analysts led by a lieutenant colonel with a civilian deputy and conducted ORSA studies to determine the optimal location for recruiting offices and to identify other key recruiting parameters.[43]

Table 3–4—Estimated Cost of HQDA SSA/FOA ORSA Operations for FY 1978 (Thousands of Dollars)

		Source of Funds				Method of Performance	
			Direct				
Organization	*Total*	*Indirect*	*MPA*	*OMA*	*RDTE*	*In-House*	*Contract*
ARI	21,044	1,123	630	0	19,291	11,968	9,076
CAA	8,605	25	2,885	5,695	0	8,376	229
MILPERCEN	1,975	0	510	1,465	0	1,975	0
USAREC	552	0	145	407	0	367	185
SSI	1,565	0	775	790	0	1,565	0
USANCA	508	0	310	198	0	490	18
LEA	3,117	0	85	3,032	0	3,033	84
RDAISA	955	0	30	925	0	911	44
ESC	2,758	1,000	210	1,548	0	2,742	16
SSA/FOA TOTAL	41,079	2,148	5,580	14,060	19,291	31,427	9,652
Army TOTAL	139,015	10,866	18,655	53,669	55,825	114,716	24,299

Source: RAA II, app. D, p. D-I-19.

SSI was established in August 1962 at Carlisle Barracks, Pennsylvania, as the United States Army Institute for Advanced Studies (IAS), a Class II activity of the Combat Developments Command. Pursuant to the STEADFAST reorganization of the Army, on 1 February 1973, IAS was redesignated the Strategic Studies Institute (SSI), a DCSOPS FOA assigned to the United States Army War College.[44] The mission of SSI was to conduct "strategic studies on the nature and use of the U.S. Army during peace and war" and to contribute "independent studies and analyses on issues of current or future import to the Army."[45]

Effective 20 May 1974, the Nuclear and Chemical Surety Group (with fifteen military and five civilian personnel) was transferred from the ACSFOR to the DCSOPS and redesignated the United States Army Nuclear and Chemical Agency.[46] As the name implied, analysts assigned to USANCA dealt with matters of nuclear weapons effects, policy, and employment.

Initially, LEA operated as a DCSLOG SSA, but it was later redesignated an FOA. Its function was to assist the DCSLOG in developing logistics plans, guidance, and policy and providing central direction and oversight of Army logistical matters. LEA analysts also reviewed and validated "logistics analyses by application of operations research, system analysis and economic techniques" and analyzed Army logistic developments to recommend approval of logistic doctrine, organization, and systems.[47] The 1985 RAAEX study group found that the ORSA resources assigned to LEA were insufficient for it to perform its analytic mission and thus recommended that LEA be given a "line-of-credit" with AMSAA for additional analytical support.[48] The United States Army Research, Development, and Acquisition Information Systems Agency (RDAISA) performed similar functions for the DCSRADA, and ESC, known earlier as the Strategic Planning Group, the Engineer Strategic Studies Group, and the Engineer Studies Group, provided support to the chief of engineers.[49]

Although not identified by the RAA study group as having an ORSA capability, three other agencies should be added to the list of ORSA-capable HQDA SSA/FOA. The first is the United States Army Intelligence Threat Analysis Detachment (USAITAD), an SSA supervised by the ACSI. In FY 1980, USAITAD became the Intelligence and Threat Analysis Center under the Intelligence and Security Command (INSCOM). The second is the United States Army Cost and Economic Analysis Center (CEAC), an FOA reporting to the comptroller of the Army (later to the assistant secretary of the Army for financial management). CEAC's mission was to provide "uniform, consistent, and accurate cost estimates for the Army."[50] OMA funding for CEAC from FY 1991 through FY 1995 amounted to some $44.1 million, and during that period the authorized end strength of CEAC was seven military and eighty-five civilian personnel.[51] The third and most significant addition is the Operational Test and Evaluation Agency (OTEA), established at Fort Belvoir, Virginia, on 25 September 1972, as a Class II activity under the ACSFOR with an initial strength of fifty-three officers, two enlisted men, and sixty-five civilians.[52] OTEA was created pursuant to congressional mandate to ensure that the Army had an independent capability for conducting necessary tests and evaluations of new equipment. Effective 20 May 1974, OTEA was transferred to DCSRADA as an FOA with 148 military and 102 civilian personnel.[53] It subsequently was placed under the director of the Army Staff, and on 15 November 1990, it was redesignated the United States Army Operational Test and Evaluation Command (OPTEC).[54] On 1 October 1999, OPTEC was redesignated the United States Army Test and Evaluation Command (ATEC).

United States Army Materiel Command

The United States Army Materiel Command (AMC) was established in July 1962 as part of the 1962 reorganization of the Army and was responsible for the development of weapons systems and other equipment as well as Army logistics in general.[55] From the beginning, the leaders of AMC acknowledged the value of ORSA and sought to make it an integral part of the new command's collection of tools. AMC absorbed the ORSA elements of the former technical services, and, together with the Combat Developments Command, AMC subsequently provided the bulk of the Army's in-house ORSA capability.

Between 1970 and 1973, AMC lost nearly 35,000 civilian spaces in the drawdown from Vietnam and general cutbacks in federal employment, but AMC was changed very little by the 1973 STEADFAST reorganization.[56] However, certain changes were recommended by the Army Materiel Acquisition Review Committee (AMARC) in the early 1970s and were implemented under General Henry A. Miley Jr., the AMC commander from 1970 to 1975. On 23 January 1976, AMC was reorganized and renamed the United States Army Materiel Development and Readiness Command (DARCOM) "to symbolize the change to a more corporate structure."[57] Subsequently, DARCOM gradually shed the centralized and civilianized structure prompted by the AMARC recommendations. In the mid-1980s under General Richard H. Thompson, the DARCOM commander from 1984 to 1987, HQ DARCOM gradually adopted a more military structure, and the name of the command was changed back to the United States Army Materiel Command. AMC, like the rest of the Army, continued to undergo frequent reorganizations and force reductions, and by 1995 it was operating with less than half of the strength it possessed during the 1980s.

As of 1978, DARCOM employed about 37 percent of the Army's military and civilian professional ORSA analysts identified by the RAA study group, which identified some twenty-three separate DARCOM elements involved in ORSA work.[58] Most of DARCOM's analytical assets were concentrated in the United States Army Materiel Systems Analysis Activity (AMSAA), established in 1968 at Aberdeen Proving Ground, Maryland.[59] However, DARCOM also employed significant numbers of ORSA analysts in its headquarters, in its subordinate research and development and readiness commands, and in many of its other subordinate agencies. In addition to AMSAA, ORSA elements in HQ DARCOM included the Systems Analysis Division and Battlefield Systems Integration (BSI) Directorate.[60] The five DARCOM materiel readiness commands—Armament (AARCOM), Communications-Electronics (CERCOM), Missile (MIRCOM), Tank-Automotive (TARCOM), and Troop Support & Aviation (TSARCOM)—each had its own ORSA element. Similarly, the eight DARCOM research and development commands—Armament (ARRADCOM), Aviation (AVRADCOM), Communications (CORADCOM), Electronics (ERADCOM) and Harry Diamond Laboratories (HDL), Missile (MIRADCOM), Mobility Equipment (MERADCOM), Natick (NARADCOM), and Tank-Automotive (TARADCOM)—had assigned ORSA elements. Active ORSA cells were also to be found in seven other DARCOM commands and agencies: the Army Management Engineering Training

Agency (AMETA); the Depot System Command (DESCOM); the Inventory Research Office (IRO); the Logistics Control Activity (LCA); the Logistics Studies Office (LSO); the Procurement Research Office (PRO), and the United States Army Security Assistance Center (USASAC).[61]

One AMC element not listed by the 1978–1979 RAA study group—a significant oversight—was the Army Logistics Management College/Center (ALMC), at Fort Lee, Virginia. ALMC was the principal in-house trainer of military and civilian ORSA analysts for the Army analytical community.[62] On 1 October 1991, the Army Logistics Management College at Fort Lee, Virginia, was transferred from AMC to TRADOC, but the Army Logistics Management Center remained responsible for coordinating the AMC Logistics Study Program and conducting logistics research, developing advanced inventory models, and preparing a variety of other ORSA-type studies and analyses. ALMC also operated the Defense Logistics Studies Information Exchange, the mission of which was to collect, store, and disseminate information about logistics studies and related material of interest to DOD agencies.

The RAA study group amassed detailed data on ORSA personnel at HQ DARCOM, AMSAA, and the various subordinate DARCOM commands, and a separate collection of data and analysis was performed for other DARCOM organizations.[63] The study group found that DARCOM had more personnel authorized in its ORSA activities than any other command or agency. As of FY 1978, the twenty-three DARCOM analytical elements identified by the RAA study group were authorized a total of 1,248 personnel (34 percent of the Army total of 3,658 personnel authorized for analytical agencies), of which 978 were ORSA professionals.[64] Only about 7 percent of the assigned personnel were military. The distribution of personnel among the various DARCOM analytical elements is shown in Table 3–5.

The RAA study group also found that DARCOM was the largest Army ORSA organization in terms of funding. The total DARCOM ORSA–related funding for FY 1978, as shown in Table 3–6, was $52,193,000, about 38 percent of the Army total estimated funding for studies and analyses in FY 1978.[65]

Between 1973 and 1995, the ORSA elements of AMC/DARCOM participated proportionately in the frequent reorganizations and force reductions, but the importance of ORSA to the command's core missions was such that the AMC/DARCOM analytical elements were generally preserved as effective organizations and played important roles in supporting the organization's three core competencies: logistics power projection, acquisition excellence, and technology generation and application. Knowledge of each materiel system's effectiveness, survivability, and performance over its life cycle were essential, and in many cases this knowledge was gained from analysis.[66] The AMC/DARCOM ORSA elements were thus at the heart of the command's many accomplishments during the period, including the development of the Big Five weapons systems, "smart" munitions, global positioning fuses, heavy-lift helicopter rotor blades, optical automatic target acquisition equipment, and combat identification methods as well as worldwide logistical support of the Army, the simplification and expedition of the development, testing, and acquisition processes, reduction in the time required to procure and stock items, streamlining of the proposal process, and improvement of simulator testing procedures.[67]

United States Army Training and Doctrine Command

The United States Army Training and Doctrine Command (TRADOC) was established at Fort Monroe, Virginia, on 1 July 1973 as a major part of the STEADFAST reorganization of the Army.[68] TRADOC absorbed most of the combat development functions of the old Combat Developments Command (CDC) as well as the training responsibilities of the Continental Army Command (CONARC) and thus became responsible for the development, testing, and evaluation of organizational and tactical concepts as well as training management. TRADOC also took over the ORSA elements resident in CDC, CONARC, the Army service schools, the Command and General Staff College, and the various test boards. In 1974, the TRADOC commander created the TRADOC Systems Analysis Activity (TRASANA) at White Sands Missile Range in New Mexico, and by the early 1980s, the ORSA elements assigned to the Combined Arms Center (CAC) at Fort Leavenworth, Kansas, had evolved into the Combined Arms Operations Research Activity (CAORA). In 1986–1987, TRASANA and CAORA were consolidated under the TRADOC

Table 3–5—Distribution of DARCOM ORSA Personnel, FY 1978

Organization	*Number of Personnel Authorized*	*Number of Professionals Authorized*	*Civilian Professionals Assigned*	*Military Professionals Assigned*
SA Div, HQ DARCOM	10	8	4	3
BSI, HQ DARCOM	22	17	4	9
AMSAA	440	346	305	15
DARCOM Readiness Commands				
AARCOM	43	34	31	2
CERCOM	12	11	9	0
MIRCOM	76	30	27	2
TARCOM	21	16	10	2
TSARCOM	22	18	17	0
DARCOM Research and Development Commands				
ARRADCOM	272	223	201	11
AVRADCOM	12	10	10	0
CORADCOM	21	17	12	0
ERADCOM	39	30	25	4
MERADCOM	26	20	15	1
MIRADCOM	19	17	14	0
NARADCOM	33	26	26	0
TARADCOM	33	28	27	1
Other DARCOM Commands and Agencies				
AMETA	38	38	36	0
DESCOM	13	11	9	0
IRO	12	10	10	0
LCA	8	6	4	0
LSO	60	49	33	14
USASAC	16	13	13	0
DARCOM TOTAL	1,248	978	842	64
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D, p. D-I-4.

Note: "Number of Personnel Authorized" includes clerical and other administrative personnel. The personnel of the Procurement Research Office are not included.

Analysis Command/Center (TRAC), located at Fort Leavenworth. Although TRAC ultimately became TRADOC's principal analytical organization, a good deal of important work continued to be done at the integrating centers at Fort Leavenworth, Kansas, Fort Benjamin Harrison, Indiana, and Fort Lee, Virginia; at the Command and General Staff College at Fort Leavenworth; and at the various Army service schools and their related test boards.[69]

In FY 1978, TRADOC accounted for about 30 percent of the Army's total ORSA assets.[70] The RAA study group identified eighteen separate TRADOC analytical elements responsible for conducting studies and analyses.[71] They included the Analysis Directorate,

Table 3–6—Estimated Cost of DARCOM ORSA Activities for FY 1978
(Thousands of Dollars)

		Source of Funds				Method of Performance	
			Direct				
Organization	*Total*	*Indirect*	*MPA*	*OMA*	*RDTE*	*In-House*	*Contract*
SA Div, HQ DARCOM	269	0	85	184	0	269	0
BSI Dir, HQ DARCOM	3,911	0	270	0	3,641	1,085	2,826
AMSAA	16,225	2,860	440	1,500	11,425	15,412	813
DARCOM Readiness Commands							
AARCOM	1,505	23	20	1,462	0	1,505	0
CERCOM	655	138	0	517	0	359	296
MIRCOM	1,305	235	75	995	0	1,305	0
TARCOM	201	0	0	201	0	201	0
TSARCOM	695	0	0	695	0	695	0
DARCOM Research and Development Commands							
ARRADCOM	13,425	4,030	300	150	8,945	12,794	631
AVRADCOM	310	0	20	24	266	310	0
CORADCOM	471	0	0	0	471	471	0
ERADCOM	1,519	51	25	40	1,403	1,319	200
MERADCOM	1,199	0	110	0	1,089	1,199	0
MIRADCOM	897	310	0	0	587	897	0
NARADCOM	1,837	60	0	24	1,753	1,709	128
TARADCOM	994	0	25	539	430	994	0
Other DARCOM Commands and Agencies							
AMETA	3,728	154	0	3,574	0	3,699	29
DESCOM	320	0	0	320	0	320	0
IRO	485	0	0	485	0	485	0
LCA	156	0	0	156	0	156	0
LSO	983	97	0	886	0	950	33
USASAC	1,103	0	0	1,103	0	903	200
DARCOM TOTAL	52,193	7,958	1,370	12,885	30,010	47,037	5,156
Army TOTAL	139,015	10,866	18,655	53,669	55,825	114,716	24,299

Source: RAA II, app. D, p. D-I-21.
Note: The budget for the Procurement Research Office is not included.

in the Office of the Deputy Chief of Staff for Combat Development, HQ TRADOC, at Fort Monroe, Virginia; TRASANA at White Sands Missile Range, New Mexico; ORSA elements in the three TRADOC integrating centers—the Combined Arms Center (CAC) at Fort Leavenworth, Kansas (the Combined Army Combat Developments Activity [CACDA]); the United States Army Logistics Center (LOGCEN) at Fort Lee, Virginia; and the United States Army Personnel and Administration Center (ADMINCEN) at Fort Benjamin Harrison, Indiana. The RAA study group also identified ORSA elements at thirteen of the Army service schools but did not mention the ORSA elements at the Command and General Staff College;

Table 3–7—Distribution of TRADOC ORSA Personnel, FY 1978

Organization	*Number of Personnel Authorized*	*Number of Professionals Authorized*	*Civilian Professionals Assigned*	*Military Professionals Assigned*
Analysis Div, DCSCD, HQ TRADOC	37	30	13	12
TRASANA	321	232	176	27
CACDA	133	114	52	51
LOGCEN	98	70	42	17
ADMINCEN	100	70	22	16
Air Defense School	53	41	13	22
Armor School	78	58	20	30
Artillery School	51	44	13	16
Aviation School	57	46	8	22
Engineer School	39	31	7	14
Infantry School	37	32	4	17
Intelligence School	66	53	11	24
Military Police School	23	21	3	16
Missile and Munitions School	17	13	3	6
Quartermaster School	29	21	7	10
Signal School	28	25	2	19
Transportation School	26	23	11	12
TRADOC TOTAL	1,193	924	407	331
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D, p. D-I-3.
Note: "Number of Personnel Authorized" includes clerical and other administrative personnel.

the Institute of Military Assistance; the Institute of Administration; and the service schools under the purview of the Personnel and Administration Center (adjutant general, judge advocate general, chaplain, finance, Women's Army Corps, data processing, and the Academy of Health Sciences).

As of FY 1978, the seventeen TRADOC analytical elements identified by the RAA study group were authorized a total of 1,193 personnel (33 percent of the Army total of 3,658), of which 924 were ORSA professionals.[72] About 45 percent of the assigned personnel were military. The distribution of personnel among the various TRADOC analytical elements is shown in Table 3–7.

The RAA study group also found that TRADOC was behind only DARCOM and the HQDA SSA/FOA in the amount of funding provided annually for its ORSA work. The total estimated TRADOC ORSA-related funding for FY 1978, as shown in Table 3–8, was $37,908,000, about 27 percent of the Army total estimated funding for studies and analyses in FY 1978.[73]

The TRADOC analysis organization depicted by the RAA study group underwent substantial reorganization and refinement after 1979, leading to the establishment in 1986 of the TRADOC Analysis Command/Center (TRAC).[74] The various TRADOC integrating centers, service schools, test boards, and other elements continued to have small but active ORSA cells that did important work on the analysis of equipment requirements, organization, doctrine, and training as well as in the growing field of modeling, simulations, and war games. Over time, the TRADOC adjusted its analytical organization to meet the changing needs of the Army's

Table 3–8—Estimated Cost of TRADOC ORSA Activities for FY 1978
(Thousands of Dollars)

		Source of Funds				Method of Performance	
			Direct				
Organization	*Total*	*Indirect*	*MPA*	*OMA*	*RDTE*	*In-House*	*Contract*
Analysis Dir, DCSCD, HQ TRADOC	3,504	0	205	799	2,500	934	2,570
TRASANA	9,590	342	765	8,183	300	8,927	663
CACDA	5,528	97	1,620	3,796	15	5,388	140
LOGCEN	1,633	0	575	1,058	0	1,609	24
ADMINCEN	2,465	6	1,030	1,429	0	2,449	16
Air Defense School	3,652	198	490	2,727	237	2,653	999
Armor School	572	0	160	412	0	366	206
Artillery School	2,592	65	1,140	1,387	0	2,591	1
Aviation School	235	0	235	0	0	235	0
Engineer School	1,748	51	660	967	70	1,738	10
Infantry School	1,348	0	420	928	0	1,346	2
Intelligence School	2,560	0	1,380	1,180	0	2,060	500
Military Police School	370	0	0	306	64	340	30
Missile and Munitions School	288	0	105	183	0	288	0
Quartermaster School	1,193	1	520	664	8	1,193	0
Signal School	—	—	—	—	—	—	—
Transportation School	630	0	630	0	0	630	0
TRADOC TOTAL	37,908	760	9,935	24,019	3,194	32,747	5,161
Army TOTAL	139,015	10,866	18,655	53,669	55,825	114,716	24,299

Source: RAA II, app. D, pp. D-I-19 to D-I-22.
Note: Figures for the Signal School are not given in the original document.

premier agency for the development of organization, doctrine, and training, and TRADOC analytical organizations played a major role in the reshaping of the Army after the Vietnam War. The authors of *Prepare the Army for War* expressed TRADOC's achievement succinctly:

> The U.S. Army Training and Doctrine Command spearheaded the sustained efforts to reform weapons, equipment, doctrine, and training in the 1970s and 1980s which produced the "Army of Excellence" that restored democratic government to Panama in Operation JUST CAUSE in 1989–90, decisively defeated and expelled the Iraqi army from Kuwait in Operation DESERT STORM in 1991, [and] conducted peace-keeping and humanitarian relief operations in Somalia, Bosnia-Herzegovina, Haiti, and Rwanda and elsewhere during the period.[75]

Other Army Major Commands

The RAA study group identified only four other Army major commands (MACOMs) with elements conducting studies and analyses on a regular basis.[76] They were the United States Army Communications Command (USACC), the United States Army Forces Command (FORSCOM), the United States Army Intelligence and Security Command (INSCOM), and the United States Army, Europe (USAREUR).[77] Altogether, the four major commands accounted for only 136 personnel (just 4 percent of the Army total of 3,658 personnel authorized in Army analytical organizations), of which 103 were ORSA professionals.[78] About 30 percent of the assigned personnel were military. The distribution of personnel among

Table 3–9—Distribution of Other MACOM ORSA Personnel, FY 1978

Organization	*Number of Personnel Authorized*	*Number of Professionals Authorized*	*Civilian Professionals Assigned*	*Military Professionals Assigned*
USACC	10	10	7	0
FORSCOM	15	15	7	7
INSCOM	111	78	41	35
USAREUR	0	0	5	9
Other MACOM TOTAL	136	103	60	51
Army TOTAL	3,658	2,803	1,787	668

Source: RAA II, app. D, p. D-I-5.

Note: "Number of Personnel Authorized" includes clerical and other administrative personnel. Figures for USAREUR are not given in RAA I, Appendix D, but are taken from RAA I, p. 13-1. Thus, the "Other MACOM TOTAL" given in Table 3–9 is different from that in RAA I, Appendix D, p. D-I-5. The "Army TOTAL" figures have not been changed. As of 1986, there were twenty-two SC 49 officers, mostly captains and majors, assigned to USAREUR and nineteen to FORSCOM (see U.S. Department of the Army, *Department of the Army Pamphlet 600–3–49: Functional Area 49—Operations Research/Systems Analysis* [Washington, D.C.: HQDA, 1 August 1987], p. 5).

the four MACOM analytical elements cited is shown in Table 3–9.

The four MACOM analytical elements identified by the RAA study group accounted for only $480,000 in estimated FY 1978 costs, as shown in Table 3–10. That amounted to about 3 percent of the Army total estimated funding for studies and analyses in FY 1978.[79]

Major Commands in CONUS

The RAA study group generally viewed the arrangements for ORSA support in the operational MACOMs to be barely adequate. The Systems Analysis Branch of the Systems and Economic Analysis Division, Office of the Comptroller, HQ USACC, was authorized ten civilian ORSA analysts but had only seven assigned, who were engaged in resource allocations and study of the effectiveness of current communications systems.[80] HQ FORSCOM was authorized fifteen ORSA personnel.[81] Five ORSA officers were assigned to the Program Analysis and Evaluation Office and two to the Office of the DCSOPS, and seven civilian analysts were assigned to the Office of the Deputy Chief of Staff-Comptroller. The RAA study group also noted that there was no organizational entity or personnel dedicated to or directly involved in sophisticated quantitative analysis, but the study group made no recommendations regarding HQ FORSCOM.[82]

United States Army, Europe

In FY 1978 there were no formally established ORSA elements in either Headquarters, United States Army, Europe (HQ USAREUR), or its subordinate commands.[83] However, there were a number of ORSA professionals assigned and working under other job titles. In HQ USAREUR there were four civilian and two military analysts assigned to the Resources Review and Analysis Division of the Office of the Deputy Chief of Staff for Resource Management and one civilian analyst in the Force Modernization Division of the Office of the Deputy Chief of Staff for Operations.[84] In addition, there were seven military analysts assigned to subordinate commands: one at HQ V Corps, three at HQ VII Corps, and three at HQ 21st Support Command.[85] The Army ORSA personnel in HQ USAREUR and its subordinate commands were involved in cost and economic analysis in support of the planning, programming, and budgeting system; preparation of input to the annual HQDA OMNIBUS study and other force-structuring issues; and some battle simulation work.[86]

The 1978–1979 RAA study group noted in general terms that Army civilian analysts based in the United States had little first-hand knowledge of the issues facing Army units in the field. The study group

Table 3–10—Estimated Cost of Other MACOM ORSA Activities for FY 1978
(Thousands of Dollars)

		Source of Funds				Method of Performance	
			Direct				
Organization	*Total*	*Indirect*	*MPA*	*OMA*	*RDTE*	*In-House*	*Contract*
USACC	240	0	0	240	0	240	0
FORSCOM	240	0	240	0	0	240	0
INSCOM	—	—	—	—	—	—	—
USAREUR	—	—	—	—	—	—	—
Other MACOM TOTAL	480	0	240	240	0	480	0
Army TOTAL	139,015	10,866	18,655	53,669	55,825	114,716	24,299

Source: RAA II, app. D, p. D-I-22.

Note: No figures are provided for either INSCOM or USAREUR in the original document. In the case of USAREUR, most of the civilian personnel were on loan from other Army analytical agencies and some of the costs were borne by those agencies rather than by USAREUR.

also expressed concern regarding the adequacy of the ORSA support being provided to the Army's field commands, particularly in USAREUR. Specifically, they stated their belief that "not enough operational analysis is being conducted in USAREUR."[87] Accordingly, the study group recommended the initiation of discussions among all interested parties aimed at the establishment of "an analytical activity in USAREUR . . . by end FY 79."[88]

The DUSA (OR), David C. Hardison, who was also the chairman of the RAA study group, worked closely with HQ USAREUR personnel to implement the RAA study group's recommendation. The plan they devised was to create a small analytical cell controlled by the HQ USAREUR chief of staff, headed by an ORSA-qualified officer in the grade of lieutenant colonel, and staffed by civilian analysts on temporary assignment from the various CONUS-based Army analytical organizations (AMSAA, TRASANA, CAA, etc.). The mission of the proposed HQ USAREUR ORSA cell would be to perform both short- and long-term analyses of issues important to the command. They believed that the proposed cell would benefit the CONUS-based agencies providing the personnel by broadening the understanding of the assigned analysts regarding USAREUR issues while significantly increasing the ORSA support immediately available to HQ USAREUR.

The planned HQ USAREUR ORSA cell was established in August 1980.[89] Lt. Col. Harry Thie was assigned as the cell chief, and four civilian analysts were assigned for a two-year tour (1980–1982). The initial civilian complement included Joseph Koletar, the GM–15 program manager of the OMNIBUS studies and a graduate of the Army War College, from CAA; Donna Vargas, a GM–14, from TRASANA; Floyd Rivera, a GS–13, also from TRASANA; and Kenneth Matthews, a GS–13, from AMSAA.

The USAREUR ORSA cell received strong command support right from the start. Hardison and his successor, Walter W. Hollis, maintained an active interest in the program and made frequent visits to Germany to observe progress and ensure continued command support of the program. The analysts offered by the various Army analytical agencies for temporary assignment were top-notch and received the full backing of their parent organizations in CONUS. The commander-in-chief USAREUR (CINCUSAREUR) and his staff and subordinate commanders also supported the new organization, which was located in the Office of the USAREUR Chief of Staff in order to facilitate the establishment of priorities and ensure that its analytical expertise was made available throughout the command.

In the summer of 1981, Colonel Thie's tour ended, and he was replaced by Lt. Col. James H. Malley, who served as the cell chief from July 1981 to September 1984. In 1981, two additional civilian analysts were added to the initial complement of four in order to handle the increasing analytical workload and to provide continuity and overlap so that each year there would be analysts departing upon completion of their two-year tour, analysts remaining for their second year, and new analysts arriving to start their tour. Replacements were drawn from a variety of CONUS-based analytical organizations both large and small. For example, from 1981 to 1986 analysts were assigned to the HQ USAREUR ORSA cell from the Intelligence Center and School at Fort Huachuca, Arizona; the Infantry Center and School at Fort Benning, Georgia; the Army Logistics Center at Fort Lee, Virginia; HQ TRADOC at Fort Monroe, Virginia; TRASANA at White Sands Missile Range, New Mexico; AMSAA at Aberdeen Proving Ground, Maryland; OTEA in Falls Church, Virginia; CAA in Bethesda, Maryland; the Office of the Army Comptroller in Washington; and Natick Laboratories in Natick, Massachusetts.[90] The annual selection of civilian analysts for temporary assignment to the HQ USAREUR ORSA cell was managed by the DUSA (OR), often with the assistance of a committee that included the technical adviser to the DA DCSOPS and representatives from the Army Study Program Management Office, HQ TRADOC, and various Army ORSA organizations.[91] The selectees, normally Series 1515 analysts in the grades of GM/GS–12/13, remained on the roster of their parent organization during their two-year "accompanied" tour in Heidelberg, Germany.

Efforts were made to ensure that the analysts temporarily assigned to HQ USAREUR obtained maximum professional benefits from their tour. Newly assigned analysts were challenged to observe and understand Europe and the deployed forces, and to develop their own perspectives on issues of importance to the command and to the broader analytical community. They were assisted by those analysts already "in-theater," and were encouraged to travel whenever possible by automobile, train, or helicopter so as to get a "better feel" for the "terrain."[92] Orientation visits to HQ Berlin Command were conducted every other year, and HQ USAREUR also offered opportunities for the assigned analysts to attend conferences in Europe that would have been prohibitively expensive had they been stationed in CONUS. This encouraged analysts to continue their individual professional development while stationed overseas and fostered the interchange of ideas among CONUS-based and European-based Army analytical organizations and NATO and European academic ORSA specialists. In the summer of 1983, the DUSA (OR) imposed a requirement that each analyst completing his or her tour in USAREUR must submit a paper describing some aspect of their tour and their perspective on its importance.[93] The DUSA (OR)'s guidance on topic and form were quite broad, the intent being to encourage the assigned analysts to use their "spare time" for the ultimate benefit of the analytical community and the Army.

Immediately upon its formation in August 1981, the HQ USAREUR ORSA cell launched an ambitious program of studies and analyses focused on issues of importance to the command. Among the early projects undertaken were four that stand out: (1) an evaluation of USAREUR ammunition stockpile positioning undertaken by Joseph Koletar at the direction of the CINCUSAREUR, General Frederick J. Kroesen, that resulted in the restoration of the policy of having vehicles "combat loaded" in unit motor pools; (2) a study by Donna Vargas for the USAREUR DCSOPS of USAREUR's internal planning, programming, and budgeting system (PPBS) that resulted in the inclusion of an execution phase to address how the results of the PPBS were implemented, a step soon thereafter adopted by OSD as well; (3) the design by Floyd Rivera for the USAREUR deputy chief of staff for engineering of a process for compiling, assessing, and prioritizing facility maintenance requirements to more effectively accomplish repairs in a timely manner and at lower cost; and (4) the work by Kenneth Matthews and Donna Vargas on the Army-wide proliferation of command and control information systems and how their potentially adverse impact on HQ USAREUR might be minimized.[94] Other efforts undertaken in the first few years included an analysis of tank crew qualification procedures; assistance to the Seventh Army Training Center (7th ATC) in improving coordination and scheduling of firing ranges; data collection and analysis in support of the "Canadian Cup" armor competitions among armored forces from the various NATO countries; a study of nontactical vehicles; crime forecasting for the Military Police; assistance to the USAREUR printing plant in responding to congressional requirements for the justification of the need for new or additional printing equipment; assistance to the USAREUR DCSOPS in the development of a strategic command, control, and communications (C3) plan and in the design of physical security provisions for ultra-secure caserns; and presentation in-theater of the results of analytical studies conducted by CONUS-based Army ORSA agencies.[95] In the spring of 1982, the USAREUR ORSA cell began to observe and participate in the major theater-level command-post exercises (CPXs) conducted in USAREUR, such as Wintex, Crested Eagle, and Able Archer. Analysts were assigned to the major headquarters in the field, observed and recorded activities and relationships, and then collated and analyzed their observations, which were presented to the HQ USAREUR chief of staff as an independent evaluation of how the exercise was conducted.[96]

The success of the HQ USAREUR ORSA cell prompted the establishment of similar, formal ORSA cells in the subordinate USAREUR commands. The commander of HQ VII Corps in Stuttgart, Germany, was the first to request such a cell, and the VII Corps ORSA cell was formed in the summer of 1981 with two ORSA-qualified officers provided by the corps headquarters and two civilian analysts provided through the DUSA (OR) selection process, again for two-year terms.[97] Continuity for the small VII Corps ORSA cell was provided by staggering the tours of the military and civilian analysts. A few of the early studies and analyses conducted by the HQ VII Corps cell included the VII Information Systems Planning (ISP) study conducted by Steve Pearcy to determine HQ VII Corps information needs and to recommend solutions to recognized information management problems; a related Corps Management Information Systems study, again done by Steve Pearcy, to determine information needs during the transition to war and to provide recommendations regarding the linkage of peacetime and wartime information management systems; a community organization and resource planning system study to determine facility requirements based on current assets and projected needs and to indicate how units could be moved to achieve the best utilization of existing facilities and where new construction should be planned; an analysis of tank crew training effectiveness; restationing studies; and studies of vehicle utilization.[98]

The commander of the V Corps in Frankfurt and the commander of the 21st Support Command in Kaiserslautern also sought the establishment of ORSA cells in their headquarters. The DUSA (OR) and CINCUSAREUR agreed, and ORSA cells were established at HQ V Corps and HQ 21st Support Command in the summer of 1984.[99] Each cell was composed of two ORSA-qualified officers provided by the command and two civilian analysts provided for two-year tours by the DUSA (OR) selection process. As was the case with the HQ VII Corps ORSA cell, the cells in HQ V Corps and HQ 21st Support Command reported directly to the command's chief of staff with a technical channel to the HQ USAREUR ORSA cell, which provided staff oversight.[100]

Training was an important core activity in USAREUR, and all of the USAREUR ORSA cells participated in training-related studies and analyses. There were also a number of other ORSA activities in USAREUR that evolved separately from the HQ USAREUR ORSA program. In 1983, 7th ATC entered into an agreement with the TRADOC Systems Analysis Activity that led to the establishment of a TRASANA field office in Grafenwoehr, Germany.[101] The initial mission of the TRASANA Field Office was to perform a comprehensive on-site field evaluation of unit training on the M2/3 Bradley infantry fighting vehicle. In November 1985, 7th ATC and TRASANA mutually agreed to expand the field office's mission to include a broad variety of training studies and training effectiveness analyses and to act as a "forward deployed" element of the TRADOC analysis community to conduct training analyses requiring USAREUR involvement.[102]

The Memorandum of Agreement (MOA) between 7th ATC and TRASANA signed in 1985 provided that TRASANA would provide four man-years of analytical support annually to 7th ATC in exchange for necessary base operations support.[103] The MOA also allowed TRASANA to have up to thirteen persons in the field office without asking for USAREUR approval. TRASANA analysts assigned to the field office agreed to a three-year commitment. The first chief of the TRASANA field office was Dr. Robert LaRocque. He was followed by Walter Butler in 1986. Dr. Claude Miller was the last chief of the field office before the mission was returned to TRAC-White Sands Missile Range (TRAC-WSMR) in the early 1990s.

In accordance with the 1985 MOA, the major functions of the TRASANA/TRAC-WSMR Field Office were to:

a. Conduct studies, analyses, and evaluations of Army training issues best addressed in the USAREUR training environment;
b. Provide analysis support to USAREUR through the 7th ATC;
c. Work with the 7th ATC commander and staff to determine analytical requirements and best approach; and
d. Report results to HQ USAREUR and make them available to the TRADOC community as applicable.[104]

Another important ORSA-related program conducted in Germany by Army ORSA elements outside the HQ USAREUR program was the joint USAREUR/USAFE (United States Air Force, Europe) Warrior Preparation Center (WPC) at Einsiedlerhof Air Station.[105] The WPC grew out of an annual corps-level command-post exercise initiated in the early 1980s by Lt. Gen. William J. Livsey Jr., the VII Corps commander, and his G–3, then-Col. Gordon R. Sullivan. The series of VII Corps CPX used a simulation based on the McLintock theater model to generate the situations to which the corps and subordinate division decision makers had to respond. General Livsey's successor, Lt. Gen. John Galvin, expanded the effort to include more frequent repetitions of the exercises at the corps headquarters in Stuttgart. The success of the VII Corps effort led to a joint initiative by the CINCUSAREUR and the commander in chief, United States Air Forces, Europe (CINCUSAFE), to develop an environment in which Army commanders and staff officers at corps level and below could interact with their Air Force counterparts in a realistic simulation.

The initial organization for the WPC called for an Air Force commander and an Army civilian technical director, with the command position alternating between the services for later iterations. In order to expedite the establishment and use of the WPC, the DUSA (OR) agreed to support the technical director position for the first two years with an analyst assigned through the USAREUR ORSA program. Lee Pleger, a GM–15 assigned to TRAC-Fort Leavenworth, filled the position while steps were taken to authorize the position on a permanent basis. The first permanent occupant of the technical director position, beginning in the summer of 1984, was Donna Vargas, who had been one of the original members of the HQ USAREUR ORSA cell in Heidelberg.[106]

Overall, the USAREUR ORSA program achieved the objectives set for it. First and foremost, HQ USAREUR and its subordinate commands received the increased direct ORSA support recommended by the 1978–1979 RAA study group. At the same time, several generations of CONUS-based Army analysts became more familiar with issues of concern to commanders in the field, and their parent analytical organizations were stimulated to provide additional back-up support for USAREUR commanders and staffs.

Other Overseas Commands

The success of the ORSA program in USAREUR spurred interest in establishing such cells at Headquarters, United States Army Western Command, and Headquarters, United States Army Southern Command.[107] In the summer of 1984, Bill Dunn, then on loan to the HQ USAREUR ORSA cell from OTEA, was offered and accepted a permanent reassignment to head a newly organized ORSA cell at Headquarters, United States Forces, Japan.[108] In Korea, the United States Eighth Army and the Combined Forces Command also established a joint operations analysis group that included Army analysts.[109]

Other Army Analytical Elements

The 1978–1979 RAA and 1985 RAAEX study groups were selective in what organizations they included in the Army analytical community. In general, they included only those organizations that performed studies and analyses using ORSA methods, and, as noted, they generally excluded the Army cost analysis, project manager, and test and evaluation communities, including CEAC, OTEA, and CDEC, as well as those Army ORSA specialists working for DOD, the JCS, and other government agencies.[110]

Nor did they include those analysts working in the Army medical community, for example, in the Office of the Surgeon General. There were also a number of other Army analytical organizations created after 1985. Two of the more important focal points of Army analytical activity not included in the RAA and RAAEX studies were the ORSA elements at the United States Military Academy (USMA) and the ORSA contractors working for the Army, including the Arroyo Center.

The ORSA elements at USMA were generally overlooked in all of the surveys of the Army analytical community. The study of ORSA was introduced at West Point by the Department of Mathematics (now the Department of Mathematical Sciences) in the 1970s, and a Department of Systems Engineering (DSE) was established in 1989.[111] By 1986, there were twenty-one SC 49 officers assigned to USMA.[112] Today, the Department of Systems Engineering offers instruction in systems engineering, engineering management, information engineering, systems management, and operations research, and together with the Department of Mathematical Sciences (DMS) co-sponsors an interdisciplinary major in operations research.[113] The two departments also jointly sponsor the USMA Operations Research Center of Excellence (ORCEN), the purpose of which is to "provide a small, full-time analytical capability in support of the Academy's purpose and mission, the goals of the academic program and the disciplines of systems engineering, operations research and engineering management."[114] The ORCEN provides both faculty and cadets with opportunities to "investigate a wide range of interdisciplinary, systemic issues and to apply many of the operations research, systems engineering, and engineering management concepts studied in the classroom," and to work on real-life problems and with actual Army simulation models in the DSE Combat Simulation Lab (CSL).[115] The ORCEN is sponsored and funded by the assistant secretary of the Army for financial management and comptroller, and is led by a permanent professor, USMA, supplied by the DSE.[116] Both the DMS and the DSE provide full-time analysts for the ORCEN drawn from their assigned faculty.[117]

The RAA study group addressed Army ORSA contractors only in the context of the balance between in-house and contract ORSA studies and did not attempt to identify the Army ORSA contract organizations or to quantify their personnel, costs, or study programs.[118] The study group found considerable enthusiasm among OSD officials for substantial increases in the proportion of studies done by contractors, but Army leaders were somewhat indifferent.[119] They also considered the data on in-house vs. contract work for the period FY 1969–FY 1978 and found that while in-house Army ORSA strength grew about 127 percent during the period, contract efforts declined by over 80 percent, or about 500 professional man-years.[120] Between FY 1969 and FY 1978, the expenditures on Army ORSA contracting declined from $27,600,000 to $8,700,000 and the percentage of total Army ORSA program professional man-years assigned to contractors declined from 37 percent to 9 percent.[121] The RAA study group also noted that the estimated Army ORSA contract expenditures for FY 1978 included some $24,299,000, about 17 percent of the total estimated Army FY 1978 ORSA budget of $139,015,000.[122]

The RAA study group raised the issue of establishing a new Army Federally Funded Research and Development Center (FFRDC) to provide analytical support to the Army, but concluded that such action would be very difficult to accomplish given the prevailing climate.[123] The enthusiasm for contract ORSA work expressed by OSD officials in 1978 was a significant departure from the attitudes that had prevailed earlier. By the early 1970s, budget constraints coupled with complaints from private industry, increasing congressional criticism, and growing dissatisfaction among Army leaders had led to the demise of the Army's FFRDCs.[124] The Research Analysis Corporation (RAC), then the Army's principal ORSA contractor, was sold to the General Research Corporation and its special relationship with the Army, which had existed since the formation of the Operations Research Office (ORO) in 1948, was severed. The Human Resources Research Office (HumRRO) became a private company, and the Center for Research in Social Systems (CRESS), the successor to the Special Operations Research Office (SORO), was also shut down.[125] Thus, by the fall of 1972, all four of the Army's FFRDC's had been eliminated and their functions assumed, if at all, by in-house Army analysis agencies.[126] The Army continued to use independent contractors, and some

Air Force–sponsored FFRDCs, to perform ORSA tasks, but thenceforth relied primarily on its newly created in-house capabilities.[127]

However, by the early 1980s it became apparent that there was indeed a need for an Army FFRDC to support the Army Studies Program. Thus, in FY 1982, the Army established a studies and analysis element at the California Institute of Technology's Jet Propulsion Laboratory to "meet the need for forward-looking policy and technical studies to support Army planning and programming for future change."[128] The new organization was named the Arroyo Center and quickly grew in size and importance to the Army. In FY 1984, as a result of considerable pressure from the Cal Tech faculty, the Army chief of staff decided to move the Arroyo Center from the Jet Propulsion Laboratory to the RAND Corporation.[129] That was done, and the Arroyo Center became a new Army-sponsored FFRDC.[130] As of FY 1990, there were six military and 120 civilian personnel assigned to the Arroyo Center, the military constituting only 5 percent of the total.[131] The same fiscal year, the basic cost for operating the Arroyo Center was $21.5 million.[132] The purpose of the Arroyo Center was "to provide the Army with objective, independent analysis of medium- and long-term problems," and the focus of Arroyo Center studies was on policy issues of interest to the Army.[133] The annual Arroyo Center research program was vetted by the Arroyo Center Policy Committee, composed (as of January 1994) of three senior DA civilians and nine general officers.[134] As of 1995, the work was divided into four programs: Strategy and Doctrine, Force Development and Technology, Military Logistics, and Manpower and Training.[135]

A final category of Army ORSA personnel not otherwise accounted for includes those Army ORSA professionals, both military and civilian, assigned to DOD or JCS positions or working in other, non-Army positions. As of 1986, there were some forty-three SC 49-qualified officers assigned to DOD agencies and another thirty-five assigned to joint activities.[136] For example, several Army analysts were assigned to the JCS's Studies Analysis and Gaming Agency, which also considered NATO issues. Several Army ORSA analysts were also assigned to the Program Evaluation and Evaluation Directorate of OSD, where they reviewed Army programs and budgets as part of the DOD PPBS. Other qualified Army ORSA personnel also worked in NATO and other joint and combined activities.

The Army Study Program

The annual workload of the many diverse elements of the Army analytical community was coordinated through the Army Study Program (TASP), the objective of which was to avoid duplication of effort and to coordinate the efforts of the various Army analytical organizations for maximum efficiency and effectiveness.[137] The scope of activities governed by *AR 5–5* and included in TASP was defined as

> a broad class of intellectual activity characterized by the application of the tools of operational or systems analysis to Army problems. These studies are analytical examinations to assist Army decisionmakers. They develop assessments, alternatives, recommendations, or supporting methodologies.[138]

Published annually in the fall or early winter, TASP was "a snapshot at a point in time."[139] Once approved by the vice chief of staff, TASP was printed and distributed to the HQDA staff agencies and MACOMS. No attempt was made to track changes to TASP after publication; the authority to make such changes rested with the MACOM commanders and the HQDA staff agency heads.[140] The information included in TASP changed from time to time, as did the format, but it generally included a compilation of all the HQDA staff agency and MACOM study programs and provided information on:

> (a) Studies by major study categories (manpower, operations, management, intelligence, etc.).
>
> (b) Studies by MACOM and HQDA Staff agency.
>
> (c) Studies by fiscal year, for the next two years.
>
> (d) Names, addresses and phone numbers for MACOM and Staff agency Study Coordinators.
>
> (e) Study points of contact in OSD and the Services.
>
> (f) In-house study agencies and reference facilities.[141]

As noted earlier, the DUSA (OR) was responsible "for the Army Study Program, for study policy formulation, and for program direction of operations research/systems analysis activities of the Army."[142] From 1974, day-to-day management of the Army Study System and preparation of TASP was the responsibility of the director of the Study Program Management Office in the Directorate of Management, Office of the Director of the Army Staff.[143] *AR 5–5* also prescribed the responsibilities of the heads of Army agencies and the commanders of major Army commands as well as the functions of the Study Program Coordination Committee, the purpose of which was to coordinate study program objectives, priorities, and resources.[144] As prescribed by *AR 5–5*, the management of Army studies and analyses was characterized by "centralized guidance, decentralized program development, and centralized review and monitorship," and the policies under which the program was to be conducted included:

> (1) Studies will be conducted to provide useful and important input in the development of plans, programs, and budgets. The purpose of a study will be to support action when there is a reasonable expectation of a significant contribution to decision-making or policy development.
>
> (2) Scarce study resources will be centrally budgeted in the annual Army budget. Individual study efforts will be managed to insure efficient and effective conduct, cost control, implementation of results, and recording in DOD study data banks.
>
> (3) Contract studies will be conducted according to the policies of AR 5–14.
>
> (4) Studies will build on results of current or previous studies, research, and tests. They should not necessarily duplicate other analytical work.
>
> (5) Studies should be performed with state-of-the-art technologies. Study analysts should remain current in training, and modern analytical tools and methodologies should be available for their use.
>
> (6) Studies will be conducted in an open environment, consistent with security constraints (AR 380 series).
>
> (7) Study information and data will be collected and provided to Government agencies and to the public, when requested, in accordance with AR 5–14, AR 340–21, and AR 340–17.[145]

The types of studies undertaken by the various Army analytical organizations encompassed a wide range, including:

> a. Cost, benefit, or effectiveness analyses of concepts, plans, tactics, forces, systems, policies, personnel management methods, and policies or programs.
>
> b. Cost and operational effectiveness analyses (COEA) (AR 71–9).
>
> c. Technology assessments, and management and operations research studies in support of RDTE objectives.
>
> d. Evaluation of foreign force and equipment capabilities, foreign threats, net assessments, and geopolitical subjects.
>
> e. Evaluations of organizational structure, administrative policies, procedures, methods, systems, and distribution of functions.
>
> f. Research and development of data bases, models, and methodologies for the accomplishment of studies and analyses.
>
> g. Analyses of materiel, personnel, logistics, and management systems.
>
> h. Studies to establish materiel requirements.
>
> i. Studies in support of operational testing.[146]

The number of study projects included in TASP each year as well as the general themes and the specific topics addressed, the sponsoring agencies, and the resources applied changed over time in accordance with the available analytical resources and the shifting focus of Army priorities. Each TASP included a number of studies begun in earlier years, but perhaps just under half of the studies listed in each TASP represented new initiatives.[147] It should be noted that not all of the work performed by Army analytical agencies was included in TASP. Many projects originated within the analytical agency itself or were performed in response to some immediate requirement not foreseen in the annual Study Planning Guidance (SPG). As time went by, the number of such "quick reaction" studies tended to increase, and as resources of personnel and operating funds declined, the number of studies included in TASP tended to decline as well.[148] Thus, the total number of studies and analyses under way in a given year may have been up to four times the number included in that year's TASP. For example, the RAA study group identified 1,409 on-going studies in FY 1978 and 1,236 in FY 1979.[149] However, the FY 1978 TASP listed only 383 studies and the FY 1979 TASP only 390.

Over the years, a number of categorization schemes were used to align the studies in each TASP against the Army's interests and priorities. From FY 1976 to FY 1982, the primary categories were established by DOD Directive 5010.22, dated 22 November 1975, as shown in Table 3–11.

Table 3–11—Studies by DOD Category, FY 1976–FY 1982

	Fiscal Year						
Category	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*
Manpower and Personnel	32	47	55	35	46	62	72
Concepts and Plans	95	74	45	50	56	30	16
Operations and Force Structure	141	93	107	123	102	92	101
Installations and Logistics	112	79	90	78	81	88	74
Science, Technology, Systems, and Equipment	34	25	21	45	64	98	72
Management	44	45	43	37	51	46	33
Intelligence	—	—	13	21	22	28	19
International Security	—	—	9	1	2	11	0
TOTAL	458	363	383	390	424	455	387

Source: Based on the Army Study Program (TASP), published annually, 1976–1982.

Note: There were 608 studies in FY 1974 and 411 in FY 1975 prior to implementation of the DOD categorization. The intelligence and international security categories were introduced in FY 1978. The use of the DOD categories was discontinued beginning with the FY 1983 TASP.

To ensure that Army priority issues were addressed, TASPs from FY 1973 through FY 1976 identified the Principal Areas of Concern (PACs) for the fiscal year. In FY 1977, this was changed to the Priority Problem Areas (PPAs), which were used until FY 1984. The PACs/PPAs were identified by the Army Secretariat, the Army Staff, and the MACOMs and were published each year in the annual Study Planning Guidance to guide studies toward problems of critical importance to the Army. For example, the PPAs addressed in the FY 1977 Study Planning Guidance were the following categories: Soldier Quality, Recruitment, Training, and Retention; Human, Materiel, and Energy Resources Utilization—Peacetime Efficiency and Wartime Effectiveness; Readiness; Modernization; Future Planning and Forecasting; and Army Roles, Missions, and Capabilities in Light of Changing Conditions, Relationships, and Threats.[150] In FY 1980, the PPAs included the following categories: Initial Force Effectiveness and Survivability; Force Readiness/Rapid Reinforcement; Tactical Nuclear and Chemical Warfare; Command, Control, Communications, and Intelligence (C3I); Air Defense; Manpower Availability and Personnel Management; Force Design, Planning, Programming, and Modernization; Sustainability; Coalition Warfare; Threat Assessment; Support to the Forces in the Field (Logistics/Health Services/Engineer); Training the Force; and Quality of Life.[151]

Speaking to attendees at AORS XVIII in 1979, Army Chief of Staff General Edward C. Meyer addressed some of the problems of TASP as he saw them, stating:

> Each command has difficult and pressing issues which require resolution. So some study effort needs to be placed on those problems, and that's right and good. But not to the neglect of issues which preclude the entire Army from moving forward. This year, for the first time, the study program guidance (SPG) will go to the field woven into the program and budget guidance package. The critical areas that demand study, and hopefully resolution, are identified. These Priority Problem Areas must be addressed.[152]

He also noted that at least half of the available study effort was focused on "things" rather than on "people," and that

> there is not any remote semblance of balance in our study program if one measures the level of effort across the identified Priority Problem Areas. Doctrine and tactics, the twin fountainheads of how we conceptually tie the organic pieces of the Army into a rational operation, and how we fight to win at the cutting edge of that operation, receives a mere 3 percent of the total level of effort. And personnel, the Army's #1 problem, receives but 4 percent of the total level of effort.[153]

General Meyer was, of course, correct. Army materiel requirements tended to dominate TASP throughout the period. From 1973 to 1990 the emphasis was on studies and analyses directed toward the design, testing, and fielding of the so-called Big Five weapons systems. Following the 1990–1991 Gulf War, a new set of weapons and equipment was emphasized: the Block II Abrams tank, the improved Bradley infantry fighting vehicle, the line-of-sight anti-tank missile (LOSAT), the fiber-optic guided missile (FOG-M), the Army tactical missile system (ATACMS) Block II longer-range missile, the Comanche attack helicopter, the improved Patriot missile system, and identification-friend-or-foe equipment.[154]

Another major area of interest was the performance of Cost and Operational Effectiveness Analysis (COEA). The RAA study group found that a good deal of the Army's ORSA workload was dedicated to COEA. *Army Regulation 1000–1: Basic Policies for Systems Acquisition by the Department of the Army* required that for each major decision milestone in the acquisition cycle of new materiel a cost vs. benefit analysis be conducted that compared the developmental item system with alternative systems for accomplishing the requirement.[155] Toward the end of the period, the emphasis on COEA waned somewhat as interest in other matters increased.

As a means of organizing TASP, the PPAs were not entirely satisfactory. As the compilers of the 1982 DAHSUM wrote:

> While logically appealing, the procedure suffered from three basic problems: the priority areas were very broad; in the field, the problems changed by the time the elaborate analytical process identified them; and the process was not universally understood. The Office of the Chief of Staff found no convincing evidence that the effort expended produced a commensurate improvement in studies management.[156]

After considering the substitution of "Major Mission Statements" for the PPA, Secretary of the Army John O. Marsh Jr. and Army Chief of Staff General Edward C. Meyer issued a statement on 7 December 1981, in which they defined and explained a new set of seven "Total Army Goals" to be used to infuse greater efficiency into Army planning guidance, including the annual Study Planning Guidance for TASP.[157] The seven "Total Army Goals" were:

- READINESS: A Total Army prepared for the "three days of war"; to deter the day before war; to fight and win on the day of war; and to terminate conflict in such a manner that on the day after war, the United States and its allies have an acceptable level of security.
- HUMAN: A Total Army composed of military and civilian professionals who loyally serve their nation in rewarding careers.
- LEADERSHIP: A Total Army whose leaders at all levels possess the highest ethical and professional standards committed to mission accomplishment and the well-being of subordinates.
- MATERIEL: A Total Army equipped and sustained to win any land battle.
- FUTURE DEVELOPMENT: A Total Army sensitive to innovative approaches to accomplish its mission.
- STRATEGIC DEPLOYMENT: A Total Army organized, manned, and equipped so as to be capable of deploying, with transportation assistance, to any part of the globe to counter a wide spectrum of threats.
- MANAGEMENT: A Total Army which efficiently and effectively uses the resources mad available.[158]

The number of studies aligned against each goal in the FY 1983 through FY 1985 TASP is shown in Table 3–12.

The "Total Army Goals" were used to categorize the studies included in TASP from FY 1983 through FY 1986, when the decision was made to replace that approach with one that aligned the various study projects in TASP against a set of nine functional areas, as shown in Table 3–13.

From FY 1987 to FY 1995 TASP also included an analysis of the proportion of each year's studies that addressed critical Army issues. These issues were derived from the expressed concerns of key Army personnel collected as part of the preparation of the annual Study Planning Guidance.[159] In general, the goal was to have at least 25 percent of all studies in a given fiscal year address critical issues, but more often over 50 percent did so, as shown in Table 3–14.

Most of the studies included in TASP from FY 1974 to FY 1995 were performed in-house by one of the Army's own analytical organizations. Various contractors performed others, and mixed in-house/contractor teams performed some, but

Table 3–12—Studies by Total Army Goal, FY 1983–FY 1985

	Fiscal Year		
Army Goal	*1983*	*1984*	*1985*
Readiness	93	135	147
Human	14	26	14
Leadership	4	7	5
Materiel	86	89	80
Future Development	60	98	137
Strategic Deployment	13	13	8
Management	62	100	94
TOTAL	332	468	485

Source: Based on TASP, published annually, 1983–1986.

Note: A copy of TASP for FY 1986 has not been found, but the "TOTAL" for FY 1986 was 458 studies.

from the late 1960s the trend was toward greater emphasis on the enhancement and use of in-house study capabilities with a corresponding decrease in reliance on contractors.[160] Historically, about 80 percent of the annual Army study effort was done in-house and only 20 percent by contractors.[161] Between FY 1975 and FY 1985, some 4,556 studies were included in TASP.[162] Of that total, over 67 percent were performed in-house, over 19 percent were performed by contractors, and the remaining projects were performed by mixed in-house/contractor teams.[163]

With only a few exceptions, TASP did not report the agency actually performing the studies included in each year's program. However, TASP did include data on the agency sponsoring studies each year. In general, 4,120 (43 percent) of the 9,489 studies included in TASP from FY 1974 through FY 1995 were sponsored by TRADOC. HQDA and the various HQDA SSA/FOA accounted for 2,681 studies (28 percent), DARCOM/AMC for 1,572 studies (17 percent), and other Army commands and agencies for 1,116 studies (12 percent), as shown in Table 3–15.

The resources expended by the various Army analytical agencies on carrying out each year's TASP were also reported from FY 1983 through FY 1995. Again, TRADOC led the way with some 16,397 professional staff years (PSYs) of effort, 73 percent of the total 22,628 PSYs committed over the period FY 1984–FY 1995. HQDA accounted for 3,251 PSYs (14 percent), DARCOM/AMC for 960 PSYs (4 percent), and all other commands and agencies for 2,020 PSYs (9 percent).[164] The peak commitment was reached in FY 1987 and declined steadily thereafter with a temporary bump-up in FY 1989. The average PSY per study fell from 5.7 PSY in FY 1989 to only 3.1 PSY per study in FY 1995.[165]

Although early in the period under consideration, TASP listed each study by title and provided a modicum of other information regarding the annual program, it was not until the 1980s that each TASP began to include a more detailed and thorough analysis of the program. Even then the information provided was often cursory. For example, 1985 RAAEX study group found that the FY 1983 TASP included 332 studies, some 53 percent of which were continuations of studies initiated in earlier years.[166] Again, the RAAEX study group found that the "large majority" (about 67 percent) of studies and analyses done in FY 1983 were done in-house, about 15 percent were done on contract, and the remainder was done by mixed in-house/contractor effort.[167] Studies related to readiness and materiel accounted for nearly 55 percent of the total studies and absorbed over 40 percent of the available program resources, and studies related to future development represented less than 20 percent of all studies, but received more than one-third of the resources. The RAAEX study group also found that with respect to the FY 1983 TASP, over half of the analysis work effort was in support of HQDA decisions, 93 percent was in support of five functional areas (training; force design and structure; combat developments; research, development, and acquisition; and logistics), and 37 percent was directed at combat developments.[168] The average study or analysis required 6.8 technical staff months (TSMs), varying from an average of 2.8 TSMs for cost studies to 24.9 TSMs for force design and structure studies.[169]

Looking primarily at the FY 1983 TASP, the RAAEX study group also found that "important, non-urgent, non-milestone problems [were] not identified," "urgent problems [were] identified, but not always well-defined nor prioritized, and drive out other analyses," and that there was "no Army

Table 3–13—Studies by Functional Area, FY 1987–FY 1995

	Fiscal Year								
Functional Area	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*
Structuring	40	17	10	—	51	39	36	20	24
Manning	60	51	20	—	41	31	23	18	12
Training	66	51	61	—	72	69	73	54	38
Mobilizing and Deploying	32	32	40	—	33	60	52	17	13
Providing Facilities	3	1	2	—	4	0	2	1	0
Managing Information	46	10	18	—	14	21	30	21	14
Equipping	146	146	209	—	164	174	152	143	106
Sustaining	94	41	45	—	43	55	38	24	16
Managing	33	12	38	—	58	67	29	15	13
TOTAL	520	361	443	492	480	516	435	313	236

Source: Based on TASP, published annually, 1988–1995.
Note: A copy of TASP for FY 1990 has not been found, but the "TOTAL" for FY 1990 was 492 studies. The "TOTAL" for FY 1995 does not include an additional seventy projected studies.

Table 3–14—Studies Addressing Critical Army Issues, FY 1987–FY 1995

Fiscal Year	*Total Number of Studies*	*Studies Addressing Critical Issues (No.)*	*Studies Addressing Critical Issues (%)*
1987	520	129	25
1988	361	167	46
1989	443	235	53
1990	492	—	—
1991	480	206	42
1992	516	287	56
1993	436	217	50
1994	313	245	78
1995	236	131	56
TOTAL	3,797	1,617	

Source: Based on Chapter 3 of TASP, FY 1987–FY 1995.
Note: Data for FY 1990 are not available.

wide prioritization of problems."[170] The study group recommended two solutions: to "institutionalize identification of major analysis issues" and to "emphasize integration of analysis, staff process and decision-making."[171] The study group also recommended that the procedure used to develop issues for the FY 1984 Arroyo Center program, known as the Issue Assessment Process (IAP), be applied to the TASP as a whole. That process consisted of the identification of issues through interviews with Army decision makers and then prioritization of those issues by an assistant secretary of the Army/three star–level committee for inclusion in the annual Study Planning Guidance, with the highest-priority issues tasked to the appropriate agencies and MACOMs.[172] With respect to the latter, the

Table 3–15—Studies by Sponsor, FY 1974–FY 1995

Fiscal Year	*HQDA*	*TRADOC*	*AMC*	*Other*	*Total*
1974	189	86	282	51	608
1975	36	116	208	51	411
1976/T*	164	147	74	73	458
1977	121	169	22	51	363
1978	118	163	60	42	383
1979	109	162	73	46	390
1980	120	145	113	46	424
1981	156	124	142	33	455
1982	150	139	70	28	387
1983	152	109	50	21	332
1984	162	161	75	70	468
1985	131	212	64	78	485
1986	173	183	41	61	458
1987	174	241	44	61	520
1988	94	176	27	64	361
1989	92	247	21	83	443
1990	113	303	17	59	492
1991	108	267	60	45	480
1992	115	286	56	59	516
1993	89	241	49	57	436
1994	55	227	12	19	313
1995	60	216	12	18	306
TOTAL	2,681	4,120	1,572	1,116	9,489

Source: Based on TASP, published annually, 1974–1995.
Note: FY 1995 "Total" includes seventy additional projected studies not identified by sponsor.
*T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

study group recommended that the turbulence created by study requirements—"driven by milestones, Congressional interest and other events"—be smoothed out by better planning and integration of analysis and staff processes.[173]

The annual Army Study Program was only a guide. The actual workload of the Army analytical community was substantially greater and more complex. Within the guidance provided by the annual Study Planning Guidance and TASP, the various elements of the Army analytical community managed their portion of the studies and analyses independently.

Conclusion

Each of the many and diverse elements of the Army analytical community made its own unique contribution to assisting Army decision makers in dealing with the complex choices regarding weapons and equipment systems, organization, doctrine, and training during the period 1973–1995. Each used ORSA techniques to various degrees, and the resultant Army studies and analyses ranged from mathematically intense simulations to historically oriented narratives. What drew them all together was their emphasis on the collection of accurate data, the selection of appropriate measurement standards, the application of scientifically sound analysis methods, and the production of conclusions and recommendations useful to the decision maker in arriving at a viable solution to a complex problem.

The Army analytical community grew and changed during the period under consideration. Some organizations changed more often and more radically than others. The size of the Army analytical community appears to have peaked about the time of the 1978–1979 Review of Army Analysis. Thereafter, constraints on Army budgets and manpower levels were felt in the Army analytical community just as in the Army at large, and Army ORSA managers were forced to do more with fewer resources. This they accomplished in good order, and the Army experienced no general decline in the level of support provided by its ORSA elements. Indeed, constant refinement in the techniques of ORSA and tighter management of the Army analytical community itself led to increases in productivity.

Each element of the Army analytical community had its role to play in the overall application of ORSA techniques to Army decision-making, and even the smallest, one-man shop contributed. However, during the period 1973–1995 a substantial part of the Army's ORSA workload was performed by just four organizations: the Army Materiel Systems Analysis Activity (AMSAA); the Operational Test and Evaluation Agency/Command (OTEA/OPTEC); the TRADOC Systems Analysis Activity (TRASANA) and the Combined Arms Operations Research Activity (CAORA), which were combined in 1986 to form the TRADOC Analysis Command/Center (TRAC); and the Concepts Analysis Agency (CAA). In FY 1978, these four activities alone accounted for around 37 percent of the Army's total ORSA manpower and for around 27 percent of the Army's total ORSA budget, as shown in Table 3–16. As the Army's ORSA manpower and budgets declined during the period, the "Big Four" assumed an even more prominent role in the Army analytical community.

Although their assigned missions did overlap somewhat, the Big Four were complementary organizations rather than competing ones. AMSAA was charged with conducting studies and analyses pertaining to the design and development of individual weapons and equipment systems, and OTEA/OPTEC performed tests and evaluations at the same level. TRAC and its predecessors, TRASANA and CAORA, were responsible for the development of organizational and tactical concepts as well as training, user testing, and materiel requirements for integrated functional systems up to corps level. CAA focused on alternative force structures and simulations and war gaming at the theater and Total Army level. What follows in the next chapters is a "mini-history" of each of the Big Four during the period 1973–1995.

Table 3–16—"Big Four" Personnel and Budgets, FY 1978

Organization	*Number of Authorized Personnel*	*Total Funding (Thousands of Dollars)*
AMSAA	440	16,225
OTEA	261	14,711
TRASANA and CAORA	454	1,565
CAA	299	8,605
"Big Four" TOTAL	1,454	41,106
Army TOTAL	3,919	153,726

Source: RAA II, app. D, passim; Ltr, Office of the Deputy Chief of Staff for Personnel, HQDA, to Commander, USAOTEA, Washington, 3 Jan 79, sub: Manpower Management Survey of the U.S. Army Operational Test and Evaluation Agency (OTEA), p. 1; U.S. Army Operational Test and Evaluation Agency, Annual Historical Review (RCS CSHIS-6 [R-3])—1 October 1977 to 30 September 1978 (Falls Church, Va.: U.S. Army Operational Test and Evaluation Agency, 1978), p. 11.

Note: TRAC, which was not established until 1986, is represented by the combined totals for TRASANA and CAORA.

Chapter Three notes

[1] For an overview of the Army analytical community in the preceding period, 1962–1972, see Volume II, Chapters Five, Six, and Seven.

[2] Lt. Col. Larry R. Tinberg, *Operations Research and the US Army* (Carlisle Barracks, Pa.: U.S. Army War College, 7 April 1983), p. 10.

[3] U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume II: Appendices C-M* (Washington, D.C.: U.S. Department of the Army Special Study Group, April 1979), app. D (Data), p. D-I-5 (cited hereafter as RAA II).

[4] Ibid.

[5] Ibid.

[6] Ibid.

[7] The "Big Four" Army analytical organizations are discussed in detail in Chapters Four, Five, Six, and Seven, below.

[8] Abraham Golub, "Present & Future ORSA Trends—A Forecast for the US Army," in U.S. Army Concepts Analysis Agency, *Proceedings of the Thirteenth Annual United States Army Operations Research Symposium (AORS XIII), 29 October–1 November 1974, Fort Lee, Virginia, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1974), pp. 19–20.

[9] The trend toward centralization and the spread of ORSA techniques was recognized as early as 1968. See Philip H. Lowry, "Operations Research/Systems Analysis: What Are They?" in U.S. Army Research Office-Durham, *Proceedings of the [7th] United States Army Operations Research Symposium, 22–24 May 1968, Durham, North Carolina, Part I—Unclassified Volume* (Durham, N.C.: U.S. Army Research Office-Durham, 1968), p. 135; and Daniel F. McDonald, "The Next Ten Years in Army Operations Research," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Sixteenth Annual US Army Operations Research Symposium (AORS XVI), Fort Lee, Virginia, 12–14 October 1977, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1977), p. 44.

[10] U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: U.S. Department of the Army Special Study Group, April 1979), pp. 2-1 to 2-9 (cited hereafter as RAA I).

[11] Ibid., p. 2-11.

[12] Ibid., pp. 2-1, 2-4. In an address at AORS XVIII in 1979, E. B. Vandiver III described the problem of trying to define the Army analytical community in terms of "three bowls of acronym soup." The smallest bowl represented those Army studies and analysis agencies governed by *AR 5–5*, and the second-smallest bowl included a broader range of HQDA SSA/FOA as well as the analytical elements of U.S. Army Materiel Development and Readiness Command (DARCOM) and the major commands. The largest bowl consisted of a wide range of other organizations using ORSA techniques, including the cost analysis and test and evaluation communities, the Office of the Surgeon General, and other Army research organizations. As Vandiver explained, the Review of Army Analysis (RAA) study group chose to deal with only the two smallest bowls (see U.S. Army Concepts Analysis Agency, *Final Proceedings of the Eighteenth Annual US Army Operations Research Symposium [AORS XVIII], Fort Lee, Virginia, 13–16 November 1979, Volume I* [Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1979], p. 10 [Slide 6]).

[13] Ibid., p. 2-4. The 1985 Review of Army Analysis Extended (RAAEX) study group was even more selective, restricting their investigation to those "analysis producing activities with formal programs" and "SC49 military and 1515 civilian authorizations and assets." See U.S. Department of the Army Special Study Group, *Final Report-Review of Army Analysis Extended (RAAEX), Volume II: Task Reports* (Washington, D.C.: U.S. Army Special Study Group, March 1985), pp. 8-4, 8-6 (cited hereafter as RAAEX II). The RAAEX study group did, however, include a chapter on the relationship between costing and analysis in which they identified some 740 personnel involved in cost analysis activities, the majority of whom (about 60 percent) were in the OR series (1515). See U.S. Department of the Army Special Study Group, *Final Report-Review of Army Analysis Extended [RAAEX], Volume I: Executive Summary* (Washington, D.C.: U.S. Department of the Army Special Study Group, March 1985), p. 11-30 (cited hereafter as RAAEX I). Neither study group attempted to assess the number of contractor personnel involved in Army studies and analyses. In the following survey of the Army analytical community I, too, have excluded the cost analysts, but I have chosen to try and describe the mission, organization, resource allocations, and work program of the Army test and evaluation community (principally OTEA) insofar as it employed ORSA methods. This decision was based primarily on the fact that during the period under consideration the deputy under secretary of the Army for operations research (DUSA [OR]) assumed substantial responsibilities in the test and evaluation and materiel acquisition areas.

[14] RAA II, app. D, p. D-I-5. The RAA study group's total did not include several important clusters of Army ORSA personnel, including those analysts in OTEA, in the Office of the Surgeon General (OTSG), or at the U.S. Military Academy (USMA); those cost analysts assigned to the Office of the Comptroller of the Army (OCA); or those analysts employed by various Army ORSA contractors.

[15] The concept of the Army ORSA community as a pyramid has been attributed to Brig. Gen. Richard W. Tragemann, then commander of TRAC, speaking at the fifty-ninth Military Operations Research Society Symposium at West Point in 1991 (see Walter W. Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," *Phalanx* 24, no. 3 [September 1991]: 8).

[16] RAA II, app. D, p. D-I-22.

[17] Ibid.

[18] Ibid.

[19] RAA II, app. D, p. D-I-5.

[20] Ibid. Neither the RAA study group nor the RAAEX study group included in their totals either those Army ORSA professionals in OTEA, CEAC, and some smaller elements or those working for Army contractors.

[21] John A. Riente, "Restructuring and Realignment of Analysis Agencies," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium [AORS XXX], Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1991), Slide 7 (Baseline Organizations) and Slide 15 (Military/Civilian Balance).

[22] RAA I, p. 2-4.

[23] Ibid., pp. 2-5, 2-6, Table 2–1 (Army Studies and Analysis Community Organizations).

[24] RAA II, app. D, p. D-I-2. RAA II, Appendix D, Chapter III, contains a demographic profile of the Army ORSA personnel employed in HQDA.

[25] For the early history of the ODUSA (OR), see Volume II, Chapter Three and Chapter Two, above. The Study Program Management Office and its later incarnations are discussed in Volume II, Chapter Five; in Chapter Two, above; and in this chapter.

[26] U.S. Department of the Army, *Organization and Functions of the Army Staff* (Washington, D.C.: Office of the Adjutant General, HQDA, 10 May 1974), p. 1-8 (cited hereafter as 1974 OFM). The prioritization effort later shifted to ODCSOPS.

[27] RAA II, app. I (Analysis of Army Manpower/Personnel Studies Capability), and RAAEX II, ch. 12 ("Manpower and Personnel Analysis").

[28] RAAEX II, ch. 10 ("Inter-Relationship of Intelligence and Analysis").

[29] U.S. Department of the Army, *Army Regulation No. 10–5: ORGANIZATION AND FUNCTIONS—Department of the Army* (Washington, D.C.: HQDA, 1 December 1980), par. 2–24c.

[30] 1974 OFM, p. 1-15.

[31] RAAEX II, ch. 13 passim.

[32] 1974 OFM, pp. 1-45, 5-59

[33] RAA I, pp. 2-5, 2-6, Table 2-1 (Army Studies and Analysis Community Organizations). Staff Support Agencies (SSAs) "exist primarily to provide data processing, analytical or other specialized support services to the staffs of Army management headquarters. These

agencies each report to a specifically designated staff section and would not exist in the absence of the headquarters to which they are assigned" (see 1974 OFM, p. 2-3). Field Operating Agencies (FOAs), on the other hand, are defined as "an agency under the supervision of Headquarters, Department of the Army, but not a major Army command or part of a major Army command. It has the primary mission of executing policy and would be required even in the absence of the Staff agency to which it reports" (1974 OFM, p. 3-4).

[34] RAA II, app. D, p. D-I-2. RAA II, Appendix D, Chapter III, contains a demographic profile of the Army ORSA personnel employed in HQDA SSA/FOA.

[35] RAAEX II, p. 8-21, Table; and p. 8-25, Table.

[36] Ibid., app. D, p. D-I-19.

[37] 1974 OFM, p. 3-6.

[38] RAAEX II, p. 12-9.

[39] Ibid., pp. 12-14, 12-26

[40] Ibid. See also Karl E. Cocke, comp., *Department of the Army Historical Summary, Fiscal Year 1974* (Washington, D.C.: Center of Military History, U.S. Army, 1978), p. 128 (cited hereafter as 1974 DAHSUM).

[41] As one of the "Big Four" Army analytical organizations, CAA is discussed in detail in Chapter Seven, below.

[42] For the pre-1973 operations of OPO, see Volume II, Chapter Three.

[43] Personnel communication to the author from Col. (USA Ret.) Brian R. McEnany, 22 August 2006.

[44] The early history of IAS/SSI is discussed in Volume II, Chapter Seven.

[45] U.S. Department of the Army, Office of the Chief of Staff Army, Management Directorate, Study Program Management Office, *The Army Study Program FY 1982* (Washington, D.C.: SPMO, Management Directorate, OCSA, HQDA, 31 May 1982), p. C-5 (cited hereafter as FY 1982 ASP).

[46] 1974 OFM, p. 3-11.

[47] Ibid., p. 2-9; FY 1982 ASP, p. C-4.

[48] RAAEX II, p. 13-10.

[49] For an excellent history of the ESC, see William C. Baldwin, *The Engineer Studies Center and Army Analysis: A History of the U.S. Army Engineer Studies Center, 1943–1982* (Fort Belvoir, Va.: Engineer Studies Center, U.S. Army Corps of Engineers, 1985).

[50] U.S. Department of the Army, Deputy Under Secretary of the Army for Operations Research, *Army Management Review Task Force-Final Report by DUSA (OR)* (Washington, D.C.: ODUSA-OR, HQDA, 15 August 1989), p. 4-10.

[51] Ibid., p. 4-33. As noted, CEAC is not discussed in detail in this study.

[52] As one of the "Big Four" Army analytical organizations, OTEA is discussed in detail in Chapter Five, below. A brief history of OTEA and its successors is included in U.S. Army Test and Evaluation Command, *ATEC Regulation 10–1: ORGANIZATION AND FUNCTIONS—ATEC Headquarters Organization, Mission, and Functions* (Alexandria, Va.: Headquarters, USATEC, 15 September 2005), pp. 72–75.

[53] 1974 OFM, p. 3-5.

[54] *ATEC Regulation 10–1*, p. 72.

[55] For the history of AMC and its ORSA elements from 1962 to 1973, see Volume II, Chapter Seven. From 1976 to 1985, AMC was known as the U.S. Army Materiel Development and Readiness Command (DARCOM).

[56] U.S. Army Materiel Command Historical Office, *A Brief History of AMC, 1962–2000*, p. 2, available at http://www.amc.army.mil/pa/A%20Brief%20History%20of%20AMC.doc (accessed 28 June 2008). For a short review of organizational change in AMC, see U.S. Army Materiel Command Historical Office, *Organizational Change in the Army Materiel Command, 1962–1998* (Fort Belvoir, Va.: Historical Office, U.S. Army Materiel Command, 1998). Only minor adjustments in mission and organization were made in the STEADFAST reorganization. For example, on 20 May 1974, the Army Research Office (ARO), formerly an FOA under the chief of research and development, was transferred to AMC with sixteen military and eighty-two civilian personnel (see 1974 OFM, p. 3-10).

[57] *A Brief History of AMC*, p. 2.

[58] RAA II, app. D, p. D-I-5; RAA I, pp. 2-5, 2-6, Table 2-1 (Army Studies and Analysis Community Organizations).

[59] As one of the "Big Four" Army analytical organizations, AMSAA is discussed in detail in Chapter Four, below.

[60] On 1 October 1980, the Directorate for Battlefield Systems Integration, HQ DARCOM, was disestablished and its mission, without resources, was transferred, in most part, to AMSAA.

[61] The Army Management Engineering Training Agency (AMETA), located at Rock Island Arsenal in Illinois, conducted studies of systems, productivity assurance techniques, standard time reporting systems, personnel fatigue and rest factors, and management techniques and then applied management science techniques to a variety of DARCOM-wide problems. The Depot System Command (DESCOM) was established on 1 September 1976 to centralize command and control of Army depots. The Inventory Research Office (IRO) was responsible for solving logistical problems using ORSA techniques, developing new methods, and providing technical assistance to DARCOM elements and other Army organizations on request. Traditionally, IRO studies focused primarily on wholesale supply management with a peacetime emphasis. The Logistics Study Office (LSO) performed independent research and consulting in logistics doctrine, management systems, operations, and procedures that lead to development of new concepts and improvement of the Army and defense logistics systems. The Procurement Research Office (PRO) was established at Fort Lee, Virginia, in 1969 to provide the Army with research and consulting expertise in the acquisition of weapons systems, supplies, and services. On 1 October 1981, the Logistics and Readiness Analysis Division of AMSAA absorbed IRO, LSO, and PRO. The RAA study group erroneously identified USASAC as the U.S. Army International Logistics Command (USAILCOM). USASAC was formed in 1977 from USAILCOM and had the mission of acting as the DA executive agent for security assistance matters. USASAC was reorganized in 1986 as the United States Army Security Affairs Command and was redesignated in 1990 as the United States Army Security Assistance Command.

[62] For details regarding the course offerings and other activities of the Army Logistics Management College in the period under consideration, see Chapter Two, above.

[63] See RAA II, app. D, chs. I, V, VI.

[64] RAA II, app. D, p. D-I-4.

[65] Ibid., app. D, p. D-I-21.

[66] B. Plunkett, T. Sager, and J. Schmid, eds., *An AMSAA History, 1974–1976, Addendum I* (Aberdeen Proving Ground, Md.: U.S. Army Materiel Systems Analysis Activity, December 1977), p. 1.

[67] *A Brief History of AMC*, p. 5.

[68] For a brief overview of the TRADOC predecessor organizations and the establishment of TRADOC, see U.S. Army Training and Doctrine Command, Military History Office, *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command, 1973–1998* (Fort Monroe, Va.: Military History Office, USATRADOC, 1998), p. 5-8 (cited hereafter as *Prepare the Army for War*).

[69] TRAC was one of the "Big Four" Army analytical organizations. The evolution of TRAC and the other TRADOC analytical elements are discussed in detail in Chapter Six, below.

[70] RAA I, pp. 2-5, 2-6.

[71] Ibid.

[72] RAA II, app. D, p. D-I-3. See RAA II, Appendix D, Chapter VII, for a demographic profile of the Army ORSA personnel employed in TRADOC.

[73] Ibid., app. D, pp. D-I-19 to D-I-22.

[74] A brief synopsis of the development of the various TRADOC analysis organizations is given in *Prepare the Army for War*, pp. 143–44.

[75] *Prepare the Army for War*, p. 1.

[76] RAA I, p. 2-5, Table 2-1 (Army Studies and Analysis Community Organizations).

[77] The Army Intelligence and Threat Analysis Center (ITAC), located at Arlington Hall Station in Virginia, was under INSCOM and was responsible for the production of intelligence and threat analysis (see FY 1982 ASP, p. C-4). In fact, the USAREUR ORSA cell was formally established after the RAA study group rendered its final report.

[78] RAA II, app. D, p. D-I-5.

[79] Ibid., app. D, p. D-I-22.

[80] RAA I, p. 13-3.

[81] Ibid.

[82] Ibid.

[83] I am particularly indebted to Col. (USA Ret.) Brian R. McEnany and Lt. Col. (USA Ret.) James H. Malley for information regarding the USAREUR ORSA elements. The following narrative follows closely the excellent draft paper on USAREUR ORSA activities prepared by Jim Malley titled "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells."

[84] RAA I, p. 13-1.

[85] Ibid.

[86] Ibid., p. 13-2.

[87] Ibid., p. 13-3.

[88] Ibid., p. 15-5. The study group recommended a team of four to eight analysts (see RAA I, p. 13-4).

[89] RAAEX II, p. 2-82. See also Dick Lester, "Army ORSA Cells: Putting the O Back in MOR," *Phalanx* 17, no. 2 (May 1984): 22, and Gloria Brown, "MOR in USAREUR," *Phalanx* 18, no. 4 (December 1985): 25.

[90] Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," p. 5.

[91] Initially, the selection process was managed by the Study Program Management Office, OCSA (Eugene P. Visco, personal communication with the author, 10 October 2006).

[92] Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," pp. 8–9.

[93] Ibid., pp. 6–7.

[94] Ibid., pp. 3–4.

[95] Ibid., p. 5.

[96] Ibid., p. 6.

[97] Among the first analysts to be assigned to the HQ VII Corps ORSA cell were Maj. Joe L. Smith, Steve Arrington, Steve Pearcy, Phil Billingsley, and George Youmans Jr. (see Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," p. 6).

[98] Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," p. 6.

[99] Ibid., p. 9; Lester, "Army ORSA Cells," p. 22; Tim Linn and Lamar Newman, "V Corps ORSA Cell," *Phalanx* 19, no. 3 (September 1986): 17.

[100] Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," p. 9.

[101] Ibid., p. 10. With the formation of the TRADOC Analysis Command in 1986, TRASANA was reorganized as TRAC-White Sands Missile Range (TRAC-WSMR) and the Grafenwoehr field office became known as the TRAC-WSMR Field Office.

[102] Ibid.

[103] Ibid.

[104] Ibid., pp. 10–11.

[105] Ibid., p. 10. See also Paul Rehmus, "The Warrior Preparation Center," *Phalanx* 24, no. 2 (June 1991): 13–15.

[106] Vargas subsequently ended her career as the SES director of TRAC-WSMR.

[107] Lester, "Army ORSA Cells," p. 22.

[108] Malley, "US Army, Europe Operations Research & Systems Analysis—The USAREUR ORSA Cells," p. 5.

[109] Walter W. Hollis, "Keynote Address," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twenty-Second Annual US Army Operations Research Symposium (AORS XXII), Fort Lee, Virginia, 3–5 October 1983* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1983), pp. 2-10, 2-11.

[110] They also excluded the large Army modeling, simulations, and training community outside the major commands. However, most of that community, for example, the Program Executive Office for Simulation, Training, and Instrumentation in Orlando, Florida, was established after the 1985 RAAEX study group's report. Considerations of time and space preclude discussion of it here.

[111] David C. Arney, "Detailed Department History," available at http://www.dean.usma.edu/departments/math/about/history/longdeph.htm (accessed 14 June 2006), and U.S. Military Academy, Department of Systems Engineering, "Systems Academics," available at http://www.se.usma.edu/newsie/academics/startup.asp?f~academics (accessed 14 June 2006). Prior to the creation of DSE in 1989, the Department of Engineering partnered with the Department of Mathematics in ORSA-related curriculum matters.

[112] *DA Pam 600–3–49*, p. 5.

[113] USMA DSE, "Systems Academics." The focus of ORSA instruction at the Military Academy is on "optimization methods, applications of probability and statistics, modeling, and operations analysis" (see Lt Col Vernon M. Bettencourt Jr., "Combat Modeling Education at USMA," *Phalanx* 20, no. 2 [June 1987]: 6).

[114] "The U.S. Military Academy's ORCEN—Operations Research Center of Excellence," available at http://www.orcen.usma.edu/organization/Mission_Statement.htm (accessed 14 June 2006). The ORCEN has been fully staffed and funded since AY 1990–1991 (see U.S. Military Academy, *Annual Report of the Operations Research Center for Academic Year 2000* [West Point, N.Y.: U.S. Military Academy, 2001], p. 4).

[115] *Annual Report of the Operations Research Center for Academic Year 2000*, p. 4.

[116] Ibid., p. 3.

[117] As of FY 2000, the ORCEN was staffed by a director, three analysts from DSE, and one analyst from DMS augmented by faculty members from the two departments and other USMA departments for specific projects (see *Annual Report of the Operations Research Center for Academic Year 2000*, p. 4).

[118] See RAA II, Appendix H (Contract Support) for the RAA study group comments on Army contract ORSA work. See also, RAA II, app. G (Budget Strategy).

[119] RAA II, app. H, pp. H-1, H-2.

[120] Ibid., app. H, pp. H-2, H-3.

[121] Ibid.

[122] Ibid., app. D, p. D-I-22, app. H, p. H-5.

[123] Ibid., app. H, pp. H-10 to H-12. By 1978, the Federal Contract Research Centers (FCRCs) had been redesignated as Federally Funded Research and Development Centers (FFRDCs).

[124] The details of that process are discussed in Volume II, Chapter Six.

[125] U.S. Congress, Office of Technology Assessment, *A History of the Department of Defense Federally Funded Research and Development Centers* (Washington, D.C.: Government Printing Office, July 1995), pp. 32–33.

[126] Ibid. The fourth Army FFRDC, the Army Mathematics Center at the University of Wisconsin, had already been closed. The bulk of RAC's work was taken over by the newly established (January 1973) Concepts Analysis Agency.

[127] The RAA study group found that for FY 1979 the Army proposed to expend some $21,210,000 for contract research, mostly on hardware items, with the Aerospace Corporation, MITRE Corporation, and Lincoln Laboratory (see RAA II, app. H, p. H-12).

[128] Karl E. Cocke and others, comps., *Department of the Army Historical Summary Fiscal Year 1982* (Washington, D.C.: U.S. Army Center of Military History, 1988), p. 40. The Jet Propulsion Laboratory was a National Aeronautics and Space Administration FFRDC. A brief overview of the establishment of the Arroyo Center and its mission, organization, and work program is provided in Joann Langston, "Arroyo Center Research Program," *Phalanx* 19, no. 4 [December 1986]: 8–9).

[129] Dwight D. Oland, comp., *Department of the Army Historical Summary Fiscal Year 1984* (Washington, D.C.: U.S. Army Center of Military History, 1995), p. 48.

[130] *A History of the Department of Defense Federally Funded Research and Development Centers*, p. 35. The organization, functions, and operations of the Arroyo Center are governed by U.S. Department of the Army, *Army Regulation 5–21: MANAGEMENT–Army Policy and Responsibilities for the Arroyo Center* (Washington, D.C.: HQDA, 14 October 1994).

[131] John A. Riente, "Restructuring and Realignment of Analysis Agencies," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium (AORS XXX), Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1991), Slide 7 (Baseline Organizations) and Slide 15 (Military/Civilian Balance).

[132] Ibid., Slide 7 (Baseline Organizations). In-house costs reflect operating budgets, not total costs.

[133] *A History of the Department of Defense Federally Funded Research and Development Centers*, p. 43.

[134] Ibid.

[135] Ibid., pp. 43–44.

[136] *DA Pam 600–3–49*, p. 5.

[137] The organization and management of the Army Study System (TASS), of which TASP was a part, is described in Chapter Two, above. The evolution of TASS from 1962 to 1973 is covered in Volume II, Chapter Five. For a brief overview c. 1982, see Joann H. Langston, "Change in the Army Study Community," *Phalanx* 15, no. 3 (September 1982): 1, 4–5.

[138] U.S. Department of the Army, *Army Regulation No. 5–5: MANAGEMENT–Army Studies and Analyses* (Washington, D.C.: HQDA, 15 October 1981), par. 1-4.

[139] RAA II, app. E (Management of the Army Study Program and Study System), p. E-4.

[140] However, for a time in the mid-1980s updates were published in May.

[141] RAA II, app. E, p. E-3. The material included and the analysis of that data increased after FY 1982.

[142] *AR* 5–5, par. 4-2.

[143] Ibid., par. 4-3. The SPMO was renamed the Study Program Management Agency (SPMA) in 1979, and in 1986 it became a FOA of the DUSA (OR). In 1987, SPMA was merged with the Army Model Management Office and became the Model Improvement and Study Management Agency (MISMA), a FOA of the under secretary of the Army with operational control exercised by the DUSA (OR).

[144] Ibid., pars. 4-4, 4-5.

[145] Ibid., par. 1-6.

[146] Ibid., app. B (Examples of Study and Nonstudy Efforts), par. B-1.

[147] U.S. Department of the Army, Office of the Chief of Staff, Army, Management Directorate, Study Program Management Office, *The Army Study Program FY 1983 Report, Volume I* (Washington, D.C.: Study Program Management Office, Management Directorate, Office of the Chief of Staff, Army, HQDA, 22 December 1982), p. vi.

[148] U.S. Department of the Army, Office of the Deputy Under Secretary of the Army (Operations Research), Model Improvement and Study Management Agency, *The Army Study Program, Fiscal Year 1995 Report* (Washington, D.C.: Model Improvement and Study Management Agency, Office of the Deputy Under Secretary of the Army (Operations Research), HQDA, 28 March 1995), p. 2-3.

[149] RAA II, pp. D-II-10, D-II-16.

[150] U.S. Department of the Army, Office of the Chief of Staff, Army, Management Directorate, Study Management Office, *The Army Study Program, Fiscal Year 1977* (Washington, D.C.: Study Management Office, Management Directorate, Office of the Chief of Staff, Army, HQDA, [1976]), p. 1-9; Karl E. Cocke and others, comps., *Department of the Army Historical Summary, Fiscal Year 1977* (Washington, D.C.: U.S. Army Center of Military History, 1979), p. 27.

[151] U.S. Department of the Army, Office of the Chief of Staff, Army, Management Directorate, Study Program Management Office, *The Army Study Program FY 1980* (Washington, D.C.: Study Program Management Office, Management Directorate, Office of the Chief of Staff, Army, HQDA, 22 February 1980), p. 1-2.

[152] General Edward C. Meyer, "Keynote Address," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Eighteenth Annual US Army Operations Research Symposium (AORS XVIII), Fort Lee, Virginia, 13–16 November 1979, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, 1979), p. 5.

[153] Ibid.

[154] General Maxwell R. Thurman (USA Ret.), *Today's Victories and Tomorrow's Army* (Arlington, Va.: Institute for Land Warfare, Association of the United States Army, July 1991), p. 7.

[155] RAA I, p. 3-8.

[156] 1982 DAHSUM, p. 40.

[157] Ibid., pp. 40, 146–47; FY 1983 TASP, vol. I, p. 1-1. The "Total Army Goals" were first enunciated by Secretary of the Army Clifford L. Alexander Jr., and Army Chief of Staff General Bernard W. Rogers in September 1977. The original seven goals were Better Equipment, Better Organization, Better Tactics, Better Training, Better Support, Better Morale, and Better Soldiers (see Ltr, General William E. DePuy (Cdr, TRADOC) to General Walter T. Kerwin Jr. (VCSA), Fort Monroe, Virginia, 24 Mar 77).

[158] U.S. Department of the Army, Office of the Chief of Staff Army, Management Directorate, Study Program Management Office, *The Army Study Program FY 1983 Update* (Washington, D.C.: Study Program Management Office, Management Directorate, Office of the Chief of Staff, Army, HQDA, 31 May 1983), inside front cover.

[159] U.S. Department of the Army, Office of the Deputy Under Secretary of the Army (Operations Research), Model Improvement and Study Management Agency, *The Army Study Program, Fiscal Year 1994 Report* (Washington D.C.: Model Improvement and Study Management Agency, Office of the Deputy Under Secretary of the Army (Operations Research), HQDA, 10 November 1993), p. 1-1.

[160] U.S. Department of the Army, Office of the Chief of Staff, Army, Management Directorate, Study Management Office, *The Army Study Program, Fiscal Year 1975* (Washington, D.C.: Study Management Office, Management Directorate, Office of the Chief of Staff, Army, HQDA, July 1974), p. 1-2.

[161] U.S. Department of the Army, Office of the Deputy Under Secretary of the Army (Operations Research), Model Improvement and Study Management Agency, *The Army Study Program Fiscal Year 1993 Report* (Washington, D.C.: Model Improvement and Study Management Agency, Office of the Deputy Under Secretary of the Army (Operations Research), HQDA, 16 November 1992), p. 1-4.

[162] Based on TASP, published annually, 1975–1985. The Method of Performance was not reported in TASP for FY 1974, FY 1976/T, or FY 1986–FY 1994. The figure for "Both" in FY 1977 includes five studies done by other government agencies. In FY 1995 TASP there were 154 in-house, forty-one contract, and forty-one mixed in-house/contract studies reported with an additional seventy projected studies not reported at all. FY 1976/T was the extended fiscal year that ran from 1 July 1975 to 30 September 1976 introduced to facilitate the changeover to 30 September as the end of the fiscal year.

[163] Ibid. Data for FY 1976/T is not included.

[164] Based on TASP, published annually, 1984–1995. Figures are given in professional staff years (PSYs) for FY 1984–1987 and in staff year equivalents (SYEs) for FY 1988–1995. The PSYs/SYEs given are estimated resources for planned programs. Actual resources required for executed programs varied.

[165] FY 1995 TASP, p. 2-2, Table 2.2 (Distribution of Studies and Associated Resources PSY Equivalents by Year).

[166] Mary Ellen Condon-Rall, comp., and Cheryl Morai-Young, ed., *Department of the Army Historical Summary, Fiscal Year 1983* (Washington, D.C.: U.S. Army Center of Military History, 1990), p. 50.

[167] RAAEX II, p. 8-30.

[168] Ibid., p. 6-4.

[169] Ibid., p. 6-5. The total number of FY 1983 studies and analyses reported to the 1985 RAAEX study group probably included some double counting due to multiple analytical agencies working on the same project. Thus, the total number of studies and analyses worked on in FY 1983 was something less than 2,709. Note that RAAEX II (page 6-12) refers to 2,719 studies and analyses, although the number of studies given in RAAEX II (page 6-5) totals only 2,709.

[170] Ibid., p. 3-6.

[171] Ibid., p. 3-8.

[172] On the Issue Assessment Process, see Joann H. Langston and Elaine Sager, "IAP Topics Discussed at Workshop," *Phalanx* 19, no. 3 (September 1986): 8–9, 16; Joann H. Langston and Tom Buckley, "Issue Assessment Process Update: Army Mobilization Integration Cell Established," *Phalanx* 20, no. 4 (December 1987): 7; and H. S. Becker and W. Donald Goodrich, *Identifying Issues for Army Policy Analysis: A Description of the Arroyo Center Program Development Process—Final Report* (Glastonbury, Conn.: The Futures Group, December 1983).

[173] RAAEX II, p. 3-8.

CHAPTER FOUR

United States Army Materiel Systems Analysis Activity 1973–1995

The United States Army Materiel Systems Analysis Activity (AMSAA) was formed at Aberdeen Proving Ground, Maryland, in 1968 to give the United States Army Materiel Command (AMC) a "professional systems analysis capability necessary to evaluate complex modern weapons systems."[1] Initially called the Army Materiel Systems Analysis Center, AMSAA was a lineal descendant of the Weapons Systems Laboratory (WSL) established in 1946 as part of the Army's Ballistics Research Laboratories (BRL).[2] Thus, AMSAA was the only one of the Big Four to antedate the 1973 STEADFAST reorganization of the Army. It was also the most stable of the Big Four, retaining its title, basic mission, and command relationships essentially unchanged from 1973 to 1995. AMSAA's internal organization and the focus of its annual work program did change during the period, however, and although AMSAA's budget grew steadily, there were substantial personnel reductions in the early 1990s, similar to those faced by other Army analytical agencies. As the Army's principal element for the design, test, and evaluation of item-level systems, AMSAA worked on virtually every major Army weapon and equipment system developed in the two decades between 1973 and 1995, and thus contributed substantially to the adoption of new technology, the U.S. Army's dominance of the battlefield, and the consequent one-hundred-hour victory in the Gulf War of 1990–1991.

AMSAA Mission and Functions

During the period 1973–1995, the core mission of AMSAA remained basically unchanged with one major exception—the addition in 1975 of responsibility for the design and independent evaluation of developmental tests. From time to time functions were added or taken away, but there were no fundamental changes. Between 1973 and 1995, AMSAA was responsible for performing studies, analyses, and evaluations as well as modeling and simulation in three main areas: (1) design and performance of item-level materiel systems (i.e., individual weapons and equipment systems), to include the survivability, reliability, availability, and maintainability of Army systems; (2) integration of Army materiel systems, with emphasis on support systems; and (3) logistics readiness and sustainment concepts, policies, and procedures.[3] In addition, the director of AMSAA had a number of other oversight and coordination responsibilities. By September 1981, the list of specific major functions assigned to AMSAA had solidified and included:

- Serving as the AMC lead activity for: Systems Analysis, Survivability, Reliability, Availability and Maintainability Methodology; and Battlefield Systems Integration;
- Conducting independent development test design and evaluation for major, designated nonmajor, and selected other systems;
- Providing overview of life-cycle surveillance programs;

- Providing item-level system effectiveness estimates for cost and operational effectiveness analyses (COEAs) and other Army studies;
- Providing system analysis support to AMC, major subordinate commands, and project managers;
- Maintaining direct contact with Army users in the field;
- Performing logistics and readiness-related analyses; and
- Administering the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME).[4]

Studies and analyses related to the evaluation of the design and performance of item-level Army materiel systems throughout their life cycle was a major AMSAA mission element.[5] As a result of the recommendations of the Army Materiel Acquisition Review Committee (AMARC), in 1975 the AMSAA evaluation mission was expanded to include responsibility for the design of developmental tests and the independent evaluation of developmental tests of "major, designated non-major, and selected other systems."[6] The development Test Design and Evaluation (TD&E) mission became perhaps AMSAA's most visible mission and consumed a large percentage of AMSAA's technical manpower effort.[7] In 1984, AMSAA was also assigned responsibility for initial production TD&E and for preparing the independent evaluator statement for the Materiel Release Review Board. To fulfill its independent TD&E mission, AMSAA was required to:

- Participate in test integration working groups.
- Prepare independent evaluation plans and reports (IEP/Rs).
- Prepare test design plans (TDPs).
- Participate in development of failure definition/scoring criteria.
- Monitor tests.
- Participate in reliability scoring conferences.
- Participate in reliability, availability, and maintainability (RAM) assessment conferences.
- Analyze test data.
- Prepare independent evaluation reports.
- Brief independent evaluations to pre-Army Systems Acquisition Review Councils, HQDA, the Office of the Secretary of Defense, and others.[8]

The 1978–1979 Review of Army Analysis (RAA) study group found a number of areas for improvement in the analysis of item-level systems. Among the study group's recommendations were that AMC, and especially AMSAA, should:

> Develop data regarding the performance of systems under the real conditions of usage . . . develop capability to analyze C^3I systems . . . monitor efficiency of ongoing efforts to remedy problems in developing vulnerability data and take appropriate action . . . develop data regarding the manpower/personnel ramifications of items systems.[9]

The follow-up 1985 Review of Army Analysis Extended (RAAEX) study group found that AMSAA had in fact improved its ability to produce more realistic data on conditions of use for systems as well as its ability to analyze command, control, communications, and intelligence (C3I) systems but that problems remained in AMSAA's ability to deal with vulnerability data and the manpower/personnel ramifications of items and systems.[10]

On the whole, AMSAA's ability to produce accurate and usable item-level systems data was unmatched, and over time other Army analytical agencies came to rely on AMSAA for such data. In May 1988, HQ AMC designated AMSAA as the AMC focal point for all requests for item system data for Army studies.[11] The types of data collected and supplied by AMSAA for use by other analytical agencies were target acquisition data; weapons system's firepower (combat hit and kill probabilities) data; mobility, survivability, and reliability data; probability estimates of successful communication links; and data regarding effects of electronic and other countermeasures.[12]

Another important part of the item-level systems evaluation process was the review of requirement documents. AMSAA's participation in the review of requirement documents fell into two categories. First, as a member of various AMC/TRADOC groups, AMSAA assisted in the drafting of some requirement documents. Second, AMSAA reviewed all pertinent requirement documents at various stages from their first draft to their approval.[13]

Another important AMSAA mission element was the integration of Army material systems. As part of a general reorganization, the HQ AMC Directorate for Battlefield Systems Integration was disestablished on 1 October 1980 and its mission (but not its resources) was transferred to AMSAA. The functions specifically assumed by AMSAA were to:

- Participate, representing the Army materiel developer, in creative, interdisciplinary design work treating the Army in the field as a total and cohesive system, integrated so that combat subsystems such as ground forces, organic aerial, and appropriate components of the Tactical Air Command (TAC) of the U.S. Air Force work in a common framework, with each element configured to maximize total system capabilities.
- Identify and document gaps in current and future battlefield systems where materiel engineering deficiencies impede integrated combat systems in the field, or limit the realization of the full combat capabilities of new items of equipment embracing advanced technology.
- Participate in ongoing combat development and materiel acquisition activities, so as to be familiar with evolving tactical concepts and equipment development and to provide combat systems engineering guidance in the formative stages of system development.[14]

The third major AMSAA mission element involved studies and analyses of logistics readiness and sustainment concepts, policies, and procedures. AMSAA's principal efforts in that area included logistics methodology development and application; field logistics studies and evaluation; studies of policy, procedures, and operations at AMC major subordinate commands and depots; resource analyses addressing manpower, dollar, and policy issues; data collection and analysis efforts with respect to fielded equipment and developmental systems; and independent evaluation as both the independent logistician and independent evaluator for the Army.[15] The two primary data-collection efforts were Simulation Data Collection and Field Exercise Data Collection (FEDC). The objective of the FEDC program was to collect field exercise data on the use of repair parts; ammunition; petroleum, oils, and lubricants (POLs); and maintenance manpower.[16] Beginning in 1985, AMSAA also provided support to the Mission Area Materiel Plan (MAMP) process to ensure that the technology base and materiel development programs prioritized for the Long-Range Research Development and Acquisition Plan were consistent with, and effectively addressed, present and projected battlefield deficiencies. Specific areas of support provided included:

- Participating in the evolution of the joint AMC/TRADOC MAMP process.
- Supporting development of TRADOC Mission Area Analysis (MAA).
- Integrating the results of the U.S. Materiel Counters to Future Soviet Threat Study into MAA's and the finite prioritization of battlefield deficiencies.
- Assisting in rating technology and developmental program contributions to the resolution of stated deficiencies.
- Providing, to the extent possible, cross mission area perspective to individual MSC/mission area managers and support integrating groups.[17]

AMSAA also had a worldwide stockpile surveillance mission, which required it to provide AMC an overview of the reliability and performance of nuclear and nonnuclear ammunition, missiles, and materiel systems in deployment or stockpile.[18] In this role, AMSAA evaluated the operational readiness, serviceability, safety, reliability, and performance of items in storage and deployed in the hands of troops and conducted programs to ensure that the testing, analytical methodologies used, and the results and reports emanating from the stockpile reliability program were the best that could be obtained. In addition, AMSAA performed "customer funded" evaluations of the conventional ammunition program for the U.S. Army Munitions and Chemical Command and evaluations of Army ammunition items stored aboard certain pre-positioned ships or uploaded in tanks as part of the ammunition basic load.[19]

In addition to the missions and functions discussed above, the director of AMSAA was also charged with a number of other tasks during the period 1973–1995. One of the more important tasks involved models, simulations, and war games. Throughout the period, AMSAA developed, maintained, and used a full range of models and simulations—ranging in level from single systems through division—to support its analyses.[20] Accordingly, AMSAA was the AMC lead activity for the Army Model Improvement Program (AMIP), initiated by the under secretary of the Army in 1978 to ensure consistency and efficiency in Army analysis by improving the Army's combined arms and support models.[21] The AMIP required the development of "a hierarchy of new combined arms and support simulation models to provide force-on-force results, including attrition rates and resource consumptions, for simulated combat at small units through major organizational levels" and envisioned "the family of Army analytical simulations as a hierarchy of models including theater, corps/division, and battalion level simulations."[22] The director of AMSAA was the AMC representative on the Army Model Committee, and AMSAA's efforts were directed toward "improving the organization, automation, and audit of the item level data base" in support of the AMIP.[23]

At the international level, the director of AMSAA served as the U.S. national leader and executive chairman of Panel W–6 (General Weapons System Effectiveness) of the Technical Cooperation Program (TTCP), which included the United States, the United Kingdom, Canada, Australia, and New Zealand.[24] Senior AMSAA personnel also served as technical project directors with prime responsibility for five international Data Exchange Agreements (DEAs) and as alternate technical project directors for another thirty-five DEAs with twelve countries.[25] AMSAA also participated actively in various NATO and bilateral projects and supported the state department on negotiations regarding the laws of warfare pertaining to inhumane weapons.[26]

The commander of AMC was designated the functional chief for Office of Personnel Management (OPM) Career Program 16 (CP 16–Engineers and Scientists—Non-Construction), the program under which most Army civilian ORSA specialists were managed.[27] Initially, the commander of AMC chose one of his deputies as the functional chief's representative (FCR) and thus head of the Army Career Program Office for Operations Research and the Army proponent for civilian OR analysts in CP 16. In July 1988, CP 16 was reorganized, and the Army's deputy chief of staff for personnel (DCSPER) directed that TRAC and AMC be given joint proponency for the Series 1515 (ORSA analyst) subprogram. The commanding general of AMC thereupon designated the director of AMSAA to serve as the FCR for Subprogram 1515 and to sit as co-chairman of the Joint Civilian and Military ORSA Advisory Committee.[28] As FCR, the director AMSAA had Army-wide responsibility for all matters pertaining to the education and career development of Army civilian ORSA personnel, including administration of the Army ORSA Fellowship Program, a program for the exchange of civilian analysts among Army analytical agencies, internship programs, in-service training and education, special award programs, and similar matters.[29] Within AMC, the director of AMSAA was responsible for systems analysis conferences, the AMC systems analysis business plan, joint AMSAA–major subordinate command projects, AMC and DA systems analysis awards, the Army Operations Research Symposium (in turn), and DUSA (OR) reviews.[30]

By the mid-1990s, AMSAA's mission statement had changed very little from what it was in the mid-1970s. As of FY 1994, the primary functions being performed by AMSAA were to:

- Provide systems analyses support for Army Materiel Command (AMC) and Department of the Army (DA) Senior Leaders.
- Provide systems analysis support to AMC Major Subordinate Commands (MSCs), Program Executive Officers (PEOs), and Program Managers (PMs).
- Perform Test Design and Evaluation (TD&E) of major Army acquisition systems to support decision makers at key milestones during the development cycle.
- Serve as the Army's official source of input data for Army Studies.
- Develop, use, verify, validate, and accredit models and simulations supporting systems analysis and the development of system performance data.
- Review and analyze draft materiel requirements documents.
- Serve as the Army's lead activity for reliability, availability, and maintainability (RAM) methodology.
- Perform logistics and readiness-related analyses.
- Serve as independent logistician to support the deputy chief of staff for logistics (DCSLOG).
- Maintain awareness of and collect data on fielded equipment performance and readiness.
- Serve as the executive agent for administering the JTCG/ME organization.[31]

Although by the mid-1990s AMSAA's core mission had not changed substantially, the emphasis placed on various mission elements had changed in response to the changing international security environment, changing Army priorities, and the drawdown in personnel and funding that began in the late 1980s. As a consequence, AMSAA had reduced analytical efforts in such mission areas as conventional systems survivability; RAM; industrial and production modeling; ammunition stockpile surveillance; development of methodology; and requirements documentation reviews.[32] Some activities had been abandoned altogether, including mathematics programs; threat simulator analysis; cost and producibility factors in risk assessments; and construction of a TD&E database.[33] At the same time, AMSAA was increasing efforts in a number of mission areas, including modeling and simulation oversight; C4I (command, control, communications, computers, and intelligence); digitization; risk assessment; Advanced Technology Demonstrations and Advanced Concept Technology Demonstrations (ATDs/ACTDs); physics of failure; live-fire strategies; operational logistics; evaluation of technology; policy, strategy, and business practices; and integrated logistics support evaluation.[34]

AMSAA Organization

During the period 1973–1995, the internal organization of AMSAA changed frequently in response to new requirements and new missions. Although old offices were eliminated and new offices were created, in general the changes were superficial and involved only the redistribution of functions or the renaming of activities. However, major reorganizations took place twice, in FY 1981 and again in FY 1994. Thus, the internal organization of AMSAA can be conveniently divided into three main periods: FY 1974–FY 1980, FY 1981–FY 1993, and FY 1994–FY 1995. For most of the first period, from FY 1974 through FY 1980, AMSAA was organized with seven divisions and nine offices, as shown in Figure 4–1.

From FY 1974 to FY 1980, the four divisions most concerned with the core AMSAA missions were the Ground Warfare Division, the Air Warfare Division, the Combat Support Division, and the Reliability, Availability, and Maintainability Division. The Ground Warfare Division designed tests, collected test data, and independently evaluated Army ground warfare systems to provide "assessments on the military worth and combat utility of existing and proposed ground warfare systems throughout their life cycle" for the purpose of providing a basis for decisions concerning their "design, development, acquisition, employment, and deployment, particularly with regard to their performance and effectiveness."[35]

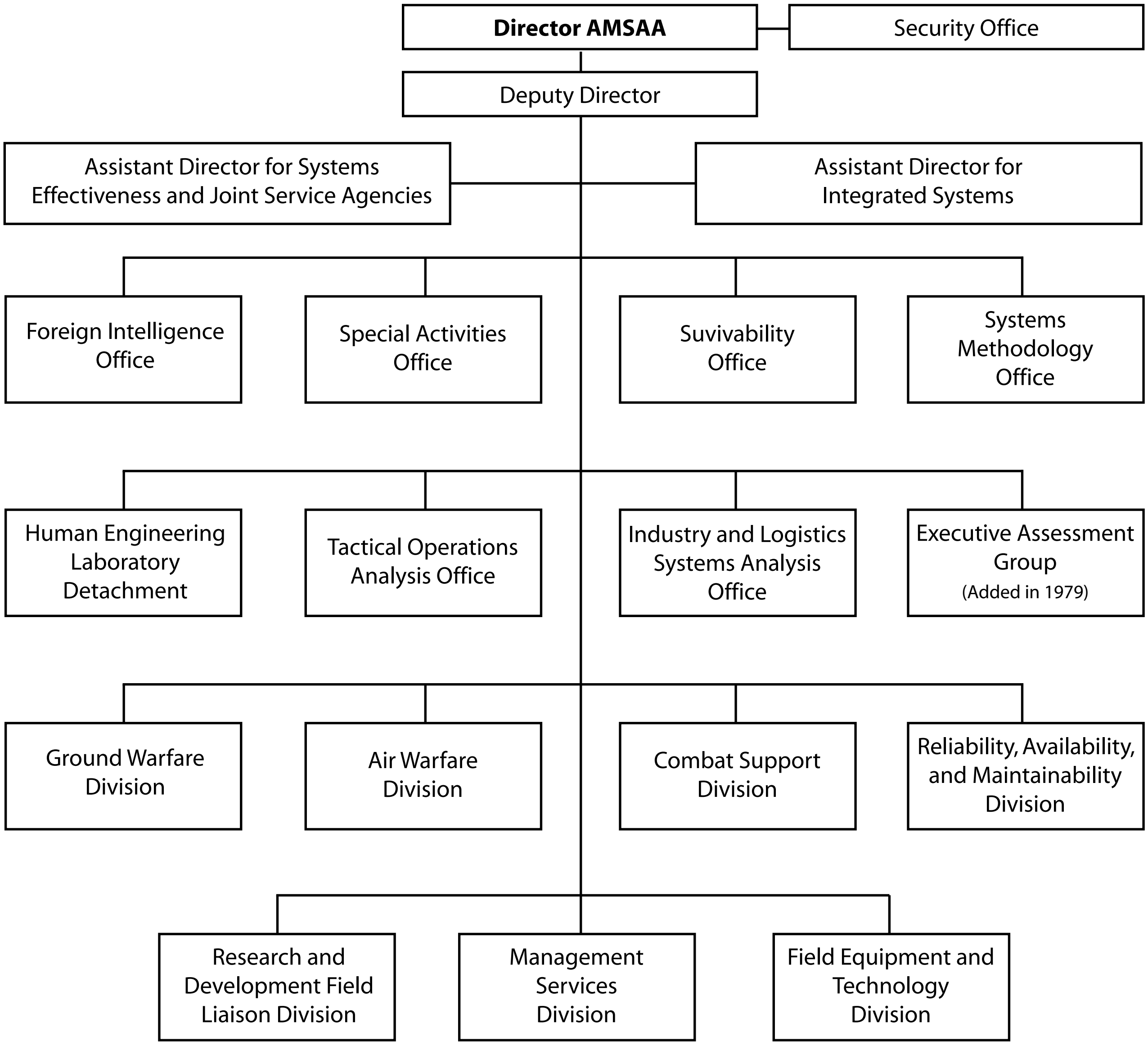
The Air Warfare Division was responsible for analyzing, "the worth and military utility of existing and proposed Army air defense and aviation materiel systems through their life cycle, while maintaining a continuous cognizance of the research and development of Army air defense, attack helicopter, and scout helicopter systems."[36] The Air Warfare Division supported TRADOC initiatives and initiated Independent Evaluation Plans for several major systems in support of AMSAA's TD&E mission.[37] The Air Warfare Division also supported cost and operational effectiveness analyses (COEAs) for other Army analytical agencies.[38]

The Combat Support Division was charged with considering "the worth and military utility of existing and proposed Army materiel in the areas of logistic system support operations, air and surface mobility, and communications and electronics throughout their life cycle" as a basis for decision making.[39] The Combat Support Division also provided direct support and input to other AMSAA elements in the form of "performance characteristics, optimum design parameters, and valuable assessment of the economic consequences involved in the life cycles of various systems" in its areas of competence.[40]

The Reliability, Availability, and Maintainability Division served as the AMC center for reliability, availability, and maintainability (RAM) methodology for Army materiel systems.[41] The Reliability, Availability, and Maintainability Division also provided HQ AMC an overview of the worldwide life-cycle surveillance program on the reliability and performance of nuclear and nonnuclear ammunition, missiles, and materiel systems in deployment or stockpile.[42]

In 1974, the Army Materiel Acquisition Review Committee (AMARC) recommended that AMSAA assume responsibility for test design and independent evaluation of all development tests performed throughout the material acquisition cycle of Army materiel, but HQDA decided that AMSAA would be responsible only for major systems, designated nonmajor systems, and selected other systems.[43] AMSAA thus became responsible for TD&E for systems in all three stages of development testing: DT I (Validation), DT II (Full-Scale Development Test), and DT III (Initial Production).[44] All elements

Figure 4–1—AMSAA, FY 1974–FY 1980



Source: *AMSAA History*, Organizational Directory.

of AMSAA participated in TD&E tasks, but the Reliability, Availability, and Maintainability Division was the lead element and performed certain key functions in the TD&E process.[45]

Two other AMSAA divisions—the Research and Development Field Liaison Division and the Field Equipment and Technology Division—also performed important core mission-related functions. The Army's Land Warfare Laboratory was disestablished on 30 June 1974, and the Research and Development Field Liaison Division was established in AMSAA to maintain direct contact with Army materiel users in the field for the purpose of ascertaining "specific requirements for improving materiel."[46] Subsequently, the Research and Development Field Liaison Division managed AMSAA's field liaison program, established in May 1975 by *AMC Regulation 70–7: Research and Development Field Liaison Visits Conducted by the U.S. Army Materiel Systems Analysis Activity*.[47] Teams from the Research and Development Field Liaison Division visited Army commands and agencies and prepared reports with the objective of "providing timely solutions to equipment problems being experienced by soldiers in the field."[48]

The mission of the Field Equipment and Technology Division was quite similar—to maintain "direct contact with Army materiel users in the field to identify needed improvement in existing materiel and/or requirements for new materiel, to evaluate these findings, and to serve as a catalyst for achieving needed materiel improvements that are acceptable to the user and the development."[49] The Field Equipment and Technology Division also served as the AMSAA focal point for training device development and reviews all materiel requirement documents.[50]

The Field Equipment and Technology Division was also home for the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME).[51] The JTCG/ME was established in 1963 by the Joint Chiefs of Staff to publish a Joint Munitions Effectiveness Manual (JMEM) for air-to-surface nonnuclear munitions, and the Army was tasked to be lead service.[52] The commander of AMC was tasked to carry out the Army's responsibilities for the JTCG/ME, which was given formal status in 1965. The JTCG/ME mission was expanded in 1967 to produce a JMEM for surface-to-surface weapons, and in 1969, the Army requested that the effort be expanded to include production of a JMEM for antiair weapons.[53] The resulting JMEMs became the standard effectiveness documentation for DOD as well as the defense establishments of many of our allies and are used by staff planners, analysts, training schools, and operational units.[54]

The AMC commander delegated his responsibilities as the DOD executive agent for the JTCG/ME program to the director of AMSAA, and AMSAA incorporated the JTCG/ME as a distinct entity in 1974, with the director of AMSAA as the permanent chairperson of the JTCG/ME Joint Service Steering Committee reporting directly to the AMC commander and the other joint logistical commanders. AMSAA provided central office management for overall JTCG/ME program and executed a significant portion of the effort to develop operational effectiveness estimates, databases, and methodology.[55]

The JTCG/ME was unique in that its work is accomplished by some 300 people from the three services working in various locations and coordinated by the JTCG/ME element at AMSAA, which employed only five full-time civilians and had a typical annual budget of \$9–\$10 million distributed among the Army, Navy, Air Force, and Marine Corps, of which AMSAA normally retained about \$500,000 from JTCG/ME for specific supporting tasks. AMSAA's Field Equipment and Technology Division planned, coordinated, and reviewed technical programs for the JTCG/ME regarding the effectiveness of air-to-surface, surface-to-surface, surface-to-air, and air-to-air munitions and weapon systems, including target acquisition and the JTCG/ME battlefield survey.

From FY 1974 to FY 1980, the Management Services Division was "the central coordinator for the direction and management of the non-technical programs of AMSAA which support the technical programs."[56] The Management Services Division was responsible for clerical support, facilities, editorial and publication, budget, operations, and manpower matters for AMSAA, and represented (in 1978–1979) about 6.6 percent of all authorized AMSAA strength.[57]

In addition to the Management Services Division and the six mission-oriented divisions, AMSAA had a number of smaller organizational elements that handled specific tasks and programs. Some provided support to other AMSAA elements and others were more mission oriented. In all, there were nine such offices active from FY 1974 through FY 1980.

The Security Office managed AMSAA programs for personnel, physical, and document security and coordinated visits by foreigners and the "special access" program.[58] In December 1976, the AMSAA security officer resigned from government service and the AMSAA foreign intelligence officer and the AMSAA security assistant assumed responsibility for the AMSAA security program.[59]

The Systems Methodology Office implemented and monitored "a program of integrated studies to insure consistency, objectivity, and technical adequacy" and performed "limited research to develop and validate methodologies, computer models, and techniques applicable to the analysis of the combined effect or operation of many materiel systems including the strategy, tactics, and logistics associated with their employment."[60] The Systems Methodology Office also conducted selected industrial engineering and mobilization planning analyses and studies relating to production processes and the problems of producing systems and component items.

The mission of the Tactical Operations Analysis Office was to define in detail "the combat environments in which materiel systems may be employed" and to develop "new war-gaming and tactical operations analysis methodologies for use in interpreting user requirements for materiel systems evaluation studies."[61] The Tactical Operations Analysis Office served as the focal point for war-gaming within AMC and was responsible for developing basic data on tactical operations for use in AMC studies through map analyses, historical studies, and cooperative efforts with user agencies. The Tactical Operations Analysis Office was also responsible for coordination with Army chemical and biological warfare agencies to assure proper evaluation of chemical and biological items and systems.

The Executive Assessment Group was established in 1979 by the AMSAA director as "an AMSAA Think Tank, to provide experienced and broad based information to AMSAA decision makers addressing selected problem areas."[62] The group consisted of five persons (two permanent and three on rotation) plus a permanent program support specialist who interacted with AMSAA consultants.

The Foreign Intelligence Office was established in June 1976 to provide "better, more responsive foreign intelligence support to analyses at AMSAA."[63] Its assigned mission was to support independent AMSAA analyses of "ongoing RDTE efforts in major and specified non-major systems" by providing threat data and doctrine and maintaining current data holdings in support of ongoing AMSAA projects. The Foreign Intelligence Office also provided a direct liaison capability with other government intelligence agencies (DA assistant chief of staff for intelligence, the Central Intelligence Agency, the Defense Intelligence Agency, and others) and served as AMSAA's sole point of contact for foreign intelligence activities.[64]

In 1974, AMSAA was designated AMC's lead activity for survivability, giving it the responsibility to promote and coordinate a systematic consideration of survivability enhancement and vulnerability reduction through the development process."[65] The following year, the AMSAA Survivability Office was established and assigned responsibility for ensuring that survivability was considered during the design, development, testing, and evaluation of all AMC-developed materiel.[66] The Survivability Office, which functioned primarily as "an initiator of survivability related efforts, and as a focal point of contact, coordination, and project leadership" for such efforts, maintained close contact with other Army agencies and received most of its analytical support from other AMSAA divisions and offices.[67]

The Human Engineering Laboratory Detachment was established in AMSAA on 21 July 1975, and was charged with providing "human factors information and recommendations in support of AMSAA's TD&E mission, and of facilitating technical coordination between the United States Army Human Engineering Laboratories at Aberdeen Proving Ground and AMSAA by providing a point of contact for the exchange of technical information."[68]

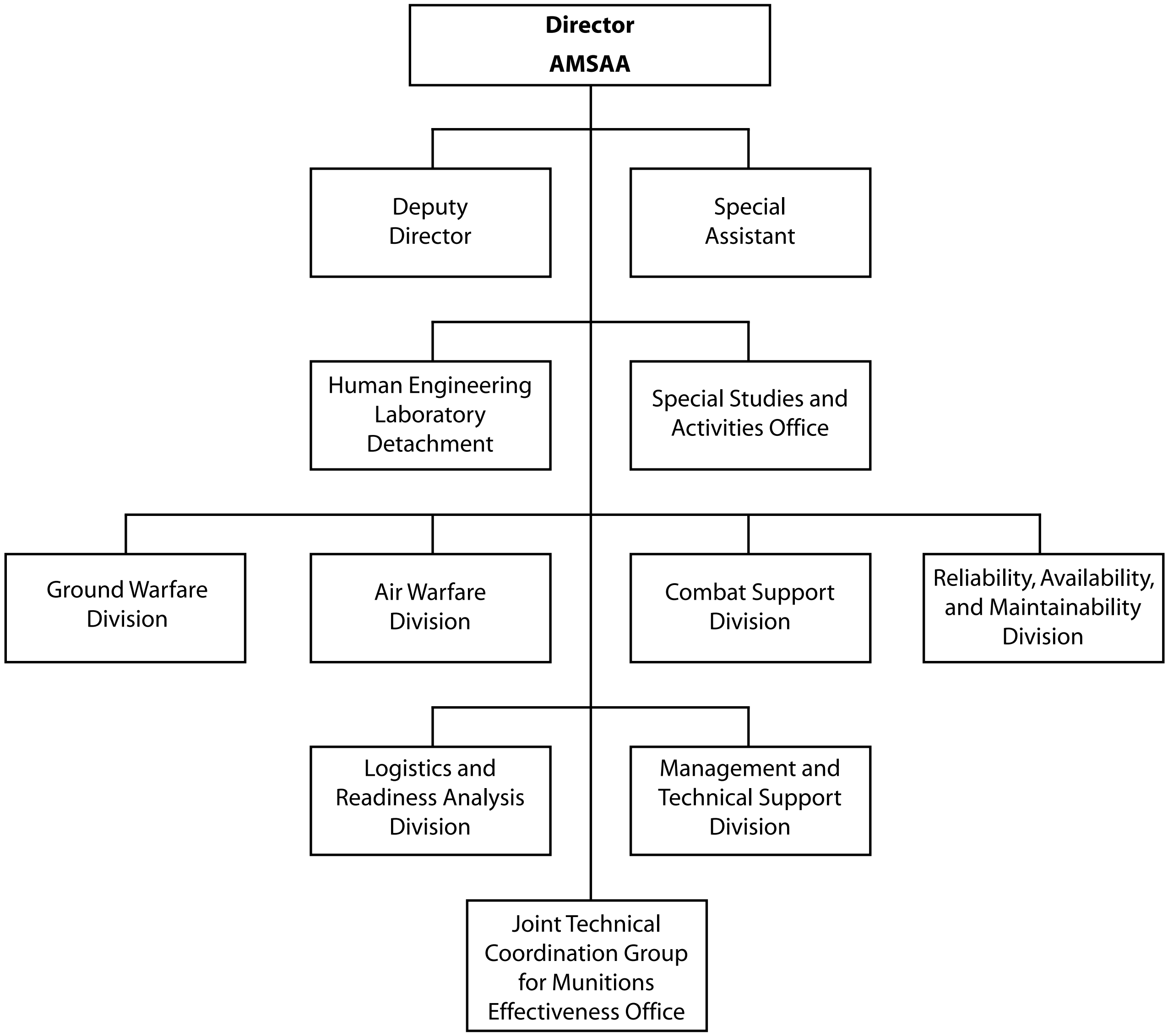
In 1976, AMSAA began regular exchanges with other key Army logistical elements, such as the HQDA Office of the Deputy Chief of Staff for Logistics (ODCSLOG), the Logistics Evaluation Agency (a DCSLOG SSA), and the TRADOC Logistics Center at Fort Lee, Virginia.[69] The AMSAA Industrial and Logistics Systems Analysis Office was the focal point for AMSAA's links to the larger Army logistics community and disseminated logistics information, particularly that needed for TD&E of major systems. One of the major undertakings of Industrial and Logistics Systems Analysis Office was the study of Manpower Authorization Criteria, defined as "the method, philosophy, and procedures used by the Army in determining the manpower levels for maintenance functions."[70]

As its name suggests, the Special Activities Office was the focal point for management of special projects for which AMSAA was responsible.

The FY 1981 AMSAA Reorganization

AMSAA was reorganized in FY 1981 as shown in Figure 4–2 and retained that basic configuration through FY 1993. The Ground Warfare; Air Warfare; Combat Support; Reliability, Availability, and Maintainability; and Management Support divisions were retained with only minor changes, but the Joint Technical Coordination Group for Munitions Effectiveness became a separate office, and a new division, the Logistics and Readiness Analysis Division, absorbed most of the miscellaneous offices as well as three hitherto separate AMC agencies (the Procurement Research Office, the Inventory Research Office, and the Logistics Studies Office).

Figure 4–2—AMSAA, FY 1981–FY 1993



Source: Myers, "AMSAA Serves Key Role in Assessing Weapons Effectiveness," p. 5; *AMSAA in Perspective*, p. 6; U.S. Army Materiel Systems Analysis Activity, Annual Historical Review for Fiscal Year 1992 (Aberdeen Proving Ground, Md.: USAMSAA, July 1993), p. 1 (cited hereafter as AMSAA AHR FY 92); AMSAA, *Annual Historical Review for Fiscal Year 1993* (Aberdeen Proving Ground, Md.: USAMSAA, July 1994), p. 5, Figure 4 (AMSAA Organizational Chart) (cited hereafter as AMSAA AHR FY 93).

The four core functional divisions (Ground Warfare, Air Warfare, Combat Support, and Reliability, Availability, and Maintainability) underwent some internal reorganization during the period FY 1981–FY 1993, but their missions and functions remained basically unchanged. The Management Services Division was renamed the Management and Technical Support Division and absorbed the Security Office and Foreign Intelligence Office, but continued to perform the same basic functions.[71]

As part of the FY 1981 reorganization, the AMSAA Special Activities Office was redesignated the Special Studies and Activities Office and was relieved of responsibility for the JTCG/ME, which was reorganized as a separate office. The missions of the Special Studies and Activities Office were

(1) to perform analytical/technical studies and provide managerial support related to AMC and Army programs in the areas of technical quality, data support for Army studies, personnel career management, independent research and development (IR&D), Army model improvement, international scientific exchange, and systems analysis proponency; and (2) to manage the AMSAA central automatic data processing (ADP) facilities and oversee all matters pertaining to ADP hardware and software acquisition, operation, and management.[72] Among the programs administered by the Special Studies and Activities Office were the AMSAA business plan; the Simulation Technology Development Program; AMC's portion of the Army Model Improvement Program; Model Validation, Verification, and Accreditation; the AMC Mathematics Program; preparing the draft of Volume 7 of *DA Pam 73–1: Modeling and Simulation in Test and Evaluation*; and proponency for OPM Series 1515 (ORSA) subprogram.[73]

The principal change occasioned by the FY 1981 AMSAA reorganization was the creation of the Logistics and Readiness Analysis Division and its absorption of the former Field Equipment and Technology Division and Research and Development Field Liaison Division as well as three formerly independent AMC offices: the Procurement Research Office, the Inventory Research Office (IRO), and the Logistics Studies Office (LSO). The Logistics and Readiness Analysis Division mission included acquiring, developing, and providing "timely information and data that contribute to AMC and Army decision making on supply, maintenance, transportation, logistics, inventory management, field support, and resources of Army materiel."[74] The integration of the three formerly independent AMC logistical research offices into AMSAA on 1 October 1981 was intended to concentrate AMC logistical research, particularly that involving ORSA methods, in one organization and to supplement AMSAA's ability to perform its stockpile surveillance and logistics evaluation missions.[75]

The Procurement Research Office, located at Fort Lee, Virginia, was established in 1969 to provide the Army with research and consulting expertise in the acquisition of weapon systems, supplies and services.[76] The Procurement Research Office was responsible for conducting in-house research studies leading to the improvement of Army procurement management, developing new procurement concepts and techniques, testing and evaluating new concepts, providing onsite consultation services on procurement and procurement-related matters, ascertaining procurement research needs and the resources to meet them, publishing research and consultation findings in reports and papers, developing procurement doctrine and policy, proposing input to procurement training, and interacting with other research activities in and out of the government.[77]

The Inventory Research Office, located in Philadelphia, Pennsylvania, was responsible for conducting "short, mid, and long range studies applying operations research techniques to logistics problems and in the development of logistics systems, providing technical assistance to AMC headquarters, commands, and others on request and performing research on operations research techniques and models."[78] IRO used operations research techniques to develop new inventory methods and provided technical assistance to HQ AMC and its subordinate readiness commands, ODCSLOG, OSD, and other agencies as requested.[79] Traditionally, IRO studies focused on wholesale supply management with a peacetime emphasis, but this changed with the transfer of IRO to AMSAA, and IRO subsequently took the lead in the development of the SESAME model, which was used by AMC's subordinate readiness commands to determine stockage levels for critical items during the provisioning and post-provisioning stages of item development and fielding.[80]

The Logistics Studies Office, located at Fort Lee, Virginia, was responsible for conducting management and operations research studies related to a variety of AMC operational problems in the fields of supply, maintenance, distribution, foreign military sales, economic analysis, management training and development, management control, and information system analysis.[81] As part of the FY 1981 reorganization, LSO activities at Fort Lee were terminated and the three assigned analysts were transferred to the Army Logistics Center, although the positions remained on the AMSAA TDA.[82] The prescribed mission of LSO was to "perform independent research and consulting in logistics doctrine, management systems, operations, and procedures which lead to development of new concepts and improvement of the Army and

Defense logistics systems."[83] LSO undertook studies primarily for HQ AMC and its major subordinate commands but also did work for HQDA and DOD agencies as requested.

The FY 1994 AMSAA Reorganization

In FY 1994, AMSAA underwent a thorough reorganization in response to downsizing and changing Army interests. The new organization was divided functionally into four divisions and three offices, as shown in Figure 4–3. The reorganization, which was designed to put customers first by aligning specific commodity areas and new staff offices so as to facilitate contacts by competency area, reduced the number of SES (Senior Executive Service) positions from six to five; flattened out the organizational structure by reducing the number of divisions from six to four and the number of branches from twenty-three to fourteen; reduced the number of first-line supervisors from sixty to thirty-seven, thereby changing the supervisor-to-employee ratio from 1:6 to 1:11; and consolidated critical expertise to provide needed resources in anticipated growth areas.[84]

The new Combat Evaluation Division had the mission of providing "timely analyses and data to AMC and Army decision-making on the performance, effectiveness, and suitability of armor, artillery, aviation, air defense, infantry and mine weapon systems."[85] The Combat Integration Division had a similar mission with respect to "C^4I systems, sensor systems, nuclear, chemical and biological defense systems, and mobility/support systems as well as providing simulation support capabilities for Distributed Interactive Simulations, engineering level simulations, and force-on-force simulations."[86] The Reliability Analysis Division was concerned with the reliability, availability, and maintainability (RAM) and electromagnetic environmental effects (E3) of Army materiel. The Logistics Analysis Division was concerned with supply, maintenance, transportation, logistics, field support, and inventory and resource management of Army materiel.

The JTCG/ME Office continued unchanged, and the Management and Technology Support Division was renamed the Management Support Office and continued to be responsible for the "necessary management, technical, and administrative support to the director and divisions to effectively and efficiently accomplish the AMSAA mission."[87] The new Strategy, Policy, and Programming Office was responsible for providing "organizational focus" and developing strategies in the areas of long-range planning and systems analysis, technology evaluation and analysis support, and acquisition evaluation and policy support as well as the identification of business opportunities presented by a rapidly changing environment and the preparation of strategies and proposals for integration of these opportunities into AMSAA's functional divisions.[88]

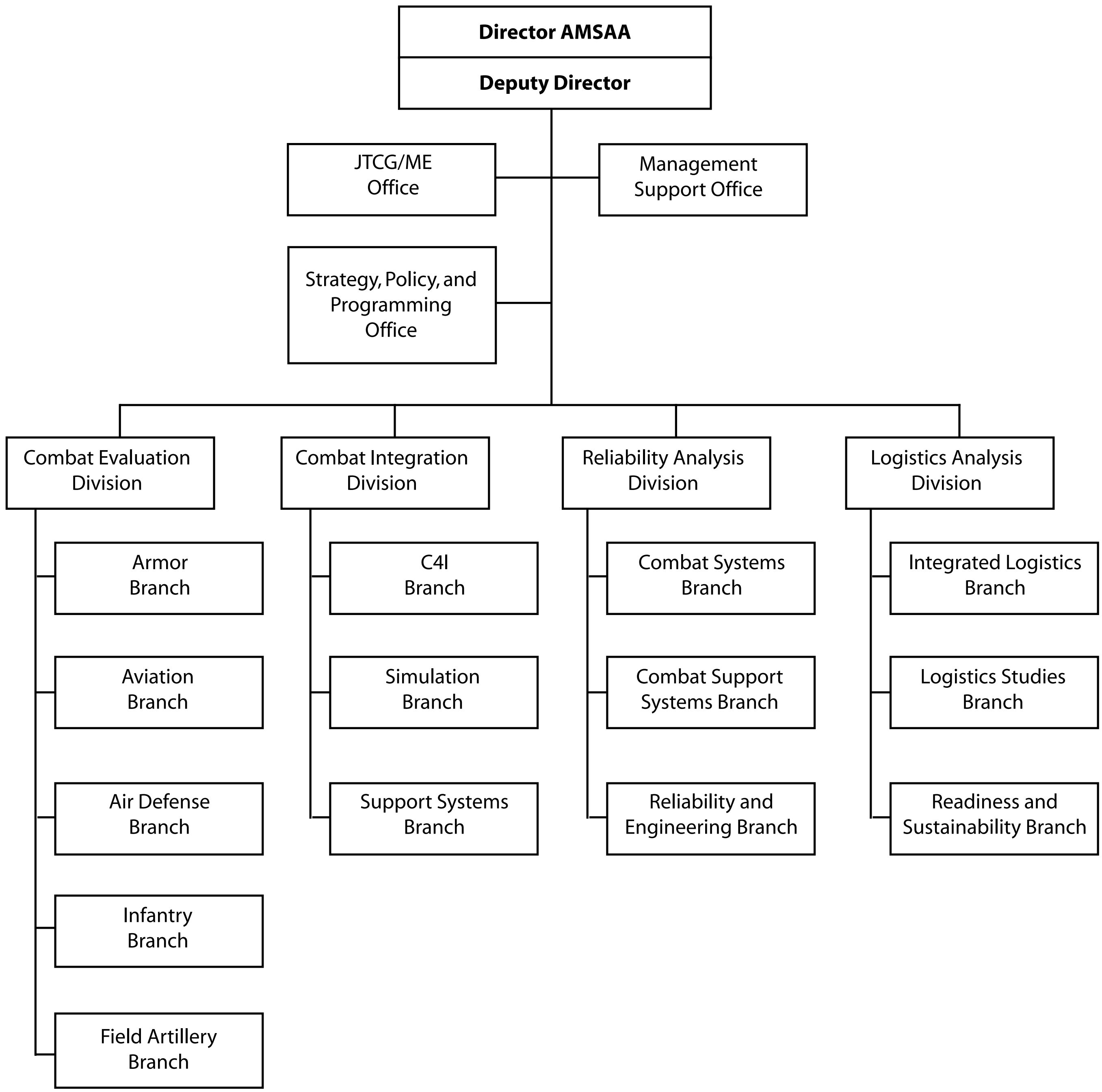
Additional major changes were made in FY 1996. As part of a consolidation of TD&E activities, AMSAA transferred its TD&E functions to the United States Army Operational Test and Evaluation Command and reorganized by reducing the number of divisions from four to three and the number of branches from fourteen to nine.[89] The Reliability Analysis Division was dropped, and an Army Functional Area Assessment office was added.

AMSAA Resources

AMSAA Leadership

Since AMSAA's establishment in 1968, there have been five directors of AMSAA, four of whom served during the period 1973–1995, as shown in Table 4–1. The first was Dr. Joseph Sperrazza, who served from 1968 to July 1979.[90] Joseph Sperrazza was born on 11 July 1920 and began working at the Army's Ballistics Research Laboratories (BRL) in the early 1940s. He rose to be associate technical director of BRL from 1962 to 1968, when he was appointed director of AMSAA. An authority on wound ballistics, Dr. Sperrazza developed a new mathematical law for estimating casualties, and during the Vietnam War he established what became known as Battle Damage Assessment and Reporting Teams to obtain and assess battlefield data. He retired from federal service in 1979 and died on 21 June 1998. As noted in his nomination for induction into the U.S. Army ORSA Hall of Fame on 20 October 2004, Dr. Sperrazza was "the catalyst for AMSAA becoming a premiere analytical organization and for its reputation as the Army's 'honest broker.' "[91]

FIGURE 4–3—AMSAA, FY 1994–FY 1995



Source: AMSAA AHR FY 94, p. 2. On the internal changes at AMSAA, see AMSAA AHR FY 94, pp. 5–50 passim.

Col. Albert De Prospero was acting director of AMSAA from July 1979 until July 1981, when Keith A. Myers became director.[92] Keith A. Myers was born on 23 March 1933. A graduate of Auburn University, he joined the Weapons Systems Laboratory of BRL as a mathematician right out of college and rose to become chief of AMSAA's Combat Support Division. At the time of his appointment as director, he was assistant director of AMSAA for analysis and integrated studies. Myers served as director of AMSAA from July 1981 to December 1993, when he retired from federal service. An expert on weapons systems performance, he developed methodology used to ensure the performance and reliability of Army

Table 4–1—Directors, AMSAA, 1968–2006

Incumbent	*Begin*	*End*
Dr. Joseph Sperrazza	1968	July 1979
Col. Albert De Prospero (Acting)	July 1979	July 1981
Keith A. Myers	July 1981	December 1993
John J. McCarthy	December 1993	March 1998
David J. Shaffer	23 March 1998	July 2006

weapons systems and also established in AMSAA a capability for logistics analysis. He was inducted into the U.S. Army ORSA Hall of Fame on 12 October 2005.

Myers' successor, John J. McCarthy, served as director of AMSAA from December 1993 until March 1998.[93] He was born in Shamokin, Pennsylvania, and received a B.S. in mathematics from Moravian College in 1963 and an M.S. in mathematics from the University of Delaware in 1969. He joined the Weapons Systems Laboratory of BRL in 1963 and rose to become chief of the Field Equipment and Technology Division at AMSAA from July 1977 to November 1981, when he left to serve as deputy director of the Operations Analysis Group, Combined Forces Command, Korea, from November 1981 to December 1983. He returned to AMSAA as special assistant to the director from December 1983 to March 1986 and then served on detail as acting director for materiel management at the Joint Logistics Service Center and as assistant deputy chief of staff for logistics policy and program management, HQ AMC, from May 1992 to July 1993. He served concurrently as chief of the Logistics and Readiness Analysis Division at AMSAA from March 1986 to December 1993, when he became director of AMSAA, in which position he served until his retirement from federal service in March 1998. McCarthy was succeeded by David J. Shaffer, who became AMSAA director on 23 March 1998 and served until July 2006.[94]

David J. Shaffer was born in Johnstown, Pennsylvania, on 11 October 1949 and received his bachelor's degree in mathematics from the University of Pittsburgh in 1971. He subsequently earned a master's degree in logistics management from Central Michigan University in 1979, graduated from the United States Army War College in 1990, and attended the Senior Management Executive Development Program as well as a number of other executive development courses. After a short career in industry, he began working at AMSAA as an operations analyst in the Combat Support Division in 1974 and rose to become the chief of the Logistics Analysis Division from August 1994 to June 1997. He was appointed to the Senior Executive Service as chief of AMSAA's Combat Evaluation Division in 1997, and on 23 March 1998, he was appointed director of AMSAA and left that position in July 2006 to become the deputy to the commander, United States Army Research, Development, and Engineering Command, at which time Col. Philip J. DiSalvo became acting director.

AMSAA Personnel

As is the case with other Army analytical organizations, complete and accurate statistics on AMSAA personnel and other resources during the period 1973–1995 are difficult to ascertain. Insofar as they can be determined, the figures for AMSAA's authorized strength by fiscal year from FY 1973 through FY 1995 are shown in Table 4–2. Throughout the period, approximately 80 percent of the authorized civilian strength was for personnel in professional positions, and from FY 1973 through FY 1995, AMSAA's in-house capabilities were augmented by contractor support that averaged thirty-nine man-years per annum from FY 1989 through FY 1995.[95] Peaks seem to have been reached in the early 1980s and again in FY 1991, but like other Army analytical organizations, AMSAA underwent a steady decline in personnel authorizations in the early 1990s, losing some 17 percent of its staff and becoming "leaner and meaner" by reducing organizational levels and thus eliminating management levels and by reducing the ratio of supervisors to analysts.[96]

Table 4–2—AMSAA Personnel Authorizations, FY 1973–FY 1995

	Military			
Fiscal Year	*Officers*	*Enlisted*	*Civilian*	*Total*
1973	16	13	322	351
1974	16	13	303	332
1975	16	13	395	424
1976/T*	16	13	418	447
1977	16	13	409	438
1978	16	13	411	440
1979	16	13	411	440
1980	16	13	411	440
1981	16	13	411	440
1982	19	12	449	480
1983	19	12	449	480
1984	19	12	450	481
1985	18	12	431	461
1986	18	12	428	458
1987	16	12	437	465
1988	16	12	437	465
1989	16	12	431	459
1990	16	12	432	460
1991	11	12	458	481
1992	23	10	431	464
1993	23	10	432	465
1994	23	10	409	442
1995	19	10	354	383

Source: Based primarily on data supplied by AMSAA, January 2007. Some data taken from AMSAA annual historical summaries, FY 1973–FY 1995, and other sources.

Note: All figures are for authorized strength at the end of the fiscal year. "Military Officers" figures include warrant officers. "Civilian" figures include both professional and support personnel. To the total for FY 1981 should be added forty civilians (thirty-one professional and nine support) and two officers attached.

*T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

By the mid-1990s, the reduced budgets and organizational downsizing began to have a serious impact. At the end of FY 1994, AMSAA had a total authorization for thirty-three military personnel and 409 civilians, down from thirty-three military and 458 civilian positions in FY 1991.[97] In FY 1995, the authorization fell to only 383 (twenty-nine military personnel and 354 civilians) and a further reduction to only 354 personnel was scheduled for FY 1996.[98] Hiring freezes continued, and AMSAA became more dependent on reimbursable funds to support the existing workforce. The intern program was cut back, as were part-time hires and the rehiring of annuitants, and training and long-term professional development programs became more selective.[99] By FY 1995, AMSAA division chiefs were required to work out priorities with AMSAA customers, as there were not enough analysts to perform all the work in a timely manner.[100] As Iris M. Kameny, the chair of the Army Science Board Analysis, Test, and Evaluation Group, observed in September 1995, if AMSAA lost another fifty personnel authorizations, its mission statement would have to be modified.[101]

In the period 1974–1976, over half of the AMSAA professional staff had training and experience in ORSA and the remainder were divided between basic sciences and engineering.[102] Sixteen held the doctorate and ninety the master's degree.[103] As of September 1981, the average Civil Service grade of AMSAA civilian personnel was GS 12.6 for professional engineering and science personnel and GS 11.2 overall.[104] At that time, 65 percent of AMSAA professional personnel held a bachelor's degree, 25 percent a master's degree, 7 percent a doctorate, and 3 percent no degree.[105] The disciplines represented were ORSA (40 percent), engineering (17 percent), mathematics (12 percent), physics and other physical sciences (8 percent), other technical (6 percent), secretarial/clerical (14 percent), and professional support (3 percent).[106] By FY 1987, the average grade of all civilian personnel had increased to GS 11.3 and that of technical personnel had fallen to GS 12.4.[107] The average age of AMSAA civilian personnel was forty-two, and 54 percent were trained ORSA analysts, 4 percent held a Ph.D., and 23 percent held a master's degree. The average age of AMSAA's total workforce in FY 1992 was forty-two, with the greatest percentage of personnel in the twenty-six to thirty age range.[108]

In FY 1992, some 68.7 percent of AMSA technical personnel were ORSA analysts or mathematicians, 27.1 percent were engineers, and 4.2 percent were in the other physical sciences, but only 3 percent of AMSAA technical personnel held a doctorate and 32 percent a master's degree.[109] The situation had changed only marginally by FY 1995, when 4 percent held a doctorate and 31 percent held a master's degree, and 66 percent were in the ORSA/math/statistics fields, 25 percent were in engineering fields, 4 percent were in the physical sciences, and 5 percent were logistics/military specialists.[110]

AMC and AMSAA were primarily civilian operations, and the number of qualified ORSA officer specialists authorized and on hand remained quite low throughout the period under consideration. The 1985 RAAEX study group found that in FY 1983, AMSAA was authorized six SC 49–qualified officers (out of 308 authorized for the Army as a whole), but that only four were supported in the HQDA Officer Distribution Plan and there were only two on hand.[111] At the same time, AMSAA was authorized 300 Series 1515 (ORSA) civilians and had 218 assigned, a fill of only 73 percent vs. an overall Army average of 85 percent.[112]

AMSAA Budget

The AMSAA budget figures available for the period FY 1973–FY 1995 appear to be even less complete and less accurate than the personnel figures for the same period. The difficulties of pinning down the precise figures for annual budgets are compounded by changing definitions and criteria and the impact of inflation over time. The best estimates for AMSAA budgets for the period FY 1973–FY 1995 are given in Table 4–3.

Labor costs represented 76–82 percent of total budgets in FY 1992 and FY 1994.[113] As budgets declined in the early 1990s, AMSAA became more dependent on reimbursable work projects to meet its minimum staffing requirements, and it was expected that by FY 2000, 40 percent of AMSAA's work would be done on a reimbursable basis.[114]

AMSAA Work Program, 1973–1995

AMSAA played a key role throughout the life cycle of most major Army weapons and equipment systems developed between 1973 and 1995. Among the many major systems for which AMSAA had Test Design and Evaluation (TD&E) responsibilities were the UH–60 Black Hawk helicopter, the multiple-launch rocket system, the Patriot missile system, the M1A1 and M1E1 Abrams tanks, the Stinger and Roland air defense missiles, and the Copperhead artillery projectile. Designated nonmajor systems for which AMSAA was responsible included the 120-mm. gun and ammunition, Viper, the squad automatic weapon, and the high-mobility multipurpose wheeled vehicle (HMMWV, better known as the "Humvee"). Other selected systems under AMSAA purview included the Joint Tactical Identification System and the M9 9-mm. personal defense weapon (pistol).[115]

Table 4–3—AMSAA Budgets, FY 1973–FY 1995

Fiscal Year	*Millions of Dollars*
1973	9.4
1974	10.8
1975	12.5
1976/T*	14.6
1977	17.9
1978	16.2
1979	18.5
1980	19.0
1981	19.0
1982	—
1983	—
1984	—
1985	32.7
1986	28.5
1987	30.5
1988	29.3
1989	38.5
1990	34.8
1991	29.4
1992	estimate 44.1
1993	estimate 44.2
1994	estimate 44.2
1995	23.7

Source: Based primarily on figures provided in AMSAA annual historical summaries. See also *AMSAA History*, p. 6; *AMSAA in Perspective*, p. 9; and McCarthy, *A Review of the AMSAA FY97 System Analysis Program*, Slide 1.

Note: FY 1977–FY 1981 figures are in constant FY 1980 dollars and do not include funding for JTCG/ME. FY 1978–FY 1985 figures include both indirect and direct (MPA, OMA, and RDTE) funding. Figures for FY 1989, FY 1990, and FY 1992–FY 1995 are based the estimates in *Army Management Review Task Force-Final Report by DUSA (OR)*, Enclosure 4 (Analysis Initiative Report), page 4-11, and Enclosure 1, pages 1–7 (pages 4-28 to 4-34 of Enclosure 4) and include only OMA and RDTE costs. Figures for FY 1991 and FY 1995 are based on Kameny to Hollis, 22 September 1995, no subject, Appendix C, p. 3, and include only RDTE and OMA funding.

*T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

AMSAA conducted a variety of systems analyses, ad hoc studies, and assessments in support of HQ AMC, the AMC major subordinate commands, and project managers as well as HQDA and other organizations as requested. As of FY 1995, AMSAA's work sponsors included the assistant secretary of the Army for research, development, and acquisition; the DCSLOG; MISMA; the DUSA (OR); the principal deputy for logistics, HQ AMC; HQ AMC LAM and transportation task forces; the USAREUR ORSA cell; and several OSD offices.[116]

The principal thrusts of AMSAA activity were the test and continuous evaluation of selected systems, the development and dissemination of item-level materiel performance characteristics, reliability assessment and methodology, and the analysis of logistics support and readiness functions and processes.[117] The details of AMSAA's annual work program are too voluminous to be easily summarized here, and the reader should refer to AMSAA's annual historical reports for details on each year's program and results. One long-term AMSAA project was the comparative analysis of key current and projected U.S. and Soviet weapons systems, performed annually since 1982, to provide Army leaders with information for use in both the budgetary process and operational planning.[118]

After 1975, Test Design and Evaluation became a major AMSAA function, and as many as sixty tests and evaluations were in progress at one time.[119] AMSAA's TD&E workload was initially about 130 man-years per annum and continued at a rate of about 100 man-years per annum thereafter.[120]

In FY 1974 alone, AMSAA worked on more than seventy-five separate major projects, including Improved HAWK Survivability; Helicopter Weapon Systems Effectiveness Study; The Threat to Army Aircraft from Friendly Artillery; Airborne Radio Frequency Homing Measurements; Airborne Infrared Measurements; Support of the BUSHMASTER 25-mm. Automatic Cannon COEA; Support of the Remotely Piloted Vehicle COEA, Phase III; Tilt Rotor Aircraft Evaluation; Alternate TOW Tracker Sensor Configurations; Analysis of Alternative Methods of Tactical Nuclear Weapon Storage; Armored Vehicle Suspension Studies; Support of the Tactical Fire Directional System COEA; Heavy Equipment Transporter

Evaluation; Joint Munitions Effectiveness Manuals; Mechanized Infantry Combat Vehicle Firing Port Weapon; DRAGON COEA; TOW/DRAGON Survivability; Support of Squad Automatic Weapon COEA; RAM Analysis of M60A2 Tank; Evaluation of the 7.62-mm. M60 Machine Gun Reliability; Indirect Fire Field Artillery and Mortar Delivery Accuracy; CH-47 Helicopter Modernization Program; The Implications of Aircraft Combat Damage Data on Maintainability/Repairability Procedures; Trilateral Main Gun Study; Industrial Logistics Studies; Terrain Analysis Studies; and Camouflage Effectiveness Analysis.[121]

Near the end of the period under consideration, in FY 1992, the AMSAA work program included item-level effectiveness, modeling and simulation, test design and evaluation, review of materiel acquisition requirements, RAM methodology, and logistics and readiness analysis.[122] The top ten programs worked on in FY 1992 included Physics of Failure Approach to Reliability; Battlefield Combat Identification System; Operational Impact of Power Shortfalls on the Longbow Missile Transceiver; M1A1/M1A2 Tank Comparison Study; Continuous Evaluation of Selected Programs; Sparing to Availability; Weapons System Combat Performance Assessment Team; Chemical Defensive Equipment Process Action Team; Risk Assessments and Engineering Analyses; and Optimum Stockage Requirements Analysis Program.[123]

AMSAA Accomplishments

For more than two decades, the Army Materiel Systems Analysis Activity took the lead in providing analysts and decision makers in the Army and other DOD agencies with detailed data and analyses regarding individual weapons systems, equipment, and munitions. Almost every item in the Army inventory, from tanks and helicopters to pistols and rucksacks, was thoroughly analyzed and evaluated as to performance, reliability, and survivability by AMSAA analysts. As a result, the United States Army was the best-armed and best-equipped army in the world, bar none, and its ability to fight and win under any set of conditions was significantly improved. The accuracy of that statement was made crystal clear in the Gulf War of 1990–1991.[124]

Chapter Four Notes

1 B. Plunkett, T. Sager, and J. Schmid, eds., *An AMSAA History, 1974–1976, Addendum I* (Aberdeen Proving Ground, Md.: USAMSAA, December 1977), p. 1 (cited hereafter as *AMSAA History*). As noted previously, from 1976 to 1985 the U.S. Army Materiel Command (AMC) was known as the U.S. Army Development and Readiness Command (DARCOM). For simplicity, I have used "AMC" throughout.

2 WSL was the first Army agency created to do weapons systems analysis as a primary mission. The early history of Ballistics Research Laboratories and Weapons Systems Laboratory is covered in Volume I, Chapter Four.

3 See, inter alia, Ltr Iris M. Kameny, Chair, Army Science Board Test and Evaluation Group, to Walter W. Hollis, DUSA-OR, Washington, 22 Sep 95, no subject [Report of the ASB T&E Group Study of Army Analytical Agencies], app. C (Army Materiel Systems Analysis Activity [AMSAA] Information), p. 1.

4 U.S. Army Materiel Systems Analysis Activity, *AMSAA in Perspective, September 1981* (Aberdeen Proving Ground, Md.: USAMSAA, 1981), p. 5 (cited hereafter as *AMSAA in Perspective*).

5 U.S. Army Materiel Systems Analysis Activity, *Annual Historical Review for FY 87* (Aberdeen Proving Ground, Md.: USAMSAA, April 1988), p. x (cited hereafter as AMSAA AHR FY 87); AMSAA, *Annual Historical Review for FY 88* (Aberdeen Proving Ground, Md.: USAMSAA, May 1989), p. xii (cited hereafter as AMSAA AHR FY 88); AMSAA, *Annual Historical Review for Fiscal Year 1991* (Aberdeen Proving Ground, Md.: USAMSAA, July 1992), p. ix (cited hereafter as AMSAA AHR FY 91).

6 *AMSAA in Perspective*, pp. 1, 16; *AMSAA History*, p. 3. In 1997, AMSAA's TD&E mission was transferred to the U.S. Army Operational Test and Evaluation Command.

7 AMSAA AHR FY 91, p. xii.

8 *AMSAA in Perspective*, pp. 16–17.

9 U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: U.S. Army Special Study Group, April 1979), pp. 9-4 (cited hereafter as RAA I).

10 U.S. Department of the Army Special Study Group, *Final Report-Review of Army Analysis Extended [RAAEX], Volume I: Executive Summary* (Washington, D.C.: U.S. Department of the Army Special Study Group, March 1985), pp. 2-38 to 2-45 [cited hereafter as RAAEX I]).

11 AMSAA AHR FY 88, pp. xvi.

12 AMSAA AHR FY 91, p. xii. Thereafter, the use of AMSAA-supplied data became essential to the analyses conducted by other Army agencies.

13 Ibid., pp. ix and xiv.

14 *AMSAA in Perspective*, pp. 28–29.

15 AMSAA AHR FY 91, p. xvii.

16 Ibid.

17 AMSAA AHR FY 88, p. xxxi.

18 AMSAA AHR FY 91, p. xvi.

19 Ibid., pp. xvi–xvii.

20 Keith A. D. Myers, "AMSAA Serves Key Role in Assessing Weapons Effectiveness," *Phalanx* 18, no. 1 (March 1985): 5. The costs of hardware tests sufficient to answer system performance questions tend to be prohibitive. One alternative is the detailed simulation of system performance in which the physical system is represented by mathematical equations in such a way that its characteristics and behavior parameters can easily be identified, adjusted, and studied. Integral parts of the systems simulation approach include the gathering and assimilation of test data and the design of experiments to obtain real-world performance measurements for validation of the models. These detailed simulations yield results to fill data voids or to compare with the results of tests conducted under conditions similar to those of the simulation. The results of these studies were used by AMSAA to define the performance of weapon systems (see AMSAA AHR FY 91, p. x).

21 *AMSAA in Perspective*, p. 32. The AMIP is discussed in greater detail in Chapter Six, below.

22 AMSAA AHR FY 87, p. xxii.

23 Ibid., p. xxiii.

24 *AMSAA in Perspective*, p. 4. The Technical Cooperation Program (TTCP) provided at the international level services similar to those provided by the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME).

25 Ibid.

26 Ibid.

27 For the details regarding responsibilities and management of CP 16, see Chapter Two, above.

28 Maj. David W. Harris, "Changing the Guard," *Phalanx* 21, no. 3 (September 1988): 24.

29 Michael Sandusky, "Army Operations Research Career Program Update," *Phalanx* 21, no. 2 (June 1988): 22; John McCarthy, *A Review of the AMSAA FY97 System Analysis Program* (Aberdeen Proving Ground, Md.: USAMSAA, 13 August 1996), Slide 18.

30 McCarthy, *A Review of the AMSAA FY97 System Analysis Program*, Slide 18.

31 U.S. Army Materiel Systems Analysis Activity, *Annual Historical Review for Fiscal Year 1994* (Aberdeen Proving Ground, Md.: USAMSAA, August 1995), p. 1 (cited hereafter as AMSAA AHR FY 94).

32 Ltr, Kameny to Hollis, 22 Sep 95, app. C, p. 3.

33 Ibid.

34 Ibid.

35 Ibid., p. 19; J. Roberta Rivello, Sandy Johnson, and Robin DeFranks, eds., *AMSAA Profile, 1978–1979* (Aberdeen Proving Ground, Md.: USAMSAA, [1979]), p. 15.

36 *AMSAA Profile, 1978–1979*, p. 15.

37 *AMSAA History*, p. 37.

38 Ibid., p. 73.

39 Ibid., Organizational Directory; *AMSAA Profile, 1978–1979*, p. 15.

40 *AMSAA History*, p. 13; *AMSAA Profile, 1978–1979*, p. 63.

41 *AMSAA History*, Organizational Directory.

42 Ibid.

43 *AMSAA Profile 1978–1979*, p. 107. As of 30 December 1978, AMSAA was responsible for nineteen major systems, thirty-one designated nonmajor systems, and four selected other systems.

44 Ibid., pp. 16, 107.

45 Ibid. RAMD prepared independent evaluation plans, test design plans, and independent evaluation reports; analyzed data; monitored tests and conducted concurrent analysis of data; and participated in test integration working groups, failure scoring conferences, and failure data screening committees.

46 *AMSAA History*, p. 27.

47 Ibid., p. 61.

48 Ibid.

49 Ibid., Organizational Directory; *AMSAA Profile, 1978–1979*, p. 15.

50 *AMSAA Profile, 1978–1979*, p. 15.

51 Prior to 1975, the JTCG/ME was managed as part of the AMSAA Special Activities Office (SAO), which had the dual function of supporting the assistant director for systems effectiveness and joint service activities as well as the JTCG/ME (see *AMSAA History*, p. 29).

52 The background of the creation of the JTCG/ME and the evolution of its products is given in AMSAA AHR FY 87, pp. 7-4 to 7-5.

53 *AMSAA in Perspective*, p. 34.

54 The Joint Munitions Effectiveness Manuals (JMEMs) were the principal JTCG/ME products and provided a single authoritative source of munitions effectiveness data coordinated among the three services and used throughout DOD (see AMSAA AHR FY 91, p. xix).

55 McCarthy, *A Review of the AMSAA FY97 System Analysis Program*, Slide 23.

56 *AMSAA History*, Organizational Directory; *AMSAA Profile 1978–1979*, pp. 15–16.

57 *AMSAA Profile 1978–1979*, pp. 15–16.

58 Ibid., pp. 16, 119–20.

59 Ibid., pp. 119–20.

60 *AMSAA History*, p. 31.

61 *AMSAA Profile 1978–1979*, p. 16; *AMSAA History*, p. 107.

62 *AMSAA Profile 1978–1979*, p. 15.

63 Ibid., pp. 15, 91.

64 Ibid., p. 91. The Foreign Intelligence Office began with one man in June 1976 and expanded to five by August 1979.

65 *AMSAA History*, p. 3.

66 *AMSAA Profile 1978–1979*, p. 16.

67 Ibid., pp. 121, 124A.

68 Ibid., p. 15; *AMSAA History*, p. 57. The HEL conducted human factors research and engineering and conducted analyses of human factors bearing on system design and performance (see Volume II, Chapter Seven). The Human Engineering Laboratory Detachment at AMSAA began with one liaison officer. By 1976 it was authorized a strength of three psychologists, two engineers, and a secretary, but it remained understaffed for most of its existence.

69 *AMSAA History*, p. 92.

70 Ibid.

71 AMSAA AHR FY 92, p. 5.

72 AMSAA AHR FY 91, pp. 91–92.

73 Ibid. The chief, Special Studies and Activities Office, was the Army assistant functional chief's representative for the Series 1515 ORSA subprogram of OPM Career Program 16.

74 Ibid., p. 45.

75 Myers, "AMSAA Serves Key Role in Assessing Weapons Effectiveness," p. 5.

76 *AMSAA in Perspective*, pp. 25–26.

77 Ibid.; U.S. Department of the Army, Office of the Army Chief of Staff, Management Directorate, Study Program Management Office, *The Army Study Program FY 1982* (Washington, D.C.: Study Program Management Office, Management Directorate, Office of the Army Chief of Staff, HQDA, 31 May 1982), p. C-2.

78 *The Army Study Program FY 1982*, p. C-2.

79 *AMSAA in Perspective*, p. 24.

80 Ibid.

81 *The Army Study Program FY 1982*, p. C-2.

82 *AMSAA in Perspective*, p. 23.

83 Ibid.

84 AMSAA AHR FY 94, p. 2. On the internal changes at AMSAA, see AMSAA AHR FY 94, pp. 5–50 passim.

85 Ibid., p. 5.

86 Ibid., p. 19.

87 Ibid., p. 54.

88 Ibid., p. 49.

89 U.S. Army Materiel Systems Analysis Activity, *AMSAA Annual Historical Review for Fiscal Year 1996* (Aberdeen Proving Ground, Md.: USAMSAA, July 1997), p. 3 (cited hereafter as AMSAA AHR FY 96).

90 For biographical data on Dr. Sperrazza, see Patricia Cook, "First Induction of Army ORSA Hall of Fame," *Phalanx* 38, no. 2 (June 2005): 29; and David J. Shaffer, "Nomination [of Dr. Joseph Sperrazza] for Induction US Army Operations Research/Systems Analysis Hall of Fame," 9 June 2004.

91 Shaffer, "Nomination [of Dr. Joseph Sperrazza] for Induction US Army Operations Research/Systems Analysis Hall of Fame."

92 For biographical data on Keith A. Myers, see Erwin M. Atzinger, "Nomination [of Keith A. Myers] for Induction US Army Operations Research/Systems Analysis Hall of Fame," 23 May 2005, and Myers, "AMSAA Serves Key Role in Assessing Weapons Effectiveness," p. 5.

93 For biographical data on John J. McCarthy, see "Resume for Senior Executive Service of John J. McCarthy," 28 April 1997, and the one-page biographical sketch prepared at AMSAA (n.d.) (both in possession of the author).

[94] Biographical information was provided to the author by David J. Shaffer.

[95] U.S. Department of the Army, Office of the Deputy Under Secretary of the Army for Operations Research, *Army Management Review Task Force-Final Report by DUSA (OR)* (Washington, D.C.: Office of the Deputy Under Secretary of the Army for Operations Research, HQDA, 15 August 1989), p. 4-31.

[96] Walter W. Hollis, "Walt Hollis on Army OR: 'The Times, They Are A-Changin!'" *Phalanx* 28, no. 1 (March 1995): 7.

[97] Ltr, Kameny to Hollis, 22 Sep 95, no subject, app. C, p. 3.

[98] Ibid., app. C, p. 1. By FY 1997, AMSAA's authorized end strength had been reduced to only 268 full-time equivalent personnel (see U.S. Army Materiel Systems Analysis Activity, *AMSAA Annual Historical Review for Fiscal Year 1998* [Aberdeen Proving Ground, Md.: USAMSAA, October 1999], p. 4).

[99] AMSAA AHR FY 94, p. 3.

[100] Ltr, Kameny to Hollis, 22 Sep 95, no subject, app. C, p. 3.

[101] Ibid., app. C, p. 1.

[102] *AMSAA History*, p. 6.

[103] Ibid.

[104] *AMSAA in Perspective*, p. 7.

[105] Ibid., p. 8.

[106] Ibid.

[107] AMSAA AHR FY 87, pp. vii–ix.

[108] AMSAA AHR FY 92, p. 2.

[109] Ibid., p. 3.

[110] Ltr, Kameny to Hollis, 22 Sep 95, no subject, app. C, p. 1.

[111] RAAEX II, p. 8-15, Table (SC 49 Personnel [Authorized/ODP/On Hand]).

[112] Ibid., p. 8-21, Table; and p. 8-25, Table. Note the difference in authorizations between the RAAEX study group report and the figures provided to the author by AMSAA in 2007. That difference is accounted for by the fact that not all AMSAA professional civilians (449 authorized in FY 1983) were in Series 1515.

[113] Ltr, Kameny to Hollis, 22 Sep 95, no subject, app. C, p.1.

[114] Ibid., pp. 1, 3.

[115] *AMSAA in Perspective*, p. 16.

[116] Ltr, Kameny to Hollis, 22 Sep 95, no subject, app. C, p. 1.

[117] AMSAA AHR FY 88, p. xi.

[118] Lorna Jaffe, *Quantitative Analysis and Army Decision Making* (Alexandria, Va.: Historical Office, U.S. Army Materiel Development and Readiness Command, December 1984), p. 14.

[119] Myers, "AMSAA Serves Key Role in Assessing Weapons Effectiveness," p. 5.

[120] *AMSAA in Perspective*, p. 16.

[121] *AMSAA History*, passim.

[122] AMSAA AHR FY 92, p. 6.

[123] Ibid., pp. 6–12.

[124] AMSAA's contributions during the 1990–1991 Gulf War are discussed in Chapter Eight, below.

CHAPTER FIVE

United States Army Operational Test and Evaluation Agency/Command, 1972–1995

Since World War II, the weapons and other equipment used by the United States armed forces have become increasingly complex and increasingly expensive to acquire and maintain. Accordingly, the materiel acquisition processes of the Army and the other services have become themselves more complex and expensive. A core element of the materiel acquisition process is the Test and Evaluation (T&E) of new weapons and equipment conducted at various stages during development. By the late 1960s, Congress, the Executive Branch, the Department of Defense (DOD), and military leaders themselves recognized that the T&E process was fragmented and began to question whether the armed forces were properly organized to conduct independent, reliable T&E. Thus, during the last three decades of the twentieth century, the United States armed forces, prompted by Congress and DOD, reorganized their T&E organizations for greater efficiency and effectiveness. The creation of the United States Army Operational Test and Evaluation Agency (OTEA) in September 1972, its transformation into the United States Army Operational Test and Evaluation Command (OPTEC) in November 1990, and the subsequent establishment of the United States Army Test and Evaluation Command (ATEC) in 1999 were a major part of that process for the Army.

Even before the terms "operations research" and "operations analyst" entered common usage during World War II, the techniques and methods of operations research/systems analysis (ORSA) were employed extensively in the Army T&E community. To be most effective, the T&E process must extend over the entire life cycle of a system, from initial requirement to the extension of its life by adaptation to new uses, and it must use ORSA-related analytical studies, component testing, testing of other systems, and eventually testing of the system itself.[1] Following World War II, the number of trained ORSA analysts assigned to Army T&E organizations increased, and they contributed significantly to the successful testing and evaluation for a growing number of complex systems. Although neither the 1978–1979 Review of Army Analysis (RAA) nor the 1985 Review of Army Analysis Extended (RAAEX) explicitly recognized those ORSA analysts working in the T&E area, they constituted an ever-increasing element of the Army analytical community and were finally recognized as such by the late 1980s.

The development of OTEA/OPTEC between 1972 and 1995 followed a somewhat different course than the development of the other Big Four Army analytical agencies.[2] First, the continuing interest of the Congress, DOD, and Army leaders in improving the materiel acquisition process—and the T&E process in particular—resulted in frequent expansion of the OTEA/OPTEC mission and the consolidation of T&E elements from other commands under OTEA/OPTEC control. Second, the absorption of other Army T&E elements made OTEA/OPTEC a somewhat larger and certainly more complex organization that its sister analytical organizations. Third, although not entirely immune to the resource restrictions imposed on the Army in the early 1990s, OTEA/OPTEC appears to have been somewhat less affected by personnel reductions and budget cutbacks, perhaps because it continued to absorb the missions and functions as well as the assets of other Army T&E elements.

Army Test and Evaluation

To understand the evolution of OTEA/OPTEC and of the Army T&E community after 1972, as well as the role played by ORSA in that community, it is necessary to have a basic understanding of the various types of T&E conducted by the Army and the historical development of T&E in the Army. The Army conducts essentially two types of materiel testing and evaluation: Developmental Test and Evaluation (DT&E) and User Test and Evaluation (UT&E). DT&E is conducted by the materiel developer to demonstrate that the engineering design and development process is complete, the design risks have been minimized, and the system will meet specifications, and to estimate the system's military utility when introduced.[3] DT&E is most often carried out by specialists or technicians, usually civilians, in a laboratory or technical test range environment.

UT&E includes Operational Test and Evaluation (OT&E), Force Development Test and Evaluation (FDT&E), and Joint Test (JT).[4] OT&E normally consists of sequential testing and evaluations at various points in the development of a particular item of equipment keyed to the decision points in the Army/DOD systems acquisition review process and parallel to the development testing and evaluation.[5] OT&E is usually conducted by an operational testing agency using player personnel similar in experience and skills to those troops expected to use and maintain the system when deployed, and it takes place in as realistic an operational environment as possible. Its purpose is to

> estimate the prospective system's military utility, operational effectiveness, and operational suitability (including compatibility, interoperability, maintainability, and logistic and training requirements), and need for any modifications. In addition, OT&E provides information on organization, personnel requirements, doctrine, and tactics. Also it may provide data to support or verify material in operating instructions, publications, and handbooks.[6]

As noted by the Blue Ribbon Defense Panel in 1970, OT&E can contribute to military decision making in four important ways:

1. OT&E can provide essential inputs to help with decisions as to what kinds of new weapons or systems should be developed and what capabilities will provide worthwhile increases in total force effectiveness.
2. OT&E can and should be done in time to provide important inputs to decisions regarding the size and composition of military forces.
3. OT&E is particularly helpful in developing tactics and techniques for employing new systems or adapting old systems to new uses.
4. Traditionally, an important objective of OT&E was to test production systems and obtain data on which to base decisions as to whether to continue or discontinue production.[7]

Force development testing and experimentation includes a variety of tests and field experiments ranging from "small in scope, highly instrumented, high resolution field experiments to the broader in scope, less instrumented, low resolution and highly subjective field tests."[8] The purpose of FDT&E is to "support the force development process by examining the impact, potential, and effectiveness of selected concepts, tactics, doctrine, organization, and materiel."[9] Joint user testing and evaluation is that in which the Army participates with another service.[10] Such tests and evaluations are conducted "to evaluate Army systems or concepts having an interface with or requiring a test environment of another service, or systems or concepts of another service which require testing in an Army environment."[11]

From 1920 until 1962, each Army combat arm and technical service was responsible for both development and service (operational) testing of new materiel as well as conducting other combat developments activities.[12] The test board co-located with each branch's service school normally accomplished T&E. During World War II, the new combat centers (Armor, Air Defense, Tank Destroyer, and Airborne) also established boards. In 1947, each branch retained a board at its service school under Army Field Forces—later Continental Army Command (CONARC)—control. In the 1962 Army reorganization, the combat arms and technical services were discontinued and their boards were transferred to the new Test and Evaluation Command (TECOM) under Army Materiel Command (AMC). The combat developments mission of each branch was assumed by a new branch-oriented combat developments agency under the newly formed Combat Developments Command (CDC), which also took over the Combat Developments Experimentation Command (CDEC) from CONARC.[13] In 1972, the term "service test" was replaced by the term "operational test," and OTEA was established to conduct Army OT&E for major systems.

Ideally, the organization conducting OT&E should be independent of the developing agency. However, prior to the establishment of OTEA in September 1972, both DT&E and OT&E were accomplished by the same agency.[14] In order to provide some degree of independence between the two testing functions, the TECOM test boards associated with the various service schools and centers conducted service (operational) tests according to plans concurred in by HQ CONARC and approved by HQ CDC. Meanwhile the TECOM proving grounds conducted "engineering tests," and CDC was responsible for initial and expanded service (operational) testing and submitted independent evaluations to the HQDA assistant chief of staff for force development (ACSFOR).[15]

In 1973, the Army underwent a major reorganization in Project STEADFAST. CDC and CONARC were eliminated and the new United States Army Training and Doctrine Command (TRADOC) assumed responsibility for combat developments, including the combat developments functions of the service schools and control of CDEC. The following year the service test boards were transferred from TECOM to TRADOC.[16] AMC remained responsible for DT&E and OTEA for OT&E for major systems and selected nonmajor systems, while TRADOC became responsible for OT&E of nonmajor systems and for FDT&E.

The Origins of OTEA

Although often considered part of the 1973 STEADFAST reorganization of the Army, the establishment of the United States Army Operational Test and Evaluation Agency (OTEA) on 25 September 1972 antedated implementation of the STEADFAST reorganization by almost a year and had a somewhat different impetus.[17] On 16 June 1972, Maj. Gen. James G. Kalergis, the project manager for reorganization, briefed Vice Chief of Staff of the Army (VCSA) General Bruce Palmer Jr. on the overall Army reorganization plan, including the establishment of OTEA. At that time, General Palmer expressed the view that the OTEA should be established as soon as possible, independent of the milestone schedule for the CONUS reorganization.[18]

General Palmer's sense of urgency was based on growing congressional and DOD pressures to reform the OT&E process. By the late 1960s and early 1970s, the high cost of procurement, numerous system failures, and the need for extensive postproduction modifications were causing general dissatisfaction with the OT&E process.[19] For example, DOD studies showed that of twenty-two weapons systems employed in Southeast Asia between 1965 and 1970, nineteen had entered production before undergoing adequate OT&E and twenty-one exhibited significant deficiencies in combat.[20] Critics of the DOD OT&E process included the Military Aircraft Panel of the President's Scientific Advisory Committee; the Defense Science Board Task Force on Research and Development (R&D) Management; the Bureau of the Budget; the Comptroller General of the United States; and various congressional committees. One of the most vocal advocates of increased and improved OT&E in DOD was the assistant secretary of defense (systems analysis), who needed good OT&E data on the capabilities of both new systems and those already in the hands of the troops in order to prepare planning, programming, and budgeting system (PPBS) documents, review service budget proposals, and perform analyses of alternative force structures.[21]

The defects in military OT&E were highlighted by the Blue Ribbon Defense Panel, which rendered its report to the president and secretary of defense in July 1970, noting that there was "a large body of opinion that OT&E in the Department of Defense has been done much less well than it should have been and that there is a potentially large pay-off for performing OT&E more effectively."[22] The panel concluded that OT&E was not being adequately managed or supervised at OSD level, that the services had too few qualified and experienced OT&E personnel, that budgeting for OT&E was inadequate, that OT&E facilities were only marginally adequate, and that OT&E within the services was most effective when conducted by organizations that reported directly to the chief of the service.[23] The panel also noted: "No matter what safeguards are built into the system, theoretically it is not in the interests of unbiased and objective OT&E to have those who perform it report through the developer to the Chief of Staff level where important decisions may rely extensively on test results or expert but basically subjective evaluations."[24] Accordingly, in its final report the panel recommended that the DOD:

1. Establish an Operational Testing and Evaluation Group, with civilian leadership, within the Office of the Secretary of Defense, reporting directly to the Deputy Secretary of Defense.
2. Consider establishing a Defense Test Agency with broad authority and responsibility for DOD test activities and giving particular emphasis to OT&E.
3. The Secretary of Defense should communicate to the Military Departments the importance he assigns to the accomplishment of productive, objective, and timely OT&E, including his conviction that the cause of effective OT&E is best served when independent OT&E organizations report directly to Chiefs of Services, Service Secretaries—or both.
4. An early task and continuing responsibility of the OSD OT&E group should be to develop means to insure that productive joint OT&E is accomplished when it is needed.
5. A substantial budget for OSD-sponsored OT&E should be provided, and administered by the OT&E group.
6. Require the Services to budget separately for an OT&E program element.
7. Require the Weapons Systems Evaluation Group to increase its capability to perform OT&E tasks. Assign selected OT&E tasks to WSEG as it develops the required capability to accept them.[25]

The views of the Blue Ribbon Defense Panel were repeated by Deputy Secretary of Defense David L. Packard, who had been its chairman, in an 11 February 1971 memorandum that required each of the services to have an independent field agency for OT&E, separate and distinct from the developing, procuring, and using commands.[26] In the same memorandum, Packard encouraged more joint operational test and evaluation and established a deputy director for test and evaluation within the Office of the Director of Defense Research and Engineering (ODDRE) with "across-the-board" responsibility for OSD T&E matters.[27] He then followed up in July 1971 by directing that the results of OT&E would be presented to the Defense Systems Acquisition Review Committee (DSARC) at the time the decision to go into production was made.[28] Deputy Secretary Packard's actions were reinforced on 19 November 1971, when Congress passed Public Law (PL) 92–156, which required that beginning in 1972 the services would prepare an OT&E report for each weapon system for which procurement funds had been requested.

The Army had already begun to improve its OT&E process. In June 1969, Army Chief of Staff General William C. Westmoreland directed a review of Army OT&E procedures, and in October 1970 a field exercise was added to the service (operational) testing process to create what was called the Expanded Service Test (EST), which was intended to increase the objectivity and thoroughness of the OT&E process and to ensure that new equipment was tested by typical troops under conditions replicating as closely as possible those of actual combat. A new *AR 1000–1: Basic Policies for Systems Acquisition by the Department of the Army* was published on 30 June 1972 to incorporate the changes in policy, and a Letter of Instruction (LOI) was issued that required the Assistant Secretary of the Army for R&D to monitor OT&E in coordination with the deputy under secretary of the Army for operations research (DUSA [OR]) and designated the assistant chief of staff for force development as the focal point for OT&E on the Army Staff.[29]

The next step in response to the Blue Ribbon Defense Panel report, Deputy Secretary Packard's memorandums, and the passage of PL 92–156 was for the Army to establish an independent OT&E agency. A thirteen-member study group under the direction of Maj. Gen. John T. Carley (then the deputy ACSFOR for T&E) was established at Fort Belvoir, Virginia, and met from 26 July to 22 September 1972 to develop a plan for such an agency. On 19 September 1972, the plan was briefed to the new vice chief of staff of the Army, General Creighton W. Abrams Jr.[30]

The discussions in the summer of 1972 leading up to presentation of the plan to the vice chief of staff of the Army had not been entirely positive in the views expressed about the proposed organization. Dr. Wilbur B. Payne, the DUSA (OR), felt that the proposed new OT&E organization was a simplistic solution to a very complex problem and noted:

> Establishment of a new OTE organization without the personnel who have the necessary expertise to actually perform the overall test process from design through the final report will not provide objectivity nor will it aid in our quest for quality. It is highly probable that an OTE agency that has only programmatic/budgeting and directive authority will become, in a brief period, just another organization with which to staff papers to get their "chop."[31]

Lt. Gen. Alfred D. Starbird, the deputy DDRE for T&E, also had several criticisms of the OTEA implementation plan, and on 20 September 1972, General Abrams met with him to discuss the controversial issues regarding the establishment of OTEA.[32] General Starbird was particularly concerned that the planned personnel strength and the proposed budget for OTEA were too low, and he raised four main issues that were resolved as follows:

> ISSUE NO. 1: What programs will be tested and evaluated by OTEA? AGREEMENT: "OTEA will initially focus its efforts on major systems and selected non-major systems, and will take on additional non-major systems, as required."
>
> ISSUE NO. 2: Personnel Strength of OTEA. LTG Starbird felt the proposed OTEA strength of 120 was inadequate. AGREEMENT: "It was agreed that the initial OTEA strength of 120 would be increased to 200 during CY 73."
>
> ISSUE NO. 3: During the conduct of operational tests, who will be Test Director? AGREEMENT: "The designated user will provide the Test Commander. OTEA will provide the Test Director who will be available to provide the overall on-site full time directions for the conduct of the test. It was emphasized by both VCSA and GEN Starbird that the OTEA through its Test Director was to be responsible for the direction of the operational tests."
>
> ISSUE NO. 4: OTEA FY 74 budget. GEN Starbird opined it was too low. AGREEMENT: "An additional $4M will be earmarked for operational test and evaluation in a fenced contingency fund, which will increase FY 74 OTEA available funds to approximately $10M.[33]

The principal controversial issues having been resolved, General Carley and his team revised the OTEA implementation plan and presented it to Secretary of the Army Robert F. Froehlke for decision on 22 September 1972.[34] Secretary Froehlke approved the study group's plan on 22 September, and three days later the order for the establishment of the United States Army Operational Test and Evaluation Agency (OTEA) was issued.[35] Accordingly, OTEA was established on 25 September 1972 at Fort Belvoir, Virginia, as a field operating agency of the Office of the ACSFOR and under the command of General Carley with an initial authorized strength of 120 (fifty-three officers, two enlisted personnel, and sixty-five civilians).[36] It became fully operational in January 1973 with responsibility for all major Army systems and selected nonmajor systems, of which twelve were initially assigned.

The establishment of OTEA by no means ended the debate over the wisdom of creating such an agency. In February 1973, the AMC commander, General Henry A. Miley Jr. voiced doubts about the new organization in a letter to General Abrams, by then the Army chief of staff, in which he stated:

> My purpose in writing is to express a certain uneasiness which I feel as we enthusiastically embrace the new tenets of OTE which are being promulgated formally and informally by DDRE. I fear that, in our eagerness to respond to the very forceful OTE direction coming from OSD, the Army may over-react and, in the process, surrender its remaining independence and involve itself in expensive, time consuming, and marginally productive test programs.[37]

In reply, General Abrams expressed his support for the new process and the proposed role of OTEA.[38]

The Evolution of OTEA Missions and Functions

The mission of OTEA, initially stated in the OTEA Implementation Plan, was definitively established by *AR 10–4* in January 1974 as being to:

> a. Plan, direct, and evaluate the operational testing of all major and selected nonmajor systems; coordinate the operational testing of other nonmajor systems; program and budget the requirements financed under Operations and Maintenance, Army (OMA), Program 2, and coordinate funding for requirements to be financed by all other appropriations for assigned testing.
>
> b. Manage major and coordinate nonmajor FDTE.
>
> c. Coordinate Army participation in the planning for and conduct of joint user testing.
>
> d. Provide a strong focal point organization at HQDA to keep DA and OSD fully informed on the Army's OT needs and accomplishments.[39]

OTEA's responsibilities with respect to operational testing and evaluation were further defined in a 28 January 1974 command briefing that stated that OTEA participation would include (1) assisting the testing task force in preparation of the overall OT plan for the system; (2) preparing the OT portion of the coordinated test program; (3) scheduling and providing support through the Five Year Test Program; (4) designing the tests; (5) planning, conducting, and reporting on the tests; and (6) preparing independent evaluation of the tests.[40]

For each operational test a Test Directorate was to be formed, as shown in Figure 5–1. The user unit was to provide a test director and test troops; OTEA was to provide the deputy test director and a test cell; TRADOC was to provide a deputy test director for doctrine and training expertise; and the Test Directorate was to be filled out with personnel from the installation at which the test was being conducted, with necessary training provided by OTEA.[41]

With respect to FDT&E, OTEA participation was to include (1) processing FDT&E proposals for incorporation in the FYTP (to include programming, budgeting, and scheduling); (2) reviewing and approving test design for major FDT&E; (3) monitoring execution of major FDT&E; and (4) providing independent evaluation of major FDT&E, as required.[42] OTEA was also to be responsible for the management of those joint tests sponsored by OSD and directed by the deputy DDRE for T&E. Specifically, OTEA participation in joint testing was to include (1) providing the focal point for Army participation; (2) providing technical test expertise to the Army test director/deputy test director; (3) assisting in the review of test plans as required; and (4) preparation of an independent evaluation of the test results, as required.[43]

The original OTEA concept of operations was revised in August 1974, and OTEA was made responsible for "the overall management of user testing for the Army."[44] The August 1974 Management Concept Paper also stated that the 1974 Army Staff reorganization had established OTEA as "the Army focal point for OT&E matters of consequence to OSD" and charged OTEA with developing and coordinating "the Army position on OT&E issues that require resolution at the OSD level" as well as reporting the results of its independent evaluation of major systems through the Army Systems Acquisition Review Committee to the Army chief of staff.[45]

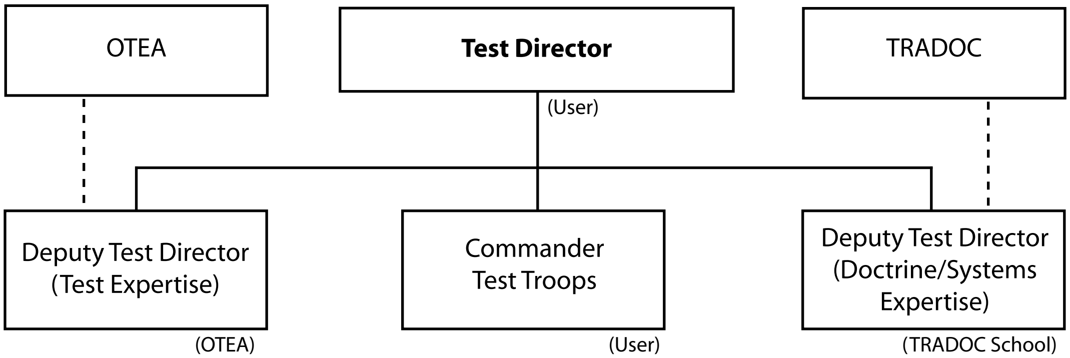
One of the primary management functions of OTEA/OPTEC was the preparation and publication of the Army's Five Year Test Program (FYTP), a compendium of outline test plans reviewed and approved semiannually by the Test Schedule and Review Committee (TSARC). *Chief of Staff Memorandum No. 72–15–221*, dated 16 October 1972, established the TSARC to act as an advisory body to the ACSFOR.[46] The specific functions of the TSARC were to:

> a. Review and approve proposals for force development tests and experiments.
>
> b. Review and establish test priorities for operational testing.
>
> c. Review and coordinate troop support for operational testing.
>
> d. Resolve conflicts between test requirements and other missions.
>
> e. Review funding for user tests.
>
> f. Review and recommend approval of the Five Year Test Program (FYTP).[47]

The TSARC included general officer representation from TRADOC, FORSCOM, AMC, the DA staff (DCSOPS, DCSLOG, comptroller, ACSFOR, and the chief of R&D), and the major test organizations (HQ MASSTER, CDEC, and TECOM) with the commander, OTEA, as chairman. The TSARC met twice a year in June and December and were on call as necessary. The semiannual TSARC meeting was preceded by a meeting of the TSARC Working Group, which included representatives from each directorate in ACSFOR. Outline Test Plans (OTPs) proposed for inclusion in the FYTP were reviewed at both the Working Group and TSARC level. Once approved, the FYTP became a tasking document for the conduct and support of user testing by major commands and test activities for the first two years of the FYTP and provided a planning basis in PPBS for the out-years.

Thus, by the beginning of 1975, OTEA had weathered its start-up period and was in full operation,

Figure 5–1—Type Operational Test Directorate



Source: Briefing, U.S. Army Operational Test and Evaluation Agency, Fort Belvoir, Va., 28 Jan 74, sub: U.S. Army Operational Test and Evaluation Agency (OTEA) Briefing, Slide 8A (Type Test Directorate).
--- Dashed line indicates direct coordination authorized.

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its mission having evolved to include the following responsibilities:

- Support the materiel acquisition and force development processes by exercising responsibility for all operational testing (OT) as well as by managing force development testing and experimentation (FDTE) and joint user testing for the Army.
- Insure that user testing is effectively planned, conducted, and evaluated with emphasis on adequacy, quality, and credibility of all user testing.
- Actively participate in conducting and providing independent evaluations of operational tests conducted on major and selected nonmajor (i.e., Category I) systems and, when required, on major FDTE, and other systems designated by appropriate authority.[48]

Recommendations for Changes in the Army OT&E Process

On 25 February 1974, an Ad Hoc Board of Visitors invited by the OTEA commander convened at Fort Belvoir, Virginia, to review and "critique the user test process, identify its strengths and weaknesses as perceived by the Board, and provide constructive recommendations leading to improvement in that process."[49] As Board Chairman Dr. Wilbur B. Payne noted in his foreword to the board's report:

> To offset this emphasis on problems in the formal report, the Chairman feels obliged to assert that his own general impression and those stated by other members of the board were overwhelmingly favorable and complimentary. OTEA is making great progress in an important area, is clearly on the right track and functioning smoothly.[50]

Dr. Payne's endorsement not withstanding, almost as soon as OTEA had become fully operational in 1973, there had begun to be criticisms and recommendations for additional changes in the Army OT&E process. A review of Army OT&E by the Office of the Army Chief of Staff in 1977 recommended maintaining the status quo, but a Government Accounting Office (GAO) [now the Government Accountability Office] audit in November 1979 recommended that OTEA be made responsible for all Army OT&E, and the same year the Army Science Board recommended that TRADOC assume that role.[51] In 1980, the deputy director of defense research and engineering for test and evaluation continued to advocate assumption by OTEA of all Army OT&E, and an ODCSOPS study recommended that OTEA be responsible for the independent evaluation of all nonmajor systems.[52] The following year a panel headed by General (USA Ret.) Walter T. Kerwin Jr. also recommended that OTEA conduct all Army OT&E.[53] The Kerwin Panel was commissioned on 22 December 1980 by Army Vice Chief of Staff General John W. Vessey Jr. to "provide a new perspective" by reviewing and discussing past studies and discussions.[54] Specifically, the panel was asked to analyze current Army staff management of T&E, evaluate organizational alternatives, and recommend appropriate improvements. The panel developed three organizational alternatives: Alternative 1—Maintain Status Quo; Alternative 2—OTEA Responsible for All Army OT&E; and Alternative 3—A Single Test and Evaluation Command.[55] To evaluate the three alternatives, the panel used three criteria: Credibility, Best Use of Available Resources, and Minimum Disruption.[56] They concluded that Alternative 2—OTEA Responsible for All Army OT&E—would have the "greatest degree of positive impact" and recommended the adoption of that alternative.[57]

An Army Audit Agency audit in 1981 recommended the creation of an independent OT&E command, but the following year General Glenn K. Otis, the TRADOC commander, recommended that the status quo be maintained as an interim solution while Army OT&E was studied further.[58] Matters came to a head on 14 June 1982 at a meeting chaired by General Vessey to discuss alternatives and decide the best organization for Army OT&E management.[59] The briefer reviewed the history of recommendations regarding the organization of Army OT&E from 1970 and in particular those of the Kerwin Panel. The three alternatives presented by the Kerwin Panel and the three evaluation criteria used by the Kerwin Panel were used to formulate a decision by the vice chief of staff, and despite repeated DOD guidance that all operational testing should be done by OTEA, General Vessey opted to maintain the status quo for two years in order to permit the TRADOC test and evaluation system to mature before a final decision was made.[60]

Continuous and Comprehensive Evaluation

Even before a final decision could be made regarding the best organizational arrangement for Army OT&E, major changes in the mission, functions, and organization of OTEA resulted from the decision in the course of FY 1983 to implement the Army Continuous and Comprehensive Evaluation (C2E) program. Design and implementation of the program was initiated in February 1983 when the Army Systems Acquisition Review Committee (ASARC) requested changes in the Army's conduct of OT&E.[61] The ASARC's concerns were outlined by the DUSA (OR) on the committee's behalf in a meeting attended by the OTEA commander and other members of the Army OT&E community.[62] Those concerns were "(1) OTEA tests were conducted on systems too early to address supportability and other deployment issues; (2) OTEA tests were too late to allow the Army to correct deficiencies in systems; (3) OTEA evaluations were too narrowly focused on the results of single operational tests."[63] In response, OTEA proposed to the DUSA (OR) in March 1983 three changes in OTEA's user testing methodology, collectively named the "Continuous Evaluation Concept." They were "(1) Start OTEA involvement much earlier in a system's life and continue it much longer; (2) Use all available test data sources and create some new ones; (3) Report interim test results continually to ASARC."[64]

In June and July 1983, the DCSOPS and DCSRDA were briefed on the "Continuous Evaluation Concept" and concurred in the OTEA proposals, and Under Secretary of the Army James R. Ambrose and VCSA General John A. Wickham Jr. subsequently added two tasks to OTEA's mission.[65] The first task was made known when the under secretary met with the new OTEA commander, Maj. Gen. Benjamin E. Doty, on 19 July and directed that OTEA "evaluate the whole acquisition scene—from beginning to end" and serve as "the evaluator of the continuous acquisition process."[66] The second task was contained in an 8 August memorandum addressed to the OTEA commander in which the VCSA specified that OTEA keep him "informed on the major deficiencies and status of corrective actions relative to the Army's major systems and DAPs (Designated Acquisition Programs)."[67]

The decision to expand OTEA's mission was reinforced by a draft GAO investigative report circulated in September 1983, which recommended the designation of a comprehensive overall Army evaluator to use all test and simulation data.[68] The GAO recommended revisions in the Army OT&E process similar to those of the "Continuous Evaluation Concept": start tests earlier; use more data sources; and continue tests longer.[69] In its draft report, the GAO recommended that the role of comprehensive overall Army evaluator be assigned to one of the Army's three main analysis organizations (CAA, AMSAA, or TRASANA), but in the final report GAO reported that: "DOD believes that the Operational Test and Evaluation Agency would be the best agency to coordinate assessments of a system's status at any time in the development cycle and report significant changes to decisionmakers."[70] Under Secretary of Defense for Research and Engineering Richard D. De Lauer replied to the draft GAO report with a statement that the Army was planning to initiate the Army Continuous Evaluation Pilot Program (ACEPP) with OTEA as the overall evaluator for five selected initial systems.[71]

Maj. Gen. Benjamin E. Doty, the commander of OTEA, recognized the similarity of OTEA's existing "Continuous Evaluation Concept" mission and its new, more comprehensive evaluation mission and named the agency's new methodology "Continuous and Comprehensive Evaluation" (C2E).[72] He also appointed a special study group during the first quarter of FY 1984 to conduct a three-phase study to determine the necessary changes in OTEA's organization, mission, and functions flowing from adoption of the new C2E methodology.[73] Phase I of the study was to define OTEA's new mission and identify new roles, functions, and products for the agency. Phase II required the formulation of organizational alternatives, the comparison of alternatives, and the selection of a preferred structure for OTEA. Phase III was to develop a new TDA that identified personnel skills, grades, and strengths to be assigned to each element of the new organization.

On 1 November 1983, the assistant DCSOPS notified the VCSA that OTEA had been designated the Army's continuous and comprehensive evaluator, and the commander of OTEA was notified formally on 2 March 1984 of his agency's designation as the lead organization for ACEPP, other participants in which were to include the Army Staff, AMC, TRADOC, CAA, and the Logistics Evaluation Agency.[74] A month later, on 2 April 1984, a new OTEA mission statement was issued that defined OTEA's mission as being "to support the materiel acquisition process by managing the Army's continuous comprehensive evaluation and user testing programs."[75] The associated functions of OTEA were defined as:

> 1) Management of the ACEPP [Army Continuous Evaluation Pilot Program].
>
> 2) Management of the Army's OT&E program.
>
> 3) In coordination with DCSOPS, identification of nonmajor systems requiring special management by Headquarters, Department of the Army (HQDA), and continuous evaluation by OTEA.
>
> 4) Providing a focal point for the Office of the Secretary of Defense (OSD) and the VCSA on OT&E matters.
>
> 5) Informing the VCSA, as required, when program management strategies or resources shortfalls preclude OT&E on continuous evaluation from being adequately accomplished.
>
> 6) Supporting the Army's user testing program.[76]

During FY 1984, OTEA worked with other participants to begin C2E. An interagency working group meeting on C2E was held on 30 May 1984, and on 11 July 1984, the OTEA commander, Maj. Gen. William G. T. Tuttle Jr., briefed the CSA, General John A. Wickham Jr., on C2E matters, including the status of OTEA's reorganization, personnel requirements, space and facilities, and initiatives to make better use of contracting and automatic data processing.[77] At a follow-up meeting on 13 July, the VCSA requested increased Army Research Institute (ARI) involvement with C2E, to include a full-time ARI Research Coordination Office at OTEA.[78] Meanwhile, OTEA revised *AR 71–3: User Testing*; *OTEA Memorandum 10–2: OTEA Administrative Staffing Procedures*; and *OTEA Memorandum 10–3: Organization and Functions–OTEA Operational Procedures* to reflect C2E. In May 1985, a Test and Evaluation Functional Area Assessment determined that the C2E pilot program was a success and directed implementation of C2E for all systems.[79]

The FY 1988 Realignment of Army OT&E

The 1986 Goldwater-Nichols Act (PL 99–433) reorganized the DOD's systems acquisition process and had an indirect impact on OTEA in that Under Secretary of the Army James R. Ambrose was designated as the Army Acquisition Executive.[80] The following year, the National Defense Authorization Act of 1987 (PL 99–661) contained two provisions that directly affected OTEA. The first barred contractors from participating in the operational testing and evaluation of their own systems, and the second required lethality and survivability testing, generally called Live Fire Test and Evaluation, for most systems.[81] To implement the two acts, the DUSA (OR) issued a memorandum on Army test and evaluation policy and procedures on 14 September 1987, which established the DUSA (OR) as the HQDA official responsible for oversight of all Army T&E, set up the Army Test and Evaluation Center, and provided guidance on the responsibilities of key Army officials and other matters.[82]

The most significant change came in FY 1988. This change, which involved a realignment of Army OT&E, was initiated by the DUSA (OR), Walter W. Hollis, who wished to resolve two primary areas of concern: the need to get independent operational evaluations of more developing Army systems and the need to improve the utilization of scarce test resources and facilities.[83] The primary thrust of the realignment, agreed upon by the OTEA commander (Maj. Gen. Jerome B. Hilmes) and the commander of TRADOC's Test and Experimentation Command (TEXCOM) (Maj. Gen. Robert L. Drudik) was that the focus of OTEA's activities would be on the "operational evaluation" of system effectiveness and suitability of a greatly increased number of Army systems rather than the OT&E of only a few systems per year. At the same time, TRADOC lost much of its system evaluation responsibility but, through TEXCOM, greatly increased its test role.[84]

An internal OTEA workgroup was formed to recommend transition methodology to the new system and determine the resultant workload. Its primary findings and recommendations were that OTEA should retain the capability to test approximately four systems per year; the retention of that minimum test capability, in addition to the previously agreed upon evaluation and endorsement responsibilities, would require an increase of sixty-three persons in OTEA strength levels; and, based on the increased manning levels and overall levels of responsibility, OTEA should reorganize its evaluation divisions into evaluation directorates with an evaluation division and an analysis division in each.[85] The workgroup's recommendations were accepted, and in March 1988, the VCSA directed a realignment of Army OT&E that reduced OTEA's annual testing mission but required an approximately fourfold increase in the number of OTEA "evaluated" systems.[86] OTEA retained a testing capability but thereafter concentrated on evaluation.

Another action of significant interest to OTEA was the creation of the Test and Evaluation Management Agency (TEMA) under the VCSA in September 1988.[87] TEMA was originally established in FY 1986 as Test and Evaluation Management Office (TEMO), a field operating agency of OCSA but under the operational control of the DUSA (OR).[88] TEMA was staffed by one SES (the director, John P. Tyler III), five other professional civilians, two clerical civilians, and one military officer and was intended to be the HQDA focal point for all Army T&E activities, including instrumentation and funding.[89] TEMA proved to be of immediate assistance to OTEA when it corrected an FY 1988 RDTE funding shortfall of approximately $20 million.[90]

Organization of OTEA, 1972–1990

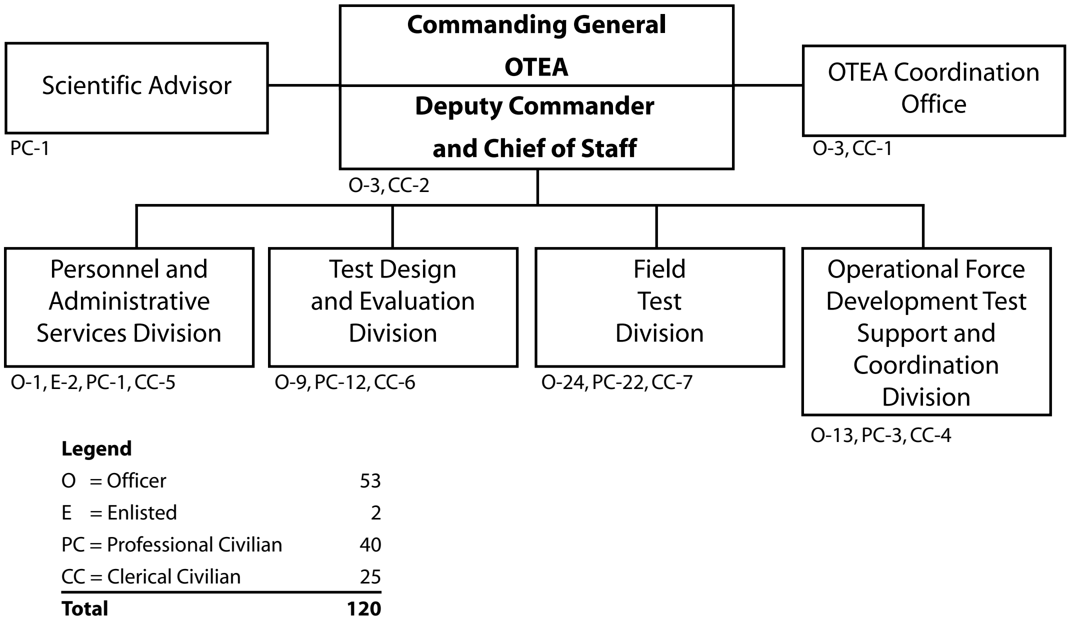
Like most other military commands, OTEA made changes in its internal organization from time to time to accommodate changes in its assigned missions and functions. During OTEA's first twelve years, from 1972 to 1984, its organization remained essentially the same, although numerous, relatively minor changes were made. In April 1984, OTEA underwent a major reorganization to align its structure with its new "Continuous and Comprehensive Evaluation" mission. Another major reorganization took place in FY 1989 to reflect the FY 1988 realignment of Army OT&E. The final major reorganization came in November 1990 with the merger of OTEA with TRADOC's Test and Experimentation Command (TEXCOM) to form the Operational Test and Evaluation Command (OPTEC).

OTEA Organization, 1972–1984

OTEA was initially organized on 25 September 1972 with four major elements: a command group including the Office of the Scientific Advisor; an OTEA Coordination Office; a coordinating staff consisting of a Personnel and Administrative Services Division; and three functional divisions (Test Design and Evaluation, Field Test, and Operational Force Development Test Support and Coordination), as shown in Figure 5–2.[91] The command group was led by a major general with a brigadier general as his deputy and chief of staff and a GS–17 civilian scientific advisor. The OTEA Coordination Office provided "a strong focal point on the Army staff for matters relating to operational and force development testing," coordinated actions between OTEA and the Army Staff, and acted as the initial point of contact for OT&E and FDT&E matters.[92] The Personnel and Administrative Services Division provided the usual range of necessary personnel management, administrative, security, and support functions.

The three functional divisions were the heart of OTEA's mission performance capability. The Test Design and Evaluation Division developed

Figure 5–2—OTEA Organization, 25 September 1972



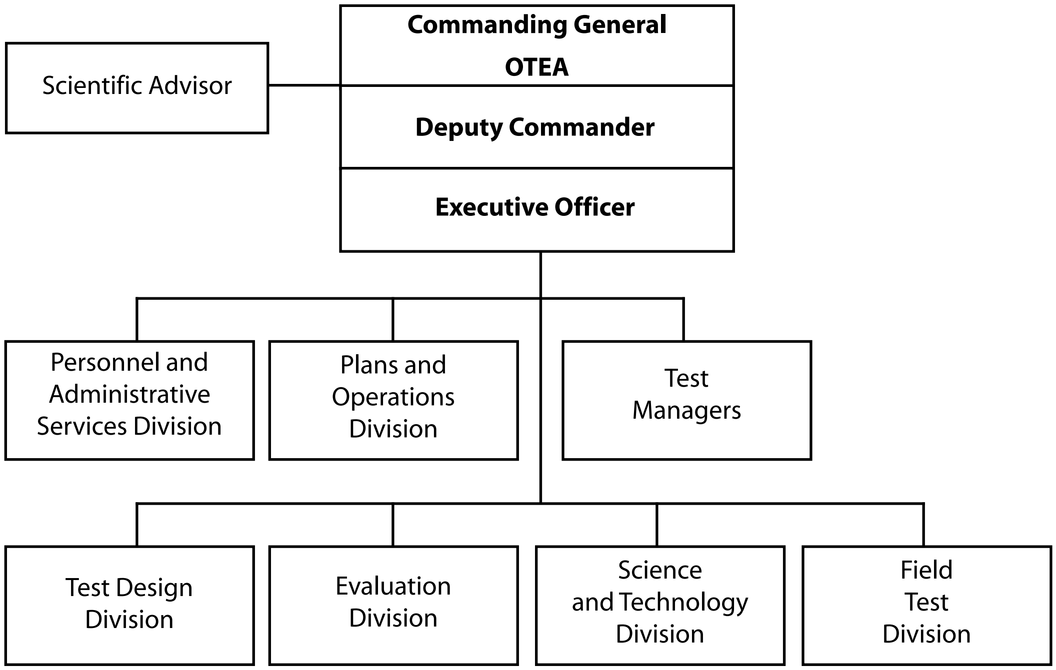
Source: U.S. Army Operational Test and Evaluation Agency, *Annual Report of Major Activities (RCS CSHIS-6 [R-2])—September 1972 to 30 June 1975* (Falls Church, Va.: USAOTEA, 1975), p. 8, Figure 1 (Initial Organization) (cited hereafter as OTEA AHR 72–75); OTEA Implementation Plan, ann. B (Organizational Structure).

operational testing methodology, designed tests, performed independent evaluation of test results, and maintained a technical library and a register of test facilities. [93] The Field Test Division participated with the Test Design and Evaluation Division to prepare tests and then organized field test teams to go to the test site, either in CONUS or overseas, and conduct or participate in tests of systems assigned to OTEA by HQDA.[94] The Operational Force Development Test Support and Coordination Division scheduled and coordinated OTEA's tests and test support activities, provided liaison with other agencies, maintained pertinent regulations and directives, budgeted, and managed OTEA functions relating to force development T&E and joint test matters.[95] The division was also responsible for the Test Schedule and Review Committee (TSARC) and the development of policies, procedures, and regulations.[96]

Perhaps the most significant organizational change during the first thirteen years was the introduction in February 1973 of the "test manager" concept by the OTEA commander, Maj. Gen. Elmer R. Ochs, to provide "a direct means of monitoring each system assigned."[97] Initially, the Test Manager Section consisted of fifteen military and two civilian personnel, and the test managers were all colonels with experience in the field with the systems assigned to them. They served as advisers to the commander, provided a focal point, both internally and externally, for matters concerning their assigned systems, and traveled often to test sites and conferences to maintain familiarity with tested systems and programs and to identify early on any problems in test programs.[98] Initially, test managers were designated for Field Artillery, Aviation, Armor, Air Defense Artillery, Infantry, and Command and Control/Telecommunications/Electronic Warfare systems, but the number and assigned systems of the test managers evolved over time.[99] By FY 1982, there were test managers for Field Artillery, Aviation, Armor, Air Defense Artillery, Infantry, Electronic Warfare and Intelligence, and Command, Control, Communications, and Intelligence (C3I) as well as a joint test manager, provided by the United States Marine Corps.[100]

The OTEA coordinating staff and functional divisions were reorganized several times during the period 1972–1974, generally to provide better staff support and tighter focus on changing mission requirements.

Figure 5–3—OTEA Organization, 1 October 1976



Source: U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3]—October 1981 to 30 September 1982* (Falls Church, Va.: USAOTEA, 1982), p. 7, Figure 2–1 (OTEA Organization Chart).

By 1 October 1976, OTEA was organized as shown in Figure 5–3 and remained in that configuration until the major reorganization in FY 1984.

OTEA Organization, 1984–1987

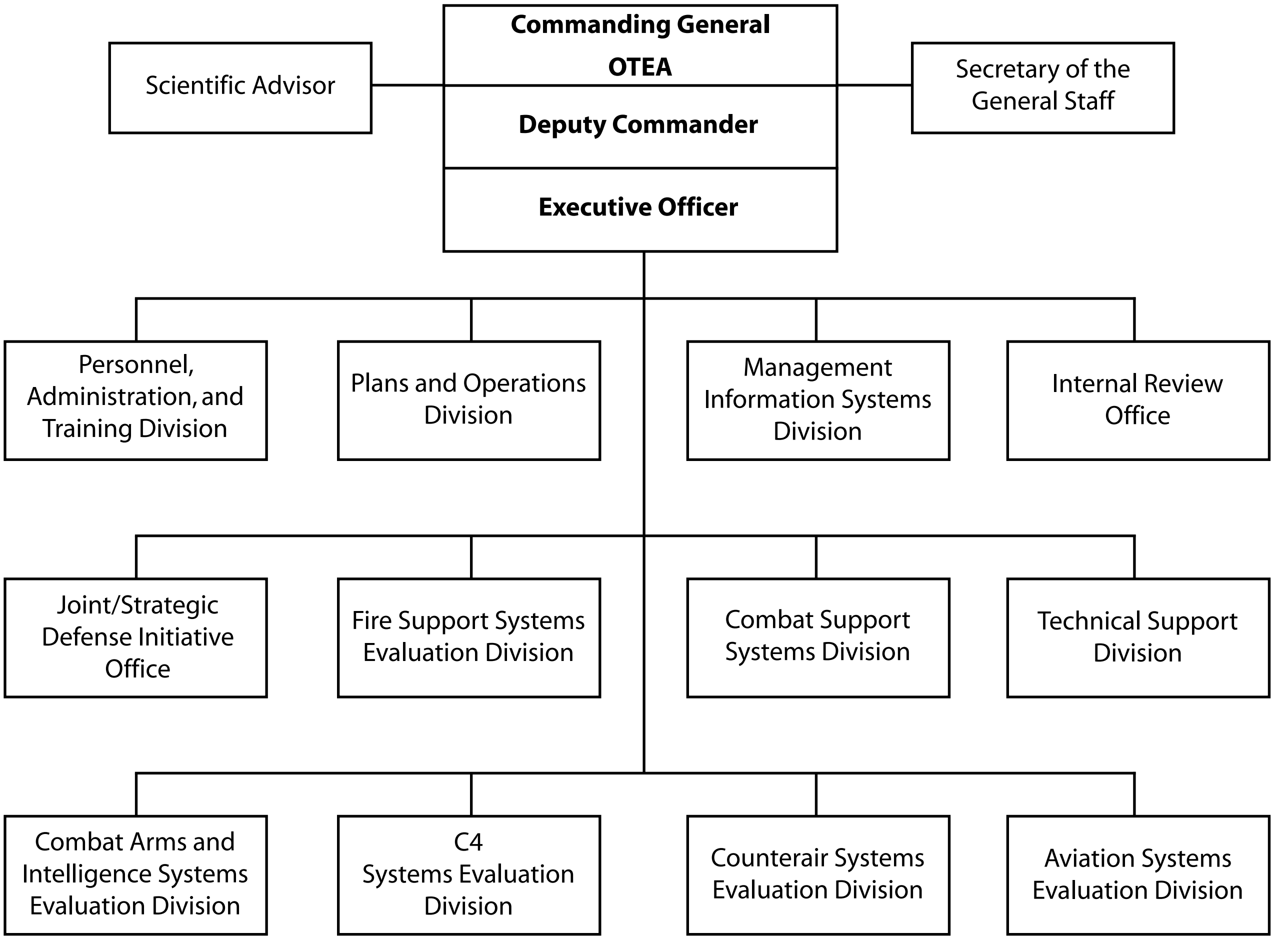
The expansion of OTEA's mission in FY 1983 and the introduction of "Continuous and Comprehensive Evaluation" (C2E) in FY 1984 required major changes in OTEA's organization and operations. Accordingly, on 2 April 1984, OTEA reorganized to better perform its expanded evaluation mission and to deal with a substantial increase in evaluation staff.[101] The eight test managers and the Test Design Division, Science and Technology Division, and Plans and Operations Division were eliminated, and four separate evaluation divisions (Combat Arms and Intelligence Systems, Combat Support Systems, C4 [Command, Control, Communications, and Computers], and Air Systems) were created, as were a Resource Management Division, Management Information Systems Division, Secretary of the General Staff (SGS) Office, Standards and Procedures Office, and Joint Test Office.[102]

The organization of OTEA continued to evolve, and on 1 July 1986, OTEA once again undertook to reorganize its internal structure.[103] In FY 1987 the Joint Test and Evaluation Office gained responsibility for the Army portion of the OT&E of the Strategic Defense Initiative and was renamed the Joint/Strategic Defense Initiative Office.[104] At that time the Counterair Systems Evaluation Division was located at Fort Bliss, Texas; the Combat Arms and Intelligence Systems Evaluation Division, at Fort Hood, Texas; and the C4 Systems Evaluation Division, at Fort Huachuca, Arizona. The resulting structure at the end of FY 1987 was as shown in Figure 5–4.

OTEA Organization, 1988–1990

The realignment of Army operational test and evaluation in FY 1988 resulted in yet another substantial reorganization of OTEA in the course of FY 1989, as the number of developing Army systems for which OTEA was responsible for evaluation increased about fourfold.[105] The principal changes, planned in FY 1988 but not put into effect until FY 1989, included the

Figure 5–4—OTEA Organization, End of FY 1987



Source: OTEA AHR FY 86, pp. 7–8; OTEA AHR FY 87, pp. 1–2, 5.

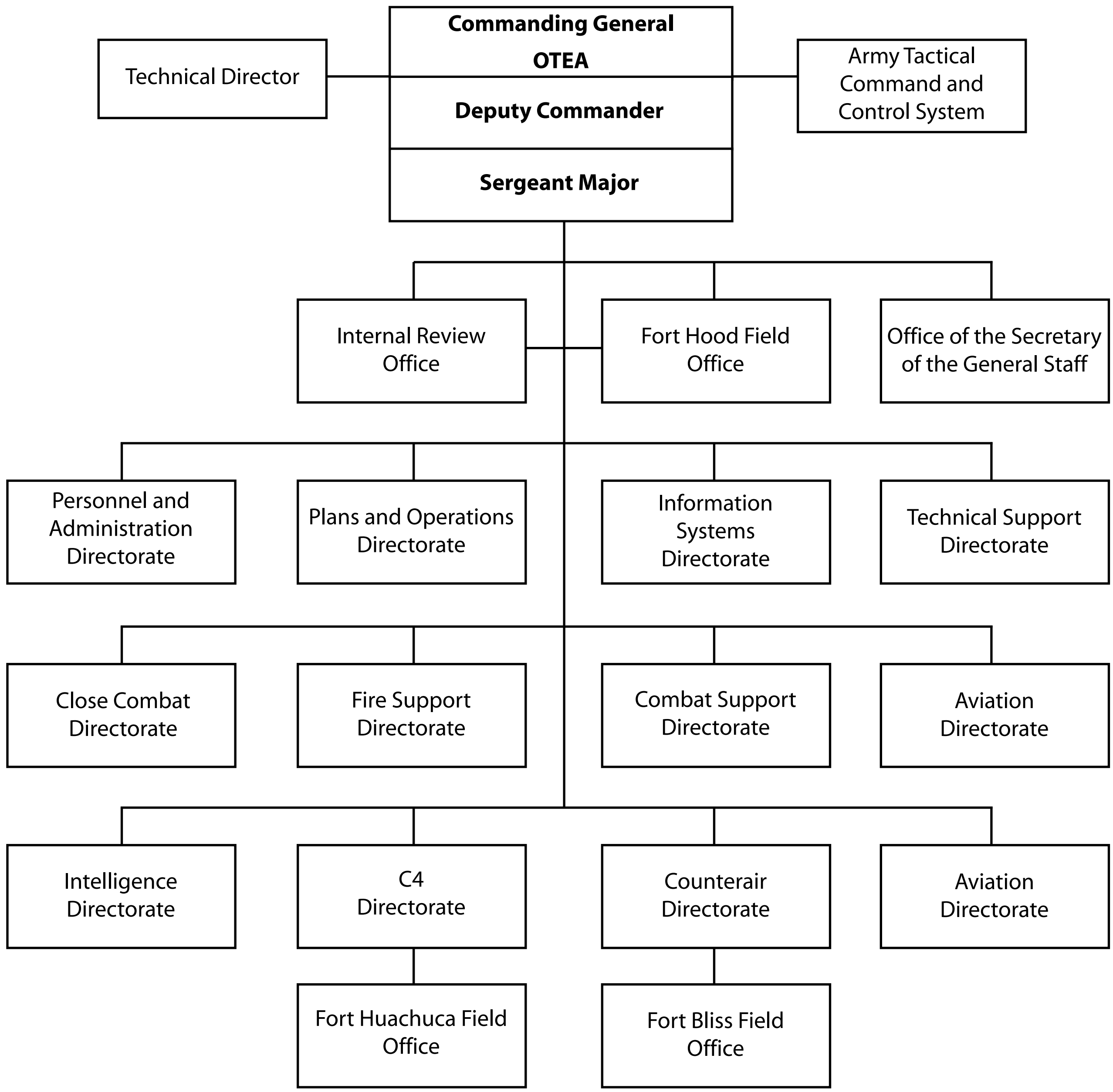
upgrade of the evaluation divisions to directorates and of their associated branches to divisions, and the addition of two new directorates, Close Combat Systems and Intelligence Systems, created from the Combat Arms and Intelligence Systems Evaluation Division, for a total of seven evaluation divisions.[106] A new Threat Coordination Office was created on 1 December 1988 as part of the Intelligence Directorate to serve in an Army-wide support role.[107] The resulting organizational structure, shown in Figure 5–5, remained in effect until the major transformation of OTEA into OPTEC in November 1990.

The Origins of OPTEC, 1988–1989

The realignment of Army OT&E in FY 1988 and the subsequent reorganization of OTEA in FY 1989 by no means quelled the demands from various quarters for an even more thoroughgoing consolidation of Army OT&E.[108] There were even proposals to form a new civilian acquisition agency to develop and buy weapons for all the armed services; they were defeated only by the intervention of an informal military reform caucus in the Congress, which believed that such an agency would threaten the independence of service OT&E and dilute the authority of the under secretary of defense for acquisition.[109]

In 1989, the publication of a Defense Management Report by Secretary of Defense Richard B. Cheney prompted the secretary of the Army and the Army chief of staff to charter a task force in July 1989 to both conduct a review and analysis and to develop implementing plans to execute the Army Management Review process.[110] The Army Management Review

FIGURE 5–5—OTEA ORGANIZATION, FY 1990



Source: OTEA AHR FY 90, p. 1, Figure 1 (OTEA Organization FY 90).

Task Force (AMRTF) was headed by Lt. Gen. John J. Yeosock (then commander, Third U.S. Army) and John S. Doyle Jr. (then deputy assistant secretary of the Army for civil works), and its report was forwarded to the secretary of defense on 16 October 1989.

The AMRTF noted at the beginning of its report: "Because the Army began implementing the Packard Commission's recommendations several years ago, a sound acquisition structure embodying the six underlying features that the Commission found common to nearly all successful commercial and government projects has already been implemented."[111] Nevertheless, the task force went on to recommend substantial changes in the way the Army was organized for T&E, noting:

> The Army has created over the past several years a veritable maze of testing and evaluation agencies. We propose now to combine four major test and evaluation

> (T&E) centers and T&E elements of other organizations to improve the effectiveness of acquisition management and to save over $300M by FY 95. The reorganization alternatives currently under study would place all T&E activities under two commands, resulting in a substantial improvement in efficiency and economy.[112]

In fact, the AMRTF proposed to combine four major materiel T&E centers and the T&E elements of other organizations into two major commands—a Technical Test and Evaluation Command at Aberdeen Proving Ground in Maryland and an Operational Test and Evaluation Command in the Washington area—with the objective of improving the effectiveness of acquisition management and net savings of some $310 million by FY 1995.[113] The AMRTF plan also involved the closing of several of the existing TRADOC test boards and the consolidation of others.

The consolidation of Army T&E elements proposed by the AMRTF was subsequently adopted by OSD and became Part C of *Defense Management Report Directive 936* (DMRD 936c), dated 20 November 1989.[114] DMRD 936c directed consolidation of Army T&E along the lines suggested by the AMRTF with an expected savings of $305 million and 1,307 management and overhead spaces by the end of FY 1995 with no reduction in T&E work.[115] Upon receipt of DMRD 936c, the DUSA (OR) (on behalf of the under secretary of the Army) and General Robert W. RisCassi, the VCSA, appointed a General Officer Steering Committee (GOSC) to develop plans for implementing the consolidation.[116] The GOSC was chaired by Maj. Gen. Richard R. Stephenson, the commander of OTEA, and included members from AMSAA, the Office of the Assistant Secretary of the Army for Research, Development, and Acquisition (SARDA), DCSLOG, Information Systems Command, OTEA, TECOM, TEXCOM, and TEMA.[117] The GOSC implementation plan, approved by the VCSA on 30 May 1990 and by the under secretary of the Army on 11 June 1990, had nine main elements:

> a. Consolidate most AMC technical T&E organizations into TECOM
>
> b. Transfer independent logistical evaluation from LEA to AMSAA
>
> c. Create a new Program Manager-Instrumentation, Targets, and Threat Simulators (PM-ITTS) to develop and acquire TT&E and UT&E ITTS
>
> d. Combine TEXCOM and OTEA into an OT&E Command (OPTEC)
>
> e. Transfer ISC T&E mission and assets to AMC and OPTEC as needed
>
> f. Make efficiencies in T&E by Strategic Defense Command (SDC)
>
> g. Make efficiencies in T&E of information systems
>
> h. Consolidate all of the TEXCOM Experimentation Command at one site
>
> i. Increase the capability of TEMA.[118]

The merger of TEXCOM and OTEA into a new Operational Test and Evaluation Command was to be accompanied by the closing of four TRADOC test boards (Armor-Engineer, Infantry, Communications-Electronics, and Aviation) and the transfer of their functions to OPTEC test directorates at Fort Hood; reducing three test boards (Artillery, Intelligence-Security, and Air Defense) to OPTEC test directorates; closing an experimentation board (at Fort Lewis, Washington); establishing Test and Evaluation Coordination Offices (TECOs) at six locations (the Army centers for Armor, Engineer, Infantry, Communications-Electronics, Aviation, and Logistics); and making other efficiencies, which would result in a savings of more than 600 personnel spaces.[119]

The establishment of OPTEC was approved by Secretary of the Army Michael P. W. Stone on 8 November 1990 and announced to the Congress and the public on 16 November.[120] Pursuant to HQDA General Orders No. 6, dated 28 February 1991 and effective 15 November 1990, the United States Army Operational Test and Evaluation Agency (OTEA) was redesignated as the United States Army Operational Test and Evaluation Command (OPTEC), and the United States Army Test and Experimentation Command (TEXCOM), was disestablished as a subordinate command of TRADOC and its mission, functions, personnel, and other assets were transferred to OPTEC.[121] Like its predecessor, OTEA, the new OPTEC was an OCSA field operating agency.

The intent of DMRD 936c was to consolidate Army testing and evaluation in order to streamline management and reduce duplication of support. As the chairman of the GOSC, General Stephenson, later noted:

> In keeping with the Defense Management Review and other trends in Defense manning and funding, we have completely reorganized Army OT&E. We combined

> the evaluation agency and the test command into an overall OT&E Command. In doing so, we reduced the number of personnel spaces by 24% and the annual budget by 10%. We did this without reducing workload or quality. Although we lost some desirable things such as 4 of the branch-specific test boards and many of the 278 civilians whose spaces we eliminated, we did not lose capability.[122]

OPTEC Mission

With one exception, the OPTEC mission statement remained essentially unchanged from 15 November 1990 to the end of 1995. As stated in the FY 1995 OPTEC annual historical summary:

> The mission of OPTEC is to plan and conduct independent operational tests, evaluations, and assessments of Army materiel and Information Mission Area systems. OPTEC also plans and conducts joint and multi-service tests. The command reports system operational effectiveness and suitability to Army leadership, the Army Acquisition Executive, and, for DoD-level systems, to the Director of Operational Test and Evaluation (DOTE) and the Under Secretary of Defense for Acquisition and Technology. OPTEC also plans and conducts force development tests in support of the Army combat developments process, performs field experiments and technology demonstrations in support of the technology base, and manages the Army's continuous evaluation programs.[123]

In the fall of 1991, OPTEC was tasked as the operational evaluator for all Major Automated Information System Review Council systems. This additional mission involved T&E for more than seventy systems and led to the development of an Information Mission Area Test Directorate with approximately 120 testers located at Fort Hood, Texas.[124]

OPTEC Organization

The organization of OPTEC did not change significantly between 15 November 1990 and 30 September 1995. As shown in Figure 5–6, OPTEC was composed of four principal subordinate mission-oriented elements: the Operational Evaluation Command (OEC), the OPTEC Threat Support Activity (OTSA), the Test and Experimentation Command (TEXCOM), and several Test and Evaluation Coordination Offices (TECOs).

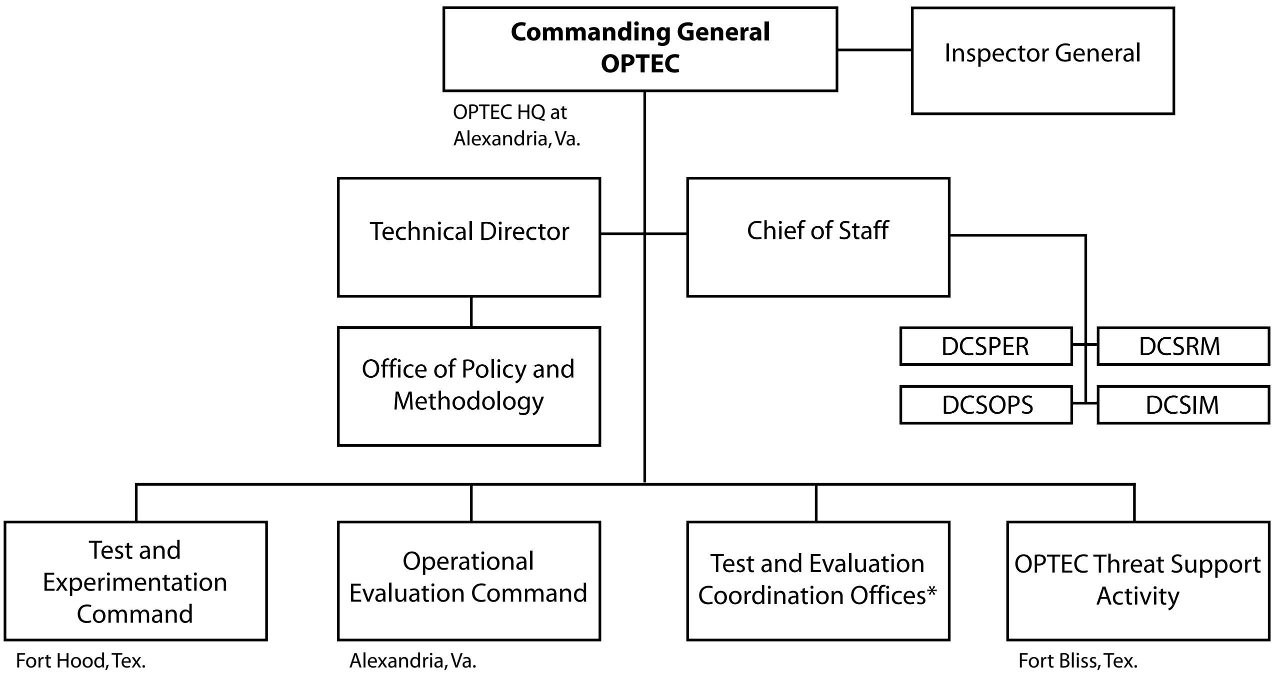
The Operational Evaluation Command (OEC)—co-located with HQ OPTEC in Alexandria, Virginia—was the direct lineal descendant of OTEA and was assigned the primary mission of evaluating "the operational effectiveness and suitability of assigned DOT&E Oversight, Defense Acquisition Programs, Level 1 systems, and the endorsement of system evaluations performed by other agencies or offices."[125] To perform that mission, OEC was organized as shown in Figure 5–7.

In FY 1991, OEC had nine directorates (Air Defense; Aviation; Combat Support; Command, Control, and Communication [C3] Systems; Intelligence; Fire Support; Close Combat; Information Mission Area [IMA]; and Science and Engineering).[126] On 1 September 1992, a number of staff functions previously performed by HQ OPTEC for OEC were transferred to OEC, and a staff for OEC in the Personnel Administration, Resource Management, Operations, Contracts, and Technical Integration areas was created using personnel from the Science and Engineering Directorate, which was eliminated.[127]

The commander of OEC was normally an Army colonel who was assisted by a civilian technical director who also served as deputy commander. The five OEC commanders who served between November 1990 and September 1995 were Col. Boyd A. Jones (15 November 1990–12 April 1992); Col. P. T. Graney (13 April 1992–30 September 1993); Col. Richard M. Walsh (1 October 1993–31 March 1995); Harold C. Pasini Jr. (Acting) (1 April–5 July 1995); and Col. Edward F. Ireck III (6 July 1995–30 September 1995 et seq.).[128] Two technical directors served in OEC during the period. Margaret Myers was the OEC technical director from 1 April 1990 to 31 January 1995, and Harold C. Pasini Jr. was the OEC technical director from 1 February 1995 through the end of September 1995.[129]

The OPTEC Threat Support Activity (OTSA) was established by the transfer to OPTEC of the former United States Army Development and Acquisition of Threat Simulators Activity (ADATS-A). Located at Fort Bliss, Texas, OTSA assisted and advised the OPTEC commander on "the fulfillment of the OPTEC-assigned responsibility for Army Threat Simulator (ATS) Program actions."[130] OTSA also operated and maintained operating replica simulators and actual threat systems and ensured that realistic threat environments were used in support of free-play,

Figure 5–6—Organization of OPTEC, FY 1990–FY 1995



Source: Based on OPTEC annual historical summaries/reviews, FY 1990–FY 1995, and other sources.

*The Test and Evaluation Coordination offices were located at the following places: Fort Rucker, Alabama; Fort Gordon, Georgia; Fort Lee, Virginia; Fort Knox, Kentucky; Fort Leonard Wood, Missouri; Fort Benning, Georgia; Fort Leavenworth, Kansas (after FY 1993); Fort Monroe, Virginia (after FY 1993).

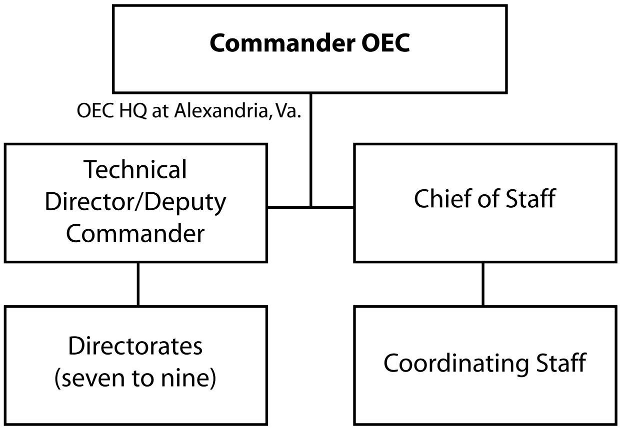
force-on-force, and real-time casualty assessment testing and training. OTSA was also responsible for the continuous improvement of the processes for optimizing resources and improving products.

In preparation for the formal activation of OPTEC on 15 November 1990, a new Test and Experimentation Command (TEXCOM) was formed when the TRADOC Test and Experimentation Command, the TRADOC Combined Arms Test Activity (TCATA), the TRADOC Test and Experimentation Center (TEC), and the seven TRADOC test boards were reassigned from TRADOC to OPTEC on 8 November with the mission of providing "the highest quality operational tests to users and combat developers."[131] The Aviation Board at Fort Rucker, Alabama; the Infantry Board at Fort Benning, Georgia; and the Armor-Engineer Board at Fort Knox, Kentucky, were closed and their functions transferred to Fort Hood, where they were reestablished as TEXCOM test directorates. A Command, Control, and Communications (C3) Systems Test Directorate was created by merging the former TCATA Battlefield Automation Test Directorate with the OTEA Fort Hood Field Office, and it assumed the mission of the Communications-Electronics Test Board at Fort Gordon, Georgia, which was also closed. The Intelligence-Security Board at Fort Huachuca, the Air Defense Artillery Board at Fort Bliss, the Field Artillery Board at Fort Sill, and the Airborne/Special Operations Board at Fort Bragg were redesignated as TEXCOM test directorates and remained in place.[132]

The resulting organization of TEXCOM in FY 1991 was as shown in Figure 5–8. In July 1992, the Infantry and Armor test directorates were combined to form a new Close Combat Test Directorate, and the engineer functions of the former Armor-Engineer Test Directorate were transferred to the Combat Support Test Directorate to form a new Combat Support-Engineer Directorate. The lineup of test directorates then remained the same until FY 1995, when a new Advanced Concepts Test and Integration Directorate was added.

Between 8 November 1990 and 30 September 1995, TEXCOM was commanded by three general

Figure 5–7—Organization of OEC, FY 1990–FY 1995



Source: Based on OPTEC annual historical summaries/reviews, FY 1990–FY 1995, and other sources.

officers. Maj. Gen. William C. Page Jr. commanded from 8 November 1990 to 23 August 1992, and Brig. Gen. Anthony C. Trifiletti commanded from 24 August 1992 to 30 September 1994. The position then remained vacant until 18 January 1995, when Brig. Gen. A. J. Madora assumed command. He served through 30 September 1995. The senior civilian at TEXCOM was the technical director, who also served as the deputy commander. Between 1 October 1993 and the end of the period under consideration (30 September 1995), there was only one TEXCOM technical director: Dr. Marion R. Bryson, who served from 1 October 1993 until 28 April 1994. A vacancy then occurred until Brian Barr became the TEXCOM technical director on 23 October 1995.[133]

The new OPTEC TEXCOM Experimentation Center (TEC) was the lineal descendant of the Combat Development Test and Experimentation Center (later the Combat Development Experimentation Center, or CDEC) established on 1 November 1956. In 1990, TEC operations were split between its headquarters at Fort Ord, California, and its operating elements at Fort Hunter Liggett, eighty miles away. Operations in two locations increased travel and TDY costs by about $1.4 million per year and interfered with the ease of operations. After a year of planning and preliminary actions, all TEC personnel, operations, and assets were consolidated at Fort Hunter Liggett on 1 March 1991. Since its establishment in 1956, CDEC/TEC had combat and support troop units assigned to carry out tests and experiments.[134] By FY 1995, the assigned test troops consisted of a reinforced armored cavalry squadron. In February 1995, the Base Realignment and Closure Commission called for the relocation of TEC from Fort Hunter Liggett to Fort Bliss, Texas, but the move was never carried out; in response to additional personnel cuts, the OPTEC commander elected to deactivate TEC rather than to move it. The commanders of the TEXCOM Experimentation Center during the period 8 November 1990–30 September 1995 included Dr. Marion R. Bryson (director), 8 November 1990–23 August 1991; Col. Oscar W. Simmons, 26 August 1991–30 September 1993; Col. Michael H. Jackson, 1 October 1993–31 July 1995; and Col. James R. Prouty, 1 August 1995–30 September 1995.

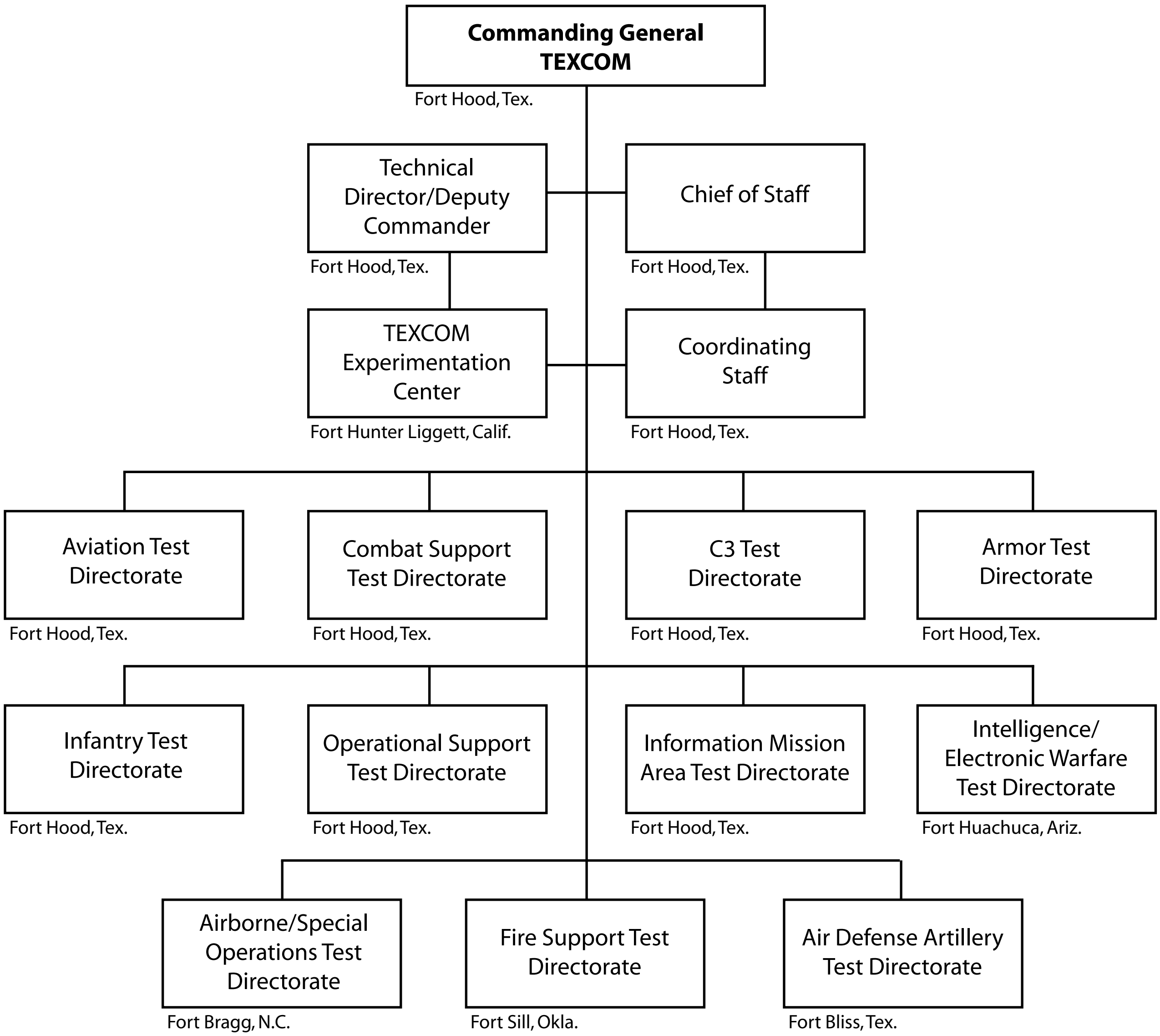
The Test and Evaluation Coordination Offices (TECOs) were located at installations where TRADOC test boards had been disestablished. They were intended to provide onsite coordination between OPTEC and the TRADOC proponent center.[135] They also provided OT&E expertise to the TRADOC proponent activity and were responsible for continuous improvement of processes for the purpose of optimizing resources and improving products. In FY 1991 there were six TECOs: Aviation TECO (Fort Rucker, Alabama); Signal TECO (Fort Gordon, Georgia); Combined Arms TECO (Fort Lee, Virginia); Armor TECO (Fort Knox, Kentucky); Infantry TECO (Fort Benning, Georgia); and Engineer TECO (Fort Leonard Wood, Missouri).[136] That arrangement remained in effect until FY 1994, when TECOs were activated at Fort Leavenworth, Kansas, to support the TRADOC Combined Arms Center and the Battle Command Battle Lab, and at Fort Monroe, Virginia, to support HQ TRADOC.[137]

OTEA/OPTEC Resources, 1972–1995

OTEA/OPTEC Leaders, 1972–1995

From the beginning, OTEA and its successor agencies were led by a general officer assisted by a military deputy and a senior civilian technical expert. Table 5–1 lists the commanders of OTEA from its inception on 25 September 1972 through 30 September 1995. Unlike AMSAA and CAA, each of which had fewer than five directors during the period 1973–1995, OTEA/OPTEC had fifteen general officers commanding, each of whom served from one to five years.

Figure 5–8—Organization of TEXCOM, FY 1991



Source: Based on OPTEC/TEXCOM annual historical summaries/reviews, FY 1990–FY 1995, and other sources.

Continuity was provided by the assignment to OTEA/OPTEC of a senior civilian. Over the years, the senior civilian had various titles, including scientific advisor, chief scientist, and technical director. The first scientific advisor was Walter W. Hollis, who was appointed on 23 April 1973 and served until 13 December 1980, when he left to become the deputy under secretary of the Army for operations research, a position that he subsequently held for more than twenty-five years. Hollis played a key role in the maturation of OTEA, and his departure in December 1980 had "a significant impact on the agency in its conduct of business" inasmuch as he "had been a cornerstone of the agency, and his reassignment, coupled with a long vacancy of this key position, placed increased responsibility on the OTEA staff."[138] The other senior civilian leaders at OTEA/OPTEC are shown in Table 5–2.

OTEA/OPTEC Personnel, 1972–1995

Table 5–3 shows the number of authorized and assigned military and civilian personnel of OTEA/OPTEC at various times between 25 September 1972 and 30 September 1995. As usual, the figures are

Table 5–1—OTEA/OPTEC Commanders, 25 September 1972–30 September 1998

Commander	*From*	*To*
U.S. Army Operational Test and Evaluation Agency (OTEA)		
Maj. Gen. John T. Carley	25 September 1972	28 June 1973
Col. Frank D. Conant (Acting)	29 June 1973	31 July 1973
Maj. Gen. Elmer R. Ochs	1 August 1973	21 November 1976
Col. T. L. Raney (Acting)	22 November 1976	25 November 1976
Maj. Gen. Julius W. Becton Jr.	26 November 1976	15 October 1978
Maj. Gen. Robert L. Kirwan	16 October 1978	19 June 1983
Maj. Gen. Benjamin E. Doty	20 June 1983	19 April 1984
Maj. Gen. William G. T. Tuttle Jr.	20 April 1984	2 February 1986
Col. R. A. Fadel (Acting)	3 February 1986	17 February 1986
Maj. Gen. James E. Drummond	18 February 1986	31 December 1987
Vacant	1 January 1988	18 January 1988
Maj. Gen. Jerome B. Hilmes	19 January 1988	October 1989
Maj. Gen. Richard E. Stephenson	October 1989	15 November 1990
U.S. Army Operational Test and Evaluation Command (OPTEC)		
Maj. Gen. Richard E. Stephenson	16 November 1990	23 August 1991
Maj. Gen. William H. Forster	24 August 1991	27 August 1992
Maj. Gen. Robert B. Rosenkranz	28 August 1992	24 June 1995
Maj. Gen. Larry G. Lehowicz	25 June 1995	30 September 1998

Source: Compiled from OTEA/OPTEC annual historical reviews/summaries and other sources.

Note: Maj. Gen. Larry G. Lehowicz served as commander of OPTEC until September 1998. Subsequent commanders of OPTEC (and after October 1999, of the Army Test and Evaluation Command) included Maj. Gen. A. J. Madora (October 1998–June 2000), Maj. Gen. John J. Marcello (June 2000–June 2002), Maj. Gen. Robert E. Armbruster (June 2002–May 2004), and Maj. Gen. James R. Myles (May 2004).

based on data that are often incomplete or in conflict and therefore cannot be considered definitive. The initial personnel authorization for OTEA in 1972 was 120 military and civilian personnel to be brought on board in two increments.[139] The first increment included key personnel, particularly in the command group and the Coordination Office, who needed to be on board by 15 October 1972 to get the new organization up and running. The second increment included the remainder of the original strength authorization of 120 personnel. It was planned to have a full complement of some 200 personnel on board by 31 December 1973.[140] Some problems were encountered in finding qualified civilian personnel to fill the authorized positions in the new organization, in part due to the existing civil service rules regarding lateral transfer rights, grade structure, and similar matters.[141] Senior members of the Army analytical community, such as Abraham Golub (the ACSFOR technical advisor) and Wilbur Payne (the DUSA [OR]), were consulted, and eventually General Carley was able to fill the spaces.

In its first fifteen years, OTEA more than doubled the number of its authorized personnel.[142] OTEA personnel authorizations were increased to 250 personnel (124 officers, 24 enlisted personnel, and 102 civilians) in April 1974 and remained relatively static for some time thereafter. There was, however, an increase in authorized strength in FY 1977 due to the allocation of additional positions for the Division Restructuring Study and the conversion of one enlisted position to civilian.[143] In late August and early September 1978, OTEA underwent a full-scale manpower survey that resulted in an overall reduction of some twenty-six manpower spaces. However, HQ OTEA appealed the

Table 5–2—OTEA/OPTEC Senior Civilians, 1973–1995

Incumbent	*Title*	*From*	*To*
Walter W. Hollis	Scientific Advisor	22 April 1973	13 December 1980
Vacant	Scientific Advisor	14 December 1980	10 October 1981
Dr. Philip C. Dickinson	Chief Scientist	11 October 1981	10 January 1986
Vacant	Technical Director	11 January 1986	9 February 1986
Arend H. Reid	Acting Technical Director	10 February 1986	8 August 1986
Vacant	Technical Director	9 August 1986	15 November 1986
Dr. Henry C. Dubin	Technical Director	16 November 1986	30 September 1995

Source: Based on OTEA/OPTEC annual historical reviews/summaries, FY 1972–FY 1995, and other sources.

decision on thirty-four spaces and got seven back for an authorization of 124 officers, two warrant officers, eight enlisted personnel, and 108 civilians, a total of 242.[144] In FY 1982, there was another substantial, if temporary, increase in the number of authorized personnel by eighteen officers, two warrant officers, thirteen enlisted personnel, and thirty-nine civilians to support the Forward Area Air Defense and Joint Logistics-Over-the-Shore joint tests.[145]

In April 1984, OTEA reorganized to accommodate its new, expanded C2E mission and the accompanying increase in staff evaluators. In May 1987, OTEA underwent another manpower survey to validate its manpower requirements based on the volume of work being conducted. The survey team recommended the "civilianization" of evaluator (systems analyst) positions as well as the addition of six analyst positions.[146] In early 1988, the VCSA directed a realignment of Army OT&E that reduced OTEA's annual testing mission but required an approximately fourfold increase in the number of OTEA "evaluated" systems. This increase in workload resulted in the authorization on 1 October 1988 of an additional sixty-three personnel spaces at OTEA, primarily in civilian analyst positions, thereby shifting the long-standing OTEA ratio of 50 percent military and 50 percent civilian in the direction of a higher percentage of civilians.[147] With the merger of OTEA and TRADOC's TEXCOM to form OPTEC in November 1990, the ratio shifted drastically in favor of a much higher proportion of civilians.[148]

Before the FY 1990 consolidation, Army OT&E agencies, including those assigned to AMC, TRADOC, and OTEA, employed almost 16,000 personnel and cost over $1.5 billion a year.[149] In FY 1990, there was, of course, a very large increase in both authorizations and personnel assigned to the new OPTEC as a result of the OTEA-TEXCOM merger. The projected number of personnel in OPTEC after consolidation was expected to be 2,578, but the number of authorizations was reduced to 2,012 spaces in FY 1990, and fell to only 1,741 spaces in FY 1995.[150] The whole consolidation was projected to save 1,307 personnel spaces and $80 million a year by the end of FY 1993, and the first year of consolidation was in fact completed by the end of FY 1991 with a savings of some 598 personnel and $25 million.[151] During the 1990s, OPTEC experienced the same drawdown of personnel authorizations felt by other Army analytical agencies. OPTEC was scheduled to lose some 44 percent of its authorized strength (1,133 spaces) between FY 1990 and FY 1998 (from a projected 2,578 spaces in FY 1990 to 1,300 in FY 1999) and in fact dropped from 2,012 authorizations in FY 1990 to 1,690 authorizations in FY 1996.[152]

OPTEC personnel were employed in several locations around the country. As of FY 1995, physical distribution of the 1,741 authorized OPTEC personnel was as follows: HQ OPTEC (Alexandria, Virginia), 135; OEC (Alexandria, Virginia), 265; OTSA (Fort Bliss, Texas), 27; TEXCOM (Fort Hood, Texas), 846; TEC (Fort Hunter Liggett, California), 430; and eight TECOs (various locations), 38.[153]

The civilian personnel assigned to OTEA/OPTEC represented a wide range of both professional and clerical/support skills. The professional and technical personnel included operations research analysts, statisticians, mathematicians, engineers of all types, engineering psychologists, automatic data processing specialists, computer programmers, and

Table 5–3—OTEA/OPTEC Personnel, 1972–1995

	Military		*Civilian*		*Total*	
Date	*Authorized (O/WO/EM)*	*Assigned (O/WO/EM)*	*Authorized*	*Assigned*	*Authorized*	*Assigned*
25 Sep 1972	53/0/2	n.d.	65	n.d.	120	n.d.
20 Feb 1973	102/1/19	56/0/6	78	38	200	100
23 Jul 1973	102/1/19	82/1/13	78	59	200	155
15 Apr1974	124/0/24	n.d.	102	n.d.	250	n.d.
1975	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1 Oct 1976	126/1/8	125/1/13	117	103	252	242
1 Oct 1977	128/2/10	133/2/7	118	108	258	250
1 Oct 1978	128/2/8	128/2/10	122	105	260	245
1 Oct 1979	126/2/8	118/2/8	111	97	247	225
1 Oct 1980	126/2/8	122/2/8	111	91	247	223
1 Oct 1981	126/2/8	114/2/9	111	96	247	221
1 Oct 1982	139/4/21	122/2/7	149	109	313	240
1 Oct 1983	139/4/22	137/3/16	148	103	313	259
1 Oct 1984	147/4/22	98/2/10	150	103	323	213
1 Oct 1985	126/4/8	114/3/9	126	103	264	229
1 Oct 1986	126/4/8	110/4/7	126	118	264	239
1 Oct 1987	126/3/8	119/5/11	126	141	263	276
1 Oct 1988	121/0/3	96/5/10	177	147	301	258
30 Sep 1989	121/0/3	108/5/8	177	180	301	301
1 Oct 1990	424/18/693	362/14/579	877	719	2,012	1,674
1 Oct 1991	423/18/673	352/14/570	849	710	1,963	1,646
30 Sep 1992	437/20/733	354/14/597	769	710	1,995	1,675
1993	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
30 Sep 1994	379/20/673	325/18/554	803	745	1,875	1,642
30 Sep 1995	348/20/576	270/19/554	797	747	1,741	1,590

Source: Based on available OTEA/OPTEC annual historical reviews/summaries and other sources.
Note: "Civilian" includes both professional and clerical/support personnel.
O = officer, WO = warrant officer, EM = enlisted men, n.d. = no data available

communications specialists.[154] Many of the military officers assigned were also qualified in the ORSA (FA 49) specialty.

OTEA/OPTEC Budgets, 1972–1995

In 1972, the DOD authorized appropriations for Research, Development, Test, and Evaluation (RDTE) for the first time. RDTE and Operations and Maintenance, Army (OMA), funding of OTEA/OPTEC varied significantly from year to year due to the number and type of tests conducted, particularly joint test projects. As is the case with personnel statistics, the data on OTEA/OPTEC budgets for the period 25 September 1972 through 30 September 1995 are difficult to access and must be considered somewhat unreliable. However, Table 5–4 provides a fair estimate of OTEA/OPTEC RDTE and OMA funding from FY 1973 through FY 1995. FDTE funds were used exclusively to support operational tests and evaluations. OMA funds were used to cover agency operating costs and to support joint tests and follow-on evaluations. Note that Table 5–4 does not include Military Pay and Allowances (MPA) appropriations or reimbursements from other organizations.

To cover the costs of initial setup and operations, OTEA was provided with a FY 1973 budget of some $9,172,000 in MPA (Military Pay and Allowances) and $823,000 in OMA (Operations and Maintenance, Army) funds as shown in Table 5–5. Direct test (RDTE) costs of $7,847,000 were covered by Combat Developments Command. Table 5–5 also shows the projected FY 1974 MPA/OMA budget for OTEA reflecting full operation for the fiscal year.

The significant increase in OMA funding in FY 1979 was due to the conduct of a number of assigned joint tests.[155] There was a significant decrease in FY 1980, and in FY 1981 OMA funding declined for a second year due to a decrease in DOD joint test requirements and the cancellation or rescheduling of a number of tests.[156] The substantial increase in FY 1982 and after was due to increased testing requirements and the introduction of the C2E program. The general drawdown of the Army budget in the 1990s affected OPTEC as well, despite a continued high level of test and evaluation activity. OPTEC funding was scheduled to decline from $151 million in FY 1990 to $124 million in FY 1998 and actually declined from $151 million in FY 1990 to $145 million in FY 1996.[157]

Not shown separately in Table 5–4 is the amount dedicated each year to contract support. In OTEA's first fifteen years, contract funding increased significantly, from $2 million in FY 1973 to about $12 million in FY 1987.[158] Contract support was provided primarily by four prime contractors and many subcontractors and focused on data management, technical analysis of systems, and studies of methodology. For example, in December 1984, OTEA issued a Request for Proposal for contract support of the C2E program, and both a Technical Evaluation Board and a Cost Review Board met to examine the contractors' proposals and recommended the best contenders to the commander of OTEA in May 1985. In June 1985, three contracts were awarded: to Advanced Technology, Inc.; to the BDM Corporation; and to a team composed of the Planning Research Corporation and ORI, Inc.[159]

OTEA/OPTEC Facilities, 1972–1995

HQ OTEA was initially housed in a series of temporary buildings at Fort Belvoir, Virginia, including seven World War II–era hospital buildings, which were described as "old but clean, well-lighted and warm . . . connected by a covered walkway which puts OTEA under one roof for all practical purposes."[160] As OTEA expanded, so too did its requirements for additional office space. In July 1975, OTEA relocated from Fort Belvoir to parts of four floors of a commercial building at 5600 Columbia Pike in Falls Church, Virginia.[161] On 24 February 1989, OTEA formally opened new facilities in the Park Center Complex IV at 4501 Ford Avenue, Alexandria, Virginia, which the Army Test and Evaluation Command still occupies.[162] The new facility provided significantly enhanced quality of life for OTEA personnel as well as greatly improved security, internal communications, briefing and meeting facilities, and computer rooms.

By FY 1995, OPTEC and its subordinate elements were operating from some fifteen different locations around the United States. HQ OPTEC and OEC continued to occupy the Alexandria, Virginia, site; TEC was at Fort Hunter Liggett, California; HQ TEXCOM and the Aviation, Combat Support-Engineering, C4, Close Combat, Operational Support, Information Mission Area, and Advanced Concepts Test and Integration Test directorates were at Fort Hood, Texas; the Intelligence-Electronic Warfare Test Directorate was at Fort Huachuca, Arizona, the Fire Support Test Directorate was at Fort Sill, Oklahoma, the Airborne-Special Operations Test Directorate was at Fort Bragg, North Carolina, and the Air Defense Artillery Test Directorate was at Fort Bliss, Texas; OTSA was also at Fort Bliss, Texas; and there were TECOs at Fort Rucker, Alabama; Fort Gordon, Georgia; Fort Lee, Virginia; Fort Knox, Kentucky; Fort Benning, Georgia; Fort Leonard Wood, Missouri; Fort Leavenworth, Kansas; and Fort Monroe, Virginia.[163]

A major factor in the constant improvement of OTEA/OPTEC capabilities was the increasing amount and capability of the computer and automated data processing equipment available. By the end of 1988, almost every individual assigned to OTEA had "immediate access to both personal and agency computers."[164] Improved word processing capabilities changed workload and altered procedures and

Table 5–4—OTEA/OPTEC Budgets, FY 1973–FY 1995

Fiscal Year	*RDTE Funds*	*OMA Funds*	*Total*
1973	$7,847,000	$823,000	$8,670,000
1974	n.d.	n.d.	5,400,000
1975	n.d.	n.d.	4,200,000
1976/T*	$4,900,000	6,524,000	11,424,000
1977	7,340,000	6,486,000	13,826,000
1978	9,001,000	5,710,000	14,711,000
1979	10,998,000	16,235,000	27,233,000
1980	11,613,000	8,406,000	20,019,000
1981	9,986,000	7,263,000	17,249,000
1982	11,651,000	11,652,000	23,303,000
1983	**	12,240,000	>12,240,000
1984	8,115,000	35,406,000	43,521,000
1985	8,880,000	27,754,000	36,634,000
1986	9,022,000	32,009,000	41,031,000
1987	11,144,799	49,762,500	60,907,299
1988	n.d.	n.d.	n.d.
1989	n.d.	n.d.	n.d.
1990	n.d.	n.d.	151,000,000
1991	n.d.	n.d.	158,000,000
1992	n.d.	n.d.	168,000,000
1993	n.d.	n.d.	146,000,000
1994	n.d.	n.d.	133,000,000
1995	n.d.	n.d.	157,000,000

Source: Compiled from OTEA/OPTEC annual historical reviews/summaries and other sources.

* T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

**Original document is unreadable.

n.d. = no data available.

responsibilities in the process, and the various OTEA test sites required ever-increasing amounts of more complex computers and databases.[165]

OTEA/OPTEC Work Program and Accomplishments, 1972–1995

Like its sister organization, the Army Materiel Systems Analysis Activity, the Operational Test and Evaluation Agency/Command participated in the development of nearly every Army weapon and equipment system in the last quarter of the twentieth century. The list of major systems alone, familiar to all who served after 1973, is far too long to be recited here. In the process, OTEA/OPTEC substantially improved the overall quality of Army operational testing and evaluation, thereby ensuring the performance and reliability of the weapons and other equipment placed in the hands of American soldiers.

In late 1972, OTEA quickly assumed its responsibilities for operational testing and evaluation of some twenty-one major Army systems and a number of selected nonmajor systems.[166] By 30 July 1973, the transfer of responsibilities from CDC to OTEA

Table 5–5—OTEA Cost Summary, FY 1973 and FY 1974

Category	*FY 1973*	*FY 1974*
MPA Funds		
Military Pay and Allowances	$720,000	$1,139,200
OMA Funds		
Civilian Pay and Allowances	673,500	1,138,100
Travel	105,300	234,300
Operations, Maintenance, and Support	160,000	241,000
Activation Costs	386,200	0
RDTE Funds		
Direct Test Costs	7,847,000	6,700,000
TOTAL	$9,892,000	$9,452,600

Source: OTEA Implementation Plan, ann. L (Funding), p. 7.

had been accomplished smoothly, and on that date, Lt. Gen. Elmer H. Almquist, the Army ACSFOR, reported to General Creighton W. Abrams Jr., the Army chief of staff, that

> the agency is now responsible for 37 major and selected nonmajor systems . . . including all of the current items reportable to Congress under Section 506 of Public Law 92–15 that require operational testing. . . . A workable concept of operations has been developed and operational testing is underway on the BUSHMASTER, LANCE, Improved HAWK, COBRA TOW, M60A2 Tank and DRAGON Launch Effects Trainer.[167]

Among the major systems for which OTEA was assigned OT&E responsibility were the AH–64 Apache advanced attack helicopter (AAH), Copperhead cannon-launched guided projectile (CLGP), division support missile (Lance), heavy lift helicopter (HLH), heliborne missile (Hellfire), joint service NAVSTAR Global Positioning System, M1 Abrams main battle tank (XM-1), man portable air defense system (Stinger), M2/M3 Bradley mechanized infantry combat vehicle (MICV), medium antitank assault weapon (Dragon), Pershing II missile, Patriot surface-to-air missile development (SAM-D), tactical fire direction system (TACFIRE), tactical operations system (TOS), UH–60 Black Hawk utility tactical transport aircraft system (UTTAS), and vehicle rapid-fire weapons system (Bushmaster).[168]

Some of the many other familiar major Army systems tested and evaluated by OTEA/OPTEC over the years were the Sergeant York Division Air Defense (DIVAD) gun, multiple-launch rocket system (MLRS), the family of remotely piloted vehicles (RPVs), Roland missile system, high-mobility multipurpose wheeled vehicle (HMMWV, or "Humvee"), standoff target acquisition system (SOTAS), and a variety of communications and radar equipment. Familiar nonmajor systems included the battery computer system (BCS), fire support team vehicle (FISTV), improved 81-mm. mortar system (SM–252), improved light antitank/assault weapon (Viper), light armored vehicle (LAV), and squad automatic weapon (SAW).

The number of major systems for which OTEA was responsible grew from about twenty in 1972 to more than seventy in 1987, and OTEA also had oversight responsibility for another 300–400 systems under evaluation by other organizations.[169] During the same period, the nature of the evaluation for each system also expanded, and by 1987 system evaluation had become "a continuous process stretching over several years from participation in the planning prior to program approval to a point some years into production and deployment when all corrective actions had been verified."[170] The introduction of "Continuous and Comprehensive Evaluation" in 1983 and the realignment of Army OT&E in 1988 reduced OTEA's responsibilities for testing by about 60 percent but increased evaluation requirements by 400 percent.[171] In FY 1994, OPTEC began to support the Force XXI effort to design "the future high-tech digitized Army that will ensure decisive victory in the 21st century."[172] OPTEC's role was to support early experimentation, which addressed issues of doctrine, training, leader development, organizational design, materiel, and soldiers pertinent to Force XXI. This was done in coordination with the TRADOC Battle Labs.

Some rough measure of the annual OTEA/OPTEC workload is provided by the number of Operational Test Plans (OTPs) prepared by OTEA/OPTEC and approved for inclusion in the Five Year Test Program (FYTP) by the Test Schedule and Review Committee (TSARC) at its semiannual meetings. As shown in Table 5–6, between March 1973 and June 1987, OTEA prepared some 1,572 major and selected nonmajor OTPs; some 4,640 nonmajor OTPs; 1,985 FDT&E OTPs; 261 joint OTPs; and 919 development OTPs, for a total of 9,377 OTPs. Yet another measure of OTEA/OPTEC workload was the number of test starts each year. These averaged about ten test starts each year over the period 1973–1988.[173] In FY 1995, OPTEC supported around twenty tests and published some seventy-five evaluations and assessments.[174]

Conclusion

Even before the creation of OPTEC in November 1990, OTEA had earned the reputation of being the Army's "honest broker" in the testing and evaluation field.[175] Its work was highly respected and valued by decision makers, and OTEA had made "a very real contribution to the Army, the Armed Forces, and an effective national defense."[176] On 24 September 1997, OPTEC celebrated the twenty-fifth anniversary of the establishment of OTEA. In his message to the command on that occasion, the OPTEC commander, Maj. Gen. Larry G. Lehowicz, noted:

> Over the last 25 years, OTEA and OPTEC have been responsible for the operational test and evaluation of such systems as the M1, M1A2 Abrams, HMMWV, Bradley, M-270 MLRS, FMTV, SINCGARS, Pershing, Patriot, Javelin, Longbow Apache, Paladin Howitzer, and most recently, the Advanced Warfighting Experiment. This is just a brief list, but it shows the diversity, complexity, and sheer number of systems. It also demonstrates the commitment and technical competence of our work force, whether military, civilian or contractor.
>
> While the size and scope of OTEA and OPTEC have changed, our basic mandate—to be separate and independent and ensure that fielded systems will be put in the hands of soldiers with the confidence that they are effective, suitable and survivable—has remained the same. That will always be OTEA's legacy.[177]

Critics of Army T&E—in Congress, OSD, and the Army itself—had long urged the complete consolidation of both developmental and operational testing. On 1 October 1996, the VCSA directed that OPTEC assume the Army's developmental evaluation mission from AMC and become the sole evaluator for Army systems.[178] The final stage in the consolidation of Army testing and evaluation came on 18 November 1998, when the VCSA made the decision that led to the reorganization of OPTEC as the United States Army Test and Evaluation Command (ATEC) on 1 October 1999.[179] The new command assumed overall responsibility for all Army developmental and operational testing, and its establishment completed the process of consolidating Army test and evaluation activities that began with the establishment of OTEA in September 1972. Although ATEC's size, scope, and mission in 1999 were far different from that of OTEA in 1972, one thing remained constant—the dedication of Army testers, evaluators, and analysts to the full reporting of objective evaluations to Army, DOD, and congressional leaders. And the watchwords of the Army testing and evaluation community continued to be: "Adequacy. Quality. Credibility."[180]

Chapter five notes

1 Blue Ribbon Defense Panel, *Report to the President and the Secretary of Defense on the Department of Defense (Packard Report)*, app. F (*Staff Report on Operational Test and Evaluation*) (Washington, D.C.: Blue Ribbon Defense Panel, July 1970), p. 10 (cited hereafter as Blue Ribbon Defense Panel Rpt).

2 The other members of the "Big Four" were the Army Materiel Systems Analysis Activity (AMSAA), the TRADOC Analysis Command/Center (TRAC), and the Concepts Analysis Agency (CAA).

3 U.S. Department of Defense, Office of the Secretary of Defense, Director, Operational Test and Evaluation, *Department of Defense Directive No. 5000.3: Test and Evaluation* (Washington, D.C.: Deputy Director of Defense Research and Engineering, DOD, 19 January 1973), p. 2.

4 Ibid., pp. 2–4; U.S. Department of the Army, *Army Regulation [AR] No. 10–4: ORGANIZATION AND FUNCTIONS—US Army Operational Test and Evaluation Agency* (Washington, D.C.: HQDA, 15 January1974), p. 1. See also U.S. Department of the Army, *Army Regulation No. 71–8: FORCE DEVELOPMENT—The Army Program for Test and Evaluation* (Washington, D.C.: HQDA, 24 May 1972), and U.S. Department of the Army, *Army Regulation No. 1000–1: Basic Policies for Systems Acquisition by the Department of the Army* (Washington, D.C.: HQDA, 30 June 1972).

5 Memo, Maj Gen Elmer R. Ochs (Commanding General [CG], U.S. Army Operational Test and Evaluation Agency [USAOTEA]) to

Table 5–6—OTEA/OPTEC Operational Test Plans, March 1973–June 1987

Date	*OT Major/ Selected Nonmajor OTP*	*OT Nonmajor OTP*	*FDT&E OTP*	*Joint OTP*	*Development OTP*	*Total OTP*
Mar 1973	6	21	61	7	n.d.	95
Jul 1973	47	22	59	4	n.d.	132
Jan 1974	58	31	70	6	n.d.	165
Jul 1974	58	55	92	5	n.d.	210
Dec 1974	55	84	99	7	n.d.	245
Jun 1975	58	119	101	8	n.d.	286
Dec 1975	69	142	89	8	0	308
Jun 1976	63	137	82	8	35	325
Dec 1976	65	167	90	7	42	371
Jun 1977	64	160	80	5	48	357
Dec 1977	68	174	93	9	44	388
Jun 1978	72	170	72	11	50	375
Dec 1978	68	156	72	15	46	357
Jun 1979	55	135	58	13	32	293
Nov 1979	50	129	53	11	34	277
Jun 1980	51	183	52	10	30	326
Dec 1980	47	176	49	10	29	311
Jun 1981	42	161	55	9	36	303
Dec 1981	41	182	74	11	33	341
Jun 1982	34	192	63	10	28	327
Dec 1982	28	200	54	9	34	325
Jun 1983	25	192	58	7	57	339
Dec 1983	34	201	60	12	53	360
Jun 1984	35	213	52	11	45	356
Dec 1984	39	206	43	10	44	342
Jun 1985	54	220	46	6	39	365
Dec 1985	73	189	42	7	39	350
Jun 1986	70	217	62	9	41	399
Dec 1986	73	189	42	7	39	350
Jun 1987	70	217	62	9	41	399

Source: Based on OTEA/OPTEC annual historical reviews/summaries, FY 1973–FY 1987.
Note: Comparable data for the period after June 1987 are not available.
n.d. = no data available

All OTEA Personnel, Fort Belvoir, Virginia, 13 Sep 73, sub: Definition and Scope of Operational Testing, p. 1.

6 DOD Directive No. 5000–3, p. 3.

7 Blue Ribbon Defense Panel Rpt, app. F, pp. 12–13.

8 *AR 10–4*, p. 1.

9 Ibid.

10 As used here, the term "joint user testing" refers to what is often called "multiservice testing" rather than to the testing and evaluation of joint systems per se.

11 *AR 10–1*, p. 4.

12 U.S. Army Operational Test and Evaluation Command, *Draft Chronology and List of Senior Personnel* (Alexandria, Va.: USOTEA, n.d. [ca. 1995]), p. 1 (cited hereafter as OT&E Chronology).

13 Several of the boards were subsequently combined. The Ordnance, Quartermaster, Transportation, and Chemical Warfare boards were merged into a General Equipment Test Activity (GETA) in 1963, and the Armor and Engineer boards were consolidated in 1964. In 1970, the GETA mission was split among the Armor-Engineer Board, the Infantry Board, and Aberdeen Proving Ground in Maryland.

14 After 1962, that agency was TECOM, which conducted both engineering (development) tests and service (operational) tests. The 1970 Blue Ribbon Defense Panel considered that to be a fault and commented negatively on the fact in its report (Appendix F, page 20). TECOM was also the subject of a number of criticisms, notably that it actually had no capability for evaluation and played a limited role in the evaluation process; that it had only a limited technical ability to conduct adequate tests; and that it was "frequently forced to test with inadequate sample sizes thus preventing a valid statistical inference from the test data" (see Memo, Wilbur B. Payne [DUSA-OR] for Under Secretary of the Army, Washington, n.d. [1972?], sub: Operational Test and Evaluation, Incl 1 [Materiel OT&E], pp. 3–4). It should be noted that in 1966, and again in 1969, Army leaders reviewed the organizational placement of the test boards and TECOM and decided to maintain the status quo.

15 U.S. Army Operational Test and Evaluation Agency, "Introductory Remarks—History" (n.p. [Fort Belvoir, Va.]: HQ USAOTEA, n.d. [after 1975]), p. 1.

16 OT&E Chronology, p. 2.

17 The history of OTEA and its successors, OPTEC and ATEC, is exceptionally well documented. Although OTEA and its successors never employed a staff historian, the staff of the Public Affairs Office and of the Technical Library have done an outstanding job of selecting and preserving the key historical documents needed to prepare an adequate history of the organization. Items of particular value to the historian include the annual OTEA historical reviews (AHRs) and the annual OPTEC historical summaries (AHSs); U.S. Army Operational Test and Evaluation Agency, "15-Year History of the US Army Operational Test and Evaluation Agency," *OTEA Update* 6 (August 1987): 1–8; ARC Professional Services Group, *History of OTEA, 1972–1988* (Alexandria, Va.: USAOTEA, n.d. [January 1990]); U.S. Army Operational Test and Evaluation Command, *25th Anniversary Celebration, 19 May 1988, Radisson Plaza Hotel*, Brochure (Falls Church, Va.: U.S. Army Operational Test and Evaluation Command [USAOPTEC], 1988); and U.S. Army Operational Test and Evaluation Command, *History of OPTEC, Fiscal Years 90, 91, and 92* (Alexandria, Va.: USAOPTEC, n.d. [1992]). The U.S. Army Test and Evaluation Command Public Affairs Office (PAO) has also assembled key OTEA/OPTEC/ATEC historical documents in two CDs: U.S. Army Test and Evaluation Command, "Historical References: Evolution of OTEA, –1979" (Alexandria, Va.: PAO, USATEC, n.d. [November 2005]), and U.S. Army Test and Evaluation Command, "Historical Policy Documents, 1970–1984" (Alexandria, Va.: PAO, USATEC, n.d. [November 2005]).

18 Ltr, Maj Gen John T. Carley (Deputy Assistant Chief of Staff for Force Development [ACSFOR] for OT&E) to Maj Gen Sidney B. Berry (Chief of Personnel Operations), Washington, n.d. [1972], no subject, with enclosure (Memorandum for Record [MFR], Maj Gen John T. Carley [Deputy ACSFOR for OT&E], Washington, 10 Aug 72, sub: Meeting with Generals DePuy, Williams, Gribble, Deane, Carley, and Secretary Johnson on the Letter of Instructions for Implementing the New Materiel Acquisition Guidelines).

19 U.S. Air Force Test and Evaluation Center, "Background Paper: Origin and Evolution of Operational Test and Evaluation (OT&E)" ([n.p.]: USAFTEC, 6 March 1996), p. 1 (hereafter referred to as "Background Paper").

20 Ibid.

21 Blue Ribbon Defense Panel Rpt, app. F, p. 15.

22 Ibid., p. 2.

23 Ibid., pp. 6–8.

24 Ibid., p. 21.

25 Ibid., p. 9.

26 Memo, David L. Packard (Deputy Secretary of Defense) for Service Secretaries, Chairman of the Joint Chiefs of Staff, and the Director of Defense Research and Engineering, Washington, 11 Feb 71, sub: Conduct of Operational Test and Evaluation. In his memorandum Packard wrote: ". . . this function can best be performed by an agency which is separate and distinct from the developing command and which reports the results of its test and evaluation efforts directly to the Chief of the Service. . . . Accordingly, each Service is requested to restructure its organization for OT&E along the lines specified above. I would like the Service Secretaries to advise me by March 31 of their plans to accomplish this, and to be prepared to have the new structure in effect by the end of this fiscal year."

27 Blue Ribbon Defense Panel Rpt, app. F, p. 2.

28 U.S. Air Force Test and Evaluation Center, "Background Paper," p. 1. The Defense Systems Acquisition Committee was later replaced by the Defense Acquisition Board.

29 Ltr, Office of the Assistant Chief of Staff for Force Development (DAFD-SDY), Washington, 3 Aug 72, sub: Letter of Instruction (LOI) for Implementing the New Materiel Acquisition Guideline.

30 Memo, Maj Gen John T. Carley (Deputy ACSFOR for T&E) for Lt Gen R. R. Williams (ACSFOR), Washington, 20 Sep 72, sub: OTEA Briefing for General Abrams, 19 Sep 72.

31 Memo, Wilbur B. Payne (DUSA-OR) for Under Secretary of the Army, Washington, n.d. [1972], sub: Operational Test and Evaluation, p. 4.

32 MFR, Lt Col George M. Baxter (Assistant Secretary of the General Staff), Washington, 22 Sep 72, sub: Operational Test and Evaluation (OTEA) Implementation. Also in attendance at the meeting were Lt. Gen. William E. DePuy (AVCSA), General Williams (ACSFOR), Maj. Gen. James G. Kalergis (project manager for Reorganization), and General Carley (deputy ACSFOR for T&E).

33 Ibid., pp. 1–2. Earlier, in a 28 August 1972 memorandum to General Carley, General Starbird had laid out his comments on the implementation plan (see Memo, Lt Gen Alfred D. Starbird [Deputy DDRE for T&E] for Maj Gen John T. Carley [Deputy ACSFOR for T&E], Washington, 28 Aug 72, sub: Implementation Plan, United States Army Operational Test and Evaluation Agency, 21 August 1972).

34 MFR, Lt Col Donald M. Campbell (DACS-MR), Washington, 25 Sep 72, sub: Decision Briefing for the Secretary of the Army.

35 U.S. Department of the Army, Office of the Assistant Chief of Staff for Force Development, *General Orders No. 69* (Washington, D.C.: OACSFOR, HQDA, 25 September 1972). The plan was contained in U.S. Army Operational Test and Evaluation Agency, n.p. [Fort Belvoir, Va.], 20 Sep 72, sub: Implementation Plan–United States Army Operational Test and Evaluation Agency (cited hereafter as OTEA Implementation Plan).

36 Ltr, Office of the Adjutant General (DAAG-ASO-D [M] [22 Sep 72] DAFD), HQDA, to Assistant Chief of Staff for Force Development, Washington, 25 Sep 72, sub: Establishment and Organization of Unit. The OTEA Implementation Plan (page 2) called for the initial strength of 120 to be reached by 15 January 1973 and to increase to 200 during the course of calendar year 1973. The OTEA Implementation Plan (page 2a) called for OTEA to be co-located at Fort Belvoir with the soon-to-be-established Concepts Analysis Agency (CAA) in the expectation that the two organizations would be able to share certain support facilities, such as computers, and perhaps even their analytical talent. OTEA was in fact

located at Fort Belvoir, but the anticipated sharing of facilities with CAA was never realized.

37 Ltr, General Henry A. Miley Jr. (Commander, AMC) to General Creighton W. Abrams Jr. (CSA), Washington, 21 Feb 73, no subject [Operational Test and Evaluation], p. 1. General Miley went on to assert the independence and efficacy of the existing TECOM organization.

38 Ltr, General Creighton W. Abrams Jr. (CSA) to General Henry A. Miley Jr. (Commander, AMC), Washington, 16 Mar 73, sub: Operational Test and Evaluation.

39 *AR 10–4*, 15 January 1974, pp. 1–2; OTEA Implementation Plan, p. 2. The version of the OTEA mission given in *AR 10–4* was nearly identical to that given in the Implementation Plan.

40 Briefing, U.S. Army Operational Test and Evaluation Agency, Fort Belvoir, Va., 28 Jan 74, sub: U.S. Army Operational Test and Evaluation Agency (OTEA) Briefing, Slide 9 (Summary of OTEA Participation in Operational Testing).

41 Ibid., narrative accompanying Slide 8A (Type Test Directorate). OTEA was to maintain close contact with its deputy test director to assure the adequacy and quality of test plans, execution, and reports.

42 Ibid., Slide 13 (Summary of OTEA Participation in Force Development Testing and Experimentation [FDTE]).

43 Ibid., Slide 16 (Summary of OTEA Participation in Joint User Testing).

44 Management Concept Paper: Concept of Operation for U.S. Army Operational Test and Evaluation Agency [OTEA], enclosure to Memo, Maj Gen Elmer R. Ochs (CG, OTEA) for Army Chief of Staff, Fort Belvoir, Va., 28 Aug 74, sub: U.S. Army Operational Test and Evaluation Agency (OTEA) Concept of Operation, and Command and Staff Relationships, p. 1 (cited hereafter as Management Concept Paper). The Management Concept Paper incorporated guidance provided in *Chief of Staff Memorandum No. 74–10–8*, dated 16 January 1974, and received by the OTEA commander at meetings with the Army assistant vice chief of staff in April and May 1974.

45 Ibid. "Independent evaluation" was intended to provide an assessment of the military utility, operational effectiveness, and operational suitability of the system tested.

46 U.S. Department of the Army, Office of the Chief of Staff, Army, *Chief of Staff Memorandum No. 72–15–221: Department of the Army Test Schedule and Review Committee (TSARC)* (Washington, D.C.: HQDA, 16 October 1972).

47 Ibid., p. 1.

48 U.S. Army Operational Test and Evaluation Agency, *Report on Ad Hoc Board of Visitors, 1975* (n.p. [Fort Belvoir, Va.]: USAOTEA, n.d. [1975]), p. 4.

49 U.S. Army Operational Test and Evaluation Agency, Ad Hoc Board of Visitors (Wilbur B. Payne, DUSA-OR, Chairman), *Ad Hoc Board of Visitors, 25–26 February 1975, After Action Report* (Fort Belvoir, Va.: Ad Hoc Board of Visitors, USAOTEA, n.d. [February 1975]), p. 1.

50 Ibid., p. ii. One concern the Ad Hoc Board of Visitors did express, however, had to do with the assignment of qualified personnel (see *Ad Hoc Board of Visitors, 25–26 February 1975, After Action Report*, p. 5).

51 Memo, Walter W. Hollis (DUSA-OR) for Reorganization Commission, Washington, 14 Nov 86, sub: Test and Evaluation Study Cell Results, pp. 3–4; U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—1 October 1978 to 30 September 1979* (Falls Church, Va.: USAOTEA, 1979), p. 10 (cited hereafter as OTEA AHR FY 79). The first draft of the GAO report was circulated on 17 November 1978 and a second draft on 20 April 1979. The second draft noted four problem areas: test realism, completeness and timeliness of test reports, production decisions on systems with significant operational test deficiencies, and conduct of operational texting by other than the independent tester. See U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—1 October 1979 to 30 September 1980* (Falls Church, Va.: USAOTEA, 1980), pp. 10–11 (cited hereafter as OTEA AHR FY 80).

52 Memo, Hollis for Reorganization Commission, 14 Nov 86, p. 4.

53 Rpt, General (USA Ret.) Walter T. Kerwin Jr. to General John W. Vessey Jr. (VCSA), [Washington], 9 Mar 81, no subject [Report of Outside Review Panel on Management and Conduct of Army T&E] (cited hereafter as Kerwin Panel Rpt). Other members of the panel included General (USA Ret.) George S. Blanchard, Lt. Gen. (USA Ret.) Julian J. Ewell, Maj. Gen. (USA Ret.) Charles T. Horner, and Abraham Golub.

54 Kerwin Panel Rpt, p. 3.

55 Ibid., pp. 6–8.

56 Ibid., pp. 4–5.

57 Ibid., pp. 8, 16.

58 Ltr, U.S. Department of the Army, Office of the Auditor General, to Director of the Army Staff, Deputy Chief of Staff for Operations and Plans, and Deputy Chief of Staff for Research, Development, and Acquisition, HQDA, Washington, 14 Dec 81, sub: Audit of Operational Testing and Evaluation of Nonmajor Materiel Systems Report No. HQ 82–202; Memo, Hollis for Reorganization Commission, 14 Nov 86, p. 4.

59 MFR, Col R M. Bunker (Chief, Coordination, Analysis, and Reports Division, Management Directorate, OCSA), Washington, 24 Jun 82, sub: Operational Test and Evaluation Meeting, 14 June 1982, with one enclosure (Decision Briefing Charts). The meeting was attended by General Vessey and representatives of TRADOC, AMC, OTEA, ODCSOPS, DAS, and the Management Directorate, OCSA.

60 Ibid., p. 3. Taskings arising from the VCSA's decision were set forth in Letter, Lt. Gen. James M. Lee (DAS) to SEE DISTRIBUTION, Washington, 30 June 1982, sub: Taskings for Operational Test & Evaluation Management. *DOD Directive 5000.3: Test and Evaluation* (19 January 1973; updated December 1979), and *DOD Directive 5000.1: Major Systems Acquisitions* (March 1982). Both required that each service have a single independent agency responsible for OT&E.

61 U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1983* (Falls Church, Va.: USAOTEA, January 1987), p. 1 (cited hereafter as OTEA AHR FY 83).

62 U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1984* (Falls Church, Va.: USAOTEA, February 1987), p. 1 (cited hereafter as OTEA AHR FY 84).

63 OTEA AHR FY 83, p. 1.

64 Ibid.

65 Ibid., pp. 1–2.

66 Ibid., p. 2.

67 Ibid.

68 OTEA AHR FY 84, p. 1. The final report appeared as United States Government Accounting Office, *Report to the Secretary of the Army: The Army Needs More Comprehensive Evaluations to Make Effective Use of Its Weapon System Testing* (Washington, D.C.: Government Accounting Office, 24 February 1984) (cited hereafter as GAO Rpt, 24 Feb 1984).

69 OTEA AHR FY 83, p. 2.

70 GAO Rpt, 24 Feb 1984, p. v.

71 OTEA AHR FY 84, pp. 1–2. The five systems were the Advanced Field Artillery Tactical Data System, the Joint Tactical Missile System, the Military Computer Family, the Remotely Piloted Vehicle, and the Short Range Air Defense Command and Control System.

72 Ibid., p. 1. The origin and nature of the C2E concept is outlined succinctly in Lt. Col. Charles J. Borns, "Continuous Comprehensive Evaluation," *Army Research, Development & Acquisition Magazine* (May–June 1985): 8–10.

73 Ibid.

74 Ibid., p. 2.

75 Ibid.

76 Ibid., p. 6. The April 1984 mission statement remained valid until OTEA was disestablished with the creation of OPTEC in November 1990.

77 Ibid., p. 3.

78 Ibid.

79 OTEA 25th Anniversary Brochure, p. 6.

[80] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review—Fiscal Year 1988* (Falls Church, Va.: Prepared by ARC Professional Services Group for USAOTEA, 19 January 1989), p. i (cited hereafter as OTEA AHR FY 88).

[81] Ibid. The same two provisions were included in Section 5 of PL 99–500 passed in 1986.

[82] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review—Fiscal Year 1987* (Falls Church, Va.: USAOTEA, 1987), p. 10 (cited hereafter as OTEA AHR FY 87). The Army Test and Evaluation Center, a HQDA staff agency, should not be confused with the successor to OTEA/OPTEC, the U.S. Army Test and Evaluation Command (ATEC).

[83] Ibid., p. 8.

[84] In November 1990, OTEA merged with TRADOC's Test and Experimentation Command (TEXCOM) to form the Operational Test and Evaluation Command (OPTEC), of which a new Test and Experimentation Command (TEXCOM) was a subordinate element.

[85] Ibid.

[86] U.S. Army Operational Test and Evaluation Agency and U.S. Army Test and Experimentation Command, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1990* (Alexandria, Va.: USAOTEA, 1990), p. I (cited hereafter as OTEA AHR FY 90).

[87] Memo, John P. Tyler III (SARD-RPP) for DUSA (OR), Washington, 12 Sep 88, sub: DA Level Test and Evaluation Office; Walter W. Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," *Phalanx* 24, no. 3 (September 1991): 8–9.

[88] Fact Sheet, Test and Evaluation General Officer Steering Committee (CSTE-GOSC), n.p. [Alexandria, Va.], p. 4, Dec 1991, sub: Army Test and Evaluation Reorganization, p. 3 (cited hereafter as Fact Sheet–Army Test and Evaluation Reorganization).

[89] Ibid.

[90] OTEA AHR FY 88, p. 8.

[91] OTEA Implementation Plan, pp. 3–5. The Concept of Operation for how the various parts of the OTEA structure were to work together was contained in the OTEA Implementation Plan, pp. 5–11.

[92] Ibid., p. 4. The head of the OTEA Coordination Office served concurrently as the HQDA assistant deputy ACSFOR for OT&E.

[93] OTEA Implementation Plan, p. 4; OTEA AHR 72–75, app. A, pp. A-8, A-9.

[94] OTEA AHR 72–75, p. 19.

[95] OTEA Implementation Plan, p. 5.

[96] OTEA AHR 72–75, app. A, pp. A-9 to A-10.

[97] *History of OTEA, 1972–1988*, pp. 2–3; OPTEC 25th Anniversary, p. 5.

[98] OTEA AHR 72–75, p. 15.

[99] OPTEC 25th Anniversary, p. 5.

[100] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—1 October 1981 to 30 September 1982* (Falls Church, Va.: USAOTEA, 1982), p. 8 (cited hereafter as OTEA AHR FY 82).

[101] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1985* (Falls Church, Va.: USAOTEA, April 1987), p. 2, Figure 1 (OTEA Organization—Beginning and End of FY 1985) (cited hereafter as OTEA AHR FY 85).

[102] An Aviation Systems Evaluation Division was created in September 1984. The primary mission of the evaluation divisions was C2E of assigned major, Designated Acquisition Process (DAP), and Category 1 In-Process Review (IPR) systems (see OTEA AHR FY 84, pp. 11–12).

[103] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1986* (Falls Church, Va.: USAOTEA, September 1987), p. 1 (cited hereafter as OTEA AHR FY 86).

[104] OTEA AHR FY 87, pp. 1–2, 5.

[105] OTEA AHR FY 88, p. 1.

[106] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1989* (Falls Church, Va.: USAOTEA, 1989), p. 1, 2, Figure 1 (FY 1989 OTEA Organization), and pp. 6–7 (cited hereafter as OTEA AHR FY 89); and OTEA AHR FY 90, p. 1, Figure 1 (OTEA Organization FY 90).

[107] OTEA AHR FY 89, p. 7. The office managed the OTEA threat program to ensure system evaluators incorporated threat data into user testing and C2E programs.

[108] A GAO report on OT&E issued in May 1990 reiterated the view that "the Congress continues to express concern that weapon systems have begun production without operational test and evaluation" (see U.S. Air Force Test and Evaluation Center, "Background Paper," p. 2).

[109] U.S. Air Force Test and Evaluation Center, "Background Paper," p. 2.

[110] U.S. Department of the Army, Army Management Review Task Force (AMRTF), *Army Management Review—Report to the Secretary of Defense* (Washington, D.C.: AMRTF, HQDA, October 1989), with Memo, Michael P. W. Stone (Secretary of the Army) for Secretary of Defense and Deputy Secretary of Defense, Washington, 16 Oct 89, sub: Army Management Review Report.

[111] Ibid., p. 4. The six common features of successful projects were clear command channels; program stability; limited reporting requirements; small, high-quality staff; communications with users; and better system development.

[112] Ibid., p. 16.

[113] U.S. Department of the Army, Army Management Review Task Force, *Extracts from Army Management Review Task Force Briefings and Reports describing the T&E Proposal, September–November 1989, Leading Up to the SA and CSA Approval* (Washington, D.C.: AMRTF, HQDA, n.d. [1989]). The four existing major T&E commands involved were OTEA, AMSAA and TECOM (under AMC), and TRADOC's TEXCOM. Other elements affected were to include the Army Engineering Flight Activity (AEFA), meteorological teams of the Atmospheric Science Laboratory (ASL), and parts of the Communications-Electronics Command, Missile Command, Information Systems Command, Strategic Defense Command, and Logistics Evaluation Agency.

[114] Fact Sheet–Army Test and Evaluation Reorganization, p. 1.

[115] Ibid.

[116] OTEA AHR FY 90, p. 12.

[117] Fact Sheet–Army Test and Evaluation Reorganization, p. 1.

[118] Ibid.

[119] Ibid., p. 2.

[120] The provisional reorganization of AMC began on 1 October 1990, was approved by the secretary of the Army on 14 December 1990, and was announced to the Congress and the public on 19 December 1990. The GOSC reported its final results and decision to dissolve itself in a memorandum to the under secretary of the Army and the VCSA on 19 June 1991. See Fact Sheet–Army Test and Evaluation Reorganization, p. 3.

[121] U.S. Department of the Army, *General Order No. 6: United States Army Operational Test and Evaluation Command*, Washington, 28 February 1991.

[122] Memo, Maj Gen Richard R. Stephenson, for Vice Chief of Staff of the Army, Washington, 21 Aug 91, sub: End-of-Tour Report, p. 2. In fact, only three OTEA civilians actually lost their job in the consolidation.

[123] U.S. Army Operational Test and Evaluation Command, *Annual Historical Summary, 1995* (Alexandria, Va.: USAOPTEC, 1995), p. 1 (cited hereafter as OPTEC AHS FY 95).

[124] U.S. Army Operational Test and Evaluation Command, *Annual Historical Review—Fiscal Year 1991* (Alexandria, Va.: USAOPTEC, 1991), p. 15 (cited hereafter as OPTEC AHR FY 91).

[125] OPTEC AHS FY 92, p. 2.

[126] OPTEC AHR FY 91, p. 5, Figure 1 (OPTEC Organization FY 91). The Air Defense Directorate was subsequently renamed the Counterair Directorate, the Intelligence Directorate renamed the Intelligence and Electronic Warfare Directorate, and the Combat Support Directorate renamed the Combat Service Support Directorate.

[127] OPTEC AHS FY 92, pp. 2–3, 5, Figure 1 (OPTEC Organization FY 92).

[128] Ibid.

[129] Compiled from OPTEC annual historical summaries/reviews and other sources.

[130] OPTEC AHR FY 91, p. 8.

[131] U.S. Army Operational Test and Evaluation Agency/U.S. Army Test and Experimentation Command, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1990* (Alexandria, Va.: USAOTEA, 1990), p. 5 (cited hereafter as OTEA/TEXCOM AHR FY 90). In FY 1991, the charter of the new TEXCOM was revised to assign to it responsibility as the tester for all major systems.

[132] Subsequently, the Intelligence-Security Test Directorate was renamed the Intelligence-Electronic Warfare Test Directorate, and the Field Artillery Test Directorate became the Fire Support Test Directorate.

[133] Brian Barr served as the TEXCOM technical director until May 1999, when he became the OPTEC technical director. He retired in 2006 as the technical director of the U.S. Army Test and Evaluation Command.

[134] At one time, the assigned test troops amounted to a reinforced brigade of infantry and armor troops with an attached aviation company, a transportation company, and an instrumentation company.

[135] OPTEC AHR FY 91, p. 8.

[136] Ibid.

[137] U.S. Army Operational Test and Evaluation Command, *Annual Historical Summary, 1994* (Alexandria, Va.: USAOPTEC, 1994), pp. 2, 3, Figure (OPTEC FY 94) (cited hereafter as OPTEC AHS FY 94).

[138] *History of OTEA, 1972–1988*, p. 16.

[139] OTEA AHR FY 72–75, pp. A-2, A-4.

[140] OTEA Implementation Plan, ann. L (Funding), p. 7.

[141] Memo, Maj Gen John T. Carley (Commander, OTEA) thru Maj Burke for Lt Gen Williams (ACSFOR), Washington, 27 Sep 72, sub: Status Report on OTEA.

[142] 15-Year History of OTEA, p. 7.

[143] U.S. Army Operational Test and Evaluation Agency, *Annual Historical Review (RCS CSHIS-6 [R-3])—1 October 1976 to 30 September 1977* (Falls Church, Va.: USAOTEA, 1977), p. 9, Figure 2-2 (Agency Strength Figures) (cited hereafter as OTEA AHR FY 77).

[144] Ltr, DCSPER, HQDA, to Commander, OTEA, Washington, 3 Jan 1979, sub: Manpower Management Survey of the United States Army Operational Test and Evaluation Agency (OTEA), p. 1.

[145] OTEA AHR FY 83, p. 8, Figure 4 (OTEA Strength Figures), and OTEA AHR 86, p. 6, Figure 5 (OTEA Strength Figures). The augmentation dropped to two civilians by 1 October 1985 and had disappeared altogether by 1 October 1986.

[146] OTEA AHR FY 87, p. 10.

[147] OTEA AHR FY 90, p. i; *History of OTEA, 1972–1988*, p. 32.

[148] As of 1 October 1991, the ratio of authorized personnel was 849 civilians to 423 military, or about 2:1.

[149] Fact Sheet–Army Test and Evaluation Reorganization, p. 4.

[150] See Table 5–3. See also Brig. Gen. Robert Rosenkranz (Commander [Cdr], OPTEC), *United States Army Operational Test and Evaluation Command*, Briefing (Alexandria, Va.: OPTEC, n.d. [ca. 1999]), Slide 18 (OPTEC Origins–DMR 936-1989). Brig. Gen. Rosenkranz' numbers are somewhat different.

[151] Fact Sheet–Army Test and Evaluation Reorganization, p. 4.

[152] Rosenkranz Briefing, Slide (OPTEC DRAWDOWN FY 90–98).

[153] OPTEC AHS FY 95, Figure (OPTEC Mission-Focused Organization).

[154] U.S. Army Operational Test and Evaluation Agency, *Annual Report of Major Activities (RCS CSHIS-6 [R-2])—1 July 1975 to 30 September 1976* (Falls Church, Va.: USAOTEA, 1976), p. 2 (cited hereafter as OTEA AHR FY 76).

[155] OTEA AHR FY 79, p. 11.

[156] OTEA AHR FY 80, p. 11; OTEA AHR FY 1981, p. 11.

[157] Rosenkranz Briefing, Slide (OPTEC DRAWDOWN FY 90–98).

[158] 15-Year History of OTEA, p. 8.

[159] OTEA AHR FY 85, p. 10.

[160] Memo, Maj Gen John T. Carley (Commander, OTEA) thru Maj Gen Burke for Lt Gen Almquist (ACSFOR), Fort Belvoir, Va., 21 Feb 73, sub: Status Report on OTEA.

[161] OPTEC 25th Anniversary Brochure, p. 7.

[162] OTEA AHR FY 89, p. 10.

[163] OPTEC AHS FY 95, Figure (OPTEC Mission-Focused Organization).

[164] *History of OTEA, 1972–1988*, p. 34.

[165] OTEA AHR FY 82, p. 29.

[166] Ltr, Maj Gen William A. Burke (Deputy ACSFOR) to SEE DISTRIBUTION, Washington, 10 Nov 72, sub: Transfer of Operational Test and Evaluation Responsibilities to US Army Operational Test and Evaluation Agency (OTEA), pp. 1–2.

[167] Memo, Lt Gen E. H. Almquist (ACSFOR) for CSA, Washington, 30 Jul 73, sub: Information on the Operational Test and Evaluation Agency, p. 1.

[168] OTEA Briefing, 28 January 1974, Slide 7A (Systems Assigned to OTEA for Operational Testing). Note that the list includes all of the "Big Five."

[169] OPTEC 25th Anniversary Brochure, p. 7.

[170] 15-Year History of OTEA, p. 8.

[171] *History of OTEA, 1972–1988*, p. 32.

[172] OPTEC AHS FY 94, p. 1.

[173] Based on data in *History of OTEA, 1972–1988* and the OTEA annual historical reviews/summaries, FY 1973–FY 1987.

[174] OPTEC AHS FY 95, pp. 9–15 passim.

[175] *History of OTEA, 1972–1988*, p. 34.

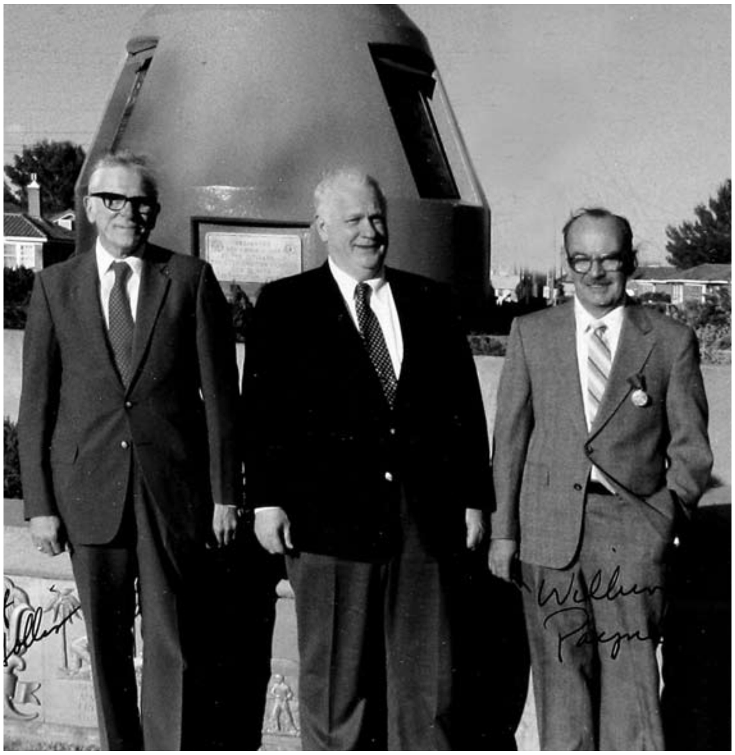
[176] Ibid.

[177] Ltr, Maj Gen Larry G. Lehowicz (Commander, OPTEC), Alexandria, Va., 24 Sep 97, sub: Commanding General's Message OPTEC Celebrates Its 25th Anniversary.

[178] OPTEC 25th Anniversary Brochure, pp. 8–9.

[179] "ATEC History," available at http://www.atec.army.mil/atec_history.htm (accessed 29 August 2006).

[180] OPTEC 25th Anniversary Brochure, p. 12.



Three deputy under secretaries of the Army for operations research (DUSA [OR])—left to right: Walter W. Hollis, David C. Hardison, and Wilbur B. Payne—get together in Fort Bliss, Texas, for the occasion of Dr. Payne's retirement, 1987.

E. B. Vandiver III, director of the Center for Army Analysis since 1984, is one of the pillars of the Army analytical community and has served in a number of important ORSA assignments.

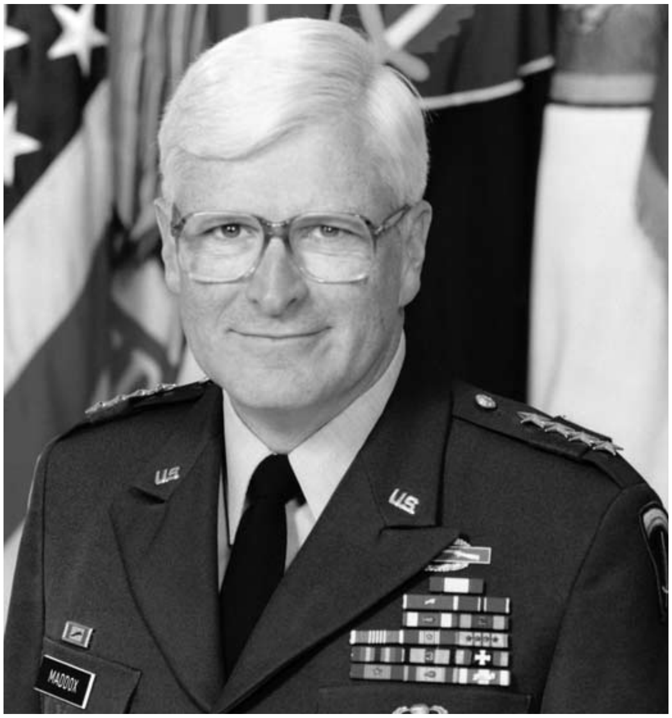
The retirement dinner for DUSA (OR) Walter W. Hollis (seated, second from left) in June 2006 brought together many of the leaders of the Army ORSA community. Identification of others in the photograph is available from the author.

Joseph Sperrazza served as director of the U.S. Army Materiel Systems Analysis Activity at Aberdeen Proving Ground (1968–1979).

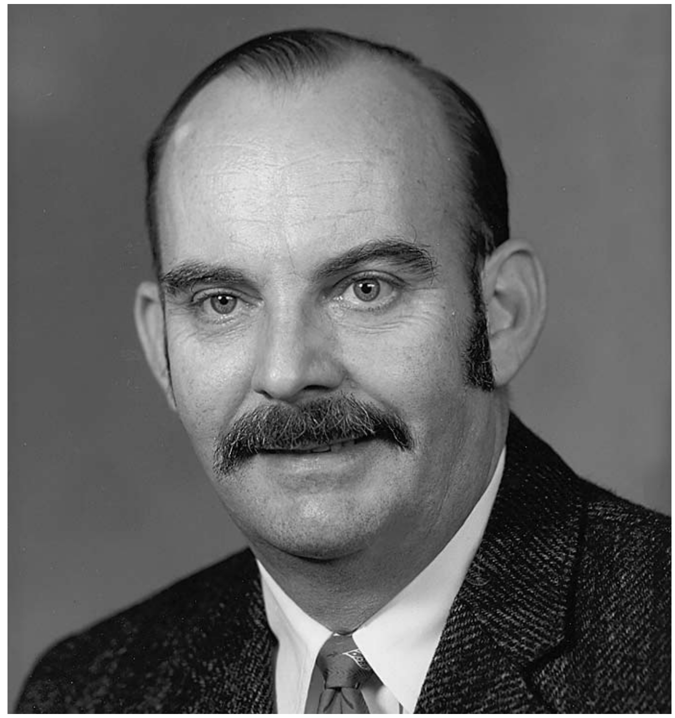
Michael F. Bauman, director of the TRADOC Analysis Center since 1993, has had many important ORSA assignments in Army training, doctrine, and combat developments.

As assistant vice chief of staff of the Army (1969–1973), and later as commander, U.S. Army Training and Doctrine Command (1973–1977), General William E. DePuy was a strong proponent of operations research.

As a major general, James G. Kalergis was the project manager for the 1973 reorganization of the Army (Project STEADFAST). He retired as a lieutenant general and was later the chairman of the Vinnell Corporation (1979–1982).



As a brigadier general, Army ORSA specialist David M. Maddox commanded the Combined Arms Operations Research Activity at Fort Leavenworth (1983–1986) and later rose to four stars and commanded the United States Army, Europe (1992–1994).



Wilbur B. Payne (1926–1990) served as the DUSA (OR) from January 1968 to November 1975 when he left to organize and lead the new TRADOC analysis organization. He was a dominant figure during the middle period of Army ORSA history.

David C. Hardison (1927–) served as the DUSA (OR) from November 1975 to August 1980 and subsequently served in the Office of the Secretary of Defense and as director of the Concepts Analysis Agency.

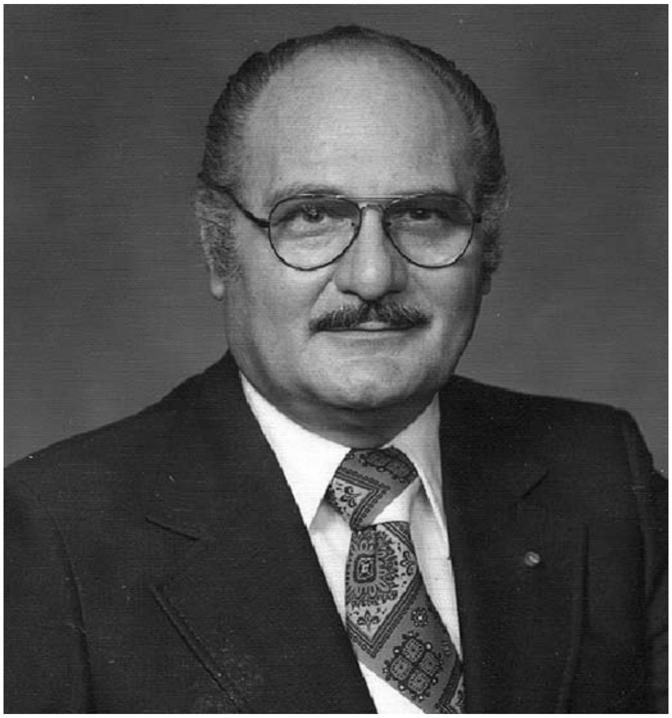
Walter W. Hollis (1926–) served as the third and last DUSA (OR) (December 1980–June 2006). Under his leadership, the Office of the DUSA (OR) assumed greater responsibilities in overseeing the test, evaluation, and acquisition processes.

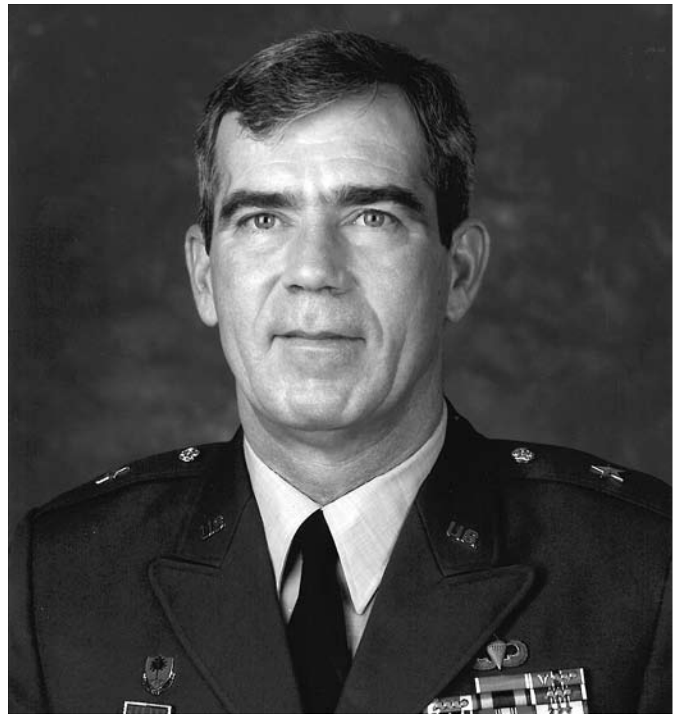
Army ORSA analysts devoted much effort to the development of the Big Five Army weapons systems of the late twentieth century (clockwise from top left): the M1A1 Abrams tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot air defense missile system.


UNITED STATES ARMY

Construction of the Wilbur B. Payne Hall was completed in March 1999 at Fort Belvoir, Virginia.

Walter W. Hollis (second from left) presents the Dr. Wilbur B. Payne Award at the 1990 Army Operations Research Symposium to the following awardees (left to right): Roy Reynolds, Lt. Col. Roger LeDoux, Dr. Dick Laferriere (all from TRAC-WSMR), and Capt. Peter Vozzo (Fort Rucker Army Aviation Center). Brig. Gen. Richard W. Tragemann, then the commander of TRAC, is on the far right.





Abraham Golub served as the assistant DUSA (OR) (1968–1970), and later served as an adviser to both the assistant chief of staff for force development (1970–1974) and the deputy chief of staff for operations and plans (1974–1976).

Brig. Gen. Richard W. Tragemann commanded TRAC (1990–1992) during its formative period and later the Army Test and Evaluation Command at Aberdeen Proving Ground (1992–1996).

Brig. Gen. Robert T. Howard commanded TRAC during a critical transitional period (September 1988–August 1990).

Maj. Gen. John T. Carley commanded the Army Operational Test and Evaluation Agency when it was first established in September 1972 at Fort Belvoir.

Maj. Gen. Hal E. Hallgren headed the Special Planning Group in the Office of the Assistant Chief of Staff for Force Development that created the U.S. Army Concepts Analysis Agency in 1972. He subsequently commanded the Concepts Analysis Agency (January 1973–February 1976).

Keith A. Myers, an expert on weapon system performance, served as director of the Army Materiel Systems Analysis Activity from July 1981 to December 1993.

Participants work on a war-game-based analysis of the Polish General Staff conducted by TRAC in Warsaw, Poland, in 1998 under the Partnership for Peace program.

CHAPTER SIX

United States Army TRADOC Analysis Command/Center and Its Predecessors, 1973–1995

The establishment of the United States Army Training and Doctrine Command (TRADOC) Analysis Command (TRAC) headquartered at Fort Leavenworth, Kansas, on 1 October 1986, represented the culmination of a thirteen-year process in which the various elements of the TRADOC analysis community—some inherited from the United States Army Combat Developments Command (CDC) and the United States Continental Army Command (CONARC) and some newly created—were organized, consolidated, reorganized, and subjected to centralized control.[1] The central theme of the history of OTEA/OPTEC from 1972 to 1995 is the consolidation and centralization of the Army's test and evaluation agencies, and the history of the TRADOC analytical community in the same period is also a story of consolidation and centralization. It involves a multitude of separate agencies scattered throughout the country and engaged in a variety of endeavors utilizing ORSA personnel. The broad range of TRADOC ORSA activity from 1973 to 1995 included Operational Test and Evaluation (OT&E); Combat Developments (CD); simulations and war-gaming; Cost and Operational Effectiveness Analyses (COEAs); force development analyses; and the integration of weapons systems, organization, and tactical doctrine as well as training developments.

Between 1973 and 1995, the bulk of TRADOC's analytical resources were slowly consolidated under centralized control. The major milestones on the path to consolidation and centralization were the assumptions by the newly established TRADOC of the ORSA elements of the former CDC and CONARC in 1973 and 1974; the establishment of new agencies such as the TRADOC Systems Analysis Activity (TRASANA) in 1974; the first but stillborn attempt to create an umbrella organization for TRASANA at White Sands Missile Range in New Mexico and the Combined Arms Operations Research Activity (CAORA) at Fort Leavenworth, Kansas, in the form of the TRADOC Operations Research Activity (TORA) in 1982; and the establishment of TRAC itself at Fort Leavenworth on 1 October 1986.

Throughout the period, the various elements of the TRADOC analytical community played a key role in the development and integration of new weapons, new organizational concepts, and new operational doctrine embodied in concepts such as the Active Defense, Deep Attack/Deep Battle, and AirLand Battle as well as new organizational designs such as the Light Division, Army 86, and the Army of Excellence as well as the training required to implement such designs successfully. Thus, TRAC and the other elements of the TRADOC ORSA community made a major contribution to the reshaping of the United States Army after Vietnam into the formidable force that achieved victory in only one hundred hours in the Gulf War of 1990–1991.

The Path to TRAC, 1973–1986

TRADOC was established at Fort Monroe, Virginia, on 1 July 1973 as a major part of the STEADFAST reorganization of the Army.[2] STEADFAST emphasized "centralized management and decentralized operations," and the principal role for TRADOC in the post-Vietnam period was to provide centralized direction of efforts to train, reform, and modernize the United States Army. As part of the STEADFAST reorganization, TRADOC absorbed most of the combat development functions of CDC as well as the training responsibilities of CONARC and thus became responsible for the development, testing, and evaluation of organizational and tactical concepts as well as training management and the installation management of those posts on which training centers or Army branch and specialist schools were located.

Both CDC and CONARC had a number of analytical elements, both in their headquarters and in their subordinate commands and agencies. TRADOC absorbed those elements, including the ORSA cells at each of the Army branch schools. Subsequently, some of them were disestablished, others were consolidated, and some new ones were created. The first TRADOC commander, General William E. DePuy, was a strong advocate of ORSA in the Army and subsequently pushed for the formation of effective ORSA organizations within the TRADOC structure, and his successors also supported the effort to improve analytical support of TRADOC through consolidation and centralized control.[3]

The ORSA elements of CDC and CONARC absorbed by TRADOC in July 1973 included headquarters elements, the ORSA cells at the Army branch schools, and a number of Test and Evaluation (T&E) elements. In August 1974, the roster of TRADOC organizations using ORSA methods was further increased by the transfer from the United States Army Forces Command (FORSCOM) of the major test facility at Fort Hood, Texas, known as Headquarters Modern Army Sensor Systems Test, Evaluation, and Review (HQ MASSTER). Further additions were made in July 1975 with the transfer to TRADOC control of five test boards from the Test and Evaluation Command (TECOM), a subordinate command of the Army Materiel Command (AMC).[4]

CDC and CONARC Headquarters ORSA Elements Absorbed by TRADOC

Both HQ CDC and HQ CONARC had substantial ORSA elements.[5] In July 1973, the bulk of those resources were incorporated into the office of the TRADOC deputy chief of staff for combat developments (DCS-CD). The detailed STEADFAST plan provided for some twelve military and twenty civilian ORSA managers and analysts in the Study Management Office, Analysis Division, Experimentation and Test Division, Systems Integration Division, Firepower Division, Operations Division, and INCS Division of the TRADOC DCS-CD.[6] Both the study coordinator and the chief of the Analysis Division were to be ORSA-qualified colonels, and there was to be a GS–16 supervisory OR analyst in the Study Management Office and a GS–15 supervisory OR analyst as head of the Systems Analysis Branch in the Analysis Division. Although the other divisions and directorates of HQ TRADOC had assigned ORSA personnel, both military and civilian, during the period 1973–1995, the largest concentration continued to be in the Analysis Division, which as of FY 1978 had authorizations for thirty-seven personnel, of which thirty were ORSA professionals.[7]

The DCS-CD Study Management Office and Analysis Division were later merged to form the Studies and Analysis Directorate (S&AD), which was responsible for overseeing the overall TRADOC program of analysis, a daunting task given the large number of widely distributed organizations and efforts. Nevertheless, S&AD managed the *AR 5–5* study program for TRADOC, tasked new studies, and monitored their conduct, relying upon critical reviews of each effort by Army Study Advisory Groups specially chartered for that purpose. The S&AD was led by a succession of capable ORSA-qualified colonels, many of whom went on to become senior general officers.[8] They were ably assisted by the S&AD technical director, Seymour L. Goldberg, until his retirement in 1985.[9] The last director of S&AD, Col. William ("Tony") A. Brinkley played a key role in the formation of the TRADOC Analysis Command (TRAC) in 1986, and then led TRAC Headquarters' Requirements and Programs Directorate (RPD), which remained at Fort Monroe, having been formed from the DCS-CD S&AD.[10]

Substantial numbers of ORSA managers and analysts were also involved in TRADOC's Operational Test and Evaluation (OT&E) mission, which grew rapidly after July 1973.[11] On 30 December 1980, TRADOC established in its headquarters the Office of the Deputy Chief of Staff for Test and Evaluation (DCS-TE) to centralize management of the work of the various TRADOC T&E organizations as well as TRADOC T&E support to other Army commands and agencies.[12] The commander of the TRADOC Combined Arms Test Activity (TCATA) served simultaneously as the HQ TRADOC DCS-TE, and the commander of the Combat Developments Experimentation Center (CDEC) assumed the additional duty of HQ TRADOC assistant DCS-TE for operations. The DCS-TE element at HQ TRADOC at Fort Monroe was headed by a civilian assistant DCS-TE for resources and policy. By 1985, the TRADOC leadership had become dissatisfied with this arrangement, which combined staff and operational responsibilities. Thus, on 12 March 1985, the Office of the DCS-TE was disestablished and responsibility for test and evaluation matters was returned to the deputy chief of staff for combat developments.

ORSA Cells in the Army Branch Schools Absorbed by TRADOC

On 1 July 1973, all of the Army branch and specialist schools and training centers formerly assigned to CONARC became subordinate commands of TRADOC. Most of the twenty-four schools and colleges had ORSA cells, and they became an important part of the TRADOC analytical community.[13] The TRADOC schools were on the front line, and the analysts assigned to each of the schools were engaged in combat developments, training developments, and test and evaluation work. As a 1982 survey group noted:

> The TRADOC Schools are and must be the source of all TRADOC actions on doctrine, materiel, organization, and training. The essential military expertise and experience resides at the schools. The school commandant is the spokesman for his mission area and is responsible for the actions by which combat effectiveness in the mission area is maintained.[14]

Those TRADOC schools with ORSA cells in 1973 included the Air Defense, Armor, Field Artillery, Aviation, Engineer, Infantry, Intelligence, Military Police, Missile and Munitions, Ordnance, Chemical, Quartermaster, Signal, and Transportation Schools, plus the Airborne Board and the Institute for Military Assistance.[15] As of FY 1978, the TRADOC schools with ORSA contingents had 504 authorized personnel, of which 408 were ORSA professionals, and there were 310 ORSA professionals on hand (208 military and 102 civilian), as shown in Table 6–1.[16] The number of authorized ORSA professionals represented about 44 percent of the total TRADOC authorization.

When surveyed in 1982, the TRADOC schools were found to have several deficiencies.[17] There was no established pattern or model for their organization and operation, and for the most part they were not following the TRADOC Study Program. Although some had good external relationships with other TRADOC analysis agencies, such as the TRADOC Operations Research Activity (TORA), most had poor internal coordination among their combat developments, test and evaluation, and training developments elements. Some were understaffed, and all had generally poor Officer Distribution Plan (ODP) fill. Most also lacked a senior (GS/GM–14/15) analyst and had no formal intern or professional development programs.

Over time, in the halcyon days before Army downsizing took its toll, the ORSA cells of the various TRADOC branch schools produced a rich collection of significant studies and analyses that profoundly impacted the Army.[18] As TRADOC command responsibilities and organization changed, so did the responsibilities and organization of the branch schools, and their ORSA cells responded to meet new, growing analysis demands, not the least of which was the first wave of Mission Area Analyses (MAAs).[19] In the early 1980s, the ORSA cells conducted individual MAAs for thirteen distinct mission areas to identify by mission and tasks, their respective branch's capabilities and deficiencies and assess potential corrective actions.[20] These unique analyses were the first comprehensive studies of branch capabilities to execute TRADOC's emerging AirLand Battle doctrine and exemplified the brand of in-depth functional analysis that became the trademark of the branch school ORSA cells.

Until 1987, the branch schools were also responsible for the Army's system Cost and Operational Effectiveness Analyses (COEAs), which were vital to underpinning and defending Army materiel needs. Notably, the branch schools produced the COEAs for the Army's "Big Five" weapons systems as well as for many other systems, both combat and noncombat.[21]

Table 6–1—Distribution of ORSA Personnel in TRADOC Schools, FY 1978

	Authorized		Assigned Professionals		
School	*Personnel*	*Professionals*	*Civilian*	*Military*	*Total*
Air Defense School	53	41	13	22	35
Armor School	78	58	20	30	50
Artillery School	51	44	13	16	29
Aviation School	57	46	8	22	30
Engineer School	39	31	7	14	21
Infantry School	37	32	4	17	21
Intelligence School	66	53	11	24	35
Military Police School	23	21	3	16	19
Missile and Munitions School	17	13	3	6	9
Quartermaster School	29	21	7	10	17
Signal School	28	25	2	19	21
Transportation School	26	23	11	12	23
Schools TOTAL	504	408	102	208	310
TRADOC TOTAL	1,193	924	407	331	738
Army TOTAL	3,658	2,803	1,783	672	2,455

Source: U.S. Department of the Army, Special Study Group, Final Report—Review of Army Analysis, Volume II: Appendices C–M (Washington, D.C.: Special Study Group, U.S. Department of the Army, April 1979), app. D. pp. D-I-2 to D-I-5.

The capabilities of the ORSA cells varied among the branch schools. Some were especially well staffed with highly qualified civilian and military analysts and equipped with special-purpose models and simulations built to address branch problem areas. A distinctive hallmark of the ORSA cells was the strong branch competencies of their analysts. However, not surprisingly, their analysis tended to focus within their branch functional areas, often at the expense of combined arms considerations and in extreme cases their work was criticized for its lack of objectivity. Nevertheless, they along with TRAC's predecessor organizations, TRASANA and CAORA, produced a significant body of work and established the enduring foundation for analysis in TRADOC during its first two decades.

CONARC and CDC Field Agencies and Test and Evaluation Agencies Absorbed by TRADOC

HQ CDC had also controlled more than twenty field agencies, most of which were co-located with the Army branch school responsible for the same functional area. The CDC field agencies were divided into three groups (Combat Arms, Combat Support, and Combat Service Support) and each field agency conducted both in-house and contract research on topics pertinent to their basic functional orientation using ORSA and other methodologies. For example, the Combat Arms Group at Fort Leavenworth was involved in the development of concepts, doctrine, organization, and evaluations in the aviation, artillery, armor, and infantry areas and did research and analyses of intelligence, firepower, communications, and mobility systems using ORSA and war-gaming.[22] With the creation of TRADOC on 1 July 1973, the various CDC field agencies were disestablished or reassigned to one of the three new TRADOC integrating centers or to one of the branch schools.

TRADOC also absorbed those CONARC and CDC elements responsible for combat developments and the operational test and evaluation of materiel, organization, and doctrinal concepts. Although they did not conduct full-fledged studies and analyses, each of them used ORSA techniques to some degree for the planning of test activities and the evaluation of completed tests. The principal T&E activities transferred to TRADOC were the United States Army Combat Developments Command Experimentation Command (CDCEC) at Fort Ord, California; Headquarters Modern Army Sensor Systems Test, Evaluation, and Review (HQ MASSTER) at Fort Hood, Texas; and the remaining branch-related test boards, which had been under AMC control since 1962.[23] The TRADOC T&E mission grew rapidly, and by 1979 TRADOC planners estimated that OT&E activities in TRADOC cost some $50 million per year and involved some 3,400 personnel.[24]

With the implementation of STEADFAST on 1 July 1973, TRADOC assumed control of CDCEC, CDC's principal subordinate test and experimentation element, and of CDCEC's active program of field tests and experiments aimed at improving Army organization and tactical doctrine.[25] On 5 July 1983, CDCEC was reduced in size and authority and redesignated the United States Army Combat Developments Experimentation Center (CDEC).[26] On 15 March 1985, the commander, TRADOC Combined Arms Test Activity (TCATA), at Fort Hood, Texas, assumed responsibility for CDEC, and on 1 October 1987, CDEC was provisionally redesignated the United States Army Test and Experimentation Command (TEXCOM) Experimentation Center (TEC). On 8 November 1990, TEC, along with TEXCOM, was merged into the new United States Army Operational Test and Evaluation Command (OPTEC).

In 1982, CDEC was authorized a total of seventeen ORSA analysts (fifteen military and two civilian), of which sixteen were on hand (fourteen military and two civilian).[27] Most were employed in the Directorate of Experimentation and the Office of the Deputy Chief of Staff for Long Range Plans and Programs, both of which were concerned with the design, monitoring, and analysis of tests, and they were supported by nineteen man-years per year of contract support.[28] The 1982 TRADOC survey team found that some tasks being performed by military analysts could be advantageously shifted to civilian analysts, that CDEC was overly reliant on contractors for expertise and analytical support, and that the interaction between CDEC and the TRADOC Deputy Chief of Staff for Test and Evaluation and other TRADOC test agencies could be improved.[29] The survey team concluded that "The operations of CDEC and TCATA are highly specialized and from the standpoint of analyses the operations are more than adequate. The dependency of CDEC on contract support might be reviewed to insure that it is the best way to perform its task."[30]

On 1 August 1974, TRADOC assumed from FORSCOM responsibility for the operation of the major test facility at Fort Hood, Texas, known as Headquarters Modern Army Sensor Systems Test, Evaluation, and Review (HQ MASSTER).[31] HQ MASSTER began on 1 October 1969 as Project MASSTER (Mobile Army Sensor Systems Test, Evaluation, and Review) to coordinate the development and application of Army surveillance, target acquisition, and night observation systems then seeing increased use in Vietnam.[32] On 1 April 1971, Project MASSTER was redesignated Headquarters Modern Army Selected Systems Test, Evaluation, and Review (HQ MASSTER) and became a permanent organization under CDC. At that time, its mission was expanded to include T&E of tactical concepts connected with the development of the Triple Capability (TRICAP) Division and the Air Cavalry Combat Brigade (ACCB).[33] The scope of HQ MASSTER testing and evaluation activities continued to expand thereafter.

With the 1973 STEADFAST reorganization, HQ MASSTER was transferred from CDC to the newly established FORSCOM, and one year later it passed to TRADOC control. On 23 April 1976, HQ MASSTER was redesignated the TRADOC Combined Arms Test Activity (TCATA) and was chartered to do large-scale tests, smaller-scale testing being left to the test boards located at the various TRADOC centers and schools.[34] On 15 March 1985, TCATA was placed under the Combined Arms Center (CAC) located at Fort Leavenworth, Kansas.

The 1982 team that surveyed TRADOC analytical agencies found that TCATA had some twenty-five ORSA personnel authorizations (fourteen ODP-supported military and eleven civilian), with twenty-two ORSA personnel on hand (twelve military and ten civilian).[35] TCATA analysts were assigned to the Office of the DCS for Programs and Operations, the Methodology and Analysis Directorate, the Battlefield Automation Test Directorate, the Combat Arms Test Directorate, and the Training and Support Systems Test Directorate, and were fully involved in all aspects of the tests conducted by TCATA.[36] The survey team also found excellent internal working relationships among the various TCATA ORSA elements, and similarly good external relationships with, for example, TRASANA and the TRADOC schools. The team also found that although there were sufficient senior analysts to advise the commander, adequate supervisory personnel were lacking in all but the Methodology and Analysis Directorate. There was also no formal intern or professional development program. The team observed, "TCATA is a well managed organization which places heavy reliance on analysts for the entire test process and for providing quality control to the TCATA product."[37] They did, however, recommend an increase in the ratio of civilian to military analysts, written taskings at the action level, strengthening of the ORSA elements in the Battlefield Automation and Training and Support Systems directorates, and establishment of formal internship and professional development programs.[38]

Following a study of how to better coordinate TRADOC test and evaluation activities led in 1987 by the TCATA commander, Maj. Gen. Robert Drudik, TCATA was replaced by a new U.S. Army Test and Experimentation Command (TEXCOM) established provisionally at Fort Hood in November 1987 and formally activated on 2 October 1988.[39] A new TEXCOM Combined Arms Test Center (TCATC) was established at Fort Hood to replace the old TCATA, and TEC at Fort Ord as well as the seven TRADOC test boards were also placed directly under TEXCOM.[40] However, TEXCOM did not last long. Pursuant to a review of the Army's test and evaluation organization directed by the DUSA (OR), on 8 October 1990, TEXCOM was removed from TRADOC control and merged with the United States Army Operational Test and Evaluation Agency (OTEA) to form the United States Army Operational Test and Evaluation Command (OPTEC) with headquarters in Falls Church, Virginia.[41] The effect of the establishment of OPTEC was to remove from TRADOC its immediately responsive test capability.

Pursuant to the recommendations in the August 1974 AMARC report, on 1 July 1975, the five test boards then controlled by AMC's TECOM were transferred to the co-located TRADOC branch schools to deal with nonmajor systems and T&E support of combat developments activities.[42] Three other boards were subsequently transferred: the Aviation Board at Fort Rucker, Alabama, on 1 July 1976; a newly established Intelligence and Security Board at Fort Huachuca, Arizona, on 31 March 1977; and a newly established Communications-Electronics Board at Fort Gordon, Georgia, on 1 July 1978.[43] The test boards gave TRADOC, as the "user representative," control over early concept development and experimentation in various fields.[44]

New TRADOC Analytical Organizations

In addition to absorbing the existing analytical organizations formerly assigned to CONARC and CDC, TRADOC also established a number of new organizations to carry out its combat developments and training missions. Most of these new organizations had their own ORSA capability, or were supported by one of the other TRADOC analytical agencies.

The TRADOC Integrating Centers

On 1 March 1973, HQ CONARC established a provisional HQ CONARC/HQ TRADOC at Fort Monroe, Virginia, and three new functional centers were created to coordinate the TRADOC combat developments effort: the Combined Arms Center at Fort Leavenworth, Kansas; the Logistics Center at Fort Lee, Virginia; and the Administration and Personnel Center at Fort Benjamin Harrison, Indiana.[45] On 1 September 1977, at the direction of the TRADOC commander, General Donn A. Starry, the three functional centers were reorganized as integrating centers, each overseeing a specified group of functionally similar branch schools and centers. The Combined Arms Center (CAC) was made responsible for combined arms and combat support matters; the Logistics Center (LOGC) for combat service support matters; and the Administration Center (ADMINC) for personnel and administration matters.[46] Each of the new integrating centers was commanded by a lieutenant general, and the TRADOC deputy commander for combat developments was moved to Fort Leavenworth, where he served simultaneously as the CAC commander directing, coordinating, and integrating the combined arms doctrine, organization, and training development programs.[47]

Each of the TRADOC integrating centers had its own analytical capability in the form of assigned ORSA managers and analysts, both military and civilian. In FY 1978, CAC's Combined Arms Combat Developments Activity (CACDA) at Fort Leavenworth was authorized 133 ORSA-related personnel, of whom 114 were professional ORSA analysts, and there were 103 professionals assigned (51 military and 52 civilians); LOGC was authorized 98 ORSA-related personnel, of whom 70 were professional ORSA analysts, and there were 59 professionals assigned (17 military and 42 civilians); and ADMINC was authorized 100 ORSA-related personnel, of whom 70 were professional ORSA analysts, and there were 38 professionals assigned (16 military and 22 civilians).[48] Five years later, in FY 1983, the three TRADOC integrating centers were authorized a total of only 24 ORSA-qualified military officers, of whom 18 were ODP-supported and 23 were on hand, and 75 civilian ORSA specialists, of whom 71 were on hand (for a fill percentage of 95 percent).[49]

In 1980, the Administration Support Center at Fort Benjamin Harrison was reorganized, given much enhanced doctrine and training responsibilities for personnel, administration, finance, and automatic data processing activities, and redesignated the United States Army Soldier Support Center (SSC).[50] The center's Institute of Administration was also replaced by the United States Army Institute of Personnel and Resource Management, under which were placed two branch schools, the Finance School and the Adjutant General School, and two new specialist schools, the Computer Science School and the Personnel Management School.[51] The 1982 TRADOC survey team found the organization of analysis at SSC to be inadequate and "from the aspect of the soldier as a combat multiplier is almost non-existent."[52] The survey team thus recommended that all analysts at SSC be consolidated into a unit similar to the Logistics Center's Operations Analysis Directorate and that there should be an increase of ten to twelve analysts in the new organization in order to increase in-house capability and lessen reliance on contractors.[53]

The 1982 TRADOC survey team also found the Logistics Center at Fort Lee to be well organized with its analysts concentrated in a single Operations Analysis Directorate headed by an experienced GM–15 ORSA specialist.[54] However, the team did point out several problems regarding the many models maintained by LOGC and suggested that LOGC models be more closely tied to other TRADOC models and that the assignment of the models to the TRADOC Operations Research Activity (TORA) and the establishment of a TORA East "offers perhaps the best solution to getting them into the mainstream of TRADOC analyses efforts."[55] They also suggested the formation of a Logistics Test Board, built around the existing Airborne Board, to centralize testing of logistics materiel.[56] In 1983, the position of commander of the LOGC was upgraded to a three-star billet and redesignated the TRADOC deputy commanding general for logistics.[57]

Among the three integrating centers, the Combined Arms Center at Fort Leavenworth was *primus inter pares* (first among equals). The bulk of CAC's ORSA capability was to be found in the Combined Arms Combat Developments Activity (CACDA), established in July 1973 at Fort Leavenworth as the successor to the CDC's Combat Arms Group. CACDA was responsible for the development of concepts, doctrine, organization and force structure, and materiel requirements for brigade and higher echelons. In 1982, CACDA was organized with ten directorates: Concept Development, Threats, Materiel Integration, Force Design, TRADOC Systems Manager, Combined Arms Studies and Analysis, Scenarios and Wargaming, C3I, Test and Evaluation, and Army Model Improvement.[58] In 1990, the commander of CACDA was redesignated the deputy commander of CAC for combat developments, and CACDA was subsequently disestablished in July 1994.

To accomplish the necessary studies and tests associated with its mission, CACDA required a significant number of technical experts in the areas of ORSA, economic analysis, war-gaming, computer modeling, and field testing and evaluation. The ORSA elements in CACDA, specifically the Combat Operations Analysis Directorate (COAD) and the War Gaming and Scenarios Directorate (WGSD), did substantial ORSA work on combat developments and training at the combined arms level but were perpetually understaffed.[59] In his presentation on the 1978–1979 Review of Army Analysis to attendees at Army Operations Research Symposium XVIII in

November 1979, E. B. Vandiver III mentioned the imbalance between CACDA's mission and its resources and noted that the analytical element in CACDA had only about eighty people but had "perhaps the toughest analytical problems in the Army which have to do with analyzing command, control, communications, and intelligence and with constructing large organizations by balancing across all of the functional areas."[60] Vandiver also noted that the RAA study group had recommended that the analysis capability at Fort Leavenworth be strengthened over three years to some 50 military and 100 civilian analysts and that CACDA develop analytical tools suitable for analysis of alternative designs of brigade, division, and corps organizations; establish actual interface with the TRADOC branch centers and with the Concepts Analysis Agency; and require that development and use of major organization models be coordinated with the Army hierarchy of models.[61]

The 1982 TRADOC survey team found that CACDA was well organized with respect to the utilization of its assigned analysts except in the C^3I Directorate, where assigned ORSA analysts were performing routine action officer functions.[62] The team concluded:

> a. There are enough personnel assigned to do the analytic tasks required at CACDA.
>
> b. Interns developed through an analytic agency program are stronger than those developed within a hardware directorate.
>
> c. Some of the spaces in C^3I should be examined for redesignation as program analysts.
>
> d. There is concern within directorates of CACDA that analytical support from CAORA [then newly established] will not be as responsive as was CASAA.
>
> e. The principal functions which analysts are providing within CACDA are (1) an objective, critical review of supporting analytical work; (2) interface with supporting analytic agencies; and (3) responsive support to CACDA in solving urgent important problems.[63]

Some limited ORSA capability also resided in other CAC elements, notably the Combined Arms Training Development Activity (CATRADA), which was responsible for training systems, doctrine, devices, techniques, and management. The 1982 TRADOC survey team noted the presence at Fort Leavenworth of eight ORSA spaces, of which two were filled, in the Command and General Staff College; five ORSA spaces, of which four were filled, in the High Technology Test Board; and two ORSA spaces, of which none were filled, in the National Training Center staff.[64] Another small but important TRADOC element involved in analytical work and located at Fort Leavenworth was the Army Model Improvement Management Office (AMMO). In May 1982, the TRADOC commander was designated the executive agent for the Army Model Improvement Program (AMIP) and chose to exercise his responsibilities through the Army Model Improvement Management Office, which was a CACDA element for most of the period under consideration. The AMMO mission was "to manage the development of a hierarchy of combat and training models (from battalion through theater levels) that are supported by consistent data bases."[65]

On 1 October 1990, during the tenure of General John W. Foss as TRADOC commander, the integrating centers were replaced with two major commands: the Combined Arms Command (CAC) at Fort Leavenworth and the Combined Arms Support Command (CASCOM) at Fort Lee, the latter being formed by a merger of the Soldier Support Center at Fort Benjamin Harrison and the Logistics Center at Fort Lee.[66] In 1994, TRADOC reacted to the changed strategic environment and growing budget constraints by trying to separate the combat developments process from the branch school system in order to make the process faster and more responsive. At the direction of the TRADOC commander, General Frederick M. Franks Jr., combat developments were transferred to a system of "battle laboratories," the principal one of which was the Battle Command Battle Laboratory (BCBL) at Fort Leavenworth, and HQ TRADOC centralized the integration of combat developments at Fort Monroe and eliminated CAC and CASCOM as integrating centers.[67]

TRADOC Systems Analysis Activity, 1974–1986

The first new organization created in TRADOC specifically dedicated to ORSA work was the TRADOC Systems Analysis Activity (TRASANA), established at White Sands Missile Range (WSMR), New Mexico, on 1 July 1974, with assets from the former SAFEGUARD Systems Evaluation Agency

(SAFSEA). TRASANA quickly became TRADOC's principal analysis agency focused on combat developments and training developments, supporting many important Army system Cost and Operational Effectiveness Analyses (COEAs) assigned to the branch schools, notably the "Big Five" Army weapons systems, and was particularly influential in the development of the new division structures and operational concepts that emerged in the late 1970s and early 1980s, such as Division 86, the Active Defense, Deep Attack/Deep Battle, and AirLand Battle.

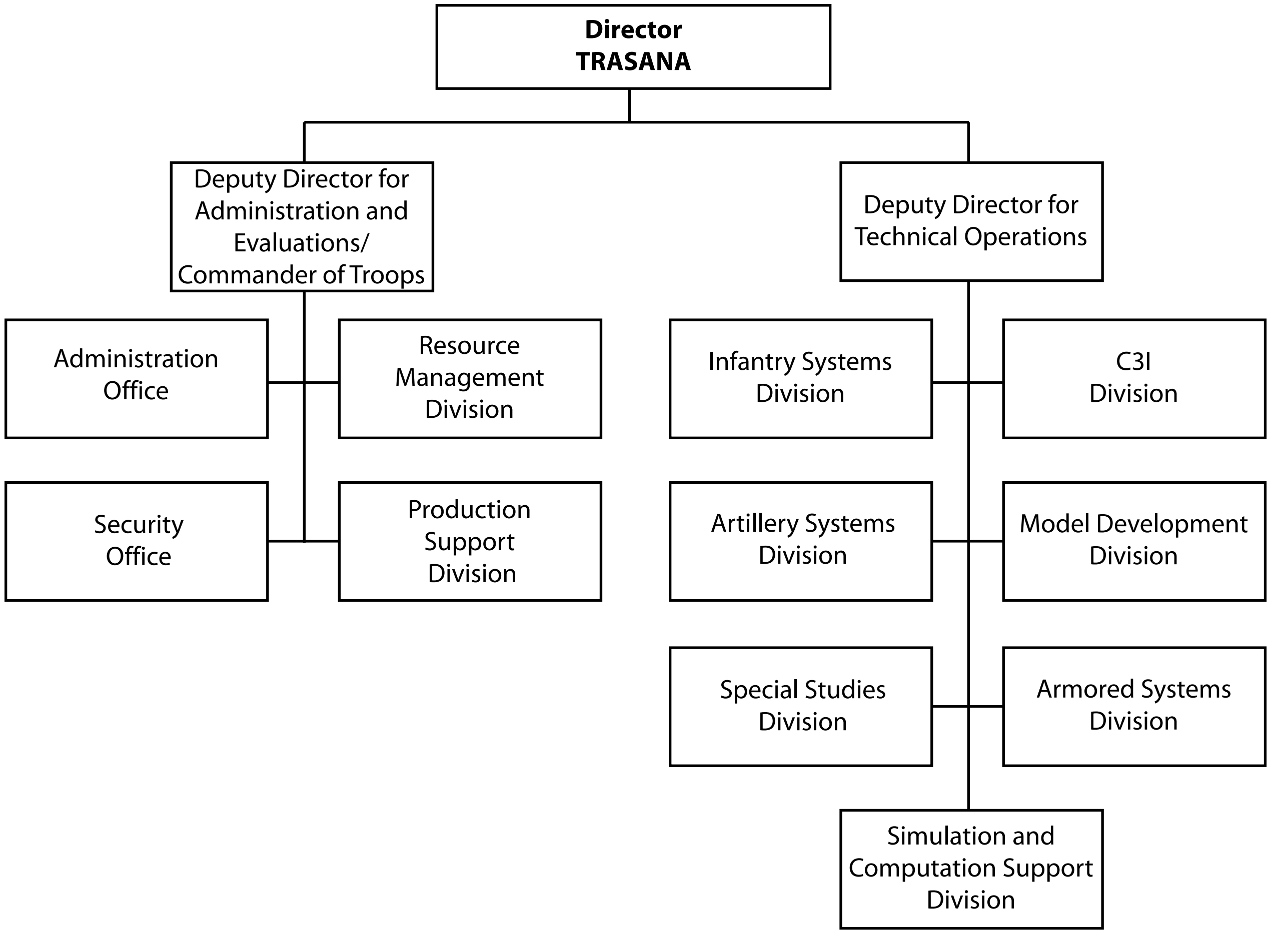
In early 1974, development of the SAFEGUARD antiballistic missile system was terminated in accordance with the terms of the Anti-Ballistic Missile (ABM) Treaty signed by President Richard M. Nixon and Soviet Premier Leonid Brezhnev on 26 May 1972, and ratified by the United States Senate on 3 August 1972. Soon after the signing of the ABM Treaty, Secretary of Defense Melvin R. Laird directed the Army to begin planning to suspend all SAFEGUARD programs prohibited by the treaty.[68] Cancellation of the SAFEGUARD development program left many scientists facing unemployment. Among the SAFEGUARD elements scheduled for closure was the United States Army SAFEGUARD Systems Evaluation Agency (SAFSEA) at White Sands Missile Range. In the early 1970s, WSMR employed almost five hundred people, and the director of SAFSEA, Leon F. Goode Jr., actively sought other Army users for his organization's expertise.[69] The pool of scientific and analytical talent represented by SAFSEA was attractive, and the new TRADOC commander, General William E. DePuy, seized the opportunity to enhance TRADOC's ORSA capabilities by making arrangements for the transfer of SAFESEA intact to TRADOC control.[70] The transfer was effective on 20 May 1974, and some 103 military and 235 civilian personnel were transferred to TRADOC.[71] The assets obtained from SAFSEA were reorganized and reestablished at WSMR as the TRADOC Systems Analysis Activity on 1 July 1974, in line with General DePuy's desires and the earlier recommendations of the Army Materiel Acquisition Review Committee, and Col. Martin L. Haskins was placed in command of the new analytical organization.[72]

The professional personnel transferred from SAFSEA were for the most part rocket scientists and engineers rather than ORSA analysts familiar with Army combat developments and training. To oversee their reorientation and to lead the new TRASANA organization, General DePuy prevailed upon Dr. Wilbur B. Payne, then the deputy under secretary of the Army for operations research, to leave Washington and become the director of TRASANA in November 1975.[73] Dr. Payne assumed direction of TRASANA on 30 November 1975, and set about making it TRADOC's principal analytical agency.[74]

TRASANA's mission was to serve as "the TRADOC center of analytical excellence for combat and training developments."[75] As such, TRASANA was responsible for conducting, monitoring, supervising, reviewing, and evaluating analyses for the TRADOC commander, including Mission Area Analyses (MAAs), Cost and Operational Effectiveness Analyses (COEAs), and Training Effectiveness Analyses (TEAs).[76] TRASANA was also responsible for analyses in such areas as the vulnerability and survivability of theater nuclear forces and electronic warfare, including countermeasures and counter-countermeasures, as well as developing, jointly with CACDA, models of combined arms warfare to support TRADOC-wide combat and training developments.[77] While TRASANA did not control the other elements of the TRADOC analytical community, it did maintain close contact with the integrating centers, particularly CAC, and the TRADOC schools and test boards. The 1982 TRADOC survey team members noted in their report, "Most of the end products of the TRASANA efforts are in support of schools and centers. A continuous and intimate participation is required if analysis is to have its biggest pay-off and if the schools/centers are to benefit from the impressive analytical capabilities at TRASANA."[78]

To perform its mission, TRASANA was initially organized with the usual command group and administrative and support elements plus eight mission-oriented directorates (Infantry Systems, Artillery Systems, Armored Systems, C3I, Systems Engineering, Simulation and Computation, SAM-D Vulnerability Studies, and SAFEGUARD Evaluation).[79] By 1977, changes in TRASANA's mission and the TRADOC commander's emphasis on the Army Model Improvement Program resulted in the organization of TRASANA shown in Figure 6–1. The two SAFEGUARD-related directorates

FIGURE 6–1—ORGANIZATION OF TRASANA, 1977



Source: *TRAC-WSMR History*, White Sands Missile Range, N.Mex.: HQ TRAC-WSMR, c. 2001, copy in TRAC History File, CAC Historian's Office, pp. 4–7 passim.

were disbanded, the Systems Engineering Directorate was redesignated the Special Studies Division, and the Analysis Support Division was redesignated the Model Development Division. A Training Effectiveness Analysis Division was added in October 1978. The TRASANA divisions were led by senior (GM–15) civilian ORSA specialists.

TRASANA was by far the largest TRADOC analytical organization during the period 1974–1986. The RAA study group found that in FY 1978 TRASANA was authorized 321 personnel, of whom 232 were ORSA professionals, and there were 203 professionals (27 military and 176 civilian) present for duty.[80] The 1982 TRADOC survey team found TRASANA was authorized 201 professional ORSA personnel, both SC 49–qualified officers and Series 1515 civilians, of which 182 were on hand.[81] The RAAEX study group found that in FY 1983 TRASANA was authorized 38 SC 49–qualified spaces, of which 36 were ODP-supported and 23 filled, as well as 180 civilian ORSA specialists, of whom 174 were present for duty (a fill rate of 97 percent).[82]

The team that conducted the 1982 survey of TRADOC analysis agencies characterized the overall organization and operation of TRASANA as excellent.[83] They did, however, note that TRASANA had no dedicated research element and no directorate specializing in testing and that TRASANA's ability to deal with the AirLand Battle was "fragmented."[84] Modeling was an important TRASANA activity, and the 1982 survey team was critical of the fact that responsibility for "development and maintenance of models is fragmented through the organization, with a possible loss in efficiency," and that TRASANA force-on-force models did not "deal adequately with logistics."[85] With respect to models, the team stated in their report that

> the model, here defined as a war game with varied degrees of computer support up to and including completely automated games form the bulk of the TRASANA analytical tools. Models are challenging and interesting. They produce most of the numbers on which TRASANA analysts do their analysis, so that they must be acquainted with how the model operates. However, there is no necessity that the analysis [analysts] get involved in the details of model development, and several reasons why they should not. It sometimes appeared to the review group that everyone in TRASANA was building models. While that is certainly not true, as an example, we found it difficult to determine who was responsible for a particular model, such as VECTOR.[86]

The RAA Study Group Critique, 1979

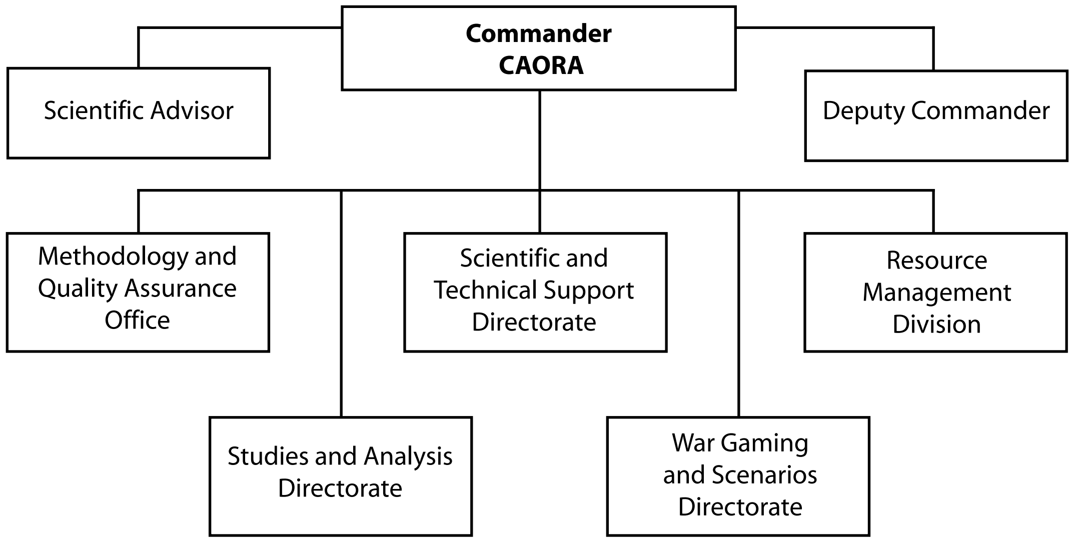
The 1978–1979 Review of Army Analysis study group identified eighteen separate TRADOC analytical elements responsible for conducting studies and analyses, which comprised about 30 percent of the Army's total ORSA assets.[87] In general, the study group was critical of TRADOC analytical efforts. They found, for example, that the TRADOC schools and integrating centers bore "the bulk of the analytical responsibility" for analyzing the functional systems, including small units and requirements for item level systems, yet they were inadequately staffed, particularly with respect to officers in the SC 49 ORSA specialty.[88] The study group thus recommended improvements in the quantity and quality of analysis devoted to functional systems, "especially the intelligence/fusion and control functions," by filling authorized TRADOC SC 49 positions with qualified officers; placing more emphasis on analysis of the control functional area; establishing "a continuing study program in each functional area [i.e., each Battlefield Functional Area] to underpin item level system requirements"; increasing TRADOC analysis resources devoted to training effectiveness analyses with a concomitant reduction in COEA efforts; and coordinating the development and use of models of functional systems with the Army hierarchy of models.[89] The RAA study group also found a number of areas for improvement in the analysis of item level systems, noting, "The tendency of TRADOC to not analyze adequately and specify a full range of environments of use of item systems is paralleled by a DARCOM [i.e., AMC] tendency to not examine the performance of items over the full set of conditions of use."[90]

The RAA study group zeroed in on the deficiencies of the Combined Arms Combat Developments Activity analysis capability. Their basic finding was that the analytical resources available to CACDA were "insufficient to support the very demanding mission of designing large combined arms and support organizations."[91] They also found that, due to inadequate capability and inadequate tools and techniques, CACDA could not "responsively design and analyze brigades, divisions, and corps," and that there was "inadequate linkage between combat development studies of large organizations and HQDA sponsored studies of forces" and "between combat development analyses and analysis in support of training developments, especially the training war games and simulations."[92] To solve these problems, the study group recommended an increase of about 150 professional analyst spaces (50 military and 100 civilian) and their concentration in a TRASANA field office in direct support of CACDA; the development of techniques for the analysis of alternative organizational structures; the establishment of an actual interface between CACDA and the other TRADOC integrating centers and schools; and the coordination of major organization models, including command group training simulations, with the hierarchy of Army models.[93]

Combined Arms Operations Research Activity, 1982–1986

By the early 1980s, it was obvious to all that some consolidation and greater centralized direction of the TRADOC analytical community was needed, and the largely negative comments of the 1978–1979 RAA study group were an important factor in precipitating TRADOC efforts to substantially reorganize and refine its analytical organization. As a first step in that direction, the Combined Arms Studies and Analysis Agency (CASAA), the analytical element in the Combined Arms Combat Developments Activity at Fort Leavenworth, was transformed into an independent entity, the Combined Arms Operations Research Activity (CAORA). CAORA was provisionally organized on 1 October 1982

Figure 6–2—Organization of CAORA, December 1985



Source: Brig. Gen. David M. Maddox, "CAORA, ORSA, and Army Analysis," *Phalanx* 18, no. 4 (December 1985): 24–25.

with the merger of CASAA with the CACDA War Gaming and Scenarios Directorate and the Battlefield Simulation Division of the Combined Arms Training Development Activity (CATRADA), which was concerned with training models.[94] CAORA was then officially established on 1 January 1983, pursuant to HQ TRADOC Permanent Orders 28-2, dated 18 March 1983.[95] Brig. Gen. John L. Ballantyne III was assigned to command the new organization assisted by a senior civilian deputy.[96] As an additional duty, the commander of CAORA also served as the executive agent of the CAC commander, who was the Army proponent for the ORSA Officer Specialty Program (Functional Area 49).[97]

The assigned mission of CAORA was to

> serve as the TRADOC Analysis and Research Center for Combined Arms Combat and Training Developments from brigade through echelons above corps. Develop and apply techniques in systems analysis, operations research, artificial intelligence, computer simulations, scenario development, and automated war gaming. Produce combat scenarios, combat knowledge data bases, simulations and war games, and studies and analyses.[98]

To perform its assigned missions and functions, CAORA was initially organized with a command group consisting of the commander (a brigadier general), a GM–15 deputy commander; a GM–15 scientific advisor; a Resource Management Office; a Management Information Systems Office; and five mission-oriented directorates (War Gaming and Scenarios, Studies and Analysis, Data Management, Resource and Support, and Training Simulation).[99] CAORA was reorganized in 1983. The Data Management and Training Simulation directorates were eliminated, the Resource and Support Directorate was renamed the Scientific and Technical Support Directorate, and a Methodology and Quality Assurance Office and a Corps Battle Analysis Directorate were added.[100] By the end of 1985, CAORA had developed the organization shown in Figure 6–2.

The Studies and Analysis Directorate focused on force design, command and control, operations, and systems involving combined arms, and the War Gaming and Scenarios Directorate prepared and conducted war games, developed TRADOC standard scenarios for combat developments, approved war game simulations scenarios, and operated the division/corps war-gaming facility. The Scientific and Technical Support Directorate developed, acquired, managed, documented, and provided data and technical information services in support of the CAORA mission and served as the nexus connecting the major TRADOC test installations and Army test centers with respect to data requirements. The Scientific and Technical Support Directorate also managed, operated, and maintained CAORA's computer and audiovisual support facilities; developed, evaluated, and validated combat models and training simulations; and conducted applied research on the application of advanced graphics, video, and artificial intelligence technology to support war games and simulations. The Methodology and Quality Assurance Office and the Resource Management Division also provided support to the other elements of CAORA.

CAORA was established with an authorized strength of eighty-one officers, fourteen enlisted personnel, and ninety-five civilians, most of whom came from CASAA.[101] With respect solely to ORSA-qualified personnel, the 1982 TRADOC survey team found that CAORA was authorized twenty-three ORSA officers (eighteen on hand) and sixty-nine ORSA civilians (fifty-nine on hand), plus twenty interns.[102] The shortage was thus fifteen analysts, or about 15 percent, which was equal to or better than most TRADOC installations. As of 15 June 1983, the total number of authorized personnel had changed to 78 officers (68 ODP-supported and 58 on hand), 11 enlisted personnel, and 100 civilians.[103] By the end of 1985, CAORA was authorized a total of 89 officers and 94 civilians.[104] CAORA was officially discontinued on 2 October 1986, pursuant to HQ TRADOC Permanent Orders 128-4, dated 30 September 1986, with an authorized strength at that time of 87 officers, 17 enlisted personnel, and 135 civilians.[105]

The 1982 TRADOC survey team conducted a detailed review of the newly formed CAORA and concluded:

> (1) The documentation implementing the reorganization [which created CAORA] is incomplete and out of date.
>
> (2) It has still not completely defined its relationship with CACDA and appears to be doing some CACDA missions. It lacks a research capability.
>
> (3) The CORDIVEM [Corps Division Evaluation Model] task force is fragmenting the operation of CAORA. Some plan should be made for returning task force members to their parent CAORA directorates, or a CORDIVEM directorate should be established with consequent reorganization of the other CAORA directorates, particularly Studies and Analysis Directorate.
>
> (4) Studies and Analysis Directorate has little or no capability to conduct analyses in the C^3I area. It should be expanded to include this capability, with the C^3I directorate of CACDA being a possible source of qualified personnel.
>
> (5) CAORA must do something to strengthen its ability to discharge its responsibilities as the SC49 proponent. The single officer now assigned to this task cannot do more than push papers.
>
> (6) CAORA has no research element.[106]

The survey team also noted in its report that

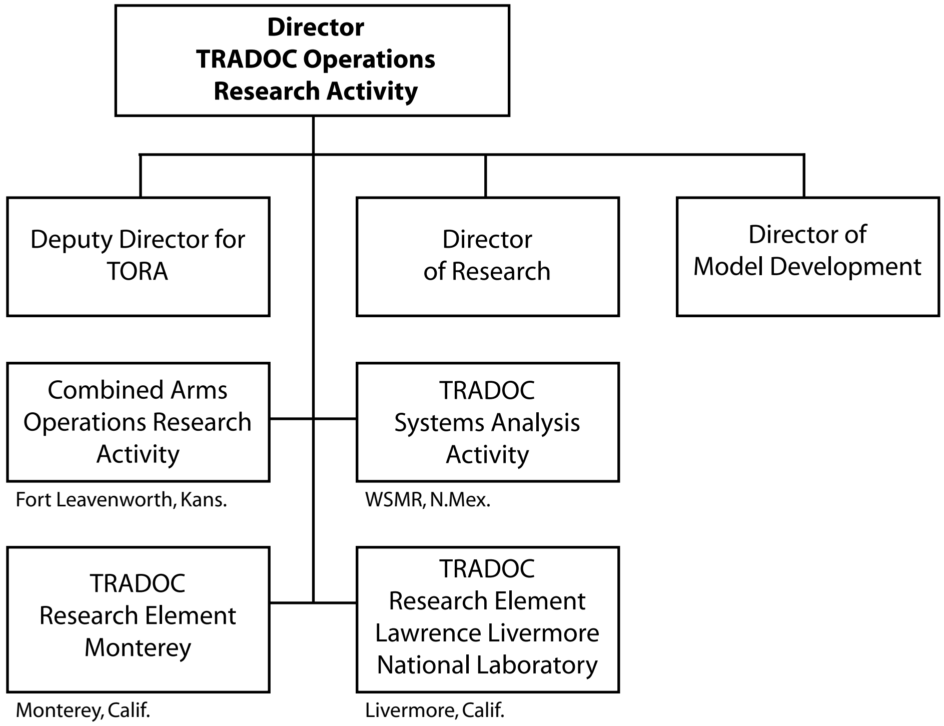
> CAORA primarily supports CACDA, but under TORA it may acquire a wide mission. While the CAORA predecessor was a part of CACDA (CASAA), the line of demarcation between the two agencies was not always clear, and that fuzziness continues. If CAORA is to support CACDA it needs analytical tools to do the job. CAORA, like other TRADOC elements, is not implementing the TRADOC Study Program. CAORA is in a shakedown period, and its exact mode of operation can be expected to evolve over the next six months.[107]

TRADOC Operations Research Activity, 1982–1986

Another important step toward consolidation and greater central direction of TRADOC analytical activities was taken with the establishment of the TRADOC Operations Research Activity (TORA) at White Sands Missile Range on 1 October 1982. The TRADOC commander, General Glenn K. Otis, directed the establishment of TORA to oversee and coordinate the work of the ORSA elements in the TRADOC integrating centers and schools, TRASANA, and CAORA and to "provide the interface with Headquarters, Department of the Army" as well as to satisfy "the requirements for closer ties between training and combat developments."[108] TORA was placed under the direction of Dr. Wilbur B. Payne, who was reassigned from his position as director of TRASANA.[109] As director, Dr. Payne reported directly to the TRADOC deputy commander for combined arms (i.e., commander, CAC) at Fort Leavenworth.[110]

As part of the plan to establish TORA, on 1 January 1983, TRASANA at WSMR, the newly created CAORA at Fort Leavenworth, and the TRADOC Research Element at Monterey, California (TREM), were formally placed under TORA command, as were some smaller TRADOC analytical elements.[111] The directors of TRASANA, CAORA, and TREM were designated as deputy directors of TORA, the organization of which was as shown in Figure 6–3.

Figure 6–3—Organization of TORA, 1983



Source: *TRAC-WSMR History*, p. 9.

The stated mission of TORA was similar to that previously assigned to TRANSANA.[112] The TORA concept plan provided that the functions of TORA were to:

1. Perform force and mix, materiel acquisition, and personnel and logistics analyses.

2. Perform training effectiveness analyses.

3. Perform requirements studies and other studies.

4. Perform analyses in support of combat developments.

5. Develop models and simulations required to support combat and training developments.

6. Establish, maintain, and operate the data bases required to support combat and training developments.

7. Develop and maintain scenarios required to support combat and training developments and approve those to be employed in analysis.

8. Establish and maintain scientific interface with other national and international analytical organizations.

9. Perform resource management function for TORA elements.

10. Provide quality assurance of TORA products and processes.

11. Establish and execute an applied research program for advancing the state-of-the-art of military operations research.

12. Establish and maintain organizational element at Lawrence Livermore National Laboratory, Naval Post Graduate School, and other designated activities as directed.[113]

Further Recommendations for Change

In 1982, soon after the provisional organization of CAORA and the establishment of TORA, HQ TRADOC undertook its own comprehensive survey of the state of the TRADOC analysis community. The study, done at the direction of the TRADOC chief of staff, involved detailed interviews with ORSA managers and analysts at nearly all of the TRADOC agencies to which analysts were assigned, with the exception of the Missile and Munitions School at Redstone Arsenal, Alabama, and the Ordnance School at Aberdeen Proving Ground, Maryland.[114] In addition to the TRADOC schools, the study included CACDA, LOGC, SSC, TORA, TRASANA, CAORA, TREM, TCATA, and CDEC. The interview teams were headed by a representative of the

TRADOC deputy chief of staff for combat developments and included a representative of the deputy chief of staff for resource management as well as a representative of the deputy chief of staff for training on visits to agencies or schools with a large training interest (except Fort Leavenworth). Representatives of the deputy chief of staff for testing and evaluation participated in visits to CDEC and TCATA. More than 300 of the approximately 600 analysts then employed by TRADOC were interviewed, with the interviews concentrated at the working level (GS–14 and below).

Each chapter in the survey team's report addressed one of the TRADOC analytical organizations and contained sections on overview, organization, operations, relationships, personnel, and controls as well as recommendations for improvement. Paragraph 2 of Chapter 1 contained an overview of the study, which asserted, "On the modern battlefield, systems and the units which fight them will be complex and expensive" and "One factor which offers a great potential for assisting in coming up with the right answer (re decisions on what weapons, organizations, and doctrines to pursue) is a convincing analysis. All armies and all services have turned increasingly to analysis to help in decision making."[115]

The survey team also noted, "TRADOC has a full complement of ORSA personnel, involved in every principal activity of the command, but concentrated in combat developments, training developments, and testing."[116] In fact, they found approximately 700 "requisitionable" analysts (i.e., SC 49 ODP-supported military and GS–1515 authorized civilian positions), divided into about one-third military and two-thirds civilians. Of the 700, about 600 spaces were filled (28 percent of the military spaces and 72 percent of the civilian spaces). Every TRADOC center and school, except those under the purview of the Soldier Support Center, was found to have an ORSA element, and there were larger numbers of analysts in TORA, CDEC, and TCATA. With respect to these military and civilian analysts, the survey team opined:

> While ORSA specialists by themselves do not perform the major work in TRADOC, they make a major contribution to it by providing a catalyst that specifies the data needed and then applies the data to accomplishment of the task. They provide the numbers and the analytical logic which assists the commander in making his decision.[117]

While the survey team considered the need for analysis as evident, they noted several gaps in the adequacy of the analytical effort needed to support major TRADOC decisions. Those deficiencies included:

> (1) The lack of uniformity or pattern among the TRADOC schools indicates that some may be inadequate or inefficient or both.
>
> (2) The lack of responsiveness of the analysis community to questions posed to it reduces confidence and causes decision makers to seek more subjective solutions.
>
> (3) The dependency of combat developments and to a lesser extent training developments on computerized models can only be accepted if some constraint is put on the number of models in use.
>
> (4) Turbulence and inadequate fill reduce the contribution of military analysts.
>
> (5) Failure of TRADOC agencies to adhere to management guidance results in devoting ORSA talent to task of low priority from a TRADOC standpoint and makes difficult the allocation of ORSA resources to principal TRADOC efforts.
>
> (6) Lack of definition of the place of school analysts in the training developments function deprives training development of a sound analytic base.
>
> (7) The lack of interaction and tie-in of the various analysis efforts at HQ TRADOC with a consequent tendency to separation among CD, TD and TE elements in the command make analyses parochial.[118]

The TRADOC survey team also addressed the problem of controls and noted, "To obtain the maximum results from ORSA resources, there must be adequate controls to assure that they are performing what is needed by the command. These controls are established at different echelons, but all have the common purpose of assisting decision-makers."[119] The principal controls cited were the TRADOC Study Program and the basic document on detailed implementation of the program, *TRADOC Regulation 5–3: The TRADOC AR 5–5 Study Program*. The survey team found that not all TRADOC analytical agencies were adhering to the provisions of the TRADOC Study Program, and that taskings at the individual level in all agencies were seldom written down; supervision of the details of the technical work done by ORSA personnel was lacking at most schools and boards, although not in the larger agencies; quality control was inadequate; and there was a tendency to lose touch with "the realities of the battlefield."[120]

To ensure that the deficiencies cited received corrective action, the survey team included a long list of recommendations focused on organization, operations, relationships, personnel, and controls.[121] Of particular interest were recommendations to consolidate logistics ORSA activities at the LOGC, improve the analytical capabilities of CAORA, require all TRADOC schools to adhere to the model for ORSA in the TRADOC schools, improve ODP fill, balance the proportions of military and civilian analysts, provide a senior analyst at GM–14/15 level for each large and medium school, initiate formal intern and professional development programs, improve internal management controls, document all taskings, and provide proper supervision of technical details of analysis.[122]

The 1982 TRADOC ORSA survey was followed in 1985 by the much broader Review of Army Analysis Extended (RAAEX), which sought to ascertain, with respect to the entire Army analytical community, the degree to which the recommendations of the 1978–1979 Review of Army Analysis had been carried out. A number of the RAA recommendations pertained to TRADOC ORSA elements, and the RAAEX study group found that, in general, TRADOC had taken appropriate action to remedy defects in its ORSA program uncovered by the RAA study group.[123] TRADOC had initiated "the development of techniques suitable to analyze the design of alternative brigades, divisions and corps"; established interfaces of CACDA with the TRADOC centers and schools, TRASANA, and CAA to "provide the linkages necessary to mission accomplishment of these agencies"; established, in the form of the Concept Based Requirements System and the Mission Area Analysis, "a continuing study program in each functional area to underpin item level system requirements"; increased "the portion of TRADOC analysis resources that are applied to analysis of training" and reduced the effort on COEA accordingly; and improved the documentation of requirements.[124]

Despite its generally favorable report, the RAAEX study group noted that much remained to be done, by TRADOC as well as the other elements of the Army analytical community. Among the priority items noted were the need for TRADOC to review its authorizations and ODP support for both military and civilian ORSA specialists in the functional centers and schools, compare them with the anticipated analytical workload, and consider redistributing its ORSA authorizations accordingly.[125] Another area of concern was the adequacy of computer support available to TRASANA, LOGC, SSC, and the TRADOC functional centers and schools and the electronic linking of the Army's major analytical organization, including CAORA and TRASANA. The RAAEX study group also noted the need for better coordination in the analysis field with the United States Air Force, the lead to be taken by TRADOC as the Army's combat developer.[126]

The Establishment of the TRADOC Analysis Command, 1986

The cumulative effect of the 1982 TRADOC ORSA survey and the 1985 Review of Army Analysis Extended was to reinforce the growing perception of TRADOC leaders that TORA had not fulfilled their expectations for consolidation and central direction of the TRADOC analytical community. By the mid-1980s, it was clear that there were problems with TORA and that despite his many positive qualities, the director of TORA, Dr. Wilbur B. Payne, was not getting the job done.[127] Moreover, the TRADOC commander at the time, General William R. Richardson, was a traditional and somewhat humorless leader, and he was not enamored of Wilbur Payne's eccentric and iconoclastic style.[128]

The original plan in 1982 had been for TORA to move eventually to Fort Leavenworth, but Dr. Payne was unwilling to leave White Sands and the plan had been set aside. However, during a visit to White Sands Missile Range on 13 June 1983, General Richardson told Dr. Payne that both TORA and TRASANA should be moved to Fort Leavenworth in order to "truly make it the focus of Army analysis."[129] Dr. Payne agreed that was a proper long-term objective, and on 30 June 1983, General Richardson initiated a study of the feasibility of moving both TORA and TRASANA to Fort Leavenworth. E. B. Vandiver III, then the technical advisor to the DA DCSOPS, led the study, and the CONCISE Office of HQ TRADOC did most of the legwork. A concept plan was prepared by mid-July and plans were set for a decision on the move in October 1983. However, on 31 August 1983, Senator Pete V. Domenici (R-NM) came out strongly against the move of TORA and TRASANA from New Mexico, and in September 1983, the Army's vice chief of staff officially killed the plan.[130] Nevertheless, the idea of further consolidation of the TRADOC analytical community and the creation of its focal point at Fort Leavenworth persisted.

By the fall of 1984, Dr. Payne was in conflict with both HQ CAC and HQ TRADOC over the "fidelity and capabilities" of both the Combined Arms and Support Task Force Evaluation Model (CASTFOREM) and JANUS model, both of which were "providing answers these two headquarters were loath to believe."[131] Junior officers at both headquarters were complaining to their superiors about Dr. Payne's ineptness at modeling, and Payne was confronted with the accusation that TORA lacked the capability to support TRADOC analysis efforts.[132] He addressed the problem of unfounded accusations and the failure of his bosses to "seek the correct answers" by firing off a "clear, concise, factual, honest and forthright" backchannel message composed in his own inimitable manner, the first sentence of which read, "Your subordinates know as much about combat modeling as I do about Nigerian tax policy."[133]

The CAC and TRADOC commanders both got the message, and there was no further overt questioning of TORA's modeling capabilities. However, General Richardson remained unhappy with Dr. Payne's performance and thus initiated the creation of a new umbrella organization, to be known as the TRADOC Analysis Center (TRAC), which would be led by a general officer rather than a civilian.[134] A concept plan calling for the disestablishment of TORA and the establishment of TRAC headquartered at Fort Leavenworth under the command of a general officer was drawn up and submitted to HQDA for approval on 18 February 1986.[135] The concept plan called for the new TRAC to assume control of the TRADOC analysis elements at Fort Leavenworth (CAORA), White Sands Missile Range (TORA and TRASANA), Monterey (TREM), and Lawrence Livermore National Laboratory (TELL) and to transform them into a single integrated organization.[136] The TRADOC deputy chief of staff for combat developments, then Maj. Gen. G. M. Krausz, noted:

> We planned TRAC to be "TORA with teeth." Organizationally, TRAC is still comprised largely of TRASANA and CAORA, representing a "paper" merger. This time, however, the bond will be made stronger by a well-heeled TRAC headquarters collocated with CAC and resourced to execute day-to-day centralized command and control, resource management, and quality oversight of TRAC.[137]

TRAC was established at Fort Leavenworth as a provisional organization on 1 May 1986, and Lt. Gen. Robert W. RisCassi, the TRADOC deputy commanding general for combined arms (DCG-CA) and commander, CAC, was designated as the commander of the new organization, primarily to avoid legal problems.[138] The commander of CAORA, Brig. Gen. David M. Maddox, was designated the deputy commander of TRAC during the provisional period inasmuch as the 18 February 1986 concept plan provided that the commander of CAORA would become the commander of TRAC upon its formal establishment.[139]

The TRAC concept plan was approved by HQDA on 25 April 1986, and pursuant to HQ TRADOC Permanent Orders 128-5, dated 30 September 1986, TRAC was formally established on 3 October 1986, with an authorized strength of 153 officers, 2 warrant officers, 56 enlisted personnel, and 444 civilians.[140] Two of the elements from which TRAC was created, TORA and CAORA, were discontinued on 30 September and 2 October 1986, respectively, and their assets reassigned to TRAC.[141]

TRAC Mission and Functions, 1986–1995

The objective of the establishment of TRAC was to provide "TRADOC-wide leadership in analysis, establish procedures permitting a balance between centralized and decentralized management, and fix responsibility with the goal of timely and quality assigned products."[142] As the TRAC commander in 1989, Brig. Gen. Robert T. Howard, stated, "TRAC provides the common ground where Combat Developments (CD) and Training Developments (TD) join together in simulation and analysis."[143] Accordingly, the mission and functions initially assigned to TRAC were to

> serve as the TRADOC center for analysis excellence for all combat, training and doctrinal development. TRAC conducts, monitors, supervises and reviews studies of the integrated battlefield related to organization, training, doctrine, and material for TRADOC and other Army agencies. TRAC is responsible for designing and developing models and simulations for combat and training developments and for establishing, maintaining, and managing the data bases, scenarios, wargaming, and training simulations facilities required to support analyses, studies, and battle staff training. Finally, TRAC

> establishes and manages technical exchange interfaces with national and international scientific organizations and conducts research on methodologies to address critical Army functions.[144]

The DUSA (OR) restated the functions performed by TRAC as part of the 1989 Army Management Review. At that time, TRAC's functions included:

> (a) Performing COEAs and CTEAs [Cost and Operational Effectiveness Analyses and Cost and Training Effectiveness Analyses].
>
> (b) Conducting force design analyses at corps level and below.
>
> (c) Developing major scenarios for corps level and below.
>
> (d) Performing other studies such as trend line analyses and trade-off studies.
>
> (e) Providing analytical support to TRADOC studies performed outside of TRAC.
>
> (f) Developing analytical models and training simulations for the Army.
>
> (g) Managing the TRADOC's portion of the AR 5–5 study program.[145]

In 1995, Iris Kameny, the chair of the Army Science Board Analysis, Test, and Evaluation Issue Group, sent a report to Walter W. Hollis, the DUSA (OR), stating that the key tasks assigned to TRAC were to conduct studies and analyses; develop and apply models; validate and verify simulations; support the TRADOC battle labs; develop standard scenarios for war games and simulations; develop and maintain databases; and conduct research on battlefield phenomenology to improve analysis and modeling.[146]

Over time TRAC also accumulated extensive responsibilities for liaison with the other services, the CINCs, and allied nations and cooperated on a number of joint and allied studies, including the US/UK Counter Target Acquisition System; the US/FRG Combined Air Defense; the Joint Surveillance and Target Attack Radar System (JSTARS); and the Unmanned Aerial Vehicle (UAV) COEA.[147] TRAC also participated in one-for-one analyst exchange programs with the United Kingdom and Australia and was active in the Quadripartite Working Group/Army Operations Research (QWG/AOR) with the United Kingdom, Canada, and Australia.[148]

TRAC Organization, 1986–1995

The TRADOC Analysis Center was activated at Fort Leavenworth on 3 October 1986, but it was not until January 1987 that the new TRADOC commander, General Carl E. Vuono, issued a formal Letter of Instruction (LOI) for the new organization.[149] The LOI provided that the name of the organization was to be the TRADOC Analysis Command as opposed to TRADOC Analysis Center, and that it would be TRADOC's principal operations research activity, "a single integrated organization to serve as the center for analytic excellence for combat, training, and doctrinal developments."[150] TRAC was to be headquartered at Fort Leavenworth, and the necessary manpower resources were to come from HQ TRADOC and the deactivation of TORA. The TRAC commander's position was established as a major general but only resourced as a brigadier general, and the TRAC deputy commander was to be a member of the Senior Executive Service (SES). The headquarters of the new organization would include a Resource and Management Directorate (RMD) to advise the commander on the allocation of resources both at Fort Leavenworth and WSMR, and a Planning and Research Directorate (PRD) to monitor quality assurance and the integration of TRAC's analytic work. The 8 January 1987 LOI also designated the TRAC commander as not only the executive agent for the FA 49 Proponent (the CAC commander) but also as the TRADOC career program manager for the Series 1515 (operations research analyst) subelement of the civilian Career Program 16 Engineer and Scientist Non-Construction Career Program.[151] The commander, TRAC, was also given authority to control the Officer Distribution Plan (ODP) and civilian personnel actions for all TRAC elements.

The LOI also provided for TRAC to absorb CAORA, which was to be reorganized as TRAC-Fort Leavenworth (TRAC-FLVN), and TRASANA, which was to be reorganized as TRAC-White Sands Missile Range (TRAC-WSMR).[152] The TRADOC Research Element at Monterey and the TRADOC Research Element at Lawrence Livermore National Laboratory were also to be absorbed by TRAC and redesignated TRAC-Monterey (TRAC-MTRY) and TRAC-Lawrence Livermore (TRAC-LL), respectively.[153]

The 8 January 1987 LOI also provided for the creation of four new elements under TRAC command. The TRADOC DCS-CD Studies and Analysis Directorate (S&AD) was to be transferred to HQ TRAC but would remain physically at Fort Monroe as the TRAC Requirements and Programs Directorate (RPD).[154] New TRAC elements were also to be established at Fort Lee, Virginia (TRAC-Fort Lee, or TRAC-LEE), Fort Benjamin Harrison, Indiana (TRAC-Fort Benjamin Harrison, or TRAC-FBHN), and Los Alamos National Laboratory, New Mexico (TRAC-Los Alamos, or TRAC-LA).[155] The effective date for the conversion of the TRADOC DCS-CD Studies and Analysis Directorate to TRAC RPD was set at 4 October 1986, and TRAC-LEE and TRAC-FBHN were to be established provisionally on 1 April 1987 and officially on 4 October 1987.[156]

Unlike its predecessor, TORA, whose Director reported to the CAC commander, the commander of TRAC reported directly to the TRADOC commander. This was done to ensure that TRAC analysis was unaligned with proponent interests, balanced in its treatment of combined arms, and accomplished in accordance with the priorities of the TRADOC commander.

Execution of the 8 January 1987 LOI resulted in the organization of TRAC shown in Figure 6–4.

Major Subordinate Elements of TRAC, 1986–1990 and Beyond

In addition to those elements included in the headquarters at Fort Leavenworth and at HQ TRADOC, TRAC consisted of a number of subordinate organizations spread throughout the country. Those elements changed over time as TRAC was reorganized to accommodate changes in mission requirements and reduced resource allocations. The two largest such elements, TRAC-FLVN and TRAC-WSMR, were the workhorses of the TRAC analysis, simulation, and war-gaming team, focusing respectively on division level and above and brigade level and below. The TRAC elements at the other two TRADOC integrating centers, the Logistics Center at Fort Lee, Virginia, and the Soldier Support Center at Fort Benjamin Harrison, Indiana (TRAC-LEE and TRAC-FBHN, respectively), played important roles in integrating and coordinating the analytical work being done in the TRADOC centers and schools and in the functional areas within their respective purviews. Finally, by 1989 a number of the smaller TRADOC analytical elements (TRAC-MTRY, TRAC-LL, and TRAC-LA), which performed important liaison and research activities and contributed to TRAC's analyses, simulations, and war games, had been placed under the TRAC director of research, whose office was co-located with TRAC-WSMR in New Mexico.

TRAC-Fort Leavenworth

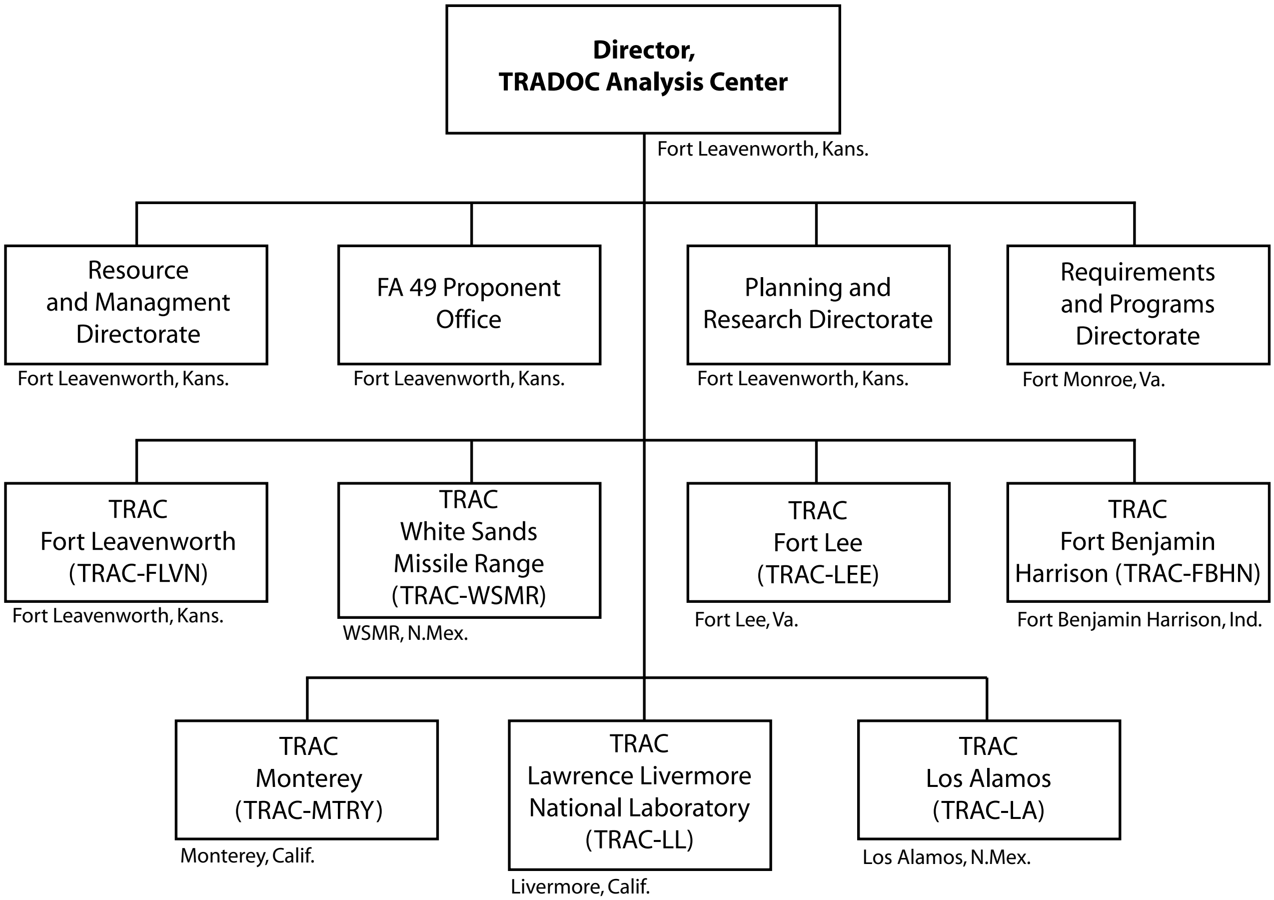
Pursuant to HQ CAC and Fort Leavenworth Permanent Orders, dated 30 January 1987, the United States Army TRADOC Analysis Center-Fort Leavenworth (TRAC-FLVN) was officially organized on 3 October 1986, with an authorized strength of 98 military and 125 civilian personnel. TRAC-FLVN focused on studies, analyses, and model development at the division and corps level in three main areas: (1) materiel systems (technology and hardware) requirements; (2) combat organizations; and (3) operational concepts, including the integration of forces, doctrine, and concepts of operations. TRAC-FLVN was organized as shown in Figure 6–5.

Two men served as director of TRAC-FLVN from 1986 to 1991, when TRAC-FLVN was disestablished and its subordinate elements were reorganized directly under HQ TRAC as the TRAC Operations Analysis Center (OAC), the TRAC Studies and Analysis Center (SAC), and the TRAC Scenarios and Wargaming Center (SWC).[157] TRAC-FLVN was authorized a member of the SES as director, but the first director was Col. S. K. Wasaff Jr., who served from 1 October 1986 to 1987, while the Director's position was established and recruited as an SES civilian. Colonel Wasaff was followed by Dr. Robert La Rocque, who served from 1987 to 1991 as the first SES director of TRAC-FLVN.

TRAC-White Sands Missile Range

TRAC-White Sands Missile Range (TRAC-WSMR) was officially established on 3 October 1986 as the successor to TRASANA with an authorized strength of 88 military and 292 civilian personnel,

Figure 6–4—Organization of TRAC, April 1987



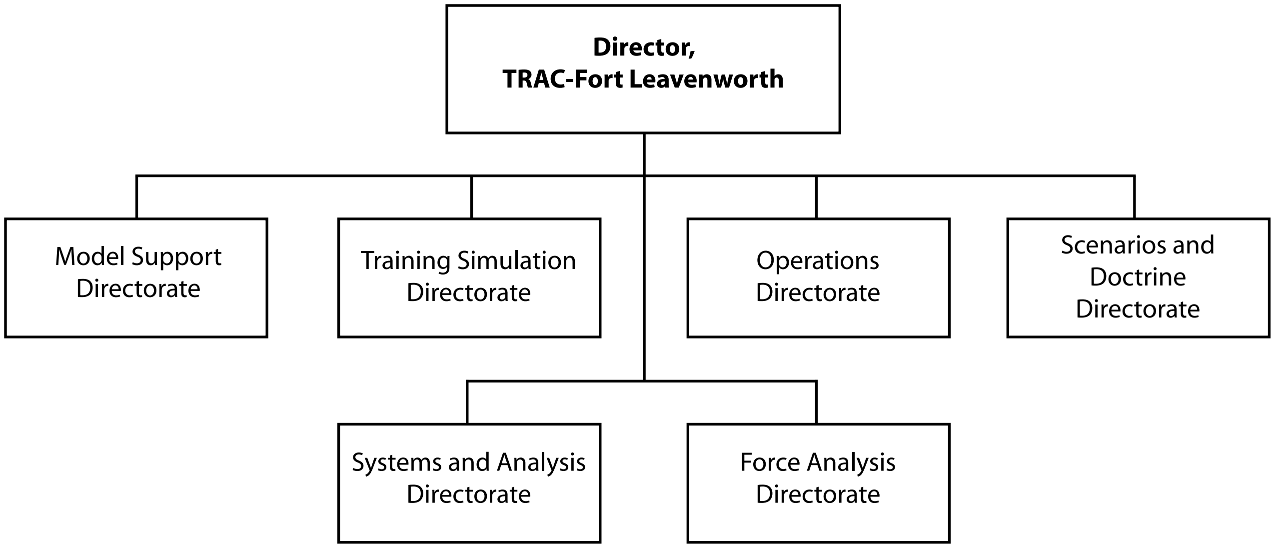
making it the largest single subordinate element of TRAC.[158] Leon F. Goode Jr., the incumbent director of TRASANA, was designated as director of TRAC-WSMR, an SES position.[159] Initially, the mission and organization of TRAC-WSMR were affected in only a minor way by the October 1986 reorganization. TRAC-WSMR continued to focus on studies, analyses, and model development at the battalion and brigade level in close cooperation with the ORSA elements in the various TRADOC centers and schools. However, changes over time in the TRADOC and TRAC missions, force reductions that began in the late 1980s, and the very size of the TRAC-WSMR operation itself subjected TRAC-WSMR to repeated attempts, many of which were successful, to focus its mission and reduce or transfer its personnel complement and other resources accordingly.

Efforts to reduce TRAC-WSMR resources began with voluntary early retirement of some seventeen top-level employees in FY 1987 as a result of HQ TRADOC mandated reductions.[160] In September 1989, Walter W. Hollis, the DUSA (OR), submitted his recommendations on the realignment of Army analysis agencies to the Army Management Review Task Force (AMRTF). One of those recommendations was that TRAC-WSMR should be consolidated with TRAC-FLVN at Fort Leavenworth, and Hollis noted:

> The consolidation of TRAC at a single location will have the long-term benefits of improved responsiveness of analytical support, harmonized training simulations and analytic models, improved physical accessibility, and moving the center of gravity from analysis of the eaches towards analyses that are one in the broader context of military needs, force design, cross mission areas and resource allocation.[161]

Hollis' recommendation to deactivate TRAC-WSMR was included in the Army Management

Figure 6–5—Organization of TRAC-Fort Leavenworth, August 1987



Source: Christina Fishback, "Draft History of TRAC-FLVN" (Fort Leavenworth, Kans.: HQ TRAC, 2003), p. 3, Diagram (TRADOC Analysis Command [TRAC] - August 1987).

Review Task Force proposals to DOD but came to naught. However, the following year, faced with almost certain resource cuts, the TRAC commander, Brig. Gen. Robert T. Howard, proposed a reorganization of TRAC in which TRAC-WSMR would bear the brunt of personnel reductions. At the time, TRAC-WSMR had a budget of about $14.9 million and authorizations for 333 military and civilian personnel, about half of TRAC's total strength.[162] General Howard proposed to cut TRAC-WSMR by about forty-five civilian spaces and to consolidate all command and control analysis at TRAC-FLVN and all combat service support analysis at TRAC-LEE. In anticipation of the implementation of the reorganization proposed by General Howard, TRAC-WSMR reduced administrative and support functions and positions and consolidated the Individual Training Effectiveness Analysis and Unit Training Effectiveness Analysis directorates into one Training Directorate.

As it turned out, General Howard's reorganization was never fully implemented, but his successor, Brig. Gen. Richard M. Tragemann, facing additional resource cuts in FY 1991 and FY 1992, used General Howard's reorganization proposal to formulate his own plan for restructuring TRAC, which had a significant impact on TRAC-WSMR. Since TRAC-WSMR was the largest TRAC element, it was scheduled to take the bulk of the mandated civilian personnel reductions in FY 1991. The TRAC-WSMR Special Studies Directorate was disestablished on 30 September 1991, and TRAC-WSMR's communications and intelligence-electronic warfare analysis work was consolidated with TRAC's command and control analysis activities at Fort Leavenworth to form a C3I modeling and analysis capability.

The FY 1991 reductions cut "analytical muscle" at TRAC-WSMR, which took 49 of TRAC's 65 civilian personnel losses.[163] Before the cuts, TRAC-WSMR was authorized 69 officers, 25 enlisted personnel, and 169 civilians; the directed reductions eliminated 20 officer authorizations, 4 enlisted authorizations, and 49 civilian authorizations, and thus, in less than a year, TRAC-WSMR went from 262 personnel authorized to only 189.[164] The commitment of General Tragemann to support the temporary overhire of permanent employees in FY 1992 and the increased employment of other excess personnel funded by an expanded reimbursable program, coupled with active interest of commercial firms in hiring former TRAC-WSMR personnel, attenuated the impact of the cuts. The emergence of a growing reimbursable program played a significant role in sustaining TRAC capabilities and operations.

In FY 1992, the TRAC-WSMR budget was $11,552,000, and TRAC-WSMR was authorized

49 officers, 20 enlisted personnel, and 155 civilians, including 35 reimbursable positions, organized with two support elements and five mission directorates as shown in Figure 6–6.[165] Only 9 percent of the civilian workforce were administrative and support personnel, the low percentage being achieved by utilizing WSMR installation personnel to perform administrative and support tasks. Over half the civilian workforce had advanced degrees, and twelve civilians held the doctorate. Thirteen members of the professional workforce had a college major in operations research, forty-nine in mathematics, thirty in engineering, nineteen in physics, fifteen in psychology, and the remaining thirty-one in other disciplines.

From 1983, TRAC-WSMR maintained an onsite cell of analysts in a field office at the Seventh U.S. Army Training Center (7th ATC) in Grafenwoehr, Germany.[166] The field office was established to perform a field evaluation of unit training with the M2/M3 Bradley infantry fighting vehicle, but its mission was expanded in November 1985 to include a broad range of training effectiveness analyses and to provide a forward agency for analytical support to USAREUR. The field office was manned by four to thirteen personnel from TRAC-WSMR on three-year tours. Three men served as head of the TRAC-WSMR Field Office: Dr. Robert La Rocque, Walter Butler, and Dr. Claude Miller. TRAC-WSMR also supported the other Army ORSA cells at HQ USAREUR in Germany and HQ Eighth U.S. Army in Korea.[167]

TRAC Elements at the Other TRADOC Integrating Centers

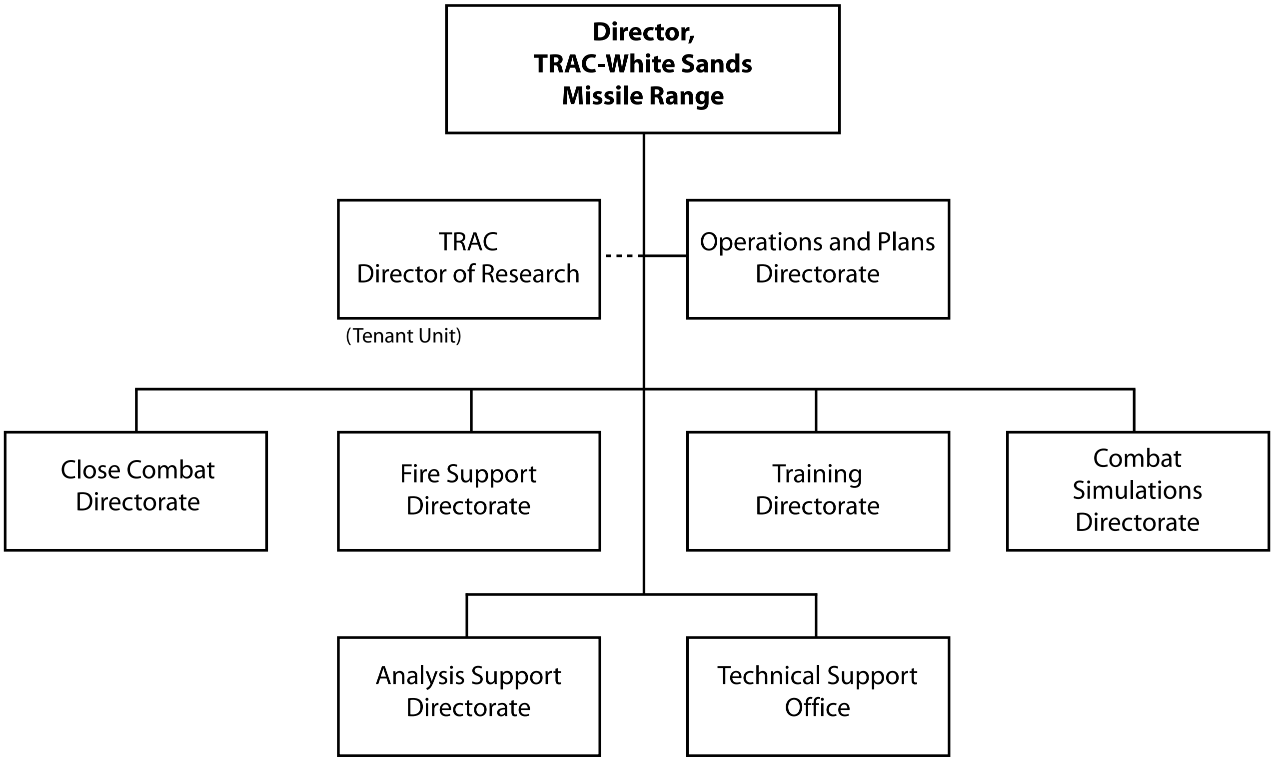
Following the establishment of TRAC in 1986, analytical support for the Combined Arms Center at Fort Leavenworth was provided by TRAC-FLVN and two new TRAC elements were established to support the other two TRADOC integrating centers—the Logistics Center at Fort Lee, Virginia, and the Soldier Support Center at Fort Benjamin Harrison, Indiana.

The consolidation of the Logistics Center's analytical elements under TORA had been one of the recommendations of the 1985 Review of Army Analysis Extended. As a result of the RAAEX recommendation, the LOGC Operations Analysis Division was reorganized, with the Simulations Division becoming the Operations Research Division, which conducted studies and analyses for the LOGC and the five associated centers and schools.[168] On 5 April 1987, the TRADOC Analysis Command-Fort Lee (TRAC-LEE) was established as part of the 1986 reorganization of TRAC.[169] The chief of the LOGC Operations Research Division, Robert A. Cameron, was chosen as the director of the new TRAC-LEE organization, the mission of which was to provide studies and analyses and the development of models, simulations, and war games pertaining to Army logistical systems, organizations, and doctrine.[170]

The TRADOC Analysis Command-Fort Benjamin Harrison (TRAC-FBHN) was authorized by the same 8 January 1987 HQ TRADOC LOI that created TRAC-LEE. However, activation of TRAC-FBHN was delayed until January 1988, when Dr. Gerald A. Klopp was assigned as director.[171] TRAC-FBHN was initially authorized twelve personnel and was co-located with and supported the United States Army Soldier Support Center.[172] By the following year, 1989, the TRAC-FBHN personnel authorization had been reduced to only nine spaces (a GM–15 director, a GS–6 secretary, an administrative NCO, an enlisted computer specialist, one ORSA major, and four GS–13 OR analysts).[173] The mission of TRAC-FBHN focused on the analysis of personnel service support issues, such as Personnel Service Support (PSS) planning factors and Soldier Dimensions in Combat Models, and its mission-related functions included providing quality control for studies conducted at the Soldier Support Center and associated TRADOC schools; performing studies in the PSS area and integrating personnel service support considerations into TRADOC studies, analyses, models, and simulations; developing, documenting, validating, maintaining, verifying and exporting PSS models and simulations; providing input to scenario developers; supporting the Army Model Improvement Program; improving and maintaining the quality of models concerned with soldier performance; developing and managing PSS data; coordinating the HARDMAN/MANPRINT programs; and acting as the activity career program manager for ORSA for the Soldier Support Center.[174]

Fort Benjamin Harrison, Indiana, was slated for closure under the 1991 DOD Base Realignment and Closure program. The bulk of the Soldier Support

Figure 6–6—Organization of TRAC-WSMR, 1992



Source: *TRAC-WSMR History*, White Sands Missile Range, N.Mex.: HQ TRAC-WSMR, c. 2001, copy in TRAC History File, CAC Historian's Office, p. 20.

--- Dashed line indicates direct coordination.

Center was moved to Fort Jackson, South Carolina, and between January and June 1993 TRAC-FBHN was merged with TRAC-LEE at Fort Lee.[175] The former director of TRAC-LEE, Robert A. Cameron, became the director of the consolidated organization, and the former director of TRAC-FBHN, Gerald A. Klopp, became the technical director.[176] There was no immediate change in the combined manpower authorization of thirty-four military and civilian spaces, and the resulting organization, TRAC-LEE, was organized with three divisions (Logistics Studies, Modeling, and Manpower/Personnel/Training Studies) focused on conducting COEAs and priority studies for TRADOC but also on providing support to the Combined Arms Support Command (CASCOM), the successor to both the Logistics Center and the Soldier Support Center.[177] The major responsibilities of the consolidated organization were to:

a. Conduct the Manpower, Personnel, and Training (MPT) and Logistics portions of COEAs and other major TRADOC studies.

b. Provide MPT and Logistics analysis support to HQ TRADOC, CASCOM, and the TRADOC schools.

c. Develop and maintain Logistics and Personnel models.

d. Conduct model verification and validation of CSS training simulations under FAMSIM [family of simulations].[178]

Among the major study efforts mounted by TRAC-LEE after 1993 were the Palletized Loading System COEA; the HMMWV Analysis of Alternatives (AoA); Logistics Impact Analyses (LIAs) for several future reconnaissance vehicles, including the Comanche helicopter, the Future Scout and Cavalry System (FSCS)/Interim Armored Vehicle (IAV), and the Tactical Unmanned Aerial Vehicle (TUAV); a study on the reconstitution and redeployment of combat forces from one major region to another; the Light Utility Helicopter AoA; and the Future Cargo Aircraft AoA.[179] TRAC-LEE also managed the HARDMAN analysis program and conducted a number of studies and analyses of manpower, personnel, and training issues.

The TRAC Research Directorate and the Smaller TRAC Research Elements

In 1986, the newly formed TRAC assumed control of three small TRADOC research elements: the TRADOC Research Element-Monterey (TREM) in Monterey, California; the TRADOC Research Element-Lawrence Livermore National Laboratory (TRELL) in Livermore, California; and the TRADOC Research Element-Los Alamos National Laboratory (TRELA) in Los Alamos, New Mexico. In 1989, all three elements were placed under the control of the TRAC director of research, who was co-located with TRAC-WSMR in New Mexico.

The largest and most active of the three TRADOC research elements was the TRADOC Research Element-Monterey (TREM), established by TRADOC Chief of Staff Maj. Gen. John B. Blount in December 1979 to provide guidance and support to Army ORSA students attending the Naval Postgraduate School (NPS) and to support research and development of air/land combat models and other research and analyses being conducted at NPS for TRADOC.[180] Initially, TREM was a small office (a military chief, four military analysts, one civilian analyst, a programmer, an administrative noncommissioned officer, and a secretary) attached to HQ CDEC at Fort Ord, with operational control exercised by the Studies and Analysis Directorate, DCS-CD, HQ TRADOC.[181] The director of TREM (later TRAC-Monterey) was normally an ORSA-qualified Army lieutenant colonel.[182] TREM analysts worked closely with students and faculty at NPS, particularly NPS professors Samuel Parry, Douglas Hartman, and Arthur Schoenstadt.[183]

TREM initially reported directly to HQ TRADOC, but the team that conducted the 1982 survey of TRADOC analytical agencies suggested that TREM might be reorganized and expanded to provide a basic research capability for both TRASANA and CAORA.[184] Following the creation of TORA in October 1982, TREM was transferred to TORA control effective January 1983, with no change in mission.[185] The 1982 concept plan for the creation of TORA stated that the mission of TREM would be to

> participate in the development of simulations required by the Army analytical community or to support thesis research at the Naval Post Graduate School (NPGS). Participate in the formulation of a program of research in Military operations research and translate the program into specific areas of research interest to students at the NPGS. Assist Army students in obtaining data, models, and other technical information to support research projects. Provide personnel and administrative support to Army students at the NPGS.[186]

Pursuant to HQ CAC and Fort Leavenworth Permanent Orders dated 30 January 1987, TREM was disestablished and TRAC-Monterey (TRAC-MTRY) was established effective 3 October 1986 with an authorized strength of six military personnel and three civilians.[187] After the 1986 reorganization, the mission of TRAC-MTRY did not change substantially, although the focus of its work did change from time to time. TRAC-MTRY concentrated on "conducting applied research to advance Army warfighting doctrine and analysis, serving as technology 'scouts' for the [TRADOC] commander, and providing a liaison between NPS faculty/students and the Army analytic community."[188]

Before 1983, TREM's principal effort was the development of the Simulation Tactical Alternative Responses (STAR) model, a high-resolution stochastic model of combat with a unique terrain model and routines depicting the operations of mechanized infantry forces.[189] STAR was run in support of the "Mortars in Combat Units" study but was scheduled to be replaced by CASTFOREM, an AMIP model. Also, TREM and the TRADOC Research Element-Lawrence Livermore National Laboratory (TELL), under the direction of the TRADOC DCS for training, conducted a joint assessment of the use of combat simulations at battalion and brigade level.[190] In 1984, Miller, the TRAC director of research, refocused the efforts of TREM away from the development of the STAR model to four new research areas: unit effectiveness/unit readiness, operational data, artillery allocation and distribution, and command and control.[191] To carry out this increased program, TREM vacancies created in 1983 were filled and new computer equipment was provided. In 1985, the TREM research program included work on the Analysis of Military Organizational Effectiveness (AMORE) model, the JANUS model, and Thermal Pinpoint data, and TREM analysts taught courses at NPS.[192]

After the 1986 reorganization, TRAC-MTRY also worked on JANUS (L) and JANUS (T), the AirLand Research Model (ALARM), and the Division Map Exercise (DIME) model.[193] In 1986, two TRAC-MTRY analysts assisted analysts from TRAC-LL and the BDM Corporation to test the feasibility of cross-country modem gaming.[194] JANUS remained a priority project, and in 1989, TRAC-MTRY analysts worked on the "Mathematical Comparison of Combat Computer Models to Exercise Data," "Human Factors in Combat Modeling," "JANUS Futures," the "Tank Recovery Study," and the "CONMOD Maneuver C2 Concept."[195] TRAC-MTRY analysts also worked with personnel at the National Training Center, and with the TEXCOM Experimentation Center at Fort Ord, California, to improve test and evaluation methodology and the usefulness of models in testing.[196]

The other two small TRADOC research elements also predated the 1986 establishment of TRAC. The TELL was established in 1979 under the control of the Studies and Analysis Directorate of the DCS-CD at HQ TRADOC. In January 1983, TELL became a subordinate element of TORA with the assigned mission of participating with Lawrence Livermore National Laboratory in "the development of models and in performing studies and analyses of issues relative to the employment of nuclear weapons, the investigation of nuclear technology and its application, and technology related to other weapons systems."[197] The TRADOC Research Element at Los Alamos National Laboratory (TRELA) in New Mexico also became a subordinate element of TORA in January 1983. The mission of TRELA was similar to that of TELL.

TELL and TRELA were both disestablished on 3 October 1986 and reorganized as TRAC-Lawrence Livermore (TRAC-LL) and TRAC-Los Alamos (TRAC-LA), respectively, pursuant to HQ CAC and Fort Leavenworth Permanent Orders, dated 30 January 1987.[198] Like TRAC-MTRY, TRAC-LL and TRAC-LA were subordinate elements of TRAC and operated under the direction of the TRAC director of research after 1989. Both TRAC-LL and TRAC-LA were very small organizations. The initial authorized strength of TRAC-LL was three military and no civilian personnel.[199] By 27 October 1988, TRAC-LL was authorized only one military and TRAC-LA was authorized two military analysts.[200]

TRAC Support of the USMA ORSA Center

In 1987, a new analytical cell was proposed by the United States Military Academy (USMA) and was staffed with HQ TRADOC and HQDA.[201] The concept behind the USMA ORSA Center was to "perform basic and applied research, analyses, and reviews of current Army issues and future Army requirements."[202] The staff of the USMA ORSA Center consisted of a center director drawn from the USMA permanent faculty, three military analysts, and one civilian analyst. TRAC supported the USMA ORSA Center by providing personnel and analytical backup.

TRAC Organization, 1990–1991

By the late 1980s it was obvious to many Army leaders that the following decade would bring enormous changes in international political, economic, and social institutions and technology that would impact United States military strategy, organization, and doctrine. It was also obvious that the 1990s would be a period of constrained resources requiring significant changes in the size of the Army and the way it was organized and operated.

Colonel (Promotable) Robert T. Howard assumed command of TRAC in September 1988, and on 26 October 1988, he wrote to the TRADOC commander, General Maxwell R. Thurman, to provide his initial assessment of TRAC.[203] In his letter, Colonel Howard noted, "TRAC has an immense wealth of talent," but "I am not satisfied that we have the proper balance between critical analysis and other technical work necessary to keep the business going. I am working to fix it."[204] He mentioned the problems of command and control imposed by TRAC's geographical dispersion and the consequent need to "focus TRAC on what's important and inject a disciplined, visionary approach to the business."[205]

He also expressed deep concern regarding the assignment of top-notch officers to TRAC, telling General Thurman that

> many are solid analysts, but not competitive for promotion and command. (For example, zero O4's on O5 list; zero officers on SSC [Senior Service College] list.) There are very serious concerns about this among my junior officers. Some TAPA [The Army Personnel Agency] assignment officers have given them advice to "get out of TRAC." The word is out, even among students at ORSA MAC I. TRAC needs its fair share of "top block and center of mass." I am launching a campaign to solve this problem – any help you can give is appreciated.[206]

Colonel Howard went on to list his immediate priorities, which included:

> a. Deliver the major COEA's . . . on-time and high quality. This is our "bread and butter."
>
> b. Lead the "single set of models." TRAC is the organization best able to get this job done. . . . Our model business is out-of-control.
>
> c. Support the "Force Design Bureau." There is a belief in some quarters of the CD community that TRAC can't respond. I am already fixing that. A solid CACDA/TRAC linkage is high on my priority list.
>
> d. Quality People and Tools. For the good of Army analysis, I need to turn around the idea that TRAC is a dead-end assignment for junior officers. . . . On the tool side, we simply must have a more responsive way to buy the computers that are for sale right now in the marketplace.
>
> e. Develop study directors. For today, train the experienced senior analysts to lead the broad, increasingly complex analysis. For tomorrow, tap the youth and grow them.
>
> f. Extend battle modeling. Apply innovative techniques to use existing models out to 60-90-180 days of combat.[207]

Colonel Howard was promoted to brigadier general in 1990, and in July 1990 he issued a White Paper outlining his proposals for the reorganization of TRAC to accommodate changing missions and an expected 25 percent cut in personnel.[208] Howard's vision of the future of TRAC was that

> TRAC will continue to operate as a major subordinate command (MSC) of TRADOC reporting to the TRADOC Commander. It will participate in TRADOC-wide resource reductions over the next several years. As a result, TRAC will decline from an FY90 level of 682 authorizations (civilians, officers, and enlisted personnel) to around 478 authorizations in the FY94 timeframe. Reductions of this magnitude require that TRAC re-examine its organization and the way it does business. TRAC must eliminate unnecessary redundancies, consolidate functions, and restructure itself to ensure that limited resources are applied to solving the Army's most pressing problems. These reductions and realignments must be done with a view toward preserving its most critical and highly skilled organic resources. TRAC must capitalize on and leverage its strengths and create new capabilities to overcome its weaknesses.[209]

General Howard also envisioned that TRAC's basic mission of conducting Army COEAs and major studies, producing integrated combined arms analyses, and leading and growing Army analysts would not change substantially, except that TRAC would be required to realign itself with changes in TRADOC organization, consolidate missions and functions, have fewer operating locations, and get by with fewer analysts TRADOC-wide.[210] However, he anticipated that "TRAC's concept of operation will change significantly. TRAC will reorganize into centers which specialize in a particular aspect of analysis and task organize to conduct major studies."[211]

The central features of the specific proposals made by General Howard to meet the challenges he foresaw included the establishment at Fort Leavenworth of a Studies and Analysis Center (SAC) to conduct the highest-priority major studies and of a Scenarios and Wargaming Center (SWC) responsible for the development of low- and high-resolution scenarios.[212] TRAC-FLVN would become the "low-resolution corps/division Modeling and Analysis Support Center (MASC)"; TRAC-WSMR would become the "high-resolution brigade/battalion MASC"; and TRAC-LEE and TRAC-FBHN would be combined to form a "Personnel/Logistics MASC."[213] The proposals also included the dual-hatting of the commander TRAC as the TRADOC deputy chief of staff for analysis (DCS-A) with a small staff at Fort Monroe to provide study program management, coordinate TRADOC analysis requirements and priorities, provide a quick-reaction analysis capability for the TRADOC commander, coordinate the allocation of TRADOC analytical resources, and oversee the TRADOC program of the RAND Arroyo Center and manage its TRADOC Research Activity (TRA).[214] The organization that would result from General Howard's proposals is shown in Figure 6–7.

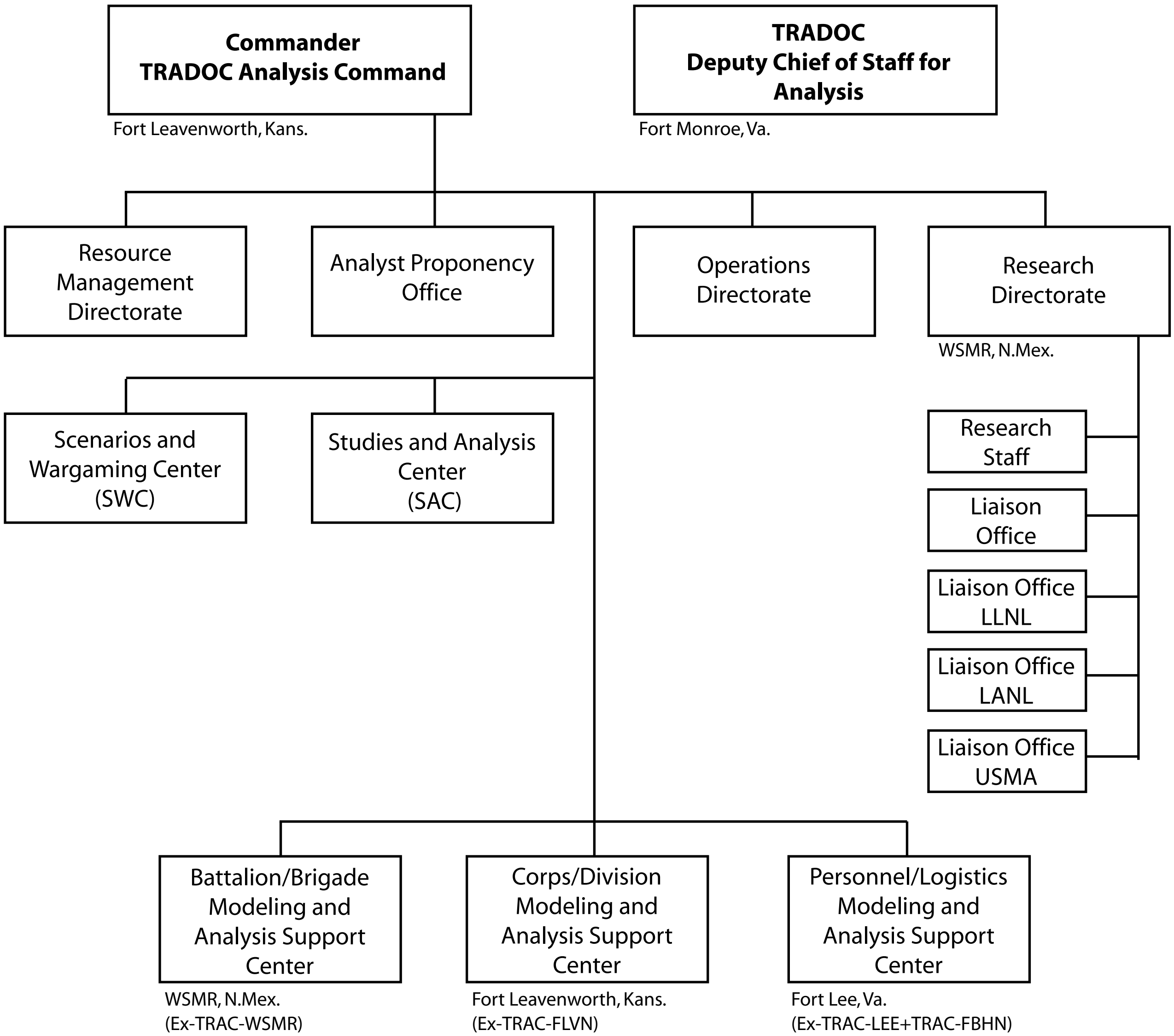
General Howard also proposed to take most of the anticipated FY 1991 personnel cuts at TRAC-WSMR, which would transfer responsibility for VIC (Vector-in-Commander), a corps- and division-level model, and command and control analysis to TRAC-FLVN and combat service support analysis to TRAC-LEE.[215] General Howard's proposals thus provoked a great deal of discussion and some anxiety among TRAC managers and analysts, particularly at TRAC-WSMR, which stood to lose the most should the proposals be implemented.[216] On 21 May 1990 and again on 22 May, Howard issued memorandums to TRAC personnel explaining the proposed reorganization.[217] The two memorandums outlined the changing international situation and its probable impact on Army organization and resources as well as the essential elements of his proposed reorganization of TRAC, including the establishment of SAC and SWC at Fort Leavenworth; the establishment of Modeling and Analysis Support Centers at Fort Leavenworth, White Sands Missile Range, and Fort Lee; dual-hatting of the commander TRAC as the TRADOC DCS for analysis and associated changes in the TRAC Requirements and Programs Directorate at Fort Monroe; the consolidation of VIC proponency and command and control analysis at Fort Leavenworth and of combat service support analysis at Fort Lee; and the concomitant impact on resources, particularly the reductions in force at TRAC-WSMR. In his 22 May memorandum, Howard announced that the proposed reorganization would take place in stages, with provisional reorganization of HQ TRAC and TRAC-FLVN to take place effective 1 June 1990, and the reorganization of TRAC-WSMR to begin in FY 1991.[218]

On 4 June 1990, General Howard wrote to General Foss to inform him of progress in the reorganization of TRAC.[219] He noted that the reorganization of TRAC at Fort Leavenworth was under way and that he had informed TRAC personnel about the coming changes with the expected apprehensive and disappointed reaction, particularly by the civilian employees at TRAC-WSMR.[220] On 27 July 1990, shortly before his departure, General Howard again wrote to General Foss to recap his proposals and the progress made toward implementing them.[221] He noted that the structure of TRAC had been "flattened and duplication has been reduced to the minimum mandated by TRAC's geographic dispersion," that TRAC had built a new TDA with 25 percent fewer authorizations, and that although the "substantial cut will not diminish TRAC's ability to focus on the most critical analysis needs of TRADOC and the Army," it would force the "sacrifice of some special functions," including the TRAC Field Office at the Seventh U.S. Army Training Center in Germany, a reduction in overall production capacity, and the need to refocus remaining capacity on "combined arms analysis at the expense of proponent functional interests."[222]

Prior to the planned reorganization of TRAC at Fort Leavenworth in June 1990, the decision was made to set aside the MASC concept, at least insofar as TRAC-FLVN and TRAC-WSMR would be redesignated the Corps/Division MASC and the Battalion/Brigade MASC, respectively. Instead, TRAC-FLVN was disestablished and its resources used to create SAC and SWC, both led by colonels, and a new entity, the Operations Analysis Center (OAC), led by the former SES Director of TRAC-FLVN, which was to perform those functions previously assigned to the proposed Corps/Division MASC. TRAC-WSMR retained its title but reorganized to focus on the role of battalion/brigade modeling and analysis support to SAC and SWC, conduct of nonmajor studies, and analysis support to TRADOC branch schools.

General Howard's proposals were not fully implemented before his reassignment on 5 August 1990, but additional steps were taken toward the objective organization by his deputy, Michael F. Bauman, who served as the acting TRAC commander until Brig. Gen. Richard W. Tragemann assumed command on 1 November 1990. It was thus General Tragemann who faced the difficult decisions of how to deal with resource reductions in FY 1991 and FY 1992.[223] Following an additional round of discussions with his principal subordinates, including a briefing by the director TRAC-WSMR, Dr. Darrell W. Collier, and the director of the new OAC, Dr. Robert La Rocque, on 12 March 1991, General Tragemann made his decision on the reorganization of TRAC, which he announced to the assistant deputy chief of staff for analysis (ADCS-A) and the TRAC directors on 22 April 1991.[224] In essence, General Tragemann decided to move forward with the organization proposed earlier by General Howard with some modifications.[225] The TRAC commander,

FIGURE 6–7—PROPOSED ORGANIZATION OF TRAC, JULY 1990



Source: Headquarters, U.S. Army TRADOC Analysis Command, *TRAC-1990s* (Fort Leavenworth, Kans.: HQ TRAC, July 1990), pp. 8–22 passim.
Note: Commander, TRAC, served simultaneously as TRADOC Deputy Chief of Staff for Analysis.

his deputy, and the TRAC headquarters staff were to remain at Fort Leavenworth and were to retain all assigned functions, although staffing would be somewhat reduced. The manning level of the office of the TRADOC deputy chief of staff for analysis (DCS-A) would also be reduced. The Study and Analysis Center (SAC) at Fort Leavenworth was to be retained to conduct special major studies, although its Analysis Directorate would be reduced in strength. Accordingly, more major studies were to be assigned to the new Operations Analysis Center (OAC) (the successor to TRAC-FLVN), TRAC-WSMR, and TRAC-LEE. The scenarios prepared by the Scenarios and Wargaming Center (SWC) were considered "vital to the Army study process" by General Tragemann and were not to be affected by directed manpower cuts in FY 1991 and FY 1992.[226] Although the division- and corps-level modeling and analysis performed by OAC at Fort Leavenworth were also considered critical to the Army, OAC, too, was scheduled for minor personnel cuts, attenuated, however, by the fact that it was scheduled to assume full responsibility for C3I modeling and analysis on 30 September 1991.

As TRAC's largest element, TRAC-WSMR was scheduled to take the largest portion of the civilian personnel reductions scheduled for FY 1991 and FY 1992. In view of the projected personnel cuts, General Tragemann directed that the TRAC-WSMR Special Studies Directorate be disestablished effective 30 September 1991, and that TRAC-WSMR would transfer its command and control analysis efforts to OAC at Fort Leavenworth. TRAC-WSMR was also to transfer its logistical analysis functions to TRAC-LEE, which was to be increased in strength. The future of TRAC-FBHN remained uncertain and no changes were made to its organization or functions.[227] TRAC-Monterey and the small TRAC elements at Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and West Point were also retained unchanged.

In concluding his memorandum, General Tragemann told his principal subordinates:

> Inasmuch as the downsizing of the Army over the next several years will generate more requirements for sound analysis than ever before, it is extremely unfortunate that TRAC had to be included in TRADOC's latest personnel reductions to the extent that it has. The Army's other analytic agencies have not been spared either. I am fully aware that the mandated cuts enumerated herein will cause TRAC to lose in the next few months immensely talented, dedicated professionals who have served the Army with distinction and earned reputations as leaders in their career field. The decisions reflected in this memorandum are the most difficult I have had to make in over 25 years of service. Please convey to the work force my pledge to do as much as I can to assist any member of TRAC who loses his or her position. TRAC will continue to provide to our leadership the timely, quality analytical products so vital to the Army's future.[228]

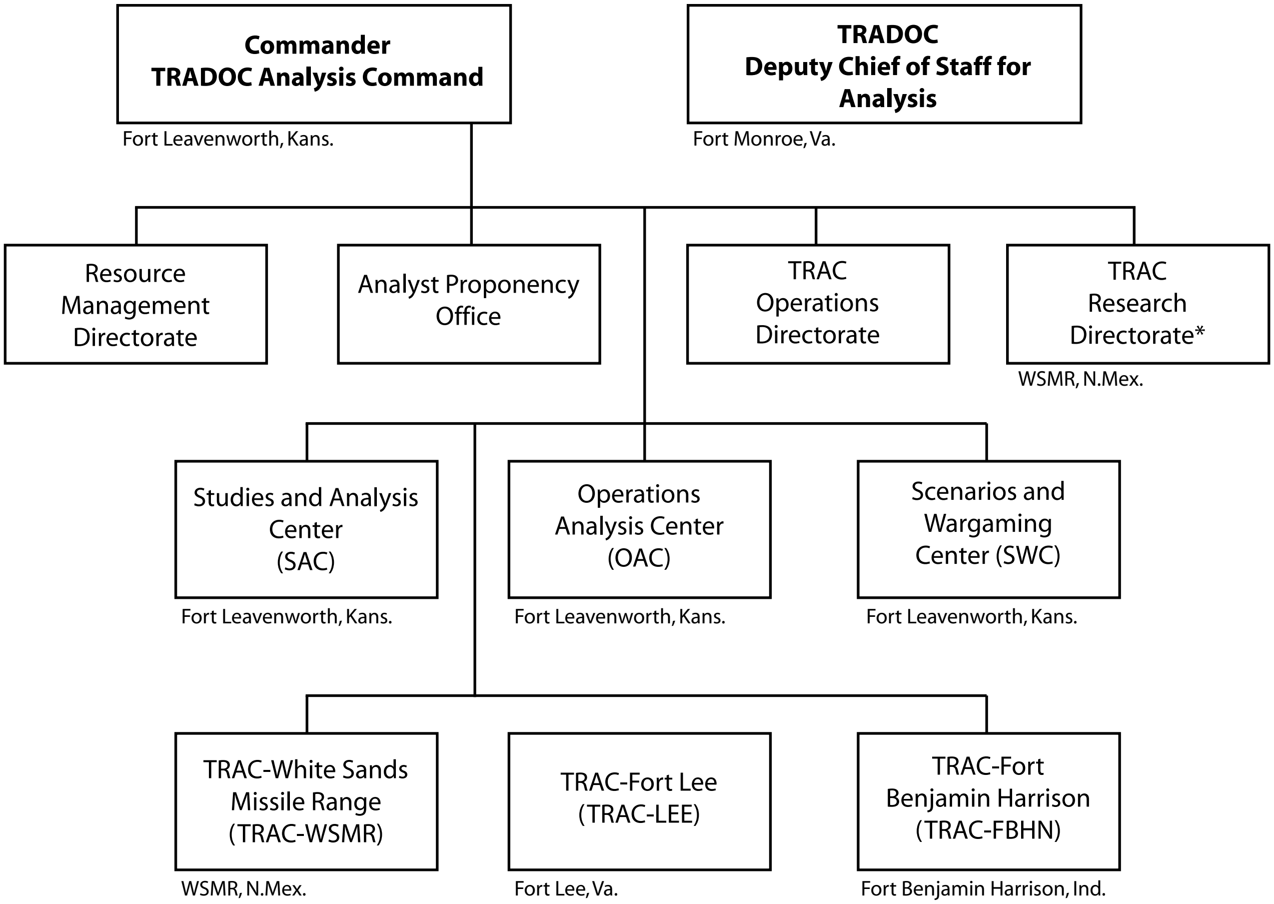
The organization of TRAC resulting from the April 1991 decisions on reorganization was as shown in Figure 6–8. The new structure gave TRAC and thus TRADOC better control of TRADOC analysis assets and programs and envisioned "fewer but more robust" studies.[229] Much of the work on small units previously done at TRAC-WSMR was transferred to the SAC and OAC at Fort Leavenworth and the staffing of TRAC-WSMR was reduced accordingly.

The centerpieces of the 1990–1991 reorganization of TRAC were the Studies and Analysis Center (SAC) and the Scenarios and Wargaming Center (SWC). The mission of the SAC was: "Lead, plan, perform, and report major COEAs and studies. Provide quick-reaction analytical support to HQDA on behalf of CG, TRADOC. Develop and oversee the TRADOC central data base for combat development studies and analysis."[230] SAC was organized with two subordinate directorates. The Analysis Directorate provided the core of the analytical work required by TRAC study directors for major studies and quick-reaction support to HQDA, and the Data Development Directorate acted as the clearinghouse for data used in all TRADOC studies and analysis.[231] SAC also supervised study directors on behalf of the TRAC commander and, through its Technical Reports Office, linked with similar offices in other TRAC elements to "integrate and produce high quality study reports and briefings, and also to provide graphical and visual presentation services to the study directors."[232] SAC had two directors during the period 1991–1995: Col. Robert H. Wood (1991) and Col. Allan M. Resnick (1991–1995).[233]

The mission of the Scenarios and Wargaming Center was to "develop and maintain TRADOC standard high and low resolution scenarios for the Army, assist TRAC study directors in the development of study scenarios, [and] conduct reviews of TRADOC study scenarios for doctrinal and tactical sufficiency."[234] To perform its mission, SWC was organized with three divisions. The Low Resolution Division was responsible for development of TRADOC low-resolution corps and division scenarios, the High Resolution Division was responsible for the development of high-resolution brigade and battalion scenarios, and the Air Force Division was composed of Air Force personnel who assisted TRAC by providing input on Air Force doctrine and assets portrayed in TRAC scenarios.[235] SWC had four directors during the period 1991–1995: Col. Charles M. Black (1991), Col. W. D. Garlock (1991–1994), Col. Allan M. Resnick (1994–1995), and William J. Krondak (1995–).

The Operations Analysis Center (OAC) consisted of four directorates (Study, Model Development and Maintenance, Production Analysis, and Technical Support) under the direction of Dr. Robert La Rocque.[236] Dr. La Rocque was followed as director by J. F. Fox (1994–1996).

FIGURE 6–8—ORGANIZATION OF TRAC, APRIL 1991



Source: Memo, Brig Gen Robert T. Howard (CG TRAC) for TRAC Personnel, Fort Leavenworth, Kans., 22 May 90, sub: TRAC Reorganization, encl.

Note: Commander, TRAC, served simultaneously as TRADOC Deputy Chief of Staff for Analysis.

*The TRAC Research Directorate oversees TRAC-MTRY, TRAC-LL, TRAC-LA, and TRAC element at USMA.

The mission and functions of the TRAC headquarters support elements—the Resource Management Division (RMD), Analyst Proponency Office (APO), and TRAC Operations Directorate (TOD)—remained essentially unchanged by the 1990–1991 reorganization, and they continued to play the same role through 1995.[237] However, a Technical Support Directorate (TSD) was later added to initiate, supervise, procure, deliver, and monitor all ADP communications, hardware, and software for TRAC elements at Fort Leavenworth.[238] The TRAC Research Activity Center, located at WSMR, was assigned the responsibility for developing and recommending research goals to the TRAC commander; planning, executing, and managing a program of applied research directed at the TRAC mission; coordinating TRAC participation in the AMIP and SIMTECH programs; and maintaining liaison with the Naval Postgraduate School, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the United States Military Academy, and other government and private research organizations.[239] In 1994, the TRAC Research Activity Center was redesignated the TRAC Research Activity.

The establishment of the Office of the HQ TRADOC Deputy Chief of Staff for Analysis (ODCS-A) on 6 August 1990 was a major part of the 1990–1991 TRAC reorganization. When TRAC was created in 1986, Col. William A. Brinkley (then director, RPD, at Fort Monroe) and others had recommended that a separate deputy chief of staff for analysis (DCS-A) be established on the TRADOC staff. That recommendation was endorsed by the Army Science Board, the DUSA (OR), the DCSOPS technical advisor, the CG CAORA, the director TRAC-WSMR, and the HQ TRADOC deputy chiefs of staff for combat developments, doctrine, intelligence, and training; but the HQ TRADOC deputy chief of staff for resource management argued against it, and the TRADOC commander, General Carl E. Vuono, decided not to proceed.[240] The issue was surfaced again in 1990 by General Howard and his deputy, Michael F. Bauman, and the TRADOC commander, General John W. Foss, agreed to move forward.[241] At the time, there was considerable discussion as to whether or not the commander TRAC/DCS-A should remain at Fort Leavenworth or relocate to Fort Monroe.

In 1990, HQ TRADOC carried out a major staff reorganization in line with the prevailing general principles of downsizing and consolidation.[242] As part of that staff reorganization, on 6 August 1990, the TRAC commander was assigned the additional position of HQ TRADOC DCS-A, although he remained physically located at Fort Leavenworth and was represented by a colonel as assistant DCS-A (ADSC-A) at Fort Monroe.[243]

The question of the physical location of the TRAC commander/HQ TRADOC DCS-A was raised again in June 1991 during a briefing of General Foss by General Tragemann regarding the reorganization of TRAC, and HQ TRAC prepared a staff study of the problem.[244] On 19 August 1991, General Foss announced his decision that the TRAC commander/HQ TRADOC DCS-A would continue to perform his duties from Fort Leavenworth.[245] At the same time, he reiterated TRAC's status as a major subordinate command of TRADOC, with the TRAC commander reporting directly to the TRADOC commander.

However, the question of the location and status of the commander TRAC/DCS-A refused to die. In 1992, it arose again in the form of a proposal to merge TRAC with the Combined Arms Center combat developments organization.[246] General Tragemann argued successfully for the status quo, noting in summary that after fifteen months in command of TRAC he observed the following:

> a. The merger of CAC-CD and TRAC would be a giant step backwards. We broke that mold years ago—it didn't work!
>
> b. TRAC cannot endure another major downsizing. The RIF last year cut into analytic muscle. TRAC will be authorized a strength of 501 as FY93 begins, and General Sullivan, then VCSA, is on record stating that 500 ought to be the floor for TRAC.
>
> c. Given the way CD is changing in TRADOC, the dual-hatted position of TRADOC DCSA and TRAC Commander would be more effective if based at Fort Monroe rather than Fort Leavenworth.[247]

Despite General Tragemann's seeming concession, there were no further successful challenges to TRAC's status or the location of the TRAC commander. Nor were there any substantial organizational changes until 1996, after the period under consideration.[248] However, in June 1993, Michael F. Bauman was appointed to lead TRAC by TRADOC Commander General Frederick M. Franks Jr., and as a consequence the TRADOC Analysis Command was redesignated the TRADOC Analysis Center and the position of commander was replaced with that of an SES director. On 15 October 1993, TRAC was designated as a federal laboratory, which allowed TRAC to partner with public and private organizations in the transfer of technology with government applications, collaborate on research and development, and provide and receive ad hoc technical assistance.[249] Also, on 27 October 1994, the HQ TRADOC deputy chief of staff for analysis was redesignated the deputy chief of staff for simulations and analysis (DCS-SA) and assumed responsibility at HQ TRADOC for integration of simulations in recognition of the increasing importance of simulations in TRADOC and the Army.

TRAC Resources, 1986–1995

TRAC Leadership

From 1974 to 1995, the TRADOC analytical community was fortunate in having a series of experienced and effective leaders, both military and civilian. Dr. Wilbur B. Payne, who assumed the directorship of TRASANA in 1975, was already one of the Army's top analysts and had years of experience at the top levels of the Army ORSA program.[250] As the TRADOC analytical community began to consolidate with the establishment of TORA in 1982, Dr. Payne was chosen to lead the combined efforts of TRASANA, CAORA, and other TRADOC analysis elements. The establishment of TRAC in 1986 transferred leadership of the TRADOC analytical community to an Army general officer backed by a civilian SES deputy. The position of TRAC commander called for a major general but only a brigadier general was authorized. Other TRAC elements, notably TRAC-FLVN and TRAC-WSMR, were authorized a civilian SES as director backed by a colonel as deputy director and senior military analyst. HQ TRAC directors were usually colonels or senior civilians. Field grade officers (majors or lieutenant colonels) led smaller TRAC elements, such as TRAC-MTRY, TRAC-LL, and TRAC-LA. Senior civilians in the grade of GM–15 led TRAC-FBHN and TRAC-LEE. The successive commanders and directors of the TRADOC Analysis Command/Center from 1986 to 1995 are shown in Table 6–2.

Several of the TRAC commanders, many of whom were qualified FA 49 ORSA officers, went on to higher rank and responsibility. Brig. Gen. David M. Maddox, who commanded CAORA from November 1983 to June 1986 and served as deputy TRAC commander at its inception, was later promoted to general and commanded the United States Army, Europe, and Seventh U.S. Army. Brig. Gen. John D. Robinson, who was the first commander of TRAC (3 October 1986–July 1988), was later promoted to major general and command of the United States Army Aviation Center at Fort Rucker, Alabama, in July 1991.[251] Brig. Gen. Robert T. Howard was promoted to major general and later served as Director of the Army Budget and as an SES civilian in the Department of Veterans Affairs. Brig. Gen. Richard W. Tragemann, commander of TRAC from 1 November 1990 to 14 September 1992, also rose to two-star rank and command of the United States Army Test and Evaluation Command and Aberdeen Proving Ground from 14 September 1992 to 18 September 1996.[252]

The decision of the TRADOC commander in 1993 to replace a general officer with a civilian SES as the leader of TRAC was prompted in part by the strong recommendation of the departing TRAC commander, Brig. Gen. Michael A. Canavan, to General Frederick M. Franks Jr., the TRADOC commander, in a 20 May 1993 e-mail message in which he stated: "First, put SES Mike Bauman in-charge as Director of TRAC. No one else better qualified anywhere to lead TRAC; as close to civilian green-suiter as you get. Know former CGs Dick Tragemann and Bob Howard would agree. Walt Hollis fully supports."[253] Bauman, who as of this writing continues as the director of TRAC, was indeed well qualified for the job; at the time of his appointment as director of TRAC on 17 June 1993, he already had some twenty-two years of government service and six years as the senior civilian in HQ TRAC.[254]

TRAC Personnel

The 1978–1979 Review of Army Analysis study group identified eighteen separate TRADOC analytical elements with a total authorization of 1,193 personnel, about one-third of all the personnel then in Army analytical organizations.[255] The process of consolidating and centralizing TRADOC's analytical organizations, notably the establishment of TORA in 1982 and of TRAC in 1986, was intended to achieve greater efficiency by reducing the resources dedicated to analytical work in TRADOC, and it was successful in doing so. However, the changes in the international security situation and the onset of substantial personnel and budget reductions beginning in the late 1980s had a far greater impact and even threatened to reduce TRADOC's analytical capabilities below the absolute minimum necessary to successfully conduct essential COEAs, studies, and analyses; develop standard simulations, models, and war games; and carry out all of the other ORSA work needed. As shown in Table 6–3, after FY 1988 TRAC experienced a steady and substantial decline in personnel authorizations with a resulting negative impact on the quantity and quality of TRAC production, despite the best efforts of TRAC leaders and analysts.

As shown in Table 6–3, TRAC achieved its peak authorized strength in FY 1988 with authorizations for 195 officers and warrant officers, 50 enlisted personnel, and 502 civilians, for a total of 747 personnel. TRAC's workforce was multidisciplinary, consisting of engineers, computer programmers, operations research analysts, systems analysts, military combined arms operations specialists, and administrative personnel. At the beginning of FY 1989, about 65 percent of the personnel assigned to TRAC were analysts and other specialists, the remainder being administrative and

Table 6–2—Commanders/Directors, TRAC, 1986–1995

Incumbent	*Begin*	*End*
TRADOC Analysis Command (Provisional)		
Lt. Gen. Robert W. RisCassi	1 May 1986	9 June 1986
Lt. Gen. G. T. Bartlett	10 June 1986	2 October 1986
TRADOC Analysis Command		
Brig. Gen. John D. Robinson	3 October 1986	July 1988
Col. J. T. Pitman	July 1988	September 1988
Col./Brig. Gen. Robert T. Howard	September 1988	5 August 1990
Michael F. Bauman (Acting)	6 August 1990	30 October 1990
Brig. Gen. Richard W. Tragemann	1 November 1990	14 September 1992
Brig. Gen. Michael A. Canavan	4 October 1992	16 June 1993
TRADOC Analysis Center		
Michael F. Bauman	17 June 1993	Present

Source: Compiled from various sources.

Note: For legal reasons, the provisional TRAC organization (1 May–2 October 1986) was commanded by the CAC commander with the CAORA commander as his deputy. The two CAORA commanders during that period were Brig. Gen. David M. Maddox (28 November 1983–June 1986) and Brig. Gen. John D. Robinson (June–30 September 1986).

support personnel.[256] At that time, there were 649 personnel (206 military and 443 civilian) assigned to TRAC, distributed as shown in Table 6–4.

By the late 1980s it was apparent that the coming decade would be a period of manpower reductions and constrained budgets. The missions added in FY 1988 and FY 1989 alone required some one hundred additional man-years of effort, but at the same time TRAC lost sixty-eight personnel spaces, and thus became more dependent on contract support.[257] On 8 February 1989, General Howard wrote to General Thurman to express his concerns regarding TRAC's personnel problems.[258] While acknowledging the necessity for TRAC to accept its fair share of any future personnel cuts, General Howard addressed the severe impact of continued cuts on TRAC's ability to perform its mission, noting:

> In the past 14 months, including the latest round of cuts, TRAC has lost 88 civilian authorizations. I can no longer afford to "salami slice" my line and staff. For the first time since TRAC was formed, we have cut an entire mission and the division that performed it. I believe this is necessary to avoid piecemeal erosion of the entire TRAC organization to the point that we can't execute our most critical mission.[259]

The overall TRAC personnel authorization for FY 1990 was 682 spaces (248 military and 434 civilian).[260] Of the 550 military and civilian analysts present for duty in FY 1990, most were employed in functional area analyses (200 of 550) and force analyses (190 of 550).[261] Other major categories of endeavor were the preparation of COEA (70 of 550) and modeling (60 of 550). The remaining analysts were employed in various types of cost analyses (30 of 550).

The crunch came on 15 March 1990, when TRAC received Budget Manpower Guidance from HQ TRADOC that reduced the projected authorized personnel strength of TRAC from 622 in FY 1991 to 501 beginning in FY 1993.[262] Then in April 1990, the TRADOC chief of staff directed the TRAC commander to develop "an objective organization" that reduced TRAC personnel strength by 25 percent across the board to 485 (151 officers, 38 enlisted personnel, and 296 civilians).[263] TRAC leaders thus anticipated a cut in personnel authorizations of about 10 percent for the next fiscal year (FY 1991)—which they planned to distribute as shown in Table 6–5—and additional 5 percent cuts in FY 1992 and FY 1993.[264]

A TRAC objective organization that would fulfill TRADOC's most critical analysis needs was designed and submitted to HQ TRADOC for approval on 30 July 1990. The approved organization, along with a buyback of 56 spaces, included authorizations for 151 officers, 38 enlisted personnel, and 296 civilians for a total of 485

Table 6–3—TRAC Personnel Authorizations, FY 1987–FY 1995

FY/Category	*HQ TRAC*	*TRAC RPD**	*TRAC RD*	*TRAC-LEE*	*TRAC-FBHN*	*TRAC-FLVN***	*TRAC-WSMR*	*Total*
FY 1987								
Officers	7	2	n.d.	n.d.	n.d.	85	63	157
Enlisted	3	0	n.d.	n.d.	n.d.	14	34	51
Civilians	19	16	n.d.	n.d.	n.d.	124	295	454
Total	29	18	n.d.	n.d.	n.d.	223	392	662
FY 1988								
Officers	11	9	11	2	1	85	76	195
Enlisted	3	1	1	1	1	15	28	50
Civilians	32	27	7	22	6	121	287	502
Total	46	37	19	25	8	221	391	747
FY 1989								
Officers	11	9	11	2	1	90	79	203
Enlisted	4	1	1	1	1	15	26	49
Civilians	28	24	5	18	6	112	266	459
Total	43	34	17	21	8	217	371	711
FY 1990								
Officers	11	9	11	1	1	88	78	199
Enlisted	4	1	1	1	1	15	26	49
Civilians	27	24	5	18	6	113	241	434
Total	42	34	17	20	8	216	345	682
FY 1991								
Officers	16	12	11	2	1	85	69	196
Enlisted	4	3	1	1	1	14	24	48
Civilians	25	28	5	19	6	128	167	378
Total	45	43	17	22	8	227	260	622

personnel.[265] TRAC subsequently requested a reprogramming that resulted in an authorized strength for FY 1993 of 153 officers, 40 enlisted personnel, and 308 civilians for a total of 501 personnel.[266]

On 1 May 1991, the TRAC commander, General Tragemann, wrote to the TRADOC commander, General Foss, stating: "Nearly all of the FY91–93 civilian cuts (numbering 65) and 20 officer cuts will be taken prior to 30 Sep 91. In FY92 another 23 officers cuts are due. By comparison, at its pinnacle in FY87, TRAC had 751 authorizations."[267] He noted that most of the civilian reductions (forty-nine of sixty-five) were to be taken at TRAC-WSMR and warned that congressional inquiries were probable. General Tragemann also stated the trade-offs and actions to be taken to accommodate the required cuts, including consolidation of command and control analysis at Fort Leavenworth, consolidation of combat service support analysis at Fort Lee, the future inability of TRAC to certify all TRADOC's analysis, and the decision to drop CORBAN, due to the fact that TRAC was no longer able to maintain three corps-level simulations (VIC and the new EAGLE were retained).[268] He concluded by writing:

> With the recent cuts to TRAC and the Schools, we are approaching a critical juncture for TRADOC analysis.

Table 6–3—TRAC Personnel Authorizations, FY 1987–FY 1995—Continued

FY/Category	*HQ TRAC*	*TRAC RPD**	*TRAC RD*	*TRAC-LEE*	*TRAC-FBHN*	*TRAC-FLVN***	*TRAC-WSMR*	*Total*
FY 1992								
Officers	16	12	10	3	1	85	49	176
Enlisted	4	3	1	1	1	14	20	44
Civilians	21	21	2	22	6	119	120	311
Total	41	36	13	26	8	218	189	531
FY 1993								
Officers	13	10	10	4	n.d.	73	43	153
Enlisted	3	2	1	2	n.d.	12	20	40
Civilians	21	20	2	28	n.d.	117	120	308
Total	37	32	13	34	n.d.	202	183	501
FY 1994								
Officers	12	8	10	4	n.d.	65	43	142
Enlisted	3	2	1	2	n.d.	12	20	40
Civilians	27	20	2	28	n.d.	116	120	313
Total	42	30	13	34	n.d.	193	183	495
FY 1995								
Officers	10	10	5	4	n.d.	70	43	142
Enlisted	3	2	1	2	n.d.	12	20	40
Civilians	20	20	2	28	n.d.	124	120	314
Total	33	32	8	34	n.d.	206	183	496

Source: Data provided by Michael F. Bauman, director of TRAC, on 21 November 2006.

Note: TRAC RD (Research Directorate) includes TRAC-MTRY, TRAC-LL, and TRAC-LA. "Officers" include warrant officers, and "Civilians" include clerical personnel and interns as well as professional ORSA personnel.

*Figures shown are for Office of the Deputy Chief of Staff for Analysis at Fort Monroe after August 1990.

**Figures shown are for Studies and Analysis Center, Scenarios and Wargaming Center, and Operations Analysis Center of HQ TRAC from April 1991.

n.d. = no data available

> The support you've given to maintain TRAC at the 500 level recommended by Mr. Hollis and endorsed by GEN Sullivan is greatly appreciated. I will need your continued support and that of your successor to preserve the unique Army analysis capability resident in TRADOC.[269]

The post–FY 1989 personnel cuts were indeed draconian. Writing in 1995, the DUSA (OR), Walter W. Hollis, recalled that over the ten-year period beginning in 1987, TRAC was expected to reduce its military staff by 53 percent and its civilian staff by 57 percent.[270] As Hollis noted, TRAC would bear "a significant burden of the drawdown" and would have "to adjust its analysis program to highlight the highest priority tasks."[271] The reality was not quite so grim, but it was grim enough. As shown in Table 6–6, between the peak authorized strength in FY 1988 and FY 1995, TRAC lost 53 officer spaces, 9 enlisted spaces, and 193 civilian spaces, at total of 255 spaces, or about 34 percent of its overall strength.

As of 31 January 1995, TRAC was authorized 142 officer positions, of which 106 were ODP supported; 40 enlisted positions, and 314 civilian positions.[272] There were 99 officers, 39 enlisted personnel, and 318 civilians (including 47 paid through the TRAC Reimbursable Program [TRP])

Table 6–4—Distribution of Assigned TRAC Personnel, 27 October 1988

Location	*Military*	*Civilian*
Fort Leavenworth (HQ TRAC and TRAC-FLVN)	113	132
Fort Monroe (TRAC-RPD)	8	21
White Sands Missile Range (TRAC-WSMR)	72	262
Fort Lee (TRAC-LEE)	4	19
Fort Benjamin Harrison (TRAC-FBHN)	2	6
Monterey (TRAC-MTRY)	4	3
Lawrence Livermore National Lab (TRAC-LL)	1	0
Los Alamos National Lab (TRAC-LA)	2	0
TOTAL	206	443

Source: Memo, Col Robert T. Howard (CG, TRAC) for General Maxwell R. Thurman (CG, TRADOC), Fort Leavenworth, Kans., 26 Oct 88, sub: Initial Assessment of the TRADOC Analysis Command, Encl ("TRAC – The Assigned Work Force").

Table 6–5—Change in TRAC Authorizations, FY 1990–FY 1991

TRAC Element	*Officer*	*Enlisted*	*Civilian*
HQ TRAC	-11	-1	-28
TRADOC DCSA+TSA	+12	+3	+23
SAC	+24	+3	+27
SWC	+27	+3	-6
TRAC-FLVN	-54	-7	-17
TRAC-WSMR	-2	-2	-72
TRAC-LEE	+1	+1	+7
TRAC-FBHN	-1	-1	-6
TRAC-MTRY, LL, LA, and USMA	0	0	0
TOTAL	-4	-1	-72

Source: Memo, Brig Gen Robert T. Howard (CG, TRAC) for General John W. Foss (CG, TRADOC), Fort Leavenworth, Kans., 4 Jun 90, sub: TRAC Reorganization, p. 1 and encl.

on hand.[273] By the end of the year, TRAC authorizations had been reduced to 119 officer positions (88 ODP-supported), 32 enlisted positions, and 260 civilian positions, with 96 officers, 30 enlisted personnel, and 312 civilians (55 paid through TRP) on hand.[274]

While the absolute numbers of manpower authorizations were a major concern, there were also other personnel issues that drew the attention of the TRAC commander and his directors. Two of the most pressing were Officer Distribution Plan (ODP) support and the assignment of qualified senior officers, particularly in the grade of colonel. Maintaining sufficient ODP support for TRAC was a perpetual problem. TRAC relied on experienced senior analysts at the lieutenant colonel and GS–14 grade levels and above to serve as study directors and mentors for junior analysts, yet in 1988, TRAC's ODP for lieutenant colonels dropped from twenty-eight to four.[275] In a point paper provided to the TRADOC commander, General Maxwell R. Thurman, on 26 October 1988, the TRAC commander, then-Col. Robert T. Howard, noted that although TRAC was supposed to manage its own ODP, it was still

Table 6–6—Declining TRAC Personnel Authorizations, FY 1987–FY 1995

Fiscal Year	*Officer*	*Enlisted*	*Civilian*	*Total*
1987	157	51	454	662
1988	195	50	502	747
1989	203	49	459	711
1990	199	49	434	682
1991	196	48	378	622
1992	176	44	311	531
1993	153	40	308	501
1994	142	40	313	495
1995	142	40	314	496

Source: For details, see Table 6–3 above.
Note: TRAC officer authorizations actually peaked in FY 1989 at 203.

being treated as part of the overall Fort Leavenworth aggregate, with the result that whenever a decrement was necessary, TRAC was forced to share the bill.[276] For example, in September 1988, CAC reduced the TRAC ODP from 179 to 168, and Colonel Howard noted, "In effect, the current CAC scrub has taken CACDA and CATA down to 84%, and pushed TRAC even further down to 81% of ODP."[277]

A little more than three months later, Howard, by then promoted to brigadier general, again addressed the issue with General Thurman, noting: "TRAC is basically a civilian led organization with about 26% of the 'present for duty' TRAC strength in military officers and of that 50% captains," and went on to lament the loss of ODP support for his essential key senior officers and of all his operations specialty (SC 54) officers (one colonel, six lieutenant colonels, and one major) who led scenario development for the entire Army.[278] He then brought up once again the problem of the TRAC ODP being "drygulched as it crossed the Missouri River" by HQ CAC.[279]

Maintaining a sufficient number of senior military analysts was also a problem. In September 1990, Michael F. Bauman, then the acting director of TRAC, wrote to the TRADOC commander to inform him of the fact that TRAC had ODP support for only one colonel and needed at least four.[280] Bauman listed his priority for colonels as (1) director, Study and Analysis Center; (2) director, Scenarios and Wargaming Center; and (3) assistant deputy chief of staff for analysis; and he noted, "I need the colonels to act as senior raters and mentors for my junior military officers, focusing on their unique training and career development requirements. My senior civilians cannot fill that role."[281] Despite constant attention to the problems of total authorizations, ODP support, and the assignment of colonels, the successive TRAC commanders were unable to make much headway in the face of DOD-wide reductions in force and the scarcity of qualified ORSA personnel. Even so, they managed very well and kept TRAC at a high level of productivity throughout the period.

TRAC Budget

Manpower authorizations are, of course, tied to budget allocations, and after FY 1991 there was a noticeable decline in TRAC's annual core mission budget, which declined about 27 percent between its peak in FY 1991 and FY 1995, as shown in Table 6–7.[282]

The impact of the decline in TRAC's core mission budget after FY 1991 was attenuated by the initiation in FY 1991 of the TRAC Reimbursable Program (TRP) through which TRAC provided analytical services to a broad range of Army, DOD, JCS, NATO, U.S. government, and other clients on a cost-reimbursable basis. The TRP was very successful and grew from $2.5 million in FY 1992 to $6.4 million in FY 1995. The TRP allowed the TRAC commander to retain skilled personnel who otherwise would have been let go for lack of funding.[283] It also provided excellent analytical services to defense-security-readiness–minded customers at affordable rates compared to private vendors. Michael F. Bauman, the director of TRAC, later estimated that the program could have grown another 50 percent and still not have met the demand, but that it might have then become unwieldy and have detracted from TRAC's core mission.[284]

TRAC Work Program, 1986–1995

From the time of its establishment in October 1986, the TRADOC Analysis Command was the principal provider of studies, analyses, scenarios, models, and simulations for TRADOC. From the beginning, TRAC commanders faced the daunting task of dealing with ever-more-complex analytical problems with steadily declining resources. As the author of the *TRAC Executive Summary* noted:

> By the late 1980s, Army analysis had become more complex than ever, and the issues studied, notably force tradeoffs and force reductions, were tougher than ever. Weapons systems had become more sophisticated, simulations had become more detailed, and the perspective had widened. Yet resources had become scarcer at the same time that important new missions were being added to TRAC's list.[285]

All of TRAC's analytical work was conducted in the context of the Concept Based Requirements System (CBRS), the process by which TRADOC developed the Army's battlefield concepts and determined the materiel requirements, organizational structures, tactical doctrine, and training methods for the Army of the future.[286] The CBRS was TRADOC's response to demands by Congress that the Army justify its development expenditures. CBRS allowed TRADOC to develop and match materiel, organization, doctrine, and training with military requirements derived from operational concepts. TRADOC formally promulgated CBRS as its methodology for combat developments in January 1981.

In 1993, the TRADOC commander, General Frederick M. Franks Jr., introduced a major change in the way TRADOC conducted combat developments when he introduced the concept of the "battle lab," the purpose of which was to employ the latest technology, primarily in the form of simulations, to "quickly and thoroughly analyze both warfighting ideas and the means of warfare produced by emerging technology."[287] Initially, five battle labs were proposed: Early Entry Lethality and Survivability (Fort Monroe, Virginia); Battlespace (a "mounted" combined arms team lab at Fort Knox, Kentucky, and a "dismounted" combined arms team lab at Fort Benning, Georgia); Depth and Simultaneous Attack (Fort Sill, Oklahoma, with assistance from Fort Rucker, Alabama, Fort Bragg, North Carolina, Fort Bliss, Texas, and Fort Huachuca, Arizona); Battle Command (Fort Leavenworth, Kansas); and Combat Service Support (Fort Lee, Virginia).[288] To support the battle labs, TRAC conducted studies and analyses to identify potential technology, demonstrated the viability of technology, explored concepts to exploit technology, and assessed operational payoffs.[289]

TRAC's stock in trade was the performance of a variety of complex studies and analyses in support of CBRS. TRAC studies and analyses covered the full range of combat, combat support, and combat service support materiel requirements, organization, doctrine, and training, and they involved several different methodologies, including COEAs, Mission Area Analyses (MAAs), and Trade-Off Analyses (TOAs). Typical of such studies was the quick-reaction study conducted by TRAC in 1989 to determine the effectiveness of the M1A2 Abrams tank.[290] The aim of the study was to provide a basis for deciding whether or not funding for the M1A2 ought to be continued and whether or not to redirect efforts toward the AH–64 Apache attack helicopter or the M2A2 Bradley infantry fighting vehicle.

Cost and Operational Effectiveness Analyses constituted a significant part of TRAC's workload, and during the period 1973–1995 TRADOC analysts devoted a good deal of their time to COEAs and their follow-on, Analyses of Alternatives (AoAs).[291] COEAs were prepared by all elements of the TRADOC analytical community, including HQ TRAC and its subordinate elements. As stated in the DOD guidelines, COEAs played a central role in the review process for the acquisition of military weapons and equipment:

> Submitted by the military services at designated milestones in the acquisition cycle, COEAs evaluate the costs and benefits—the operational effectiveness or military

Table 6–7—TRAC Command Operating Budgets, FY 1987–FY 1995 (Millions of Dollars)

Fiscal Year	*Core Mission*	*TRAC Reimbursable Program*	*Total*
1987	29.0	n.d.	29.0
1988	29.3	n.d.	29.3
1989	31.5	n.d.	31.5
1990	31.1	n.d.	31.1
1991	34.7	n.d.	34.7
1992	28.7	2.5	31.2
1993	28.2	3.5	31.7
1994	23.2	4.5	27.7
1995	25.4	6.4	31.8

Source: Data provided by Michael F. Bauman, director of TRAC, on 21 November 2006.

Note: The estimated cost of operating the entire TRADOC analytical community in FY 1978 was some $37,908,000, about 27 percent of the total estimated funding for Army studies and analyses in FY 1978 (see RAA I, Appendix D, pp. D-I-19 to D-I-22).

n.d. = no data available

> utility—of alternative courses of action to meet recognized defense needs. One of the alternatives typically represents the current program or status quo. Another is usually an improved version of the current program. Other alternatives are assessed against these cases in terms of changes in cost and effectiveness—that is, in terms of the marginal costs and benefits, thus exploring the cost and benefit of an alternative to the base case. COEAs provide information on the sensitivity of alternatives to potential changes in key assumptions, variables, and constraints. As such, they provide critical inputs to decisions on major defense acquisitions.[292]

At one point in 1983, the TRADOC commander, then General William R. Richardson, queried TORA about the desirability of assigning responsibility for all TRADOC COEAs to TORA. However, Dr. Wilbur B. Payne, the TORA director, and his staff argued that the proponent TRADOC schools should continue to be responsible for COEAs because the schools were already allocating at least as many resources to COEAs as TORA, that the school commandants were responsible for the system and should be responsible for the COEAs which represented the TRADOC commander's position on the system as it was presented to HQDA, and that, if TORA did all TRADOC COEAs, there would be a danger of TORA becoming an advocate for systems and thus losing its objectivity.[293] When TRAC was formed, the schools retained responsibility for COEAs while TRAC was assigned responsibility to plan, oversee, and certify them to ensure their combined arms integrity, objectivity, and quality. This quickly proved to be unworkable in practice, and in 1987, the TRADOC commander, General Maxwell A. Thurman, gave TRAC full responsibility for major studies, including COEAs, arguably among the most profound changes made to the roles and organization of Army analysis.[294]

The preparation and operation of scenarios, models, simulations, and war games was another of TRAC's primary functions. They, too, covered the full range of Army operations on the battlefield from battalion to corps level and beyond.[295] All elements of TRAC were involved in scenario development and the development and application of models, scenarios, and war games. TRAC-MTRY and TRAC-LL played important early roles in the development of some basic models and simulations. TRASANA and its successor, TRAC-WSMR, focused on operations at brigade level and below, while TRAC-FLVN and, after 1991, the Operations Analysis Center (OAC) and the Scenarios and Wargaming Center (SWC) at

Fort Leavenworth, focused on division- and higher-level operations.

TRAC-MTRY, in cooperation with the Naval Postgraduate School, developed and supported a number of important models and simulations.[296] They included:

- STAR (Simulation Tactical Alternative Responses) model, 1980–1984[297]
- AMORE (Analysis of Military Organizational Effectiveness) model, 1984[298]
- DIME (Division Map Exercise) model, 1986[299]
- ALARM (AirLand Research Model)[300]
- CAMMS (Condensed Army Mobility Management System) model[301]

TRAC-MTRY was also involved in the development of the JANUS model, which became TRAC's principal simulation of combat at the battalion and brigade level.[302] The original JANUS simulation was developed at TRAC-LL (then TELL) in the late 1970s to model nuclear effects on combat, and it soon gained a reputation for innovative use of graphical user interfaces.[303] The development of JANUS subsequently took place at several locations. In 1983, TRASANA adopted JANUS and developed it further as a high-resolution simulation to support analysis for Army advanced concepts and requirements.[304] In 1986, TRASANA exported JANUS to TRAC-MTRY, where additional work was done. The JANUS program per se began in 1989 to field a single version for all Army users. There was wide demand for JANUS by a variety of users, including trainers, and it evolved through several versions. JANUS (T), for example, was the TRASANA/TRAC-WSMR version of the model.

JANUS was a multisided, stochastic, interactive, combat simulation with sophisticated graphical user interfaces in which the users established the combat scenario and gamers commanded and controlled the forces.[305] JANUS was designed to portray engagement of up to a Blue brigade against a Red division force and focused on individual fighting system engagements and assessments at platoon through brigade level. It was flexible, simple, and user friendly, and could be used as a tactics trainer, combat leader trainer, operational rehearsal tool, historical analysis tool, disaster relief exercise driver, or to provide limited staff training and leader training. JANUS also offered a fully automated after-action review capability and provided "as realistic a model of the battlefield at battalion and below as can be found in Model & Simulation world."[306]

Another important TRAC model focused on the brigade level and below was the Combined Arms and Support Task Force Evaluation Model (CASTFOREM).[307] CASTFOREM replaced the old Carmonette model developed by ORO in the 1950s and was used at TRAC to evaluate weapon systems and unit tactics at brigade level and below and simulated intense battle conditions across a range of operations, including ammunition resupply, aviation, close combat, combat service support, C3, countermobility, logistics, engineering, mine warfare, fire support, intelligence and electronic warfare, mobility, survivability, and air defense.

Between 1973 and 1989, interest in higher-level (corps and echelons above corps) operations revived. Consequently, TRAC and its subordinate elements became deeply involved in the development of models and simulations depicting organization and doctrine for such higher-level operations. Development of the Vector-in-Commander (VIC) model began at CAORA in 1982, when the TRADOC commander established a requirement for a corps-level model in which AirLand Battle doctrine could be represented, and it ultimately became the Army's principal corps-level simulation.[308] VIC was a "two-sided deterministic simulation of combat in a combined arms environment representing joint air and ground forces at the U.S. Army corps level engaged with a commensurate enemy force in a mid-intensity battle."[309] In 1985, VIC was selected to be the Army's corps-division level systemic model, and configuration control of VIC was passed from TRAC-WSMR to TRAC-FLVN.

In February 1990, TRAC began work in earnest on development of corps-level scenarios for the five major unified commands (EUCOM, CENTCOM, SOUTHCOM, PACOM, and LANTCOM). The first was a scenario set in Europe. It was followed closely by a corps-level scenario set in Southwest Asia, which "bore a striking resemblance to the operational concept employed in DESERT STORM."[310] At the same time, TRAC also developed a new corps-level model, EAGLE, designed to produce a simulation based on object-oriented design principles to use as a tool for quick turnaround analyses of combat at the corps and division level.[311] EAGLE enabled war gamers to conduct course-of-action assessments and develop forces and concepts, and it could also be used as a training driver across the spectrum of combat operations and supporting operations. Work began on EAGLE in 1988, DIVISION EAGLE production runs began in January 1990, and CORPS EAGLE was completed in September 1992.[312]

TRAC elements also produced a number of other important models, simulations, and war games. TRAC-WSMR integrated two well-established models to create SOLDIER STATION, a model that simulated a dismounted infantry soldier in a 3D virtual environment with rules of movement, engagement, and tactics.[313] TRAC OAC developed the Computer Assisted Map Exercise (CAMEX), which was designed to simulate the significant aspects of AirLand operations doctrine in a corps-level scenario.[314] CAMEX was a map-oriented game whose major components were a set of unit locations represented on 1:50,000 scale military maps and a set of manual and computerized assessment algorithms, both governed by a set of game rules. CAMEX, played as either an open or a closed game, represented seven battlefield operating systems constituting military operations at corps level: maneuver, fire support, air defense, intelligence, mobility and survivability, sustainment, and command and control. The Joint Exercise Support System (JESS) was designed to support joint command post exercises and field training exercises (CPXs and FTXs). In 1986, the JESS was selected as the Army's model for the CPX driver portion of the Corps Battle Simulation (CBS) requirement.[315] The first FTX driven by JESS took place in 1987, and the Corps Battle Analyzer (CORBAN), which centered on the action of maneuver battalions in a combat situation and included simulation of air effects on ground combat through close air support, was tested at TRAC the same year.[316] In 1988, the Army adopted JESS and CBS as the standard simulations for corps- and division-level training.[317]

TRAC and its predecessors also played an important role in broader force development projects in the period 1973–1995. TRAC was instrumental in the development of Division 86, the Light Division, Army 86, the Army of Excellence, and Force XXI, and also provided a good deal of the analysis and simulations underlying the development of the doctrinal concepts of Active Defense, Central Battle, and AirLand Battle in the 1980s.[318] TRAC also played a significant role in the Army After Next (AAN) project that had its conceptual roots in 1995 but began formally in February 1996.[319]

TRAC began strong in 1986 and finished even stronger in FY 1995, the end of the period under consideration here. Despite several years of substantial personnel and budget cuts, TRAC enjoyed "another banner year" in FY 1995.[320] Major efforts in FY 1995 included:

> Being the lead for Army-wide planning and execution of the Joint Venture (JV) axis of Force XXI; establishing the Analysis and Experimentation Planning Group (AEPG) and handing it off to Department of the Army (DA) Deputy Chief of Staff for Operations and Plans (DCSOPS); producing the 5-year JV Analysis Plan; and applying 56 workyears to analytically underpin four '95 JV Advanced Warfighting Experiments (AWEs). TRAC also assisted other agencies and performed numerous studies on organizational, training, leader development, soldier, and doctrinal issues.[321]

During FY 1995, TRAC completed six major studies for HQDA, including the Firefinder Preplanned Product Improved (P3I) TMD Operational Performance Analysis; the Flatrack Shortfall Analysis; and support for the Wide Area Mine (WAM) Cost Analysis.[322] TRAC also conducted more than twenty major studies for HQ TRADOC, including the Early Entry Analysis (EEA) for a 2,000-Man Force; the Reserve Component Mobile Close Combat Tactical Trainer (M-CCTT) Integration and Deployment Study; a study of the Reconstitution of a U.S. Army Heavy Division and Its Redeployment Between Major Regional Contingencies; a Port Operations Capabilities Study; and a Combat Service Support Automation Management Office (CSSAMO) Training Analysis.[323] Other significant studies and analyses work by TRAC in FY 1995 included support to the Army Science Board; TRAC-LEE work with Army Research Laboratory on HARDMAN III model verification, validation, and accreditation; and the US/UK Combined Combat Identification (CID) Study.[324]

During FY 1995, TRAC completed several major Army COEAs involving some $41 billion in major weapon system acquisitions, including the advanced field artillery tactical data system (AFATDS); the Army tactical missile system (ATACMS) Block II; forward area air defense system (FAADS); C3I; combat service support control system (CSSCS); the Army portion of the joint surveillance and target attack radar system (JSTARS); the Apache Longbow system; and the integrated family of test equipment (IFTE) electro-optics augmentation.[325] TRAC also conducted studies and analyses in support of the CINCs; provided analytical support to the Battle Labs and Advanced Warfighting Experiments; produced eleven relevant scenarios for experiments, analysis, and COEAs "depicting a conflict spectrum of peace enforcement, military operations in built-up areas (MOBA), refugee relief, early and forced entry, and soldier night operations"; released 117 TRAC scenarios to U.S. military agencies, government contractors, and foreign governments; and continued to develop and improve modeling and simulation analysis tools.[326]

TRAC Accomplishments

In September 1995, Iris Kameny, the chair of the Army Science Board Analysis, Test, and Evaluation Issue Group, reported to the DUSA (OR), Walter W. Hollis, on the achievements of TRAC over the previous several years. Among the group's very positive observations were that TRAC had instituted changes in the COEA process with the result that a "timely product that satisfies critical issues can now be produced with about half the effort compared to that of five years ago"; an increase in the number of scenarios used in major studies, thus making "more complete understanding of the problem possible"; streamlined database efforts with an accompanying increase in efficiency; initiated a feedback mechanism for customer comments that proved "very useful in ensuring customer satisfaction"; pursued actively efficiencies in report preparation and interagency coordination; and increased computational power "by more than a factor of 10 in the past four years."[327]

The achievements reported in 1995 were only a small part of the overall achievement of TRAC and its predecessors. Prior to the formation of TRAC in 1986, TRASANA, CAORA, and the ORSA cells at the various TRADOC centers and schools made many major contributions to the development of Army materiel requirements, organization, doctrine, and training. TRAC continued that tradition of excellence after 1986, and although TRAC became TRADOC's principal analytical organization, a good deal of important work continued to be done at the integrating centers at Fort Leavenworth, Fort Lee, and Fort Benjamin Harrison; at the Command and General Staff College; and at the various Army branch schools. Indeed, all elements of the TRADOC analytical community contributed to what TRADOC was able to achieve during the period 1973–1995. The authors of *Prepare the Army for War* expressed those achievements succinctly:

> The U.S. Army Training and Doctrine Command spearheaded the sustained efforts to reform weapons, equipment, doctrine, and training in the 1970s and 1980s which produced the "Army of Excellence" that restored democratic government to Panama in Operation JUST CAUSE in 1989–90, decisively defeated and expelled the Iraqi army from Kuwait in Operation DESERT STORM in 1991, [and] conducted peace-keeping and humanitarian relief operations in Somalia, Bosnia-Herzegovina, Haiti, and Rwanda and elsewhere during the period.[328]

Chapter Six Notes

1 Although this chapter focuses on TRAC after 1986, it perforce deals with TRAC's predecessors and with the other elements of the TRADOC analytical community. The very number, diversity, and geographical dispersion of the elements involved make it difficult to identify and locate the documentation necessary to tell their story in detail. Some agencies existed for only a short time and were disestablished without leaving historical records. Others, for whatever reason, failed to prepare and publish annual historical reviews/summaries, or, having prepared them, have since lost track of their whereabouts. A useful overview of the development of TRADOC and its achievements during the period is contained in U.S. Army Training and Doctrine Command, Military History Office, *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command, 1973–1998* (Fort Monroe, Va.: Military History Office, USATRADOC, 1998) (cited hereafter as *Prepare the Army for War*), which includes a summary description of the evolution of TRADOC analysis agencies during the period. The other materials produced by the TRADOC Military History Office are also useful. Insofar as original records and documents concerning the establishment, organization, and operations of TRAC and the other elements of the TRADOC analytical community have been preserved, they are to be found in the historical files of HQ TRADOC and in the Combined Arms Center (CAC) Archives at the Combined Arms Research Library, Fort Leavenworth, Kansas. The CAC Historian's Office and HQ TRAC, both at Fort Leavenworth, also contain a good deal of useful historical information, and I am indebted to the CAC Historian, Dr. W. Glenn Robertson, and his staff and to Michael F. Bauman, the director of TRAC, for their assistance in locating the data needed to prepare this brief outline of TRAC history. Unless otherwise indicated, original documents (letters, memorandums, etc.) cited can be found in either the CAC Archives or the CAC Historian's Office.

[2] For additional details on the STEADFAST reorganization and the establishment of TRADOC, see Chapters Two and Three, above.

[3] The TRADOC commanders from 1973 to 1995 included the following: General William E. DePuy (1 July 1973–30 June 1977); General Donn A. Starry (1 July 1977–31 July 1981); General Glenn K. Otis (1 August 1981–10 March 1983); General William R. Richardson (11 March 1983–29 June 1986); General Carl E. Vuono (30 June 1986–11 June 1987); Lt. Gen. Robert H. Forman (Acting) (12–28 June 1987); General Maxwell R. Thurman (29 June 1987–1 August 1989); General John W. Foss (2 August 1989–22 August 1991); General Frederick M. Franks Jr. (23 August 1991–26 October 1994); and General William W. Hartzog (27 October 1994–14 September 1998) (see *Prepare the Army for War*, Appendix).

[4] From 1976 to 1985, the U.S. Army Materiel Command (AMC) was known as the U.S. Army Development and Readiness Command (DARCOM). For simplicity, I have used "AMC" throughout.

[5] On the ORSA elements in CDC and CONARC, see Volume II, Chapters Six and Seven.

[6] U.S. Continental Army Command, *Operation STEADFAST–Detailed Plan, Book III (On-Going Actions Which Relate to Operation STEADFAST), Volume C* (Fort Monroe, Va.: HQ CONARC, 20 July 1972), pp. III-C-1 to III-C-16 passim.

[7] U.S. Department of the Army, Special Study Group, *Final Report—Review of Army Analysis, Volume II: Appendices C–M* (Washington, D.C.: Special Study Group, U.S. Department of the Army, April 1979), app. D (Data), pp. D-I-2 to D-I-5 (cited hereafter as RAA II). The total authorization included clerical and other administrative personnel. There were twenty-five ORSA professionals on hand (twelve military and thirteen civilian).

[8] The Studies and Analysis Directorate (S&AD) was led by a succession of capable leaders. They included, in order, Lt. Gen. Max W. Noah, General David M. Maddox, and Lt. Gen. Wilson ("Dutch") A. Shoffner.

[9] Seymour L. Goldberg enlisted in the Army in 1941 and was commissioned as an infantry officer following Officer Candidate School in 1942. He served in combat in World War II and the Korean War and retired from active duty in 1966 as a colonel, at which time he joined the U.S. Army Combat Developments Command as a civilian analyst. He joined TRADOC along with other CDC personnel and served as the technical director of SA&D in the Office of the Deputy Chief of Staff for Combat Developments (DCS-CD) until his retirement in 1985. For nearly two decades, Goldberg was the trusted analytic counselor to countless Army senior officers and civilian leaders. Dogmatic and highly respected, Seymour Goldberg was the indisputable "Face of TRADOC Analysis" for many years.

[10] Col. Tony Brinkley was a prolific and respected analyst who had the remarkable distinction of leading both the "Big Five" XM1 Main Battle Tank (later named Abrams) COEA Update in 1979 and the first Close Combat Heavy MAA in 1981–1982 while assigned to Fort Knox, as well as the Light Helicopter Experimental (later named Comanche) COEA Update in 1991 while assigned to S&AD, DCS-CD, Fort Monroe.

[11] The CDC and CONARC T&E elements absorbed by TRADOC are discussed in greater detail above.

[12] *Prepare the Army for War*, p. 142; John L. Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WWII* (Fort Monroe, Va.: Historical Office, USATRADOC, 5 May 1983), pp. 7–8.

[13] *Prepare the Army for War*, p. 143. For a synopsis of the evolution of the TRADOC schools, 1973–1995, see *Prepare the Army for War*, Chapter 7.

[14] Unidentified study in ten chapters, the first of which is identified as "Main Report," Chapter 8, p. 1 (cited hereafter as MR82), copy in TRAC History File, CAC Historian's Office. The survey was done around 1982 by HQ TRADOC.

[15] Those schools that fell under the Administration (later Soldier Support) Center—for example, the Chaplain's School and the Finance School—did not have their own ORSA cells, but were supported by the center.

[16] RAA II, app. D, pp. D-I-2 to D-I-5.

[17] MR82, ch. 1, pp. 5–7, 12–17, and ch. 8 passim.

[18] While not practical to identify the complete body of studies and analyses produced by the TRADOC branch school ORSA cells, a representative sample of their work is that done by the Field Artillery School, which is documented in Appendix D.

[19] The Mission Area Analysis (MAA) was a new special type of analysis. In response to the *Office of Manpower and Budget (OMB) Circular A109*, published in 1977, the Chief of Staff of the Army directed a DA Special Study Group to determine how best to comply with OMB guidance. Their report, entitled *Army-Wide Mission Area Analysis*, was published in March 1980 and laid the foundation for the conduct of the first MAAs by the TRADOC branch schools.

[20] The thirteen distinct missions areas were as follows: Close Combat Light; Close Combat Heavy; Fire Support; Army Aviation; Air Defense; Combat Support; Combat Service Support; Battlefield Nuclear Warfare; Intelligence and Electronic Warfare; Nuclear, Biological, and Chemical; Communications; Command and Control; and Special Operations.

[21] The "Big Five" Army weapons systems of the 1980s and 1990s were the M1A1 Abrams main battle tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot missile system. The multiple-launch rocket system is sometimes incorrectly listed instead of the UH–60 Black Hawk utility helicopter.

[22] The CDC field agencies are discussed in Volume II, Chapter Seven.

[23] TRADOC test and evaluation organizations are discussed briefly in *Prepare the Army for War*, pp. 141–43. For an excellent survey of the development of Army OT&E up to mid-1983, see John L. Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WWII* (Fort Monroe, Va.: Historical Office, USATRADOC, 5 May 1983).

[24] Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WWII*, p. 9.

[25] Ibid. p. 7. Even before July 1983, CDCEC was commonly known as CDEC. In the interest of simplicity, I have followed that practice hereafter. For the earlier history of CDEC, see Volume I, Chapter Four, and Volume II, Chapters Six and Seven. The history of CDEC from 1956 to 1970 is also covered in John L. Romjue, *History of Field Experimentation Methodology in the United States Army, 1956–1970* (Fort Ord, Calif.: USACDCEC, June 1971).

[26] Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WWII*, p. 10.

[27] MR82, ch. 10, p. 1.

[28] Ibid.

[29] Ibid., pp. 1–3.

[30] Ibid., ch. 1, p. 12.

[31] *Prepare the Army for War*, p. 141. The transfer anticipated by two weeks the formal recommendation of the Army Systems Acquisition Review Committee (ASARC) contained in its 15 August 1974 report (see Karl E. Cocke, comp., Department of the Army Historical Summary, Fiscal Year 1975 [Washington, D.C.: U.S. Army Center of Military History, 2000], p. 107).

[32] For Project MASSTER and its successor organizations, see, inter alia: *Prepare the Army for War* passim; Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WW II*, pp. 6–8; U.S. Army Test and Experimentation Command, *TEXCOM: Truth In Testing—25th Anniversary Test and Experimentation Command, 1969–1994*, Brochure (Fort Hood, Tex.: USATEXCOM, 4 October 1994); and U.S. Army Test and Experimentation Command, Public Affairs Office, "Project MASSTER Chronologies" ([Fort Hood, Tex.]: Public Affairs Office, USATEXCOM, n.d. [c. 1990]).

[33] Romjue, *A Brief Overview of How the U.S. Army Has Conducted Organizational Testing Since WW II*, p. 6. The 1st Cavalry Division (Airmobile), recently returned from Vietnam, was designated the

TRICAP/ACCB test bed and was reorganized at Fort Hood on 5 May 1971 as the 1st Cavalry Division (TRICAP) with a division base, an armored brigade, an airmobile brigade, and an air cavalry combat brigade (see William Gardner Bell, comp., *Department of the Army Historical Summary Fiscal Year 1972* [Washington, D.C.: U.S. Army Center of Military History, 1974], pp. 55–56).

34 *Prepare the Army for War*, p. 142.

35 MR82, ch. 9, p. 1.

36 Ibid. The largest number were assigned to the Methodology and Analysis Directorate, which assisted and tied together the analysis efforts of the other elements and which was responsible for quality control of tests and reports on them.

37 Ibid., p. 2.

38 Ibid., p. 3.

39 *Prepare the Army for War*, p. 143.

40 Brig. Gen. John D. Robinson, "Report of Commander TRAC/FA49 Executive Agent," *Phalanx* 20, no. 3 (September 1987): 23. TRADOC Combined Arms Text Activity (TCATC) was co-located with HQ TEXCOM at Fort Hood and consisted of three test directorates (Battlefield Automation, Combat Arms, and Training Support Systems). TCATC was responsible for the conduct of large-scale force-on-force tests.

41 *Prepare the Army for War*, p. 143.

42 Ibid., p. 142. A very brief history of each of the test boards is given in Memorandum for the Record (MFR), HQ TEXCOM (ATCT-HI), n.p. [Fort Hood, Tex.], 23 March 1989, sub: Origin of the TEXCOM Boards. The five boards were as follows: the Airborne, Communications, and Electronics Board at Fort Bragg, North Carolina; the Field Artillery Board at Fort Sill, Oklahoma; the Infantry Board at Fort Benning, Georgia; the Armor and Engineer Board at Fort Knox, Kentucky; and the Air Defense Board at Fort Bliss, Texas.

43 Ibid. With the establishment of the new Communications-Electronics Board at Fort Gordon, the former Airborne, Communications, and Electronics Board at Fort Bragg was redesignated the Airborne Board.

44 Ibid.

45 William Gardner Bell and Karl E. Cocke, comps. and eds., *Department of the Army Historical Summary, Fiscal Year 1973* (Washington, D.C.: U.S. Army Center of Military History, 1977), p. 46 (cited hereafter as 1973 DAHSUM); Ltr, U.S. Continental Army Command (CS-SSG-STEADFAST) to Chief of Staff Army (DACS-MR), Fort Monroe, Va., 28 Feb 73, sub: Revision of STEADFAST Detailed Plan, 20 Jul 72, Incl 1 (Executive Summary), pp. 3–4.

46 U.S. Army Training and Doctrine Command, Military History Office, *Transforming the Army: TRADOC's First Thirty Years, 1973–2003* (Fort Monroe, Va.: Military History Office, USATRADOC, 2003), p. 65.

47 In fact, until 1983 only CAC had a three-star commander.

48 RAA II, app. D, pp. D-I-2 to D-I-5.

49 U.S. Department of the Army, Special Study Group, *Final Report—Review of Army Analysis Extended (RAAEX), Volume II: Task Reports* (Washington, D.C.: Special Study Group, U.S. Department of the Army, March 1985), p. 8-15, Table; p. 8-21, Table; and p. 8-25, Table) (cited hereafter as RAAEX II).

50 *Transforming the Army*, p. 65.

51 In 1984, the Institute of Personnel and Resource Management was renamed the Soldier Support Institute.

52 MR82, ch. 1, p. 4. The ORSA program of the Soldier Support Center is discussed in detail in MR82, Chapter 4 ("Soldier Support Center").

53 Ibid., pp. 4, 12.

54 Ibid., pp. 3, 11. The ORSA program of the Logistics Center is discussed in detail in MR82, Chapter 3 ("Logistics Center").

55 Ibid., p. 3. TRADOC Operations Research Activity (TORA) is discussed above.

56 Ibid., p. 4.

57 *Transforming the Army*, p. 65. The Logistics Center remained a tenant organization at Fort Lee, command of which was invested in the commander of the U.S. Army Quartermaster Center and Fort Lee, until 3 January 1989, when the TRADOC commander established the U.S. Army Logistics Center at Fort Lee, and the TRADOC deputy commanding general for logistics took over.

58 The 1982 CAC organization chart in the series of viewgraph transparencies depict the organization and missions of CAC at various times from 1982 to 2001 (identified hereafter as CAC Organization Charts), copy in TRAC History File, CAC Historian's Office.

59 Following the recommendation of the RAA study group, the Combat Operations Analysis and the War Gaming and Scenarios directorates as well as certain training support elements were stripped out of Combined Arms Combat Developments Activity (CACDA) and merged to form a separate, free-standing analytical organization at Fort Leavenworth, the Combined Arms Studies and Analysis Agency (CASAA), which subsequently evolved into the Combined Arms Operations Research Activity (CAORA) in 1982.

60 E. B. Vandiver III, "Review of Army Analysis," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Eighteenth Annual US Army Operations Research Symposium (AORS XVIII), Fort Lee, Virginia, 13–16 November 1979, Volume I* (Bethesda, Md.: USACAA, 1979), p. 16. At the same time, the Army Materiel Systems Analysis Activity (AMSAA) had about 300 analytical personnel, the Concept and Analysis Agency (CAA) had about 200, and TRADOC Systems Analysis Activity (TRASANA) had about 300.

61 Ibid., p. 41, Slide 25 (Actions for Area III-Studies of Combined Arms and Support Major Organizations—Brigades, Divisions, Corps).

62 MR82, ch. 1, p. 3. The CACDA ORSA program is discussed in detail in MR82, Chapter 2 ("Combined Arms Combat Development Activity").

63 Ibid., ch. 2, pp. 3–4.

64 Ibid., p. 3

65 Disposition Form, Director, AMMO [Army Model Improvement Management Office], to Commander, CAC, Fort Leavenworth, Kans., 7 Jan 83, sub: Combined Arms Center Historical Review AMMO Input (copy in Fort Leavenworth, Kansas, Combined Arms Research Library, Special Collections, Combined Arms Center Archives, File "Gap Anal SG AMIP 83 SSG AMMO–001").

66 *Transforming the Army*, p. 65.

67 Ibid., p. 66. CAC's combat developments, doctrinal concepts, and integration functions were transferred to HQ TRADOC, and the corresponding responsibilities in the administration and logistics areas were centralized in HQ CASCOM.

68 1973 DAHSUM, p. 36. The treaty limited each nation's ABM defenses to one location. In the case of the United States that site was in Grand Forks, North Dakota. The United States' large ABM development program, known as SAFEGUARD, was terminated following ratification of the ABM Treaty, which remained in effect until 13 December 2001, when President George W. Bush gave Russia notice of U.S. withdrawal from the treaty.

69 *TRAC-WSMR History* ([White Sands Missile Range, N.Mex.]: HQ TRAC-WSMR, [c. 2001]), p. 2, copy in TRAC History File, CAC Historian's Office.

70 Karl E. Cocke, comp., *Department of the Army Historical Summary, Fiscal Year 1974* (Washington, D.C.: U.S. Army Center of Military History, 1978), p. 28 (cited hereafter as 1974 DAHSUM). See also Michael W. Garrambone, Robert S. Sheldon, and Debra R. Hall, interviewers, *A MORS Oral History Interview with Edgar Bishop Vandiver III, FS* (Alexandria, Va.: Military Operations Research Society, 16 June 2005), p. 48; *TRAC-WSMR History*, p. 2.

71 Cocke, 1974 DAHSUM, p. 28. Some former SAFSEA personnel continued to perform assigned tasks for the Ballistic Missile Defense Program Manager.

72 *Prepare the Army for War*, p. 143.

73 Dr. Payne apparently did not require much urging. He and his wife had visited New Mexico and were eager to live there (see Edgar B. Vandiver III, Second Oral History Interview with Dr. Charles R. Shrader, Fort Belvoir, Virginia, 25 October 2005, USAWC/USAMHI Senior

Officer Oral History Program, "Operations Research in the United States Army" Project [Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2006], p. 18).

[74] Col. Martin L. Haskins retired on 30 September 1975, and Leon F. Goode Jr. was the acting director of TRASANA from 10 October to 30 November 1975, when Dr. Wilbur B. Payne assumed the directorship. Dr. Payne left TRASANA on 30 September 1982, and Goode became director on 1 October 1982 and served in that position until 30 September 1986, when TRASANA became a part of the TRADOC Analysis Command and was reorganized as TRAC-White Sands Missile Range (TRAC-WSMR).

[75] *TRAC-WSMR History*, p. 8.

[76] TRASANA's analytical work was organized in terms of the so-called Battlefield Functional Areas (BFAs): command and control, intelligence and security, maneuver, etc. The BFAs were major elements in the Mission Area Analyses (MAAs).

[77] *TRAC-WSMR History*, p. 8.

[78] MR82, ch. 5, p. 6. The team also commented, "The participation of schools and centers in model development appears to have been sporadic at best," and that "although many schools take full advantage of TRASANA capabilities, others do not know what is available."

[79] *TRAC-WSMR History*, p. 3.

[80] RAA II, app. D, pp. D-I-2 to D-I-5. The total number of personnel authorized included clerical and other administrative personnel. In FY 1978, TRASANA's budget was $8,513,000 ($8,046,000 in P2 OMA funds, $307,000 in RDTE funds, and $160,000 in other funds) (see *TRAC-WSMR History*, p. 7). The FY 1979 budget was $9,726,000 ($8,262,000 in P2 OMA funds for combat development studies, $315,000 in RDTE funds for support of the Theater Nuclear Force/Survivability Program, $1,006,000 in P8T funds for support of the new Training Effectiveness Analysis Division, and $691,000 in other funds) (see *TRAC-WSMR History*, p. 8).

[81] MR82, ch. 5 ("TRASANA"), p. 1.

[82] RAAEX II, p. 8-15, Table; p. 8-21, Table; and p. 8-25, Table.

[83] MR82, ch. 1, pp. 5, 8–10. Detailed discussion of TRASANA's ORSA program is in Chapter 4 ("TRASANA").

[84] Ibid.

[85] Ibid.

[86] Ibid., ch. 5, p. 5.

[87] U.S. Department of the Army, Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: Special Study Group, U.S. Department of the Army, April 1979), pp. 2-5, 2-6, 7-3, 7-4 (cited hereafter as RAA I). A number of TRADOC organizations were not mentioned by the RAA study group, including the Command and General Staff College and the Institute of Military Assistance, both of which did have some ORSA capabilities.

[88] Ibid., pp. 8-1, 8-2.

[89] Ibid., pp. 8-3, 8-4.

[90] Ibid., p. 9-1.

[91] Ibid., p. 7-1.

[92] Ibid.

[93] Ibid., pp. 7-3, 7-4.

[94] Fact Sheet, Mr. Abraham Goldberg (Director, Studies and Analysis Directorate [SAD], DCS-CD, HQ TRADOC), Fort Monroe, Va., 12 Apr 83, sub: Chain of Command for CAORA.

[95] Headquarters, U.S. Army Training and Doctrine Command, Permanent Orders (PO) 28-2, Fort Monroe, Va., 18 March 1983. The official establishment of CAORA was simultaneous with the establishment of the TRADOC Operations Research Activity at WSMR (see chapter text above).

[96] Brig. Gen. John L. Ballantyne III served as the commander of CAORA until 7 October 1983, when he was promoted to major general and reassigned to the Military District of Washington. The subsequent commanders of CAORA from October 1983 to 30 September 1986 were as follows: Col. Arvid E. West Jr. (Acting) (7–28 October 1983); Col. Stephen Friend (Acting) (18 October–28 November 1983); Brig. Gen. David M. Maddox (28 November 1983–June 1986); and Brig. Gen. John D. Robinson (June 1986–30 September 1986). Col. (USA Ret.) Reed Davis was selected for the GM–15 CAORA deputy position and reported for duty on 3 October 1983. General Maddox, General Robinson, and Colonel Davis were all qualified ORSA officers. General Maddox later rose to four-star rank and command of the United States Army, Europe.

[97] Brig. Gen. David M. Maddox, "CAORA, ORSA, and Army Analysis," *Phalanx* 18, no. 4 (December 1985): 25.

[98] Disposition Form, First Indorsement, Commander, CAORA, to Commander, CAC and Fort Leavenworth, Fort Leavenworth, Kans., 9 Dec 83, sub: Combined Arms Center Annual Historical Review, encl.

[99] Msg 181955Z Sep 82, TRADOC Chief of Staff to Commander CAC; CAC Organization Charts, Chart "1983"; MR82, ch. 5, pp. 1–6 passim. The scientific advisor was originally designated as the director of research and was responsible for setting up the CAORA research program, chairing the Project Review Board that reviewed all CAORA projects, and overseeing the one officer assigned to monitor the SC 49 program (see MR82, ch. 6, pp. 1–2).

[100] CAC Organization Charts, Chart ("1984"). See Ltr, Commander CAORA thru Director TORA to Commander TRADOC (ATRM-FI), Fort Leavenworth, Kans., 28 Apr 83, sub: Concept Plan for Reorganization of CAORA. The Corps Battle Analysis Directorate was eliminated at some point before December 1985 (see CAC Organization Charts, Chart ["1986"], and Maddox, "CAORA, ORSA, and Army Analysis," p. 24).

[101] HQ TRADOC PO 28-2, 18 March 1983. Message 181955Z Sep 82, TRADOC Chief of Staff to Commander CAC, puts the number of authorized civilians at 91, for a total complement of 186 authorized personnel.

[102] MR82, ch, 6, p. 8.

[103] Disposition Form, First Indorsement, Commander, CAORA, to Commander, CAC, ATTN: ATXL-SWI-H, Fort Leavenworth, Kans., 15 Jun 83, sub: Combined Arms Center Annual Historical Review, p. 1.

[104] Maddox, "CAORA, ORSA, and Army Analysis," p. 24.

[105] Headquarters, U.S. Army Training and Doctrine Command, PO 128-4, Fort Monroe, Va., 30 September 1986.

[106] MR82, ch. 1, p. 4. The detailed discussion of the ORSA program at CAORA is in MR82, Chapter 6 ("CAORA").

[107] Ibid., p. 10.

[108] Msg 181955Z Sep 82, TRADOC Chief of Staff to Commander CAC (Lt Gen William R. Richardson), Fort Monroe, Va., 18 Sep 82, sub: Realignment of TRADOC Analysis Capabilities; U.S. Army TRADOC Analysis Center, Fort Leavenworth, Kans., 16 July 2003, Overview Slide 4 (TRAC Analysis History), copy in TRAC History File, CAC Historian's Office; CAC Organization Charts, Chart "1982/83 Changes"; Lt. Col. Larry R. Tinberg, Operations Research and the US Army, Student Essay (Carlisle Barracks, Pa.: U.S. Army War College, 7 April 1983), p. 17.

[109] Leon F. Goode Jr. replaced Dr. Payne as director of TRASANA. Payne was not entirely happy with the new arrangement. He saw himself more as a leader of analysts than as a manager, and he apparently continued to be directly involved in TRASANA operations. Dr. Payne was the only director of TORA.

[110] Msg 181955Z Sep 82, TRADOC Chief of Staff to Commander CAC.

[111] *Prepare the Army for War*, pp. 143–44. The TRADOC Research Element-Monterey (TREM) had been established by TRADOC Chief of Staff Maj. Gen. John B. Blount in December 1979 to support Army ORSA students attending the Naval Postgraduate School (NPS) and to support research and development of air/land combat models and other research and analyses being conducted at NPS for TRADOC. Although not shown on the TORA organizational chart on page 9 of the *TRAC-WSMR History*, the TRADOC Research Element at Lawrence Livermore National Laboratory (TELL), also established in 1979, was also intended to be subordinate to TORA. The histories of both TREM and TELL and their successors, TRAC-Monterey and TRAC-Lawrence Livermore, are discussed in greater detail within the chapter, below.

[112] Compare the TRASANA mission statement given in *TRAC-WSMR History*, p. 8, with the TORA mission statement contained in

Ltr, Director, U.S. Army Systems Analysis Activity, to Commander, U.S. Army Training and Doctrine Command, ATTN: ATDC-C, White Sands Missile Range, N.Mex., n.d. [between 3 Aug and 1 Oct 82], sub: Concept Plan for Realignment of Combined Arms and Analysis Functions, Incl 1, p. 1. The same document also outlined revised missions and functions for CAORA, TRASANA, TREM, and TELL.

113 Ltr, Director TRASANA to Commander TRADOC, n.d. [1982], sub: Concept Plan for Realignment of Combined Arms and Analysis Functions, Incl 1, par I.

114 MR82, ch. 1, p. 1.

115 Ibid., p. 2.

116 Ibid.

117 Ibid.

118 Ibid., p. 3.

119 Ibid., p. 17.

120 Ibid., p. 18.

121 Ibid., pp. 19–22.

122 Ibid., pp. 19–22 passim.

123 See RAAEX II, ch. 2.

124 RAAEX II, pp. 2-20, 2-22, 2-30, 2-32, 2-36.

125 Ibid, pp. 8-37.

126 Ibid., pp. 15-14, 15-28.

127 In the early days of TORA, the joint operation of TRASANA and CAORA did not go smoothly (see *TRAC-WSMR History*, p. 10).

128 General Richardson commanded TRADOC from 11 March 1983 to 29 June 1986. Earlier, he had served as the CAC commander (9 October 1979–23 August 1981).

129 Fact Sheet, Col William A. Brinkley (Director, SAD, DCS-CD, HQ TRADOC) (Fort Leavenworth, Kans), 9 Apr 86, sub: Proposed Move of TRASANA to Ft Leavenworth.

130 Ibid.

131 *TRAC-WSMR History*, p. 17.

132 Ibid.

133 Ibid.

134 Several veterans of the Army analytical community have suggested that the creation of TRAC was in part simply an attempt by General Richardson to get rid of Wilbur Payne.

135 Ltr, Commander TRADOC (ATRM-FT) to HQDA (DAMO-FDP), Fort Monroe, Va., 18 Feb 86, sub: Concept Plan for Reorganization of TRADOC Analysis Agencies.

136 Disposition Form, Chief, Resource Management Division, CAORA (Lt Col David P. Zupancic) to SEE DISTRIBUTION, Fort Leavenworth, Kans., 29 Apr 86, sub: Reorganization and Name Change.

137 Quoted in Col. William A. Brinkley (Director, SAD, TRADOC DCS-CD), "DCSCD Assessment of LTG RisCassi White Paper on TRAC" (Fort Monroe, Va.: n.d. [before 1 May 1986]), p. 1.

138 Msg 181231Z Apr 86, CG TRADOC to DCG TRADOC, sub: Provisional Organization of TRADOC Analysis Center (TRAC). The legal impediments are outlined in Disposition Form, Brig. Gen. William H. Reno (TRADOC DCS-RM) to TRADOC Chief of Staff, Fort Monroe, Va., n.d. [1986], sub: Current Status of TRAC Concept Plan and Possible Problem Areas. Dr. Payne, the director of TORA, was notified of the provisional activation of TRAC in a letter from General RisCassi dated 29 April 1986 (Ltr, Lt Gen Robert W. RisCassi [TRADOC DCG-CA] to Dr Wilbur B. Payne [Director TORA], Fort Monroe, Va., 29 Apr 86, sub: Provisional Activation of the TRADOC Analysis Center [TRAC]). At the time, Payne was engaged full-time as director of the Forward Area Air Defense Special Study Group.

139 Disposition Form, Commander CAORA to Deputy Commanding General for Combined Arms, TRADOC, Fort Leavenworth, Kans., 25 Apr 86, sub: Appointment of Deputy Commander, TRADOC Analysis Center (TRAC)—ACTION DF. One reason TRAC was activated provisionally on 1 May 1986 was to provide sufficient overlap with Brig. Gen. David M. Maddox's successor, Brig. Gen. John D. Robinson (see Concurrence, TRADOC DCS-CD to TRADOC Chief of Staff, Fort Monroe, Va., 4 Apr 86, sub: DCSCD Concur with Comment, attached to DF, TRADOC DCS-RM to TRADOC Chief of Staff, n.d., sub: Current Status of TRAC Concept Plan and Possible Problem Areas).

140 Msg 251846Z, Apr 86, HQDA (DAMO-FDP, Washington) to Commander TRADOC (Fort Monroe, Va.), sub: Concept Plan for Reorganization of TRADOC Analysis Agencies; Headquarters, U.S. Army Training and Doctrine Command, PO 128-5, Fort Monroe, Va., 30 Sep 1986.

141 Headquarters, U.S. Army Training and Doctrine Command, PO 128-3, Fort Monroe, Va., 30 Sep 1986; Headquarters, U.S. Army Training and Doctrine Command, PO 128-4, Fort Monroe, Va., 30 Sep 1986. At the time they were disestablished, TORA had an authorized strength of 57 officers, 2 warrant officers, 35 enlisted personnel, and 300 civilians, and CAORA had an authorized strength of 87 officers, 17 enlisted personnel, and 135 civilians. The other major element, TRASANA, was reorganized and redesignated TRAC-White Sands Missile Range (TRAC-WSMR) on 1 October 1986.

142 Brig. Gen. John D. Robinson, "On TRAC," *Phalanx* 19, no. 4 (December 1986): 6.

143 Headquarters, U.S. Army TRADOC Analysis Command, *TRAC Executive Summary* (Fort Leavenworth, Kans.: HQ TRAC, n.d. [ca. 1989]), p. 1.

144 Disposition Form, Chief, RMD, CAORA, 29 Apr 86; Ltr, Headquarters, U.S. Army Training and Doctrine Command, Fort Monroe, Va., 8 Jan 87, sub: Letter of Instruction (LOI) for Organization of the U.S. Army TRADOC Analysis Command (TRAC).

145 U.S. Department of the Army, Deputy Under Secretary of the Army for Operations Research, *Army Management Review Task Force-Final Report by DUSA (OR)* (Washington, D.C.: ODUSA [OR], HQDA, 15 August 1989), p. 4-8.

146 Ltr, Iris Kameny (Chair, Army Science Board Analysis, Test, and Evaluation Issue Group) to Walter W. Hollis (DUSA-OR), Washington, 22 Sep 95, no subject [Report of Study of Army Analytical Organizations], app. D (TRADOC Analysis Command [TRAC] Information), p. 1. The Army Science Board Analysis, Test, and Evaluation Issue Group was chartered to assess the impact of personnel reductions on mission accomplishment within AMSAA, CAA, and TRAC.

147 *TRAC Executive Summary*, pp. 3–4.

148 Ibid., p. 4.

149 Disposition Form, Chief, RMD, CAORA, 29 Apr 86, Encl 1; Ltr, General Carl E. Vuono (CG TRADOC) to SEE DISTRIBUTION, Fort Monroe, Va., 8 Jan 87, sub: Letter of Instruction (LOI) for Organization of the U.S. Army TRADOC Analysis Command (TRAC) (cited hereafter as 8 January 1987 LOI). The 8 January 1987 LOI was a revision of a draft LOI prepared by the TRADOC DCS for resource management in June 1986 but not issued due to anticipation of further changes in the organization of TRAC.

150 8 January 1987 LOI, p. 1.

151 Ibid., p. 5. In his role as executive agent for the FA 49 Proponent, the TRAC commander developed and recommended requirements for changes in the ORSA Officer Specialty Program, assisted in the determination of FA 49 Army Education Requirements Board (AERB) positions, and recommended appropriate graduate schooling. He also advised on criteria for FA 49 designation and classification and maintained communications with officers in the FA 49 specialty for the exchange of ideas and dissemination of information (see Headquarters, U.S. Army TRADOC Analysis Center, "Job Description, Commander, US Army Training and Doctrine Command Analysis Center [TRAC], Fort Leavenworth, Kansas," Fort Leavenworth, Kans., n.d. [1986], p. 2). He performed similar functions with regard to his role as the TRADOC career program manager for Series 1515 civilians.

152 Ibid., p. 2. TRADOC Analysis Command-Fort Leavenworth (TRAC-FLVN) consisted of the three former CAORA technical directorates (Studies and Analysis, War Gaming and Scenarios, and Scientific and Technical Support), the missions of which remained unchanged. TRASANA became TRAC-WSMR without substantial change of mission or organization. The successor to CAORA at Fort Leavenworth was initially designated TRAC-Combined Arms Support

(TRAC-CAS) and the successor to TRASANA at WSMR was initially designated TRAC-School Support (TRAC-SS), but both those designations were dropped in favor of TRAC-FLVN and TRAC-WSMR. The directors of both TRAC-FLVN and TRAC-WSMR were to be Senior Executive Service (SES) civilians who would report directly to the TRAC commander.

153 Ibid.

154 Ibid. The director of RPD was to be a colonel and would report directly to the TRAC commander. The four manpower spaces required to staff the RPD were to come from the Doctrine Evaluation Activity of the TRADOC DCS-Doctrine.

155 Ibid., pp. 2–3. The directors of all three organizations were to be civilians reporting directly to the TRAC commander. The manpower support for TRADOC Analysis Command-Fort Lee (TRAC-LEE) was not to exceed twenty-five spaces, to be provided by the Logistics Center, and that of TRAC-FBHN was not to exceed twelve spaces, to be provided by HQ TRADOC. TRADOC Analysis Command-Los Alamos National Laboratory (TRAC-LA) was to be a much smaller organization.

156 Ibid., pp. 3–4.

157 TRAC-FLVN was reestablished in 1996 as a Center of Expertise, and continues to exist as of this writing.

158 Headquarters, U.S. Army Combined Arms Center and Fort Leavenworth, PO, Fort Leavenworth, Kans., 30 Jan 1987. Unless otherwise indicated, the following discussion of TRAC-WSMR is based on *TRAC-WSMR History*, pp. 17–23.

159 Leon F. Goode Jr. served from 3 October 1986 to 1987. His successors during the period under consideration were Dr. Darrell W. Collier (1988–1992) and Roy F. Reynolds (1992–1995).

160 Christina Fishback, *TRAC History Annotated Timeline (DRAFT)* (Fort Leavenworth, Kans.: HQ TRAC, 2003), p. 8.

161 Memo, Walter W. Hollis (DUSA-OR) for Mr. John S. Doyle Jr. and Lt Gen John J. Yeosock (Co-Chairmen, Army Management Review Task Force), Washington, 22 Sep 89, sub: Army Management Review, Issue #2 - Realignment of Army Analysis Agencies, p. 2.

162 Memo, Michael F. Bauman (Deputy Director TRAC) to Commander TRADOC (ATTN: ATPA) and Commander CAC and Fort Leavenworth (ATTN: ATZL-PAO), Fort Leavenworth, Kans., 2 Nov 89, sub: Defense Management Review and TRADOC Analysis Command. The civilian authorizations included one SES, nine GS/GM–15s, forty GS/GM–14s, and seventy-five GS–13s.

163 *TRAC-WSMR History*, p. 19.

164 Ibid.

165 Ibid., p. 21.

166 Not shown in Figure 6–6. See the discussion of the USAREUR ORSA cells in Chapter Three above.

167 *TRAC Executive Summary*, p. 4.

168 *Draft TRAC-LEE History* ([Fort Lee, Va.], n.d. [c. 2005]), p. 1.

169 Ibid.

170 Ibid. Robert A. Cameron served as director from 5 April 1987 to 1995. He was succeeded by Dr. Gerald A. Klopp, who served until 2000.

171 Ibid., p. 2.

172 U.S. Army TRADOC Analysis Command-Fort Benjamin Harrison, A Historical Review of the TRADOC Analysis Command at Fort Benjamin Harrison, Indiana (TRAC-FBHN), Period: 1 January–30 June 1989 (Fort Benjamin Harrison, Ind.: TRAC-FBHN, n.d. [1989]), p. 1.

173 Ibid.; U.S. Army TRADOC Analysis Command-Fort Benjamin Harrison, *Command Briefing*, Fort Benjamin Harrison, Ind., n.d. [1988], Chart [TRAC-FBHN WORK PROGRAM]; and Memo, Col Robert T. Howard (CG TRAC) for General Maxwell R. Thurman (CG TRADOC), Fort Leavenworth, Kans., 26 Oct 88, sub: Initial Assessment of the TRADOC Analysis Command, Encl ("TRAC – The Assigned Work Force").

174 *Draft TRAC-LEE History*, p. 2, and 1988 TRAC-FBHN *Command Briefing*, Chart (TRAC-FBHN MISSION). In 1989, TRAC-FBHN assumed responsibility for the TRADOC MANPRINT contract, which governed funding for contract studies on manpower, personnel, and training subjects (see *Draft TRAC-LEE History*, p. 2).

175 *Draft TRAC-LEE History*, p. 1. On the consolidation of TRAC-LEE and TRAC-FBHN, see also Memo, Commander TRAC for Commander U.S. Army Combined Arms Support Command, Fort Leavenworth, Kans., 25 Sep 1991, sub: Consolidation of TRAC-LEE and TRAC-FBHN.

176 Memo, CG TRAC for CG CASCOM, 25 Sep 91, p. 1. When Robert A. Cameron retired in 1995, Dr. Gerald A. Klopp became director.

177 Ibid.

178 Ibid., p. 2.

179 *Draft TRAC-LEE History*, pp. 3–4.

180 Fact Sheet, Mr. Abraham Goldberg (SAD, DCS-CD, HQ TRADOC), Fort Monroe, Va., 7 Apr 83, sub: TRADOC Research Element Monterey (TREM). Maj. Gen. John B. Blount acted in response to the direction of the TRADOC commander, General Donn A. Starry, who had had a conversation with NPS OR Professor Samuel Parry in which Parry had suggested that a TRAC billet at NPS would encourage research and teaching in the ORSA field (see Fishback, *TRAC History Annotated Timeline [DRAFT]*, p. 3). On the origins and development of TREM/TRAC-Monterey, see also U.S. Army TRADOC Analysis Command-Monterey, *Draft TRAC-Monterey History* (Monterey, Calif.: TRAC-Monterey, n.d. [c. 1989]) (cited hereafter as *1989 Draft TRAC-Monterey History*), and U.S. Army TRADOC Analysis Command-Monterey, *Draft TRAC-Monterey History* (Monterey, Calif.: TRAC-Monterey, n.d. [c. 2005]) (cited hereafter as *2005 Draft TRAC-Monterey History*).

181 *1989 Draft TRAC-Monterey History*, p. 1.

182 The first director of TREM was Lt. Col. Edward Kelleher, who served from May 1980 until his retirement from active duty in February 1983. His successors as director of TREM/TRAC-MTRY from February 1983 to September 1995 were as follows: Maj. Joseph Rozman (Acting) (February–August 1983); Lt. Col. Charles Macchiaroli (August 1983–July 1987); Lt. Col. Jack Miller (July 1987–July 1988); Lt. Col. Vernon M. Bettencourt Jr. (July 1988–April 1989); Maj. Hirome Fujio (Acting) (April–July 1989); Lt. Col. Bard Mansager (July 1989–October 1990); Lt. Col. Michael D. Proctor (May 1991–July 1994); and Lt. Col. James R. Wood (July 1994–July 1997) (list compiled from *1989 Draft TRAC-Monterey History*, p. 16, and *2005 Draft TRAC-Monterey History*, pp. 4–5).

183 *2005 Draft TRAC-Monterey History*, p. 1.

184 MR82, ch. 1, p. 7.

185 *1989 Draft TRAC-Monterey History*, p. 2.

186 Ltr, Director TRASANA to Commander TRADOC (ATTN: ATDC-C), White Sands Missile Range, N.Mex., n.d. [1982], sub: Concept Plan for Realignment of Combined Arms and Analysis Functions, p. 5.

187 Headquarters, U.S. Army Combined Arms Center and Fort Leavenworth, PO, Fort Leavenworth, Kans., 30 Jan 1987.

188 Maj. Mark Strum, "TRAC-MTRY—10 Years of Excellence," *Phalanx* 23, no. 2 (June 1990): 15.

189 Goldberg Fact Sheet, 7 Apr 83; 1989 Draft TRAC-Monterey History, p. 2. Development of STAR was led by NPS Professor Samuel Parry, and in November 1981, the decision was made to use STAR as the Force-on-Force model for the "Mortars in Combat Units" study.

190 *1989 Draft TRAC-Monterey History*, p. 2.

191 Ibid., pp. 2–3.

192 Ibid., p. 3. The AMORE model assessed "military unit capabilities as a function of time after experiencing degradation of personnel and materiel assets" and allowed resolution down to the level of the individual soldier. It thus "was a valuable replacement for STAR and contributed substantially to the determination of unit effectiveness." TRAC-MTRY analysts also played a major role in adapting JANUS to small computers, thereby making it more readily available throughout the Army and increasing the realism of command post exercises down to brigade level (see 2005 *Draft TRAC-Monterey History*, p. 2).

193 Ibid.

194 Ibid., p. 4.

195 Ibid., p. 5.

196 Ibid., p. 13.

197 Ltr, Director TRASANA to Commander TRADOC (ATTN: ATDC-C), White Sands Missile Range, N.Mex., n.d. [1982], sub: Concept Plan for Realignment of Combined Arms and Analysis Functions, p. 6.

198 Headquarters, U.S. Army Combined Arms Center and Fort Leavenworth, Permanent Orders, Fort Leavenworth, Kans., 30 January 1987.

199 Ibid.

200 Memo, Howard for Thurman, 26 Oct 88. By FY 1990, TRAC-LL was authorized two military analysts (see Enclosure [Map: TRADOC Analysis Command] to Memo, Bauman to Commander TRADOC, 2 Nov 89).

201 Robinson, "Report of Commander TRAC/FA49 Executive Agent," p. 23.

202 Ibid.

203 Ltr, Col Robert T. Howard (CG TRAC) to General Maxwell R. Thurman (CG TRADOC), Fort Leavenworth, Kans., 26 Oct 88, sub: Initial Assessment of the TRADOC Analysis Command. General Thurman assumed command of TRADOC on 29 June 1987.

204 Ibid., p. 1.

205 Ibid.

206 Ibid.

207 Ibid., p. 2.

208 Headquarters, U.S. Army TRADOC Analysis Command, *TRAC-1990s* (Fort Leavenworth, Kans.: HQ TRAC, July 1990). (hereafter cited as *TRAC-1990s*) In fact, the July 1990 White Paper was the formal expression of detailed proposals, the essence of which had been worked out earlier and submitted to the TRADOC commander, General John W. Foss, on 16 April 1990 for his approval (see Memo, Brig Gen Robert T. Howard [CG TRAC] for General John W. Foss [CG TRADOC], Fort Leavenworth, Kans., 4 Jun 90, sub: TRAC Reorganization, p. 1). General Howard's proposals were generally known as "TRAC-Future" and were later summarized in Memo, Brig Gen Robert T. Howard (CG TRAC) for General John W. Foss (CG TRADOC), Fort Leavenworth, Kans., 27 Jul 90, sub: TRAC.

209 *TRAC-1990s*, p. 2.

210 Ibid., pp. 2–3.

211 Ibid., p. 3.

212 *TRAC-WSMR History*, p. 18.

213 TRAC-1990s, pp. 18–23 passim.

214 Ibid., pp. 2–4.

215 *TRAC-WSMR History*, p. 18.

216 See, inter alia: Memo, Director TRAC-FLVN for CG TRAC, Fort Leavenworth, Kans., 11 May 90, sub: TRAC-FLVN Structure Under TRAC Reorganization; Memo, Col William A. Brinkley (Director, TRAC RPD) for Brig Gen Robert T. Howard (CG TRAC), Fort Monroe, Va., 14 May 90, sub: TRAC Reorganization and Establishment of the Office of the Deputy Chief of Staff for Analysis (ODCSA); and Memo, Dr Darrell W. Collier (Director TRAC-WSMR) for CG TRAC, White Sands Missile Range, N.Mex., 18 May 90, sub: TRAC Reorganization Issues.

217 See Memo, Brig Gen Robert T. Howard (CG TRAC) for TRAC PERSONNEL, Fort Leavenworth, Kans., 21 May 90, sub: Future TRAC; and Memo, Brig Gen Robert T. Howard (CG TRAC) for TRAC PERSONNEL, Fort Leavenworth, Kans., 22 May 90, sub: TRAC Reorganization.

218 Memo, Howard for TRAC PERSONNEL, 22 May 90, p. 2.

219 Memo, Howard for Foss, 4 Jun 90.

220 Ibid., p. 1.

221 Memo, Howard for Foss, 27 Jul 90.

222 Ibid.

223 Brig. Gen. Richard W. Tragemann was subsequently promoted to major general and commanded the U.S. Army Test and Evaluation Command and Aberdeen Proving Ground from 14 September 1992 to 18 September 1996. His terms as commanding general of TRAC and commanding general of ATEC are covered in his oral history: Maj. Gen. (USA, Ret.) Richard W. Tragemann, *Tested with the Best: An Oral History of MG Richard W. Tragemann, USA Retired*, J. Britt McCarley (TECOM Command Historian), interviewer (Aberdeen Proving Ground, Md.: HQ USATEC, April 1997).

224 Memo, Brig Gen Richard W. Tragemann (CG TRAC) for ADCS-A and TRAC Directors, Fort Leavenworth, Kans., 22 Apr 91, sub: TRAC Objective Organization. For the discussions that preceded General Tragemann's 22 April 1991 memorandum, see, inter alia, Memo, HQ TRAC, Fort Leavenworth, Kans., Feb 91, sub: TRAC Objective Organization, p. 1; Memo, Col William A. Brinkley (ADCSA) for Brig Gen Tragemann (DCSA/CG TRAC) and Dr Collier (Director, TRAC-WSMR), Fort Monroe, Va., 1 Mar 91, sub: Future DCSA and TRAC Organizations; Memo, Col Charles M. Black (Director, TRAC SWC) for Director, TRAC OAC, Fort Leavenworth, Kans., 10 Mar 91, sub: TRAC Future; MFR, Col Robert H. Wood (Director, TRAC SAC), Fort Leavenworth, Kans., 12 Mar 91, sub: TRAC Future; Memo, Lowell L. Martin (Director, TRAC Operations) for CG, TRAC, Fort Leavenworth, Kans., 18 Mar 91, sub: TRAC Future; Draft Memo, Commander TRAC for Directors, TRAC-WSMR, OAC, SAC, SWC, TRAC-LEE, and TAC-FBHN, Fort Leavenworth, Kans., n.d. [after 18 Mar 91], sub: TRAC Future.

225 Memo, Tragemann for ADCS-A and TRAC Directors, 22 Apr 91, p. 2. In his undated [after 18 March 1991] draft memorandum, General Tragemann wrote that he had concluded, "the objective organization prepared by the previous Commander, with some modifications, will best posture this command for the challenges ahead."

226 Ibid., p. 3.

227 As noted earlier, TRAC-FBHN was merged with TRAC-LEE in 1993.

228 Memo, Tragemann for ADCS-A and TRAC Directors, 22 Apr 91, pp. 4–5.

229 Walter W. Hollis, "Responding to the Fluid Influences Facing the Army and Its Analysts," *Phalanx* 24, no. 3 (September 1991): 9.

230 *TRAC-1990s*, p. 13.

231 Ibid.

232 Ibid.

233 Fishback, "Draft History of TRAC-FLVN," p. 4.

234 *TRAC-1990s*, p. 16.

235 Ibid.

236 Fishback, "Draft History of TRAC-FLVN," p. 4.

237 *TRAC-1990s*, p. 12.

238 U.S. Army TRADOC Analysis Center, *Annual Historical Summary, 1 January through 31 December 1995* (Fort Leavenworth, Kans.: HQ TRAC, n.d. [1996]), p. 29.

239 Ibid.

240 Memo, Brinkley for Tragemann, 1 Mar 91, p. 1.

241 Ibid. Colonel Brinkley argued for the relocation of the TRAC commander/DCS-A from Fort Leavenworth to Fort Monroe, along with the TRAC RMD and the Analyst Proponency Office, in order to emphasize the DCS-A functions of prioritizing and resourcing those studies and analyses most important to TRADOC.

242 *Transforming the Army*, p. 62.

243 Ibid., p. 63.

244 Headquarters, U.S. Army TRADOC Analysis Command, *Staff Study of Physical Location of TRAC Commander* (Fort Leavenworth, Kans.: HQ TRAC, 19 July 1991), p. 1.

245 Memo, General John W. Foss (CG TRADOC) for Commander CAC and Fort Leavenworth, and Commander, USACASCOM and Fort Lee, Fort Monroe, Va., 19 Aug 91, sub: TRADOC Analysis Command (TRAC), p. 1.

246 Memo, Brig Gen Richard W. Tragemann (CG TRAC) for Maj Gen Donald M. Lionetti (Chief of Staff TRADOC), Fort Leavenworth, Kans., 4 May 92, sub: TRADOC Analysis Command (TRAC).

247 Ibid., p. 3.

248 In 1996, the TRAC Studies and Analysis Center (SAC) changed roles and was reorganized as the HQ TRADOC Studies and

Analysis Directorate (SAD) at Fort Monroe. The TRAC Scenarios and Wargaming Center (SWC) became a special staff section of TRAC, and OAC was reorganized and redesignated as TRAC-Fort Leavenworth (TRAC-FLVN). For the status of TRAC as of the end of 2005, see U.S. Army Training and Doctrine Command, *TRADOC Regulation 10–5–7: ORGANIZATION AND FUNCTIONS—U.S. Army TRADOC Analysis Center* (Fort Monroe, Va.; HQ TRADOC, 29 December 2005).

[249] "About TRAC," at http://www.trac.army.mil/1-AboutTRAC (accessed 9 June 2003).

[250] See the biographical sketch of Dr. Payne in Chapter Two, above.

[251] An armor officer, General Robinson had multiple ORSA assignments at Fort Leavenworth and Fort Hood. Prior to commanding TRAC, he was the director of the Army Model Improvement Program office at Fort Leavenworth. In 1992, he received the Vance R. Wanner Memorial Award of the Military Operations Research Society (see "FLASH! COVETED WANNER AWARD WINNER ANNOUNCED! *Phalanx* 25, no. 2 [June 1992]: 8).

[252] Richard W. Tragemann was born in Philadelphia on 18 April 1942 and was a 1965 graduate of the United States Military Academy. He earned a master's degree in operations research and systems analysis (ORSA) from the University of Texas, El Paso, in 1972. An artillery officer, he served in the 101st Airborne Division and with the 173d Airborne Brigade and the 2d Squadron, 11th Armored Cavalry Regiment, in Vietnam. His post-Vietnam artillery assignments included duty with the 25th Infantry Division in Hawaii, battalion command at Fort Sill, Oklahoma, command of the 101st Airborne Division (Air Assault) Division Artillery at Fort Campbell, Kentucky, and command of the XVIII Airborne Corps Artillery at Fort Bragg, North Carolina, and in operations Desert Shield/Desert Storm. His ORSA assignment included duty with CACDA at Fort Leavenworth, Kansas, and with the Officer Systems Analysis Group of the Officer Personnel Management Directorate, MILPERCEN (see the biography included on pages 193–97 of *Tested with the Best: An Oral History of MG Richard W. Tragemann, USA Retired*).

[253] E-mail, Brig. Gen. Michael A. Canavan (CG TRAC) to General Frederick M. Franks Jr. (CG TRADOC), 20 May 93, sub: Command of TRAC.

[254] Michael F. Bauman was born on 12 March 1948 in Hutchinson, Kansas, and grew up on a farm in southwestern Kansas. He received a B.S. in aeronautical engineering from Wichita State University in 1971 and entered government service the same year as an intern with the Army Materiel Command. In 1973, he received a master's degree in industrial engineering (OR) from Texas A&M University. From 1976 to 1981 he served as an operations analyst in combat developments at the Armor School in Fort Knox, Kentucky, working on the XM1 tank among other projects. He then served from 1981 to 1983 as an OR analyst in the Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics, before becoming the technical director of studies and analysis in the Office of the Deputy Chief of Staff for Combat Developments, HQ TRADOC, at Fort Monroe. On 31 January 1988, he was appointed to the Senior Executive Service and assigned to Fort Leavenworth, as the deputy at TRAC. On 17 June 1993, he was named the director of TRAC. He has been active in the Military Operations Research Society (MORS) and was a member of its board of directors in 1992–1996. In 2002, he received MORS' Vance R. Wanner Memorial Award and in 2004 he was elected a Fellow of the society. He has also received the Army's Wilbur B. Payne Award and has been recognized four times with Meritorious or Distinguished SES Presidential Rank awards. See Bauman's official biographical sketch and Michael F. Bauman, *Oral History Interview with Dr. Charles R. Shrader, 16 May 2006*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, forthcoming).

[255] RAA II, app. D, p. D-I-3.

[256] *TRAC Executive Summary*, p. 2.

[257] Ibid., p. 3. *TRAC Executive Summary* (page 3) puts the loss in authorizations at 108 spaces, but see Table 6–3 above.

[258] Memo, Brig Gen Robert T. Howard (CG TRAC) for General Maxwell R. Thurman (CG TRADOC), Fort Leavenworth, Kans., 8 Feb 89, sub: Fixing Analysis?

[259] Ibid., p. 1. The HARDMAN mission at TRAC-WSMR was abolished along with fifteen spaces, and TRAC capability to perform Cost and Operational Effectiveness Analyses was reduced by 12 percent (six spaces) with the remainder of the cuts coming from overhead.

[260] Memo, Bauman for Commander TRADOC, 2 Nov 89, Encl (Map: TRADOC Analysis Command).

[261] John A. Riente, "Restructuring and Realignment of Analysis Agencies," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium (AORS XXX), Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, November 1991), Slide 13 (Resource Allocation [FY90]—Distribution of Analysts to Analysis Categories).

[262] Memo, Brig Gen Richard W. Tragemann (CG TRAC) for General John W. Foss (CG TRADOC), Fort Leavenworth, Kans., 1 May 91, sub: TRAC Personnel Reductions, p. 1.

[263] Fact Sheet, Mr. Reed Davis (TRAC RMD), Fort Leavenworth, Kans., 29 Apr 91, sub: FY93 Manpower Reprogramming. The original total was 478 but HQ TRADOC added seven spaces to staff the RAND TRADOC Research Activity (TRA) just added to TRAC responsibilities.

[264] Memo, Howard for Foss, 4 Jun 90, p. 1 and Encl. The actual cut was only sixty-eight authorizations rather than seventy-two.

[265] Davis Fact Sheet, 29 Apr 91.

[266] Ibid.

[267] Memo, Tragemann for Foss, 1 May 91, p. 1.

[268] Ibid.

[269] Ibid., p. 2.

[270] Walter W. Hollis, "Walt Hollis on Army OR: 'The Times, They Are A-Changin!' " *Phalanx* 28, no. 1 (March 1995): 6. For comparison, during the same period TRADOC as a whole was expected to reduce military strength by 38 percent and civilian strength by 45 percent and the Army as a whole was expected to reduce military strength by 37 percent and civilian strength by 35 percent.

[271] Ibid.

[272] U.S. Army Training and Doctrine Command Analysis Center, *Annual Historical Summary, 1995* (Fort Leavenworth, Kans.: HQ TRAC, 1996), p. 22 (cited hereafter as TRAC AHS 95).

[273] Ibid. The self-sustaining TRAC Reimbursable Program (TRP), initiated in FY 1991, involved the marketing of TRAC analytical services to other agencies on a reimbursable basis. The income was used to pay the expenses (salaries, TDY, contracts, supplies, and equipment) of those civilian employees on TRAC's rolls who were not funded through the Command Operating Budget.

[274] Ibid.

[275] *TRAC Executive Summary*, p. 2.

[276] Point Paper, 26 Oct 88, sub: TRAC Officer Distribution Plan (ODP), enclosure to Ltr, Howard to Thurman, 26 Oct 88.

[277] Ibid.

[278] Memo, Howard for Thurman, 8 Feb 89, pp. 1–2.

[279] Ibid., p. 2.

[280] Memo, Michael F. Bauman (Acting Director, TRAC) for Commander, TRADOC (ATTN: ATCS), Fort Leavenworth, Kans., 24 Sep 90, sub: FY 92 Colonel Strength, p. 1.

[281] Ibid., p. 2.

[282] TRAC manpower authorizations dropped 27 percent during the same period (see Table 6–6). Between FY 1990 and FY 1997, TRAC's core mission budget declined by about 40 percent and manpower authorizations declined by about 44 percent (see Andrew J. Krasnican, *United States Army TRADOC Analysis Center, Annual Historical Summary [RCS CSHIS-6 {7}]: 1 January 1997 through 31 December 1997*

[Fort Leavenworth, Kans.: HQ TRAC, 1998], p. 39, Figure 6–1 [TRAC Resource Review for FY97]).

[283] In FY 1992, the TRP supported about twenty-five man-years of technical effort (see Memo, Foss for Commanders CAC and USACASCOM, 19 Aug 91, Encl). In FY 1995, it generated sufficient revenue to permit TRAC to employ fifty-five permanent and temporary civilians above its core mission-funded level, thereby "retaining vital analytical capability for the Army and avoiding significant additional costs to the Army for analysis services" (see TRAC AHS 95, p. v).

[284] E-mail, Michael F. Bauman to the author, 21 Nov 06.

[285] *TRAC Executive Summary*, p. 2.

[286] Abstract of Brig. Gen. John D. Robinson, Michael F. Bauman, and Col. James Pittman, "TRADOC Analysis in the Concept Based Requirements System," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twenty-Sixth Annual US Army Operations Research Symposium (AORS XXVI), Fort Lee, Virginia, October 1987, Volume I* (Bethesda, Md.: USACAA, 1987), p. 29.

[287] Brig. Gen. Michael A. Canavan and Mr. Lowell L. Martin, "Battle Labs—A New Way of Doing Business," *Phalanx* 26, no. 1 (March 1993): 7–8.

[288] Ibid., p. 7.

[289] Ibid., p. 8.

[290] Fishback, *TRAC History Annotated Timeline (DRAFT)*, p. 9.

[291] The definition of COEA, and when, where, why, how, and by whom they were done, were prescribed in U.S. Department of Defense, Office of the Assistant Secretary of Defense (Program Analysis and Evaluation), *DRAFT Cost and Operational Effectiveness Analysis (COEA) Guidelines* (Washington, D.C.: OASD [PAE], February 1990).

[292] *DRAFT Cost and Operational Effectiveness Analysis (COEA) Guidelines*, p. 1.

[293] Fact Sheet, Col. Wilson A. Shoffner (Director, SAD, DCS-CD, HQ TRADOC), (Fort Leavenworth, Kans.), p. 1, Jun 83, sub: COEA Responsibility.

[294] *TRADOC Policy Memorandum 97–2*, 11 Sep 77, sub: Conduct of Major TRADOC Studies and Analyses.

[295] For a comprehensive listing of TRADOC models developed or supported by TRAC and its subordinate elements as of January 1993, see U.S. Army TRADOC Analysis Command, Operations Analysis Center, *Matrix of Combat Development and Training Models* (Fort Leavenworth, Kans.: TRAC OAC, January 1993).

[296] For a description of models and simulations developed at TRAC-MTRY, see *1989 TRAC-MTRY History*, pp. 8–12.

[297] STAR was a high-resolution, stochastic simulation played on a macro terrain surface that modeled combat at the individual fighting system level. Run on the NPS mainframe computer, STAR was developed by NPS faculty and students under the direction of Professor Samuel Parry.

[298] AMORE supplanted STAR in 1984. AMORE also ran on the NPS mainframe computer and assessed military unit capabilities as a function of time, after experiencing degradation of personnel and materiel assets. AMORE allowed modeling down to the level of the individual soldier.

[299] DIME was a somewhat limited model that examined corps- or lower-level air-ground warfare, other than strategic nuclear actions, primarily to determine artillery allocation and distribution.

[300] ALARM was developed by professors Parry and Schoenstadt at NPS in 1986 to evaluate the concepts and doctrine of the AirLand Battle, including such nontraditional issues as deep strike, interdiction evaluation, and man-in-the-loop war-gaming.

[301] CAMMS was used to provide the commander or terrain analyst with an analytical tool to rapidly determine possible avenues of approach for friendly and enemy forces. CAMMS considered terrain factors, weather conditions, and the emplacement of weapons, obstacles, and tactical bridging.

[302] *1989 TRAC-MTRY History*, p. 9.

[303] U.S. Army TRADOC Analysis Center, *JANUS*, Pamphlet (Fort Leavenworth, Kans.: HQ TRAC, n.d. [c. 1996]), p. 2.

[304] Ibid. Additional details on the development of JANUS at TRASANA/TRAC-WSMR can be found in *TRAC-WSMR History*, pp. 24–27.

[305] Ibid., p. 3.

[306] Fishback, *TRAC History Annotated Timeline (DRAFT)*, p. 11.

[307] Ibid., p. 9.

[308] Ibid., p. 4.

[309] *TRAC-WSMR History*, p. 27. For additional details of VIC, see *TRAC-WSMR History*, pp. 27–28.

[310] Brig. Gen. Richard W. Tragemann, "Analysis Trends in the 90's and Beyond," *Phalanx* 24, no. 3 (September 1991): 25.

[311] Ibid., p. 26; Fishback, "TRAC History Annotated Timeline," p. 9.

[312] Tragemann, "Analysis Trends in the 90's and Beyond," p. 26.

[313] See *TRAC-WSMR History*, p. 28.

[314] Abstract of Capt. Donald M. Sando, "Computer Assisted Map Exercise (CAMEX)," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium (AORS XXX), Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: USACAA, 1991), p. I-288.

[315] Fishback, *TRAC History Annotated Timeline (DRAFT)*, p. 6.

[316] Ibid., p. 7.

[317] Ibid., p. 8.

[318] Seth Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," *Operations Research* 50, no. 1 (January–February 2002): 29.

[319] Army After Next (AAN) sought to develop "a credible concept document or mechanism that was capable of gaining wide Army support for the far-future 15–30-year period ahead" (see Fishback, *TRAC History Annotated Timeline [DRAFT]*, p. 12). AAN concepts and capabilities were developed through the use of two-sided, interactive war games and player after-action reviews. TRAC effort focused on three tasks: "analyze future force concepts and organizations in tactical and operational contexts, culminating in the tactical war games; design a flexible war game architecture to support major gaming events through the adjudication of games turns and display of results at the games; and lead the observation and analysis of major AAN events, integrating strategic and operational insights for DCSDOC." See abstract of Margaret A. Fratzel, "Army After Next," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirty-Sixth Annual US Army Operations Research Symposium (AORS XXXVI), Fort Lee, Virginia, 12–14 November 1997, Volume I* (Bethesda, Md.: USACAA, 1997), Special Session 1, p. 3.

[320] Michael F. Bauman, "Director's Summary," in TRAC AHS 95, p. iv.

[321] Ibid.

[322] TRAC AHS 95, pp. 4–5.

[323] Ibid., pp. 5–10.

[324] Ibid., pp. 10–11.

[325] Bauman, "Director's Summary," p. iv.

[326] Ibid., pp. iv–v. In FY 1995 TRAC teams worked with TRADOC and other DOD agencies to complete and publish four TRADOC standard scenarios, including the EUCOM Theater-Resolution Scenario (TRS) 3.0 (Peace Enforcement); the Southwest Asia 5.0 Joint Emerging Theater Scenario; the U.S. Atlantic Command Ranger Battalion Conventional Forced Entry High-Resolution Study 48.0; and the Brigade Meeting Engagement to Hasty Attack High-Resolution Study 58.0 (see TRAC AHS 95, pp. 13–15). At the same time, TRAC continued to develop and enhance its battery of simulation models, including VIC, CASTFOREM, JANUS, SSC, the Contingency Analysis Planning System, and Operational Test Visualization (OTVIS) (see TRAC AHS 95, pp. 16–20).

[327] Ltr, Kameny to Hollis, 22 Sep 95, app. D, p. 1.

[328] *Prepare the Army for War*, p. 1.

CHAPTER SEVEN

United States Army Concepts Analysis Agency, 1973–1995

The United States Army Concepts Analysis Agency (CAA) was established on 15 January 1973, as part of the 1973 STEADFAST reorganization of the Army.[1] As the successor to the United States Army Strategy and Tactics Analysis Group (STAG), CAA's mixed team of military and civilian analysts focused on support of the Army Staff and used a variety of methods, including studies, analyses, models, simulations, and war games, to assist Army leaders in making the difficult decisions regarding force structure, readiness, and the planning and execution of the mobilization, deployment, employment, and sustainment of Army forces in contingency operations and large-scale campaigns at the theater and Army-wide levels.

The Army analytical community has never been hierarchical in the sense that one person or agency directed the operations of all the various Army ORSA elements. Instead, the principal Army analysis organizations are loosely coordinated but work together closely on a variety of issues. However, between 1973 and 1995, CAA became *primus inter pares* (first among equals), principally because of its role in the integration of the results obtained from the studies, analyses, and simulations developed by other Army analytical organizations. CAA was neither the oldest nor the biggest of those organizations, but it worked directly for the Army Staff on Army-wide and theater-level issues and thus provided capstone analyses integrating the work on individual systems of the United States Army Materiel Systems Analysis Activity (AMSAA), the data derived from tests and evaluations conducted by the United States Army Operational Test and Evaluation Agency/Command (OTEA/OPTEC), and the development of requirements, organization, doctrine, and training by the United States Army Training and Doctrine Command (TRADOC) analysis elements, in particular the TRADOC Analysis Command/Center (TRAC) after 1986.

CAA, like the rest of the Army, responded to changes in the international and domestic security environment during the period 1973–1995. New threats, shifts in national objectives and strategy, changing political and economic conditions, and the rapid advance of military technology prompted changes in mission, organization, resources, and the focus of the annual work program. AMSAA and OTEA/OPTEC were perhaps most sensitive to changing technology, while TRAC was sensitive to both changes in military technology and the evolving organization and tactics of potential opponents. Perhaps more than the others, CAA responded to changes in the international military, political, economic, and social environment, to evolving threats to American national interests, and to domestic political and economic realities, inasmuch as it was the agency most responsible for evaluating alternative force structures and theater-level plans to meet emerging threats within the constraints imposed by the national economy and congressional action.

In its first few years, CAA's work program was oriented on analyses of issues surrounding the size and composition of future Army forces in the post-Vietnam era and the reorientation of the Army to face a potential Warsaw Pact invasion of Central Europe.[2] In the late 1970s and early 1980s, the emphasis of CAA's work program expanded to include personnel and logistics issues, contingency operations, and Army-wide issues as seen from a theater-level perspective. By 1985, the CAA work program included analyses of broad issues in the areas of force structure, operational capabilities, resource requirements, and personnel and logistics processes. The real turning point came between 1989 and 1991, an unprecedented period of change and uncertainty in the national and international security environment. Among the key events that signaled a sea change in the Army's structure and orientation were the collapse of the Soviet Union and the Warsaw Pact, the end of the Cold War, the Gulf War of 1990–1991, and the emergence of a "new world order" in which the old power blocs dissolved and new threats, such as regional conflicts and terrorism, arose. As the director of CAA, E. B. Vandiver III, noted in his annual report for FY 1990, "Global and national events combined to exert greater influence on the focus of CAA analytical activities. These events presented CAA with a rich environment of analytic challenges and opportunity."[3]

Changes in the international security environment were accompanied by a shift in domestic budget priorities that portended fewer resources for the armed forces, particularly since the threat of the Soviet Union appeared to have dissipated. As U.S. national objectives and the National Military Strategy changed, so did the U.S. defense posture. The call was for a leaner (and thus less expensive) and more agile force structure, but one sized, equipped, and trained for global commitments. At the same time, there was increased interest in other national initiatives to deal with terrorism and "the war on drugs," both of which were seen as significant threats to American security. The competition for scarce resources intensified, and the U.S. armed forces left the Reagan era of military buildup and entered a period of severely constrained resources with a strong emphasis at all levels of government, including the Department of Defense (DOD), on doing more with less (dollars, new equipment, and personnel).

Thus, the principal challenges facing the Army in the wake of the Gulf War of 1990–1991 were "establishing the proper strategic force balance; adjusting capabilities to successfully address regional threats on a global scale; and structuring a leaner, more agile force while maintaining adequate strategic and regional power projections capabilities."[4] Meeting those challenges required a concerted effort by the entire Army analytical community to provide decision makers with effective and efficient choices regarding the multitude of complex, interrelated problems of how to structure, mobilize, deploy, and employ Army forces in the new environment.

The changing international security environment and domestic budget constraints in the early 1990s led to significant internal changes for CAA. Missions expanded at the same time that severe cutbacks in personnel and funds were imposed. After 1990, there were fewer analysts, fewer support personnel, fewer contracting dollars, and fewer resources all around. Nevertheless, CAA reached new levels of productivity.[5] It is a tribute to the organization's leaders that CAA continued to provide the high-quality analytical support required by Army leaders during the "bad times" that extended through the end of the period under consideration here. Despite the severe constraints, CAA and its sister organizations—AMSAA, OTEA/OPTEC, and TRAC—continued to make major contributions to the improvement of Army materiel, organization, doctrine, training, and planning during the post–Gulf War era.

The Establishment of the Concepts Analysis Agency

The decision to create CAA grew out of the Project STEADFAST goals related to providing Headquarters, Department of the Army (HQDA), with a proper analysis capability to aid decision making.[6] As U.S. participation in the Vietnam War came to an end, the Congress, the secretary of defense, and many Army leaders were eager to restructure the Army for greater effectiveness and efficiency and to improve the processes for the development, testing, and acquisition of new materiel and for designing and structuring Army forces. The 1973 STEADFAST reorganization was a major step in that direction, and both OTEA and CAA were formed to fill what were perceived as major voids in the Army's decision-making process.

STEADFAST was in large part the brainchild of the Army's assistant vice chief of staff (AVCSA), Lt. Gen. William E. DePuy, who framed the need for Army reorganization in what came to be called the "Manifesto."[7] General DePuy proposed to eliminate the existing United States Continental Army

Command (CONARC) and the United States Army Combat Developments Command (CDC) and transfer their functions to two new major commands, the United States Army Training and Doctrine Command (TRADOC) and the United States Army Forces Command (FORSCOM), and to create two new Department of the Army agencies, one for operational testing and evaluation and the other for force analysis.

On 7 April 1972, the HQDA assistant chief of staff for force development (ACSFOR) was tasked to do the initial planning for the new force analysis agency. The ACSFOR passed the job to his scientific adviser, Abraham Golub, who in turn delegated the task to E. B. Vandiver III, then one of his assistants. Vandiver developed first a concept plan, which was briefed to the STEADFAST steering committee, and then a more detailed plan in the late summer of 1972.[8]

Initial discussion of the concept plan for the new force analysis agency centered on what functions and responsibilities the new organization would have, as opposed to those of the Army Materiel Command, the new Operational Test and Evaluation Agency, and the proposed new Training and Doctrine Command. The concepts considered ranged from simply assembling a group of analysts to the establishment of a high-level "think tank" working for the entire Army Staff. One early alternative was to establish an agency to be called the Army Force Development Analysis Agency, the major mission of which would be to assist the ACSFOR in developing "the most effective and efficient force for current and future years by integrating the development of concepts, doctrine, organization, and materiel with the ACSFOR components . . . of the Army planning system."[9]

The ACSFOR concept plan, which adopted the Army Force Development Analysis Agency name, was forwarded to the Office of the Project Manager for Reorganization, under Maj. Gen. James G. Kalergis, on 5 May 1972.[10] A more detailed plan, which included a statement of missions and functions, was submitted on 20 July 1972.[11] To carry forward the planning for the new organization, a Special Planning Group was set up in the Office of the ACSFOR on 1 November 1972, with Brig. Gen. Hal E. Hallgren as its chief. The Special Planning Group was organized into a command element, a management team, a resources team, a systems integration team, and a forces team, and was authorized twenty-seven spaces, eighteen of which were filled by personnel who later were permanently assigned or temporarily detailed to CAA.[12] The high percentage of holdovers from the team that planned the organization was to prove beneficial in getting CAA off to a good start.

The two priority tasks for the Special Planning Group were the development of an Implementation Plan and the preparation of a table of distribution and allowances for CAA. The Special Planning Group also acted to obtain approval for location of the new organization within the National Capital Region; forecast its FY 1974 work program; prepare budgets for FY 1973 and FY 1974; provide the nucleus for CAA's Project Planning and Control Office; prepare job descriptions for the CAA directorates as well as determine their organization and concepts of operations; and provide the nuclei for the various directorates. The goal was to have CAA up and running no later than 30 June 1973.

On 14 November 1972, Vice Chief of Staff of the Army Lt. Gen. Bruce Palmer Jr. directed that a plan be developed for consolidating CAA and STAG, and that plan, which called for the merger of the two organizations at STAG's Bethesda, Maryland, location, was completed by the Special Planning Group two days later. Selected members of the Special Planning Group were to be combined with former STAG members to form the nucleus for CAA. The disadvantages of the plan were that it would not permit the co-location of CAA and OTEA as some had proposed, and additional space would soon be required.[13] Those disadvantages were outweighed, however, by the several perceived advantages of the merger, including "early availability of a secure computer facility; availability of space; little disruption of ongoing STAG projects in support of the Army staff; reduction in administrative support staff; and the opportunity to build onto an existing organization structure."[14]

On 24 January 1973, Secretary of Defense Melvin R. Laird approved Secretary of the Army Robert F. Froehlke's request to locate CAA in the National Capital Region. There had been considerable discussion of where to house the new organization, and one proposal had been to co-locate CAA and OTEA. Other proposed locations included the Hoffman Building in Alexandria, Virginia, and Fort Belvoir, Virginia. Those discussions were made moot by the decision to merge CAA with STAG in Bethesda, Maryland.

Among its other responsibilities, the Special Planning Group was tasked to develop an Army Regulation (AR) and a Chief of Staff Regulation (CSR) outlining the mission and functions of CAA. A draft AR was submitted to the Office of the Adjutant General on 29 December 1972, and a draft CSR was also prepared. Those documents reflected the role of CAA in incorporating the missions and functions previously assigned to STAG and other Army elements and in pulling "together previously fragmented analytical support into one independent, high-level agency dedicated to the Army staff."[15] Upon the activation of CAA responsibility for the preparation of *AR 10–38: ORGANIZATION AND FUNCTIONS—United States Army Concepts Analysis Agency*, and of a CSR in the eleven series fell to the CAA Project Planning and Control Office. In due course, the decision was made to combine the two documents and *AR 10–38* was approved by Chief of Staff of the Army General Creighton W. Abrams Jr. and published on 6 July 1973, with an effective date of 1 August 1973. *AR 10–38* was revised and reprinted on 3 October 1973 to correct typographical errors, but the revision did not affect the mission. On 10 August 1973, *CAA Memorandum 10–1: ORGANIZATION AND FUNCTIONS—United States Army Concepts Analysis Agency (CAA)* was published to prescribe in detail the organization and functions of the various elements of CAA.

The Implementation Plan developed by the Special Planning Group was completed on 24 November 1972, and was twice revised (on 30 November 1972 and on 28 February 1973, after activation of CAA). The milestones included in the Implementation Plan are as follows:[16]

Event	*Date*
1. Approval of the CAA TDA	12 March 1973
2. Transfer of the CDC Concepts and Force Design Group Library to CAA	31 March 1973
3. CAA Functionally Operational	15 April 1973
4. CAA at 95 percent TDA Fill	30 June 1973
5. CAA Fully Operational	1 July 1973

The Special Planning Group was also tasked to prepare an Activation Plan for CAA, and the draft Activation Plan was completed on 2 January 1973. To prepare for the activation, a provisional organization was to be established from 15 January to 15 February 1973, composed of personnel from the Special Planning Group and STAG, but the activation date for CAA was advanced to 15 January 1973, and the provisional organization was never established.

The United States Army Concepts Analysis Agency was formally established effective 15 January 1973 as a Class II activity under the jurisdiction of the assistant chief of staff for force development, HQDA, with initial location at Bethesda, Maryland, and an initial authorized strength of 119 officers, 1 warrant officer, 15 enlisted men, and 190 civilians under the command of Brig. Gen. Hal E. Hallgren.[17] At the same time the United States Army Strategy and Tactics Analysis Group was discontinued and its resources transferred to CAA.[18] CAA combined the resources of STAG with those of two elements of the former CDC to create "the central force analysis activity" for HQDA and its leadership.[19] The two CDC elements absorbed by CAA were the Concepts and Force Design Group and part of the Systems Analysis Group, which had the combined mission of mid-range force conceptual studies, long-range conceptual studies, land combat systems analysis, and cost and economic analyses.[20]

CAA Mission and Functions, 1973–1995

The assigned mission and functions of CAA changed over time in response to the recommendations of various boards and committees and to changes in the organization of the Army Staff and the Army's analytical needs. There were two major changes in CAA mission and functions between 1973 and 1995. They occurred in 1979 following the 1978–1979 Review of Army Analysis and in the early 1990s following the collapse of the Soviet Union, the success of the first Gulf War, and the emergence of new international security environment.

CAA Mission and Functions, 1973–1978

Prior to the establishment of CAA in January 1973, issues of Army force structure at theater and higher levels were addressed by the Operations Research Office (ORO), by ORO's successor, the Research Analysis

Corporation (RAC), and after 1961 by STAG. In 1972, STAG's specific tasks were to

> a. Conduct manual, computer-assisted, and computerized war games at various command levels and various environments to assist in evaluating operational plans and in analyzing strategic, tactical, and organizational concepts and develop models necessary to the conduct of games only when appropriate models are not already available from other sources.
>
> b. Conduct studies, evaluations, analyses, and tests using war gaming and appropriate allied techniques.
>
> c. Provide technical assistance to Department of the Army agencies in preparing for and conducting war games, as directed.
>
> d. Provide Department of the Army representation in preparing for and conducting joint war games, as directed.[21]

The initial mission statement for CAA, determined by the Special Planning Group, was quite similar in scope. The CAA mission as it finally emerged was to "perform analytical studies in support of the Army Staff to provide illumination and visibility of major issues that affect the size and mix of future Army forces and the Army's operational and strategic plans and concepts."[22] In essence, CAA was responsible for providing the analytical support required by the Army chief of staff and the heads of Army Staff agencies in four broad areas:

- Army objective force to include integration of strategy and other service forces
- Army force design with emphasis on integration of new concepts and systems
- Army materiel mix with emphasis on rationale (trade-off and cost effectiveness) developed in the context of force structure to identify alternatives in the development and acquisition of systems
- Army operational/strategic plans and concepts.[23]

On 15 February 1973, the CSA decided that CAA would be a Staff Support Agency (SSA) of the assistant chief of staff for force development. When the Office of the ACSFOR was subsequently eliminated in the May 1974 reorganization of the Army Staff, CAA was placed under the supervision of the deputy chief of staff for operations and plans (DCSOPS). CAA remained an SSA under the jurisdiction of the DCSOPS until 27 November 1977, when it was redesignated a Field Operating Agency in an effort to more accurately depict the Army-wide scope of the support it provided.

By FY 1978, the CAA mission had emerged in its most definitive form. As stated in *AR 10–38*, the official mission of CAA was to:

> a. Estimate requirements for forces, strategic mobility, materiel, manpower, and other resources in conventional, nuclear, and chemical environments to support Army inputs to the planning, programming, and budgeting system (PPBS).
>
> b. Evaluate the Army's operational capability to mobilize, deploy forces, and conduct unilateral, joint, and combined operations in support of established plans and missions.
>
> c. Design Army forces and evaluate force alternatives in support of Army missions and plans.
>
> d. Develop theater level scenarios of conventional, chemical, and nuclear contingencies consistent with HQDA plans, programs, and policy to provide context for Army combat development activities.
>
> e. Support Department of the Army (DA) international rationalization, standardization, and interoperability (RSI) initiatives.
>
> f. Provide force level related analytical support to HQDA, major commands (MACOMs), and other members of the Army analytical community.
>
> g. Develop and maintain an Army data base for studies of army force requirements, operational capability, force design, and related force issues.
>
> h. Develop, document, maintain, and improve analytical techniques for addressing Army force level issues and other analytical techniques required to execute CAA's missions.[24]

CAA Mission and Functions, 1979–1990

The 1978–1979 Review of Army Analysis (RAA) study group focused on the issue of providing adequate analysis support for HQDA. The study group found that particular areas of inadequacy included:

> (1) Limited analysis of alternative force structures, especially alternative configurations of the combat forces.
>
> (2) No analysis of the balance of combat and support forces.
>
> (3) Little analysis of the personnel and manpower aspects of forces that are examined in force level studies and little analysis of manpower and personnel issues of Army-wide interest.[25]

The RAA study group also observed:

> (1) It is a commonly held perception in OSD and in some parts of the Army that HQDA does not have access to responsive analytical support of high quality. Further, that CAA is fully engaged in supporting the DCSOPS and that requests that go to MACOMs are not responded to in time to be useful.
>
> (2) The perceptions are frequently offered in the form of a solution, namely, create an Army study and analysis FCRC [Federal Contract Research Center]. Other versions include using existing FCRCs or simply increasing the amount of studies done on contract.[26]

To fill in the gaps that they saw in the analytical support provided to HQDA, the RAA study group recommended that with respect to force-level studies the linkage between the Strategic Studies Institute at the Army War College and CAA be improved, and that, likewise, the linkage between CAA force-level studies and studies of large combined arms organizations (e.g., division and corps) done by TRADOC's Combined Arms Combat Developments Activity (CACDA) be improved.[27] They also recommended that the capability of CAA to do comprehensive force-level studies and studies of Army-wide interest be increased to include logistics, manpower, and personnel issues, and that the capability of CAA to respond to the needs of all elements of HQDA be increased by increasing the resources in in-house personnel and contract funds and that the mission of CAA be changed accordingly.[28] Finally, the RAA study group recommended that the commander of CAA report to the director of the Army Staff (DAS) rather than the DCSOPS and that each principal HQDA staff element be given a "line of credit" and authority to draw on CAA capabilities directly.[29]

The VCSA subsequently approved most of the recommendations of the RAA study group for implementation, and on 15 August 1979, CAA was reassigned to the Office of the Army Chief of Staff, and the director of CAA thenceforth reported to the director of the Army Staff.[30] At the same time, CAA's mission was enlarged to include the personnel and logistics areas and support of the entire Army Staff rather than just the DCSOPS, and CAA's capability to examine alternative concepts of force structuring was substantially improved.[31] The annual "lines of credit" for Army Staff elements to charge against CAA were approved by the DAS; CAA was provided with eight additional analyst spaces in October 1979 with recruitment accomplished by October 1980; additional contracts to support HQDA analysis requirements were established; and, as support to other Army Staff agencies increased, support to DCSOPS was proportionately and significantly reduced.[32]

CAA Mission and Functions, 1990–1995

The most significant change in CAA missions and functions came as a result of the dramatic events at the end of the 1980s and beginning of the 1990s. The collapse of the Soviet Union and the consequent evaporation of the threat of a Warsaw Pact invasion of Central Europe, the Gulf War of 1990–1991 and the subsequent prospect of regional conflicts in the Middle East and Southwest Asia, the emergence of nontraditional threats such as terrorism and international drug trafficking, and severe cutbacks in domestic defense spending brought about a substantial reorientation of Army missions and consequent changes in force structure. To assist Army decision makers in meeting these new challenges, CAA was reorganized and its mission and functions refocused.

Following the Gulf War of 1990–1991, CAA was called upon to provide the planning and analytical approaches needed by Army leaders to evaluate "the Army's future preparedness within a dramatically changed defense paradigm," and to systematically examine a variety of issues involving the revision of national security and national military strategies, a refocused Army mission, a resized Army force structure, and redefined requirements for mobilization, deployment, and reconstitution of Army forces.[33] Thus, CAA's mission was expanded to encompass "a wide range of analytical services performed in support of virtually all Army elements, and occasionally other DOD and other Government agencies."[34]

In 1991, as an outcome of the VANGUARD Study, the vice chief of staff of the Army designated CAA as the Army's Center for Strategy and Force Evaluation, a designation that formally expanded the unique role of CAA to "encompass global strategic and broad military option assessments."[35]

Thenceforth, CAA would focus on the integration of "assessments of global and strategic concepts and broad military options; theater- and regional-level analyses; and planning and operational assessments in the conduct of war."[36]

The mission and functions of CAA continued to evolve after FY 1991 in the direction accurately foretold by E. B. Vandiver III, the director of CAA, in the cover letter to his *Annual Report* for FY 1991:

> The Army of the mid-1990s will be leaner but sized to meet global threat and security commitments. Establishing the proper strategic force balance, adjusting capabilities to successfully address diverse regional threats on a global scale, structuring a leaner, more agile force while maintaining adequate strategic and regional power projection capabilities, and reducing time required for partial and full mobilization are formidable issues which must be clearly addressed in our analysis, decisionmaking, and planning.[37]

Vandiver also accurately forecast the impact of the changing analytical environment and its potential impact on CAA when he went on to state that

> the compelling need to shape our future in an uncertain and fast-changing world places a premium on flexible and responsive analysis and decisionmaking. Expert analysis must continue at the forefront in: assessing alternative worldwide strategic environments, formulating deterrent strategies, accomplishing strategic force restructuring and contingency planning, and conducting affordability and tradeoff analysis in an environment of intense resource competition. Our success in resolving these difficult issues and planning for the future will in large part be determined by how well we integrate the dynamics of future uncertainty and change into the analytical process. The analysis process must be: more flexible (accommodating many alternative worldwide scenarios and issues), more sophisticated (involving political and regional considerations), more comprehensive (recognizing all relevant considerations), more responsive (providing timely analysis for decisionmaking), and more efficient (structured with a smaller analysis force).[38]

Additional Missions and Functions

In addition to its primary analytical tasks, CAA also performed a number of related functions, such as liaison with other elements of the Army analytical community and with the operations research/systems analysis (ORSA) elements of other countries, maintaining contact with the wider academic community and professional societies, and conducting special programs. For example, in FY 1987, the CAA Office of Data Management and Model Validation provided the first CAA liaison officer to AMSAA. The purpose of the liaison officer position was to provide a single point of contact for all CAA and AMSAA requests; ensure that all data needed for CAA studies was received in a timely manner; and ensure that CAA studies were operating from a common AMSAA database.[39] CAA maintained close contact with OTEA/OPTEC, TRAC, and the Naval Postgraduate School, with which analysts were exchanged.[40] Similar contacts and exchanges were made with the ORSA elements in the other services, Office of the Secretary of Defense (OSD), Joint Chiefs of Staff (JCS), and North Atlantic Treaty Organization (NATO).

CAA also maintained a wide variety of contacts with official ORSA programs in other countries and with academics in the ORSA field around the world. CAA played an active role in the Quadripartite Working Group on Army Operational Research as well as the Quadripartite Working Group on Combat Developments. Meetings, exchanges of analysts, and other contacts were maintained with ORSA specialists in the United Kingdom, Canada, Australia, Korea, France, Germany, the Netherlands, and other NATO countries as well as Japan and even the Peoples Republic of China.

CAA played an active role in the annual Army Operations Research Symposium (AORS) and in the various professional societies. In 1974, CAA assumed responsibility for coordinating the annual AORS and for the publication of the proceedings for each annual meeting. CAA also took its turn in the rotation to act as host and sponsor of AORS, and CAA personnel participated actively by presenting papers and serving as session chairs or commentators. CAA personnel also served as officers, board members, and active conference participants in the various professional organizations, such as the Operations Research Society of America and the Military Operations Research Society.

One example of the special programs run by CAA was the CAA/USMA Summer Work Program. Each year a number of cadets from the United States

Military Academy were invited to work on ORSA projects at CAA for short periods of time during the summer.[41] The number of participating cadets was small—for example, in FY 1977 only nine cadets participated in the program—but the program had positive results in that it encouraged an interest in ORSA and CAA's work among a select group of future Army officers.[42]

CAA Organization, 1973–1995

Initial Organization of CAA, 1973–1979

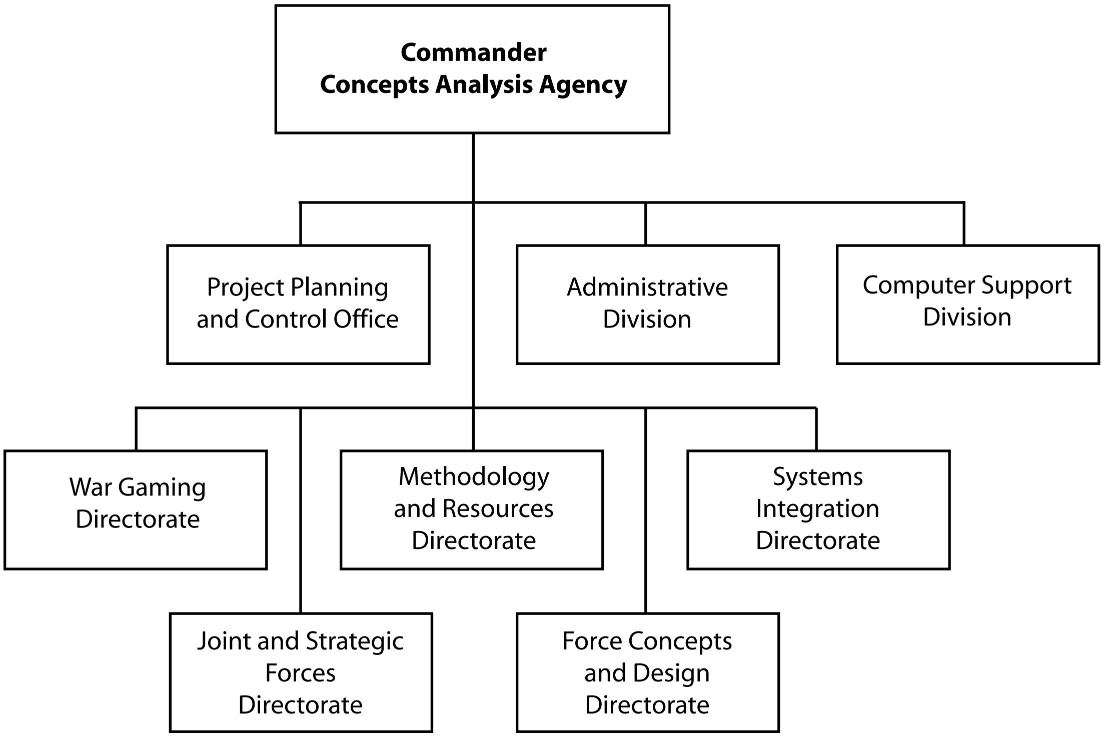
Planning for the organization of CAA was the responsibility of the Special Planning Group until 15 January 1973, at which time CAA's management team (Command Group, Project Planning and Control Office, and Administrative Division) took over. Several organizational structures for CAA were proposed during the planning period leading up to activation of the organization on 15 January 1973.[43] The starting point for designing the internal organization of CAA was the final organization of its lineal ancestor, STAG. As of 14 January 1973, STAG was organized with a Command Group, an Administrative Division, and three mission-oriented divisions: Gaming, Force Analysis, and Data Automation.[44] The initial table of distribution and allowances for CAA was approved by the Army chief of staff on 9 March 1973, and provided for a manning of 325 personnel (119 officers, 1 warrant officer, 15 enlisted personnel, and 190 civilians, of whom 114 were in grade GS–11 or higher), organized as shown in Figure 7–1.

The Office of the Commander included the commander himself, a brigadier general; a supergrade civilian technical director and deputy commander; and a military chief of staff in the grade of colonel. The Project Planning and Control Office (PPCO), the chief of which worked closely with the commander, planned and controlled the agency's analytical workload. The Project Planning and Control Office was organized with four teams (Operations, Management Analysis, Editorial, and a Pentagon Coordination Office). The Pentagon Coordination Office was responsible for facilitating the flow of information between CAA and the Army Staff, OSD, JCS, and the other services.[45] In addition, the team promoted contacts with the Army academic community in a liaison program begun in February 1974, and CAA representatives were appointed to visit universities and open channels of communication between CAA and the academic community.[46]

The Administrative Division performed the usual support functions, and the Computer Support Division provided computer and automatic data processing (ADP) support. The five mission-oriented directorates were each divided into functional groups. The mission of the War Gaming Directorate (WGD) was to "conduct manual and computer-assisted war games at various command levels and in various environments" to assist in "the analysis of interacting forces and weapons."[47] WGD also analyzed and developed theater consumption rates for ammunition and other major items and served as CAA focal point for coordination of all non-U.S. intelligence data requirements needed to support CAA analysis efforts. In FY 1974, WGD also initiated an effort to amass and analyze data related to the October 1973 war in the Middle East. The Methodology and Resources Directorate (MRD) was responsible for providing "analytical, modeling/programming, and economic/manpower/cost support to the other directorates"; developed, maintained, and exercised models, simulations, and war games; and maintained a "baseline of resource constraint factors (personnel and costs)."[48] The Force Concepts and Design Directorate (FCDD) conducted studies and analyses "to support rational decisions leading to the most effective force size and mix—within established resource constraints—to accomplish Army missions and functions."[49] The Systems Integration Analysis Directorate (SIAD) was charged with conducting "studies and analyses in support of materiel acquisition decisions."[50] SIAD thus developed methodology for and conducted analyses of weapon and support systems and also performed trade-off analyses between like and dissimilar systems. Finally, the mission of the Joint and Strategic Forces Directorate (JSFD) was to "conduct studies and analyses to support development of an Army position in the areas of strategic forces, General Purpose forces, and strategic mobility."[51] The JSFD was also charged with conducting "long-range studies which would: Assess selected technologies and concepts; develop new concepts for waging land warfare; and forecast possible conflict environments."[52]

The major reorganization of the Army Staff in May 1974 did not affect the internal organization of CAA, and CAA retained the same organizational structure

Figure 7–1—Organization of CAA, January 1973



Source: U.S. Army Concepts Analysis Agency, *Annual Historical Summary (RCS CSH1S–6 [R2]), U.S. Army Concepts Analysis Agency, 15 January 1973 to 30 June 1973* (Bethesda, Md.: USACAA, 30 November 1972), p. I-10, Figure 3 (Evolution of CAA Internal Organization).

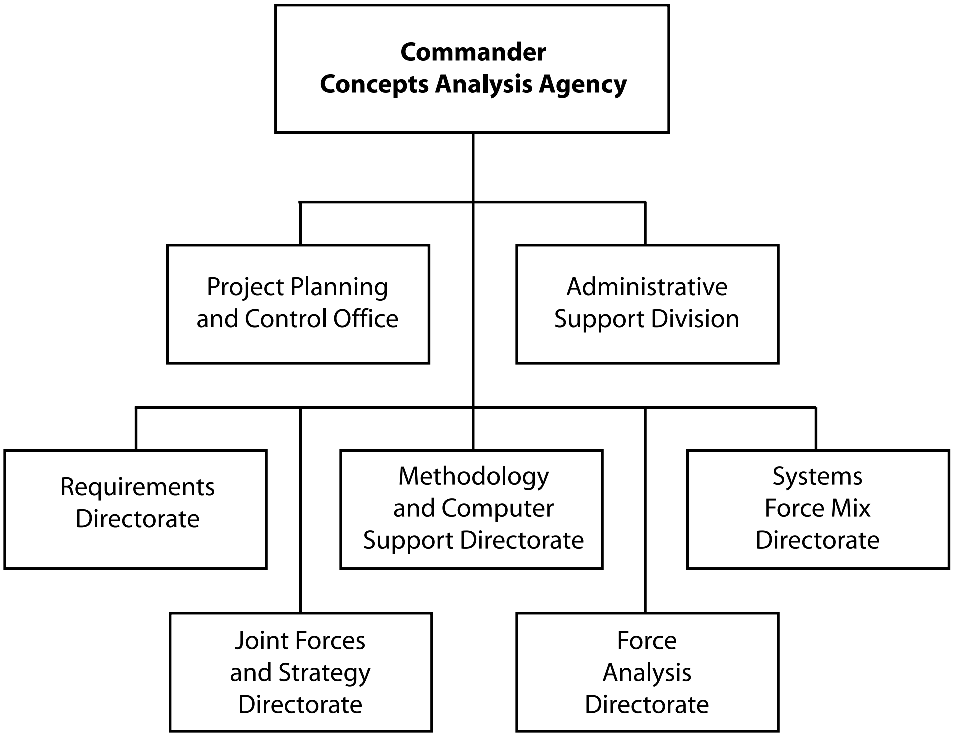
through FY 1976. Superficial changes were made in FY 1977 due a reduction in force, but the changes involved internal realignment and renaming the five mission-oriented directorates. The Pentagon Coordination Office was made directly subordinate to the Office of the Commander, and a Staff Action Office, also reporting to the Command Group, was established. The War Gaming Directorate and the Force Concepts and Design Directorate were retained. The Computer Support Division was merged with MRD to form a new Methodology, Resources, and Computation Directorate (MRCD), the mission of which was fourfold: to conduct analytical studies as required; develop, maintain, and exercise models, simulations, and war games; provide analytical assistance and expertise to other CAA directorates; and provide computer support for all of CAA. SIAD became the Systems Force Mix Directorate (SFMD), the mission of which was to conduct "comprehensive studies of combat and support systems leading to the desired mix of materiel systems contributing to improved combat effectiveness of a given force."[53] SFMD also developed methodology and conducted analyses, including trade-off analyses, of combat and support systems. The old JFSD was renamed the Joint Forces and Strategy Directorate (JFSD) and its mission was restated, making it responsible for conducting

> (a) studies and analyses to support the development of Army positions concerning general purpose forces and strategic mobility within a joint services context; (b) strategic planning studies in the mid- and long-range timeframe to support the development of doctrine, organization, materiel requirements, and alternative strategies for Army forces; and (c) studies and other activities in support of Department of the Army international rationalization, standardization, and interoperability (RSI) initiatives.[54]

CAA Organization, 1980–1990

The FY 1977 organization remained in effect until April 1980, when, in the aftermath of the 1978–1979 Review of Army Analysis, CAA was reorganized on

Figure 7–2—Organization of CAA, FY 1980



Source: U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 October 1979 to 30 September 1980* (Bethesda, Md.: USACAA, 1 August 1981), p. I-3, Figure I-1 (Organization of CAA, FY 1980).

1 April 1980 to place more emphasis on its role in the personnel and logistics areas and to reflect its expanded role in support of the entire Army Staff. The new organization was as shown in Figure 7–2.

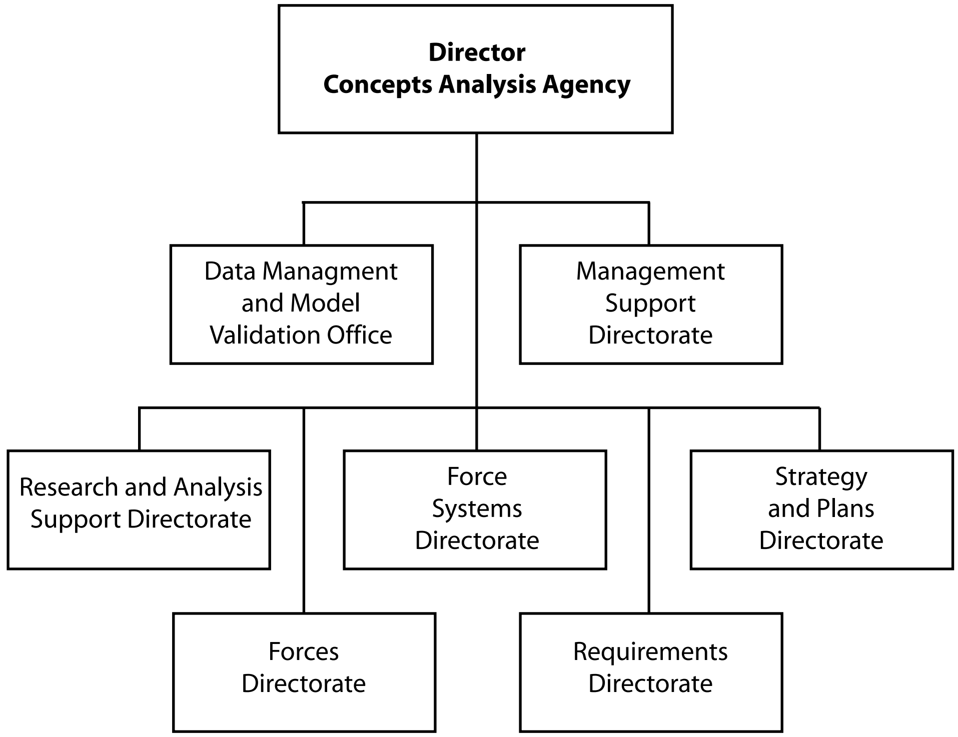
MRCD was replaced by the Methodology and Computer Support Directorate (MCD), which focused on "developing innovative methodologies and providing computer oriented technical and professional support throughout the Agency."[55] The functions of the former MRCD Resource Analysis Group were transferred to the new Requirements Directorate (RQD), the mission of which was to "conduct computer-assisted war games, studies, and analyses for the US Army in order to illuminate the tactical, strategic, materiel, and force effectiveness issues involved."[56] RQD also developed wartime materiel and ammunition requirements for a variety of nuclear, chemical, and nonnuclear contingencies.

Before September 1985, CAA was reorganized with two support directorates (Analysis Support and Management Support), which provided services in computer operations, model development, mathematical and statistical assistance, threat and intelligence support, database management, and route resources management functions.[57] There were four mission-oriented directorates (Requirements and Resources; Force Systems; Strategy, Concepts, and Plans; and Forces), each of which was manned by a mixed military-civilian team of analysts with the multidisciplinary skills needed to analyze a broad range of issues.

In FY 1987 CAA underwent a major reorganization to meet the director's goals of:

> (1) Establishing a theater operations center, TOC, adequately resourced to support FORCEM [Force Evaluation Model] requirements for annually analyzing three theaters in two timeframes;
>
> (2) Formalizing the ad hoc Combat Sample Generator (COSAGE) task force into a division operations center, DOC, that can produce the desired number of simulated division situations each year; and
>
> (3) Providing a more centralized approach to managing and coordinating data requirements in support of the Agency's study program.[58]

Figure 7–3—CAA Organization, 1 March 1987



Source: U.S. Army Concepts Analysis Agency, FY87 *Report of Stewardship* (Bethesda, Md.: USACAA, December 1987), p. I-5, Figure 2 (CAA Organization).

Note: For greater detail on the organization of CAA c. 1987, see U.S. Army Concepts Analysis Agency, CAA Memorandum 10–1: *ORGANIZATION AND FUNCTIONS—United States Army Concepts Analysis Agency (CAA)* (Bethesda, Md.: USACAA, 1 April 1987).

The resulting organization, which became effective on 1 March 1987, is shown in Figure 7–3. There were some minor internal changes in FY 1990, but for all practical purposes, the 1 March 1987 organization remained in effect until the next major reorganization in FY 1991.

Under the 1 March 1987 organization, the new Data Management and Model Validation Office (DMMVO), which replaced the old PPCO, was assigned the mission of developing and guiding CAA's data procurement, quality control, and management activities; the agency's model validation program; and intelligence support services.[59] The Management Support Directorate (MSD) was responsible for the usual support functions. The Research and Analysis Support Directorate (RSD) provided a wide range of analytical services to CAA and its clients, including the development and maintenance of models; the development of new methodologies; maintenance and application of CAA expertise in mathematical/statistical, information management, and computer sciences, and advanced computing technology; and management and operation of CAA's computer facility.[60] The Force Systems Directorate (FSD) conducted analyses in those areas that contributed to "the capability and combat effectiveness of the US Army," principally combat, combat support, logistics, and personnel systems and including resource-related and cost analyses.[61] The Strategy and Plans Directorate developed and evaluated "alternative theater force designs, strategies, and concepts in support of Army mid- and long-range planning, and non-major theater conflict analyses."[62] The Forces Directorate was responsible for providing "theater-level scenario development, computer simulations, and analyses of current and future combat and support forces to determine theater-level force capability and requirements."[63] Finally, the Requirements Directorate was responsible for "conducting wartime requirements studies for equipment, fuel and munitions (conventional, nuclear and biochemical) for US and Allied ground forces in selected theaters of operations; analyzing wartime resource requirements and developing munitions procurement strategies; supporting the Agency study program with division-level analyses; and evaluating the potential combat capabilities of Army forces in selected theaters of operations."[64]

CAA Organization, 1991–1995

The 1990 Vanguard Study included a section titled "Army Analysis Requirements for the Nineties (AAR 90)" that addressed the role and organization of the Army's analysis community for the coming decade. Implementation of the decisions outlined in Vanguard/AAR 90 "improved the Army's analysis capability by realigning and strengthening selected functions and reorienting the Army's analytical community around "centers of excellence."[65] Pursuant to the Vanguard/AAR 90 recommendations regarding the Army's analytical agencies, the Army vice chief of staff issued a directive on 23 September 1991 for their restructuring and realignment. CAA was designated the Army's Center of Excellence for Strategy and Force Evaluation, and its analytical mission was formally expanded to link strategic assessments, broad military options, and political considerations with traditional specialty areas of military operations analysis, thereby providing a more up to date, sophisticated, and responsive analytical capability for supporting Army decision makers.[66] During October 1991, CAA underwent a major reorganization to better fill that expanded role. The resulting organizational structure was as shown in Figure 7–4.

Under the October 1991 reorganization, the Forces and Requirements directorates were disestablished. The new Office of the Special Assistant for Operational Capability Assessment (SAOCA) was set up to conduct "continuing assessments of the capabilities of current forces for HQDA and for Army Components of Unified Commands."[67] A new Force Evaluation Directorate was established to "evaluate the Army's total capability to prepare for, conduct, and sustain war."[68] The Nuclear/Chemical Division of the former Requirements Directorate was transferred to the Strategy and Plans Directorate and renamed the Nuclear, Biological, and Chemical (NBC) Division. In FY 1993, the Office of the Special Assistant for Operational Capability Assessment was split into two geographically oriented offices—one for Northeast Asia (NEA) and one for Southwest Asia (SWA)—and placed under the Strategy and Plans Directorate.

On 1 February 1994, CAA again underwent a thorough reorganization into two support divisions (Management Support and Technology Support) and thirteen analysis divisions divided under two deputy directors (for Resource and Sustainability Analysis and Theater and Campaign Analysis), as shown in Figure 7–5.

The divisions under the Deputy Director for Resource and Sustainability Analysis supported the Army Staff with analyses of general matters such as overall Army force structure and modernization programs. The divisions under the Deputy Director for Theater and Campaign Analysis dealt with matters peculiar to mobilization, deployment, and activities in a theater of operations. The organization of CAA remained essentially the same through FY 1995, but the Force Structure and Force Concepts divisions were combined into a new Force Strategy Division and the two deputy director positions were eliminated while the position of technical director was revived.[69]

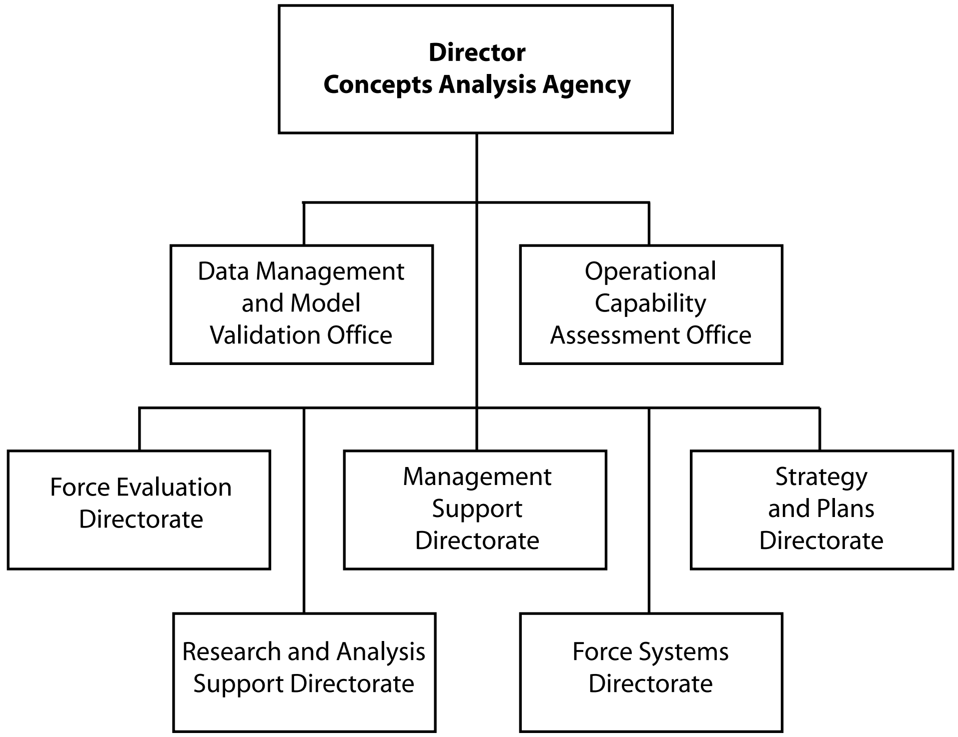
CAA Resources, 1973–1995

The key assets upon which CAA relied were good leadership, sufficient numbers of qualified personnel, adequate operating budgets, adequate facilities, and up-to-date computers and other equipment. Those assets became more difficult for CAA to obtain after 1989. The post–Gulf War drawdown in personnel and funding threatened to eviscerate CAA's analytical capabilities, but in the end good leadership and quantum improvements in computer support produced better management and greater productivity to overcome losses in manpower and dollars. Like AMSAA, OTEA/OPTEC, and TRAC, CAA struggled through the "bad time" and emerged in 1995 streamlined, more efficient, and more productive than ever before.

CAA Leadership

From January 1973 until 1982, CAA was led by a major general supported by a civilian technical

Figure 7–4—Organization of CAA, October 1991



Source: U.S. Army Concepts Analysis Agency, *United States Army Concepts Analysis Agency FY 91 Annual Report* (Bethesda, Md.: USACAA, December 1991), p. 1-3, Figure 1-2 (U.S. Army Concepts Analysis Agency).

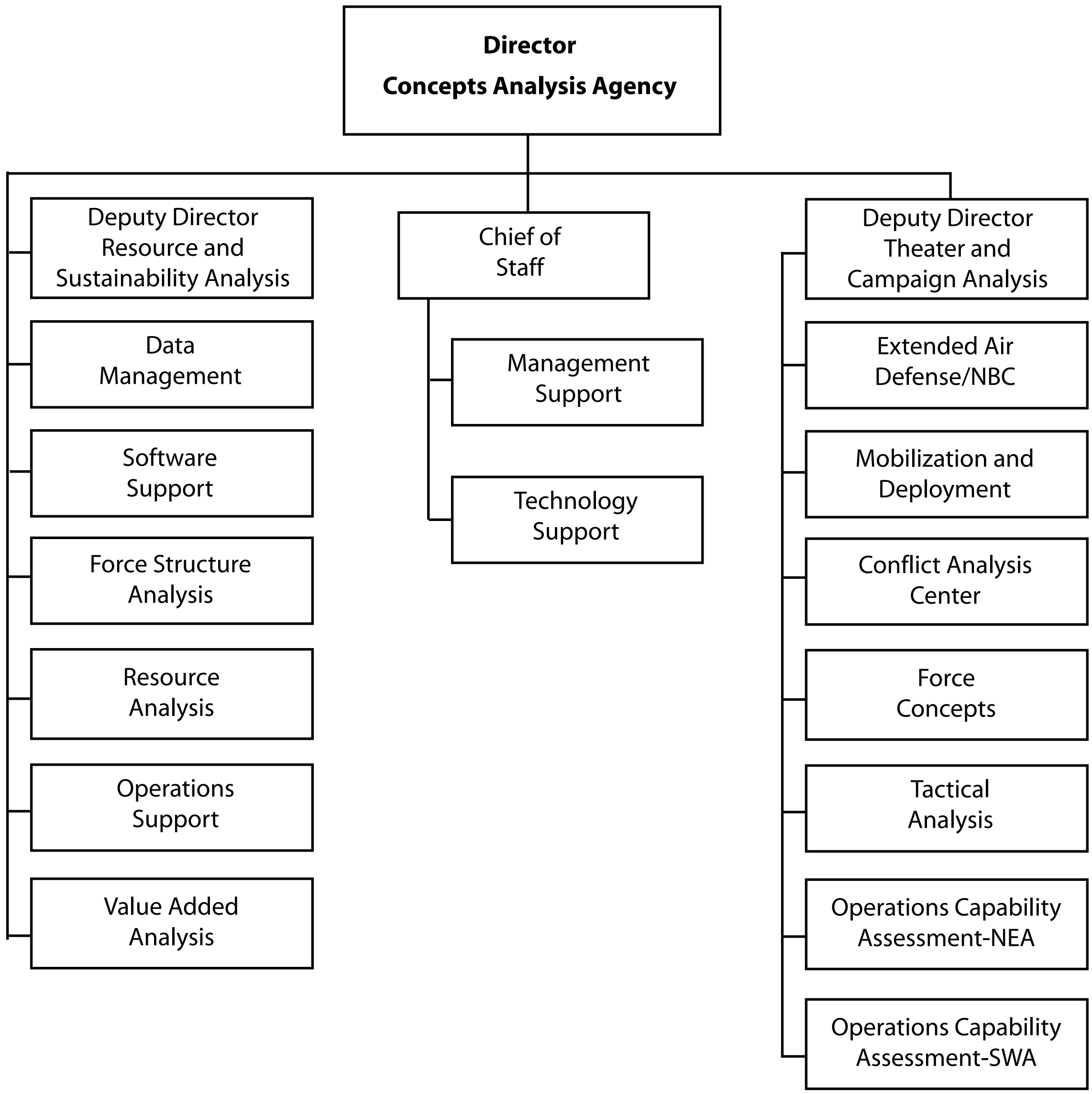
director/deputy commander and a military chief of staff in the grade of colonel.[70] The first commander of CAA was Brig. Gen. Hal E. Hallgren, who had headed the Special Planning Group that planned for the establishment of CAA. General Hallgren assumed command of CAA upon its establishment in 15 January 1973, and was subsequently promoted to major general in August 1973. Several other former members of the Special Planning Group or of STAG also occupied important positions at CAA in its early days. For example, Col. Harold K. Roach, the last commander of STAG, became deputy commander of CAA on 15 January 1973 and served until his retirement on 28 February 1973. Four of the five heads of CAA analysis directorates upon its establishment were former members of the Special Planning Group.[71]

As shown in Table 7–1, three general officers commanded CAA between 1973 and 1982: Maj. Gen. Hal E. Hallgren, Maj. Gen. Ennis C. Whitehead Jr., and Maj. Gen. Edward B. Atkeson.[72]

Col. Harold K. Roach served as deputy commander until his retirement from active duty on 28 February 1973, and then Col. Charles R. Darby served in that position for a short time until the arrival on 16 July 1973 of the new technical director, John T. Newman. Newman served as technical director until shortly before David C. Hardison became the director of CAA in 1982. Subsequent to Hardison's appointment as director, the deputy director was normally a brigadier general until Philip E. Louer became deputy director in FY 1987.

Hardison took over as the first civilian leader of CAA on 16 February 1982. Hardison had already had a long and distinguished career as an analyst and manager of analysts.[73] He had served from November 1975 to August 1980 as the deputy under secretary of the Army for operations research (DUSA [OR]) and then held an important post in OSD before Army Vice Chief of Staff General John W. Vessey Jr. persuaded him to put aside retirement plans and take over CAA in 1982.[74] By his own account, Hardison found an organization with low morale and productivity, a surfeit of colonels and senior civilians coasting to retirement, an aging and decrepit physical environment, inadequate computer support equipment, and

Figure 7–5—CAA Organization, FY 1994



Source: U.S. Army Concepts Analysis Agency, *CAA Annual Report, Fiscal Year 1994* (Bethesda, Md.: USACAA, December 1994), p. 1-2, Figure 1-2 (CAA Organization Chart).

other signs of poor leadership.[75] He at once set about to correct the most glaring problems and achieved a modest degree of success, including a tripling of the number of ongoing study projects.

Hardison retired from government service at the end of September 1984, and he was followed as director of CAA by E. B. Vandiver III.[76] It fell to Vandiver to shepherd CAA through the analytical challenges of ending the Cold War and fighting the first Gulf War followed by the personnel reductions and budget cuts of the early 1990s and the resulting transformation of not only CAA but also the entire Army analytical community.[77] This he accomplished with dedication, foresight, and technical acumen. As of this writing, Vandiver has been the director of CAA for almost twenty-five years.

CAA Personnel

The real strength of CAA lay in its people, both ORSA professionals and clerical/support personnel, military and civilian. Maintaining authorizations for adequate numbers of skilled personnel and attracting and retaining those personnel were matters

Table 7–1—Commanders and Directors of CAA, 1973–1995

Incumbent	*Begin*	*End*
	Commanders	
Maj. Gen. Hal E. Hallgren	15 January 1973	29 February 1976
Col. William N. Eichorn II (Acting)	1 March 1976	19 April 1976
Maj. Gen. Ennis C. Whitehead Jr.	19 April 1976	16 May 1980
Maj. Gen. Edward B. Atkeson	7 July 1980	13 February 1982
	Directors	
David C. Hardison	16 February 1982	29 September 1984
E. B. Vandiver III	30 September 1984	30 September 1995 to Present

of constant concern for CAA leaders throughout the period 1973–1995. As shown in Table 7–2, authorizations peaked in FY 1983 and then began to fall, and it became more and more difficult to maintain the balanced mix of skilled military and civilian personnel necessary to carry out the CAA mission. The situation reached critical proportions after the first Gulf War in 1990–1991, when Army-wide personnel cuts threatened to eviscerate the CAA program. However, excellent management and the use of advanced technology and new analytical techniques increased CAA productivity and compensated, at least in part, for severe reductions in personnel.

CAA was established on 15 January 1973 with an initial authorized strength of 119 officers, 1 warrant officer, 15 enlisted men, and 190 civilians. Staffing of the new organization with qualified personnel was a major concern during the start-up period. However, progress toward reaching the initial authorization of 325 personnel was rapid. There were 153 personnel assigned on 15 January 1973; by April the number had reached 176; and by July there were 241 personnel assigned (74 percent of authorized strength), and the projection was for the 325 mark to be reached by January 1974. Most of the 153 personnel assigned to CAA on 15 January 1973 were former STAG employees.[78] There were also 20 former members of the Special Planning Group assigned or detailed to CAA on its activation, including CAA's first commander, General Hallgren, and 4 directorate chiefs. Of the 325 personnel spaces authorized on 15 January 1973, 233 (about 72 percent) were for commissioned officers or civilians in the grade of GS–11 or higher. Of the 119 commissioned officer spaces, 31 required an ORSA specialist (SC 49); and of the 114 civilian GS–11 or higher spaces, 72 required ORSA specialists (Series 1515). The approved TDA also included four civilian "supergrade" positions: one GS–17 and three GS–16s. The GS–17 deputy commander/technical director position was approved by the under secretary of the Army on 23 May 1973 and by the Civil Service Commission on 7 June 1973. The three GS–16 directorate chief positions were approved by the under secretary on 11 June 1973 and forwarded to the Civil Service Commission for approval the following day.

CAA personnel authorizations remained unchanged in FY 1974, except for a temporary increase of fifteen officers and five civilians approved on 22 March 1974. CAA's personnel structure continued to be characterized as "a balanced mix of military and civilian professionals having a wide range of expertise within a high grade structure."[79] The number of assigned personnel continued to increase during FY 1974. By 30 June 1974, assigned strength had reached 92 percent of authorized strength. In FY 1975, CAA personnel authorizations remained the same, the twenty temporary spaces being continued, and actual assigned strength improved slightly to 94 percent for military personnel and 92 percent for civilians. The overall authorized strength of CAA remained the same in FY 1976/T, although the one warrant officer position was deleted and an E–9 position added. Assigned strength again improved slightly to 106 percent of authorized military strength and 95 percent of authorized civilian strength, taking into account the temporary fifteen officer and five civilian augmentations, which continued.

In FY 1977 there was a reduction in force, and the number of authorized military personnel fell to 108

Table 7–2—CAA Personnel, FY 1973–FY 1995

Fiscal Year	*Military* *Authorized* (O/EM)	*Military* *Assigned* (O/EM)	*Civilian* *Authorized*	*Civilian* *Assigned*	*Total* *Authorized*	*Total* *Assigned*
Jan 1973	120/15	n.d.	190	n.d.	325	153
Jul 1974	135/15	117/17	195	180	345	314
Jun 1975	135/15	127/15	195	179	345	321
1976/T*	119/16	n.d.	190	n.d.	325	n.d.
1977	108/12	111	162	152	282	263
1978	115/12	88	172	146	299	234
1979	114/12	109	171	139	297	248
1980	114/12	122	173	144	299	266
1981	117/12	120	173	170	302	290
1982	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1983	n.d.	n.d.	n.d.	n.d.	308	n.d.
1984	n.d.	n.d.	n.d.	n.d.	293	n.d.
1985	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1986	100/10	84/11	171	164	281	316**
1987	93/10	86/10	160	158	263	299**
1988	93/10	83/7	160	148	263	277**
1989	76/1	77/8	155	138	232	267**
1990	100/1	78/8	162	160	263	258**
1991	83/1	81/7	179	154	263	249**
1992	83/1	57/1	141	148	225	210**
1993	79/1	54/1	134	139	214	194
1994	63/1	56/1	140	127	204	184
1995	57/1	41/1	135	127	193	169

Source: Based on available CAA annual reports, FY 1973–FY 1995, and other sources.

Note: Unless otherwise indicated, all figures are for authorized strength at the end of the fiscal year. "Military Officer" figures include warrant officers, and "Civilian" support figures include secretarial and clerical as well as professional personnel. Figures for FY 1974 and FY 1975 include a temporary authorization for fifteen officers and five civilians. "Military Assigned" figures for FY 1978 are as of August 1978 and "Civilian Assigned" figures are as of April 1978. "Military Assigned" figures for FY 1980 and FY 1981 are averages across the fiscal year. Authorization figures for FY 1989 are based on February 1988 manpower survey.

*T= Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

**Total includes overhires and cooperative education students.

O = officer; EM = enlisted men; n.d. = no data readily accessible

officers and 12 enlisted personnel and the number of authorized civilian personnel fell to 162. Assigned military strength also declined steadily during the year, from a high of 135 in October 1976 to a low of 111 in September 1977. Assigned civilian strength averaged 174 across the fiscal year from a high of 186 in October 1976 to a low of 152 in September 1977. CAA's authorized strength increased slightly in FY

1978 to 299 (115 officers, 12 enlisted personnel, and 172 civilians), but assigned military strength continued to decline steadily, from 111 in October 1977 to 88 in August 1978. Civilian assigned strength averaged 149, fluctuating from a high of 152 in December 1977 to a low of 146 in April 1978. Of the 299 spaces authorized in FY 1978, 215 were designated as "professional," that is, they required a trained ORSA manager or analyst, and there were 91 military and 94 civilian ORSA specialists assigned.

By the end of FY 1979, CAA was authorized 297 personnel (114 officers, 12 enlisted personnel, and 171 civilians) as a result of the loss of officer and one civilian space. Military assigned strength averaged 102, from a low of 88 in December 1978 to a high of 109 in September 1979, while civilian assigned strength declined steadily from a high of 146 in October 1978 to a low of 139 in September 1979. CAA's authorized strength increased by 2 civilian spaces in FY 1980 to 299, and assigned military strength averaged 122, while assigned civilian strength increased from a low of 139 in October 1979 to a high of 144 in September 1980. By the end of FY 1981 CAA's authorized strength was 302 (117 officers, 12 enlisted personnel, and 173 civilians), and assigned military strength averaged 120 for the fiscal year, while assigned civilian strength again increased from a low of 144 in October 1980 to a high of 170 in July 1981.

The 1985 RAAEX study group found that in FY 1983 CAA was authorized 60 SC 49–qualified officers (about one-fifth of the total authorized in all HQDA SSA and FOA), of whom 51 were ODP-supported and 57 were assigned.[80] At the same time, CAA was authorized 81 civilian Series 1515 ORSA analysts (less than one-tenth of the Army total) and had 72 assigned for an 89 percent fill, slightly better than the Army average of 85 percent.[81] In FY 1983, CAA obtained 6 additional spaces to support its new contingency force analysis mission, bringing the total authorized strength to 308, but in FY 1984 HQDA imposed a 15-space reduction, reducing the authorized strength to 293. However, improvements in work processes and close monitoring of resource consumption and milestone achievements resulted in a 25 percent increase in productivity during FY 1984.

In FY 1986 CAA took another 3 percent reduction in authorized strength in the form of the elimination of seven military spaces (including the executive officer) and two civilian spaces. The revised table of distribution and allowances (TDA) authorized 100 officers (93 ODP-supported and 69 AERB-validated positions), 10 enlisted personnel, and 171 civilians. Field grade officer authorizations included 12 colonels, 15 lieutenant colonels, and 34 majors in the FA 49 ORSA specialty. The total assigned strength at the end of FY 1986 was 316 (84 officers, 11 enlisted personnel, and 164 civilians plus 18 temporary or overhire personnel and 39 cooperative education students).

A realignment in FY 1987 saw the loss of seven more officer spaces and the addition of seven civilian spaces, but toward the end of FY 1987 CAA lost eighteen civilian spaces as a result of the HQDA-directed transfer of all CAA mainframe (UNISYS) computer operations, including personnel and equipment, to Computer Systems Command. Although the transfer of equipment and operations never took place, the eighteen spaces were gone. CAA's authorized strength thus fell to 93 officers, 10 enlisted personnel, and 160 civilians, a total of 263. In another HQDA-directed action, CAA retained its authorization for a general officer as deputy director but the position was never again resourced.

The assigned strength of CAA in FY 1987 was 299 (85 officers, 1 warrant officer, 10 enlisted personnel, and 158 civilians plus 14 overhires and 31 cooperative education students). The warrant officer was part of a pilot program to train warrant officers in the SC 49 field. There was no authorized position for a warrant officer on the TDA, so a warrant officer 3 was assigned to an authorized commissioned officer position. ODP support for CAA fell from ninety-three positions to eighty-four positions over the course of FY 1987. On 1 October 1987, a mobilization TDA for CAA was approved with thirty-seven officer positions to be filled by Individual Mobilization Augmentees in the event of mobilization.

The steady decline in CAA's authorized strength began to accelerate in FY 1988. In January and February 1988, CAA underwent a Manpower Management Survey that recommended a cut of thirty-one spaces (seventeen officers, nine enlisted personnel, and five civilians). The resulting authorization was for only 76 officers, 1 enlisted person, and 155 civilians, a total of 232. CAA appealed the 1988 manpower survey team's recommendations on 30 March 1988, but the recommended 232-space TDA went into effect in FY 1989 pending a final decision on CAA's appeal. At the end of FY 1989, CAA's assigned strength was 267 (76 officers, 1 warrant officer, 8 enlisted personnel, and 138 civilians plus 19 overhires and 25 cooperative education students). ODP support decreased from ninety-three to eighty-two, and the number of validated AERB positions was set at fifty-six, including five Ph.D. positions.

Throughout FY 1990 CAA operated under a provisional TDA that reflected a successful appeal of the FY 1988 manpower survey. CAA's authorized strength for most of FY 1990 was 100 officers, 1 enlisted person, and 162 civilians, a total of 263, as in FY 1987 and FY 1988. In FY 1990, the proportion of authorized military personnel to authorized civilians was 37 percent to 63 percent.[82] Of CAA's 263 authorized personnel, 64 were administrative and overhead and 199 were engaged in studies and analyses. Of the 199 professionals, 5 were focused on strategy and policy matters, 122 on force analysis, 25 on PPBS-related cost/benefit studies, 25 on functional area analysis, 2 on cost analysis, and 20 on modeling.[83] CAA's assigned strength fell from 271 personnel at the beginning of FY 1990 to 258, including overhires and cooperative education students, by the end of the fiscal year. The replacement of losses by attrition was subsequently hampered by the imposition of a HQDA-directed hiring freeze through most of FY 1990, FY 1991, and FY 1992.

During FY 1990, the Army-wide Quicksilver drawdown resulted in the loss of eighteen CAA civilian positions, oddly enough the same number of military positions that CAA had agreed to civilianize as part of the negotiations for a new TDA.[84] The loss of military positions was reflected in the FY 1991 CAA TDA approved in January 1991 with an effective date of 1 October 1990. Under the new TDA, seventeen officer positions were eliminated, but the civilian authorization was increased by seventeen spaces.

CAA received a new TDA in July 1992, which was effective as of 2 May 1992. The new TDA incorporated the loss of civilian spaces in the Quicksilver drawdown as well as an additional cut of twenty civilian positions. The resulting authorization was for 225 personnel (83 officers, 1 enlisted person, and 141 civilians). The FY 1993 CAA TDA, effective 1 June 1993, also reflected the downsizing initiatives taking place in the Army and DOD. CAA lost an additional four officer and seven civilian spaces, reducing its total personnel authorization to only 214. The HQDA hiring freeze and high-grade cap remained in effect, and CAA hired no new civilian employees in FY 1993, nor were any Cooperative Education Program students hired. However, ODP support was increased from fifty-four in FY 1992 to seventy-seven in FY 1993. CAA's assigned strength at the end of FY 1993 was 54 officers, 1 enlisted person, and 139 civilians, a total of 194.

The authorized strength of CAA in FY 1994 fell ten more spaces to 204 (63 officers, 1 enlisted person, and 140 civilians). The FY 1995 CAA TDA, effective on 2 November 1994, also reflected the continuing downsizing efforts by the Army and DOD. CAA lost an additional eleven spaces, bringing the total FY 1995 authorization down to 193 (57 officers, 1 enlisted person, and 135 civilians). There were 169 personnel (41 officers, 1 enlisted person, and 127 civilians) assigned at the end of FY 1995.

By 1995, the cumulative cuts in CAA's personnel authorizations threatened to seriously degrade mission performance. An Army Science Board Analysis, Test, and Evaluation (ASB T&E) Issue Group study of Army analytical agencies conducted in the spring of 1995 found that with respect to workload, CAA appeared "to be at or below critical analytical mass in certain functional areas," and that "the future of Army analyses may be in jeopardy due to the offloading of key infrastructure tasks such as: study and model documentation, verification and validation activities, mentoring and recruiting of junior analysts, and reduction in cross training of analysts to provide backup or surge capability."[85] The solution recommended was the addition of 26 positions to CAA's personnel authorization, thereby restoring the FY 1994 authorized end strength of 204 from the FY 1996 authorized end strength of only 178.[86]

The ASB T&E Issue Group study results were briefed to the DUSA (OR), Walter W. Hollis, on 16 August 1995, and the following day Hollis wrote to Army Vice Chief of Staff General Ronald H. Griffith reminding him that the previous VCSA, General Dennis Reimer, had set manpower floors for CAA, TRAC, and AMSAA that had since been breached.[87] Hollis then stated:

> I am greatly concerned the CAA in particular, has been cut beyond the point where it can reliably function for use. The floor set by the Reimer message was 220. CAA is scheduled to go to 178 in 1996. The message in the ASB report is clear when one remembers that 220 was thought to be the lower limit for CAA which would permit it to execute its mission.
>
> Mr. Vandiver and I have discussed this matter. He believes, with the modernization he has accomplished in information processing, he could execute his mission with 200 authorizations. I agree with his assessment.[88]

Over the years CAA leaders took a number of initiatives designed to dampen the effect of continuing personnel cuts. Ironically, as CAA resources were cut drastically during the first half of the 1990s, productivity continued to rise due to a robust Total Quality Management (TQM) program, ongoing research and analysis activities, improved technologies and methodologies, programs to augment CAA professional manpower with visiting analysis and cooperative education students, and training for CAA personnel. As noted in both the FY 1994 and FY 1995 CAA annual reports: "The resources devoted to these initiatives are at the margins of CAA direct mission support capabilities and sometimes have been resourced at the expense of management and administrative support."[89]

In FY 1985, a Distinguished Visiting Analyst (DVA) Program was initiated to augment CAA's staff of professional ORSA analysts by bringing distinguished analysts from throughout DOD to CAA, usually for one year. The first two DVAs were Carl Builder from the RAND Corporation and Dr. Samuel Parry from the Naval Postgraduate School, both of whom were in residence at CAA in 1984–1985.[90] In FY 1986, the DVAs were Dr. Wayne Hughes from the Naval Postgraduate School and Dick Lester from the Army Secretariat, and in FY 1987, the DVAs were Dr. Jerome Bracken from the Institute for Defense Analysis and Dr. Ben Bauman from James Madison University.[91] From March 1988 to February 1989, the DVA was Dr. Allan S. Rehm from the Center for Naval Analysis. Dr. Richard Darilek arrived at CAA on 14 August 1989 from RAND Corporation to participate in the DVA Program through March 1991.

Another program initiated by E. B. Vandiver III to strengthen CAA analytical capabilities in the face of personnel cutbacks was an exchange program with the other services and selected foreign military forces.[92] The program began in October 1985 with the Air Force Center for Analyses, and USAF Maj. Philip W. Hill exchanged with Maj. George T. McGuire from CAA. In FY 1989, CAA hosted exchange analysts from the Air Force Center for Analyses and the Naval Postgraduate School as well as Kathy Drake, who came to CAA on a TRADOC fellowship program.

Another initiative was the Cooperative Education Program (CEP) for recruiting top students with the latest academic skills gained at colleges and universities offering computer science and OR degrees.[93] Under the CEP, CAA hired more than fifty college students each year for alternating work/school tours and then placed graduates in selected positions in CAA. In FY 1983, the number of CEP students rose to thirteen, up from six in FY 1982. The number in FY 1984 was ten, and in FY 1985 it was twenty-five. In FY 1986, students from thirteen universities participated in the program. In FY 1987, the Cooperative Education Program included seventy students from twelve universities and for the first time a DA Science and Engineering (DASE) Program student as well. In FY 1988, the number of cooperative education students employed was forty-seven, down from seventy in FY 1987. In FY 1989, CAA employed fifty-eight students from fifteen major universities in the Cooperative Education Program. The FY 1989 program also included three students in the DASE Program, which provided cooperative education opportunities for ROTC students. Personnel and budget cuts in FY 1990 placed the CAA Cooperative Education Program in serious jeopardy. As of 30 September 1990, CAA had thirty active CEP participants, but budget and personnel cuts in FY 1990 forced a dramatic cut in the program to only eight new CEP hires in FY 1990. As of 1 October 1991, there were ten active CEP participants, but budget restrictions forced the termination of the program in FY 1992.

The impact of personnel cuts was also attenuated to some degree by improved training for CAA personnel. There were a number of varied opportunities for professional development. In addition to scheduling internal seminars and lectures, CAA leaders contracted with George Washington University to conduct off-duty graduate programs at CAA, and CAA also had a military history program that sponsored noted guest speakers.[94] In FY 1983, some $42,000 was expended in support of training, and the graduate-level in-house training program, contracted with George Washington University, began in the fall of 1983.[95] In FY 1984, expenditures on training were $42,000, and $60,000 was programmed for FY 1985. In FY 1985, four major training efforts were under way: three microcomputer classes trained sixty individuals; three SIMSCRIPT II.5 programmer's courses trained forty-five individuals; the George Washington University ORSA graduate program enrolled twenty-five individuals; and a Historical Campaign Studies Program was initiated to provide CAA analysts with a better perspective on warfare. The professional development of CAA personnel remained a priority through the mid-1990s, but after 1989 it became increasingly difficult to find the funds necessary to do all that needed to be done.

CAA Budget

Annual CAA budget obligations grew from $4,542,143 in FY 1974 to a peak of $15,541,000 in FY 1989 and then declined somewhat as a result of budget cuts in the early 1990s. CAA's total budget obligations fell some 9 percent between FY 1989 and FY 1990 ($15,541,000 in FY 1989 vs. $13,299,000 in FY 1990), and in FY 1995, CAA's total budget obligations were only $12,937,200. The importance of CAA's role in aiding Army leaders in managing the first Gulf War in 1990–1991 and in making the difficult decisions regarding Army force structure for the post–Cold War era shielded CAA from drastic budget cuts after 1990, but, as indicated in Table 7–3, CAA total obligations after FY 1989 were a bit erratic. In general, the decline in direct funding after FY 1990 was offset by increases in the amount of external funding (reimbursements) received from other agencies for work done on their behalf by CAA.

The STAG budget for FY 1973 was $1,954,000 plus a $225,798 supplement for civilian personnel compensation and benefits for a total of $2,179,798.[96] The most significant expenditure ($1,155,960) was for civilian personnel costs. Under terms of the STEADFAST reorganization plan, any command losing an activity to another command or agency was to provide financial support to the transferred activity until 1 July 1973, the start of FY 1974. Thus, CAA was funded from 15 January to 30 June 1973 by funds from STAG and the two smaller organizations transferred from CDC.

In its first full year of operations, FY 1974, CAA total budget obligations amounted to $4,542,143. Total obligations grew erratically thereafter to a peak of $15,541,000 in FY 1989. The reduction in funding for Army analytical organizations, including CAA, which began in FY 1990, was partly offset by increased funding received from external clients. CAA's total budget obligations for FY 1990 were only $13,299,900, and CAA's budget for FY 1991 remained uncertain throughout much of the fiscal year due to operations DESERT SHIELD/DESERT STORM and was not confirmed until June 1991. CAA's total obligations of $13,588,100 in FY 1991 were slightly greater than in FY 1990, and on 5 September 1991, CAA received an additional $675,000 (not shown in Table 7–3) to pay for "borrowed" supercomputer usage and to support personnel awards and end-of-year supply actions. The following fiscal year, FY 1992, CAA's operating budget was barely adequate, and sufficient funds were not made available until the second quarter. However, in January 1992, CAA was allocated an additional $800,000 to finance operations through the end of the fiscal year. An additional $898,500 in nonrecurring funds were also received, but as the author of the FY 1992 CAA annual report noted: "Continued CAA budget reductions have eroded discretionary activities to the point where CAA's budget is almost totally dedicated to meeting nondiscretionary obligations for payroll and maintenance."[97]

In FY 1993, CAA budgeting was again adversely affected by DOD "rightsizing" efforts, which delayed determination of annual funding levels until the last month of the fiscal year. Essential programs were funded, but for "progress on some studies, sponsor-provided [i.e., reimbursed] funds were required to support Agency travel, simulation and other production essential tasks beyond CAA's funding capability."[98] Training was cut, and both travel and training were suspended altogether during June, July, and August 1993. As the author of the FY 1993 annual report noted: "The result of the funding issue had some adverse affects on employee morale and hampered the ability to maintain the level of modernization and

Table 7–3—CAA Budget, FY 1973–FY 1995

Fiscal Year	*Direct Funding ($)*	*External Funding ($)*	*Total Obligation ($)*
1973 (STAG)	n.d.	n.d.	2,179,798
1974	n.d.	n.d.	4,542,143
1975	n.d.	n.d.	5,084,933
1976/T*	n.d.	n.d.	7,033,432
1977	n.d.	n.d.	5,723,058
1978	n.d.	n.d.	5,322,439
1979	n.d.	n.d.	5,951,758
1980	n.d.	n.d.	5,951,758
1981	n.d.	n.d.	7,991,908
1982	n.d.	n.d.	n.d.
1983	n.d.	n.d.	n.d.
1984	n.d.	n.d.	n.d.
1985	n.d.	n.d.	n.d.
1986	n.d.	1,250,000	10,732,647
1987	n.d.	2,387,000	11,951,000
1988	n.d.	n.d.	12,239,000
1989	n.d.	n.d.	15,541,000
1990	n.d.	n.d.	13,299,900
1991	12,493,200	1,094,900	13,588,100
1992	11,709,500	898,500	12,608,000
1993	11,791,200	1,448,300	13,239,500
1994	11,203,200	1,332,000	12,535,200
1995	11,275,900	1,661,300	12,937,200

Source: Based on figures provided in CAA annual reports.

Note: Figures are for the amount of direct OMA funding obligations and do not include Military Pay and Allowances (MPAs).

*T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

n.d. = no data available

enhanced productivity investments of prior years. An additional effect was the inability to fund civilian personnel replacements due to natural attrition."[99] In FY 1994, CAA was able to fund essential programs from direct funding authority, but due to a large unfunded civilian pay requirement and a $42 million Pentagon renovation program, most basic operations had to be curtailed during the last four months of the fiscal year. Somewhat greater stability was experienced in FY 1995, with all funds on hand by July. CAA was thus able to "plan more thoroughly, and execute the plan with greater flexibility than had been possible in previous years."[100]

Between FY 1973 and FY 1995, the bulk of the funds obligated by CAA went to civilian pay and benefits. CAA payroll costs amounted to some $80.5 million between FY 1990 and FY 1995 (just less than one-sixth of the total for Army analytical organizations), including $16 million in FY 1990, $15.4 million in FY 1991, $15.97 million in FY 1992, $16.21

million in FY 1993, $16.46 million in FY 1994, and $16.46 million in FY 1995.[101]

From the beginning, CAA's in-house capabilities were augmented by outside consultants and contracts with outside commercial firms to provide additional services. In FY 1974, CAA expended $1,074,000 on four study contracts and $10,662 on four consultants. In FY 1975 $335,000 was allocated to two study contracts and $31,124 for six consultants. In FY 1976/T $386,103 was allocated for one study contract; $71,894 for five consultants; $251,000 for the purchase of word processing center equipment, the COMO model, and software; and $60,000 for the U.S. Air Force to evaluate the CAA computer. In FY 1977, a cost-plus-fixed-fee contract was awarded to Vector Research, Inc.; $10,355 was allocated for three consultants; and another $611,263 was expended for automatic data processing equipment (ADPE) procurement contracts.

In FY 1979, CAA expended $35,961 on the contract with Vector Research, Inc., for development of the Evaluation of the Theater Force Evaluation by Combat Simulation methodology plus another $24,500 for related training and data collection. A total of $234,000 was paid to five government laboratories for technical support of the Forward Edge of the Battle Area study; $131,227 was transferred to four government laboratories for data deployment to support the Attack Helicopter Organization study; $40,000 worth of contract effort from the Defense Nuclear Agency was purchased for redesign of the Nuclear Fireplanning and Assessment Model; three consultants were hired for a total of $18,510; and eight ADPE contracts were awarded for a total cost of $215,856.

CAA obligated $1,721,090 for contractual services in FY 1980, and the amount for FY 1981 was $1,888,364. In FY 1986, the amount obligated for study support (contracts, consultants, and Distinguished Visiting Analysts) was $121,837. The amount increased significantly to $1,035,000 in FY 1987, and then dropped back just as significantly to $225,000 in FY 1988. In FY 1989, it declined even more to $178,000, but at the same time software development was funded at $2,145,000, equipment purchases at $1,115,000, and maintenance at $1,655,000.

Despite a general decrease in funding in FY 1990, study support obligations more than doubled back up to $449,900, and they increased even more FY 1991 to $699,900 ($525,000 in direct funding and $174,900 in external funding). The following year, FY 1992, CAA obligated only $66,000 for study support, but study support obligations in FY 1993 amounted to a whopping $877,600, of which $51,600 was in direct funding and $826,000 came from external agencies. In FY 1994, study support obligations fell a bit to $507,800, entirely from external funding, but they rose again in FY 1995 to $785,200, including $50,000 in direct funding and $735,200 in external funding.

After FY 1990, external funding (i.e., reimbursement received for work done for other agencies) became more important. In FY 1986, for example, CAA received additional funds in the amount of $1.25 million from external study sponsors and centralized Army analytical organizations to upgrade existing computer operations and to acquire new computer equipment. In FY 1987 the amount was nearly twice as much, $2,387,000, the third-largest funding category after civilian pay and allowances ($8,880,600) and maintenance ($1,524,800). CAA external funding in the 1990s amounted to $1,094,900 in FY 1991, $898,500 in FY 1992, $1,448,300 in FY 1993, $1,404,000 in FY 1994, and $1,661,300 in FY 1995. External funding received by CAA in FY 1993 included $450,000 from Information Systems Command for ADP productivity enhancements; $72,300 from United States Army, Europe, and U.S. Eighth Army/U.S. Forces, Korea, for travel in support of command-sponsored studies; $826,000 from the United States Army Model Improvement and Study Management Agency (MISMA) and the Defense Nuclear Agency to support war games and various simulations; and $100,000 from the Logistics Evaluation Agency to support the Global Deployment Analysis System (GDAS).

External funding received by CAA in FY 1994 included $525,000 from Information Systems Command for ADP productivity enhancements and the first increment of the CAA ADP modernization plan; $280,000 from United States Strike Command for contract enhancements related to the Armor/Anti-Armor Mission Area Analysis; $200,000 from the Logistics Evaluation Agency and the Army Model Improvement Program to support GDAS; $130,000 from U.S. Eighth Army for travel in support of studies performed for the command and to support GDAS development and upgrade; $194,000 from OSD to support the KURSK study; and $75,000 from the DUSA (OR) Simulation Technology Development Program (SIMTECH) for the Simulation Laboratory (SIMLAB). In addition, the Army Study Program obligated $550,000 on behalf of CAA for various studies.

External funding received by CAA in FY 1995 included $200,000 from DOD for continuation of the KURSK study; $106,000 from U.S. Eighth Army/U.S. Forces, Korea, for travel to Korea in support of studies for the command; $572,800 from the United States Army Engineer Command, the Army Environmental Policy Institute, and the National Ground Intelligence Center for various environmental studies; $694,000 from MISMA for hardware and software in support of CAA studies and modeling activities; $33,300 from the Office of the Surgeon General to conduct a nuclear-biological-chemical game; and $55,000 from other sources.

CAA Facilities and Computer Support

On 24 January 1973, the secretary of defense approved the secretary of the Army's requested to locate CAA in the National Capital Region. There had been considerable discussion of where to house the new organization, and one proposal had been to co-locate CAA and OTEA so that they could share certain support facilities such as a library and graphics section. Proposed locations included the Hoffman Building in Alexandria, Virginia, or Fort Belvoir, Virginia. Those discussions were made moot by the decision to merge CAA with STAG at STAG's Bethesda, Maryland, facility. In January 1973, STAG occupied leased office space on three floors of the Woodmont Building at 8140 Woodmont Avenue in Bethesda, Maryland, and on two floors of the adjacent Rugby Building. To increase the space available for CAA, action was taken to amend the lease on the Woodmont Boulevard facility to include four more floors of the Rugby Building, which was subsequently accomplished after Congress approved the lease.[102] The additional space in the Rugby Building was finally occupied by 7 October 1973.

Between 1973 and 1995, the Bethesda location underwent a continuing process of physical renovation in an effort to improve working conditions to enhance productivity and professionalism. Specialized facilities were constructed, including space for the CAA technical and classified libraries and a "Status Room" to serve as CAA's nerve center for operations and management. By 1982, the physical plant had deteriorated to a significant degree, and upon becoming the director of CAA David C. Hardison launched a concerted effort to clean, reorganize, and renovate the Bethesda site.[103] Further major renovations were completed to the Woodmont and Rugby buildings in FY 1991 and again in FY 1994, and CAA remained at the Bethesda location until 1999, when, pursuant to a decision of the 1995 Base Realignment and Closure Commission, CAA moved to a new purpose-built facility at Fort Belvoir.[104]

CAA relied heavily on computer support for its studies, analyses, models, simulations, and war games, and a good portion of CAA's annual budget went toward the cost of acquiring computer hardware and software and the related training and maintenance. Between 1973 and 1995, CAA's computer support kept pace with the rapid improvements in computer and ADP technology and transitioned from reliance on big mainframe computers, such as the UNISYS 1184 with big card decks and printouts in 1984, to minicomputers and PCs after 1985. As a consequence, in the late 1980s and early 1990s CAA went from being able to do only a couple of dozen major simulation cases per year to many hundreds per year, and the number of completed studies increased similarly.[105] Indeed, improvements in computer technology were a primary reason CAA was able to continue to increase productivity in the face of severe personnel cuts after 1989.

One of the main reasons for the decision to locate CAA at the STAG facility was STAG's third-generation, $3 million UNIVAC 1108 computer system, which was completely installed and fully operational. After the establishment of CAA on 15 January 1973, action began immediately to convert existing models to operate on the UNIVAC 1108 system and to determine the need for such items as remote terminals and additional ADP equipment. Between 15 January and 30 June 1973, the UNIVAC 1108 system operated on a one-and-a-half-shift basis (twelve hours per day, five days per week), and some twenty projects consumed nearly 828 hours of computer time.

In FY 1974, the system configuration remained unchanged and operated at an average of 92 percent operational effectiveness. At the same time, CAA ADPE workload and operations staff grew to the point that a three-shift, five-day-per-week operation was initiated in October 1973. Steps were also taken to initiate the acquisition of greater computer capability and various hardware and software upgrades. Utilization of the existing system in FY 1974 in support of CAA amounted to some 3,184 computer hours (2,445 hours on seventeen major CAA projects), the remaining time being provided to outside users. Several equipment augmentations to the UNIVAC 1108 facility were made in FY 1975. Utilization of the system in FY 1975 amounted to 6,487 hours (2,735 hours on eighteen major CAA projects) at an average operational effectiveness of 93 percent. Hardware and software improvements and additions continued in FY 1976/T, and the system operated for some 10,075 hours (4,724 hours on twenty-eight major CAA projects) at 92 percent operational effectiveness.

In FY 1980, a contract for $2,776,149 was awarded for the purchase of a new UNIVAC 1100/82 mainframe computer to replace the existing ten-year-old UNIVAC 1108 system. The new system became operational in FY 1981 and boasted a secure environment, compatibility with other systems, capacity for 2.1 million words of memory, a processing speed of 2.5 million instructions per second, 24/7 staffing and operations, and hardware consisting of two central processing units, sixteen disk drives, seven tape drives, twenty-two interactive/remote terminals, four-color graphics workstations, and five high-speed printers. Between FY 1983 and FY 1985, the UNIVAC 1100/82 system and related peripheral equipment were upgraded several times, and by 1984 had been upgraded to a UNIVAC 1100/84. In FY 1985, CAA began the shift to microcomputers. Thirty units were purchased and installed with appropriate software, and additional purchases were scheduled for FY 1986.

As of September 1985, the CAA computer center was a state-of-the-art twenty-four-hour-a-day, seven-day-a-week operation involving four central processing units, forty-two interactive remote terminals, and four-color graphics work stations.[106] A separate facility was established for contingency force analysis and utilized a VAX 11/780-supported man-in-the-loop war game for the analysis of operations plans and contingencies. Plans were afoot in September 1985 for a new supercomputer and a simultaneous move to utilize microcomputers in every aspect of CAA work. However, at the end of FY 1987, HQDA directed that all of CAA's mainframe computer operations, including all personnel and equipment, be transferred to Computer Systems Command.

At the time CAA's mainframe computer was transferred to Computer Systems Command, large mainframe computers were rapidly becoming obsolete, and the use of microcomputers and PCs was growing rapidly. It thus became increasingly difficult to fund needed upgrades of hardware and software for the mainframe computers. In the spring of 1995, an Army Science Board study group found that the Army needed to find a way to fence funds for the technical refreshment of computers for CAA and the other Army analytical agencies in order to maintain their technical edge in automation inasmuch as, "The primary tools of these agencies are their computers and software. It is too important to the Army's as well as the Agency's mission accomplishment for the technical refreshment of these systems to remain on an ad hoc basis."[107]

CAA Work Program, 1973–1995

The Concepts Analysis Agency work program, 1973–1995, was varied and extensive.[108] CAA analytic endeavors ran the gamut of ORSA activities and included studies, analyses, and quick-reaction projects as well as the development, maintenance, and application of a wide variety of models, simulations, and war games, research and analysis aimed at developing modern analytical capabilities, the occasional special project, and cooperation with the analytical arms of DOD, the other services, and friendly foreign nations. CAA work program productivity grew steadily from January 1973 through September 1995, despite the sizeable cuts in analytical resources after 1989, and the number of projects completed each year nearly quadrupled. In its first full year of operation (FY 1974), CAA worked on forty-eight study projects and completed twenty-seven, with an expenditure of more than 1,200 technical man-months. By FY 1995, CAA was completing over 100 primary projects annually in a program structured as shown in Table 7–4.

By 1995, CAA's analytical products fell into five main categories: Studies, Quick Reaction Analyses (QRAs), Projects, Research and Analysis Activities

(RAAs), and CAA Management/Mission Support (MMS). The five types of products were defined as such:

- **Study** – A major in-house or contract effort which is externally sponsored by HQDA or DOD staff element, MACOM, or other government agency. The analysis effort generally involves more than one-half of a professional staff year (PSY) and the duration usually exceeds 90 days. . . . CAA documents the results of studies with a Study Report.
- **Quick Reaction Analysis (QRA)** – An operational or strategy oriented analysis of a pressing issue(s) conducted on a quick response basis. QRA are externally sponsored and performed in-house. The analysis effort is less than one-half a PSY and the duration is normally less than 6 months and frequently less than 30 days. CAA documents results of QRAs with a Memorandum Report.
- **Project** – An in-house or contract analytical support effort undertaken by CAA on behalf of an external sponsor. Projects include CAA analytical support activities such as model validation and verification, peer reviews of studies, and international analytic exchange programs. Projects can range from relatively low-cost, short-term efforts to major efforts equivalent in scope to a study. CAA generally documents results of projects with a Technical Paper.
- **Research and Analysis Activity (RAA)** – A CAA sponsored, in-house effort aimed at developing or improving analytical systems or techniques. Includes the development and modification of analytical models and data bases to support the conduct of studies, QRA, and projects. The product is determined by the tasking authority.
- **CAA Management/Mission Support (MMS)** – Selected work efforts supporting internal CAA program management. The product is determined by the tasking authority.[109]

The evolution of the CAA work program from 1973 to 1995 can be divided into two distinct periods. The first period ran from January 1973 through the end of FY 1989, and the second from the beginning of FY 1990 through the end of FY 1995. The key events that marked the dividing line were the collapse of the Soviet Union, the fighting of the Gulf War of 1990–1991, and the onset of a period of deep cuts in personnel and funding for U.S. military forces after the long buildup under President Ronald Reagan in the 1980s. In the first period, CAA focused on analysis in support of the rebuilding of the post-Vietnam Army and countering the Soviet threat in Central Europe under conditions of relatively scarce resources in the 1970s followed by relatively plentiful resources in the 1980s. In the second period, the focus shifted to mobilizing, deploying, employing, and sustaining U.S. forces in a variety of regional conflicts in the Middle East, Southwest Asia, the Balkans, and the Caribbean and in nontraditional roles, such as drug interdiction, under conditions of consistently constrained resources. After 1990, the demand for CAA's analytical services increased and there was a greater emphasis on relatively short term, "quick reaction" analyses to meet pressing needs for solutions to rather narrowly defined problems.[110] At the same time, CAA was engaged in supporting efforts to restructure the Army to meet the new threats while simultaneously adapting to a much lower level of manpower and expenditures and a new emphasis on joint and combined operations.

E. B. Vandiver III, the director of CAA after 1984, explained the shift and its aftermath this way:

> Well, from 1973 through 1989 is one period. The focus was sharper and sharper on exactly how we go about defeating a Warsaw Pact attack in Central Europe, and what are the weapons, how do we dispose the forces, how do we work with the Allies. . . . The focus was more and more on how to defeat large echeloned forces launching a no-notice attack. That was the focus of all major analysis. A lot of it was about weapons systems, a lot of it was about forces, and a lot of it was about doctrine. . . . That is what put together the Army you saw operate in Operation DESERT STORM; that was the Army designed to defeat the Soviets in Central Europe.
>
> Actually, before 1989 we had already started drawing down the force. And then just as that was happening and we were planning a longer range drawdown. . . . Bang! We ended up with DESERT SHIELD/DESERT STORM. Then, after that, up until 1996 when we went to Bosnia, we really didn't have much focus there in the early 1990s period. It was the post–DESERT STORM period and we got interested in Korea because it was one of the last planning scenarios we had. So we did a lot of Korea stuff.[111]

Quality Control

Quality control of CAA products was an important consideration. A system for quality control was implemented in January 1974 to ensure that CAA products met professional standards. Product Review

Table 7–4—CAA Annual Study, Work, Evaluation, and Reporting System (ANSWERS), FY 1995

Category (Type)	*Sponsor*	*Mode*	*Authority*	*Tasker*	*Approval Level* *Sponsor*	*Approval Level* *CAA*	*Analysis QA* *Sponsor*	*Analysis QA* *CAA*	*Documentation* *Product*	*Documentation* *QA*	*Documentation* *Approval*
Study	External	In-House	AR 5–5 AR 10–88	Study Directive	HQDA Stf Agency Hd MACOM Cdr	Director	GOSC SAG	ARB	Usually Study Rpt Exceptions-Dir Approved	PRB	Director CAA
		Contract	AR 5–5 AR 5–14 AR 10–88	MDM RFP	AMC SIMTECH DOD/DA		SAG IPR		Note a	COR	
Quick Reaction Analysis	External	In-House	AR 10–88 (MOD)		HQDA Stf Agency Hd MACOM Cdr	Director or Division Chief [c]	HQDA Stf Agency Hd MACOM Cdr	ARB	Memoran-dum Report	TQM	Director CAA
Project	External	In-House	AR 10–88	Study Directive	AMC SIMTECH DOD/DA or Dir, CAA (on behalf of sponsor)	Director or Division Chief [c]	n.a.	ARB	Technical Paper[a]	PRB COR	Director CAA
		Contract	AR 5–5 AR 5–14 AR 10–88	MDM RFP							
Research and Analysis Activity	Internal	In-House	AR 10–88	Study Directive	Director CAA	Director >4 PSM	n.a.	TQM	Note b	TQM	Director CAA
		Contract	AR 5–5 AR 5–14 AR 10–88	MDM RFP		Division Chief <=4 PSM		ARB	Note a	Division Chief	Division Chief
CAA Management/ Mission Support	Internal	In-House	AR 10–88	CAA Form 233	Division Chief	Division Chief	Division Chief	Division Chief	Note b	Division Chief	Division Chief

Source: CAA AR FY 95, app. A
Note a: Documentation for contracts will be as specified by RFP. May be amended by negotiation between CAA and the contractor;
Note b: Type product is determined by specified CAA approval authority; Note c: Division Chiefs have interim authority for QRA and Projects.
MDM = Management Decision Memorandum; RFP = Request for Proposal
n.a. = not available

Boards (PRBs) composed of three CAA professional analysts reviewed final CAA products to ensure that they met the highest professional standards. A comprehensive study of the efficiency of the CAA study process and publications was undertaken in FY 1988. On 27 July 1988, the director of CAA established a panel to review the study process and make recommendations for its improvement.[112] The panel was composed of experienced study directors from the four analysis directorates and representatives from other CAA directorates under the direction of CAA Chief of Staff Col. Robert E. Tozier. By 31 July 1988, the panel issued its initial observations in a memorandum for the CAA chief of staff.

The general observations of the panel members were that "the study process as it presently exists at CAA is by and large good. It accomplishes the objective of turning out quality products. Procedures are for the most part well-defined, necessary, and appropriate. Equipment resources are good. Personnel generally perform well."[113] After further consideration, the panel issued a long list of steps to be taken to improve the CAA study process. The list included the following recommendations:

a. Augment the Publications Support Branch staff;

b. Establish a panel to revise report standards;

c. Reduce the role of the Graphic Arts Center;

d. Establish a Management Information Systems (MIS) advisory committee;

e. Repeat the Study Process Review on a semi-annual basis;

f. Update and maintain the *Study Director's Guide*;

g. Provide periodic Study Director orientation briefings;

h. Improve Project Review Board (PRB) guidance;

i. Reduce the formality of PRB copies;

j. Enforce PRB scheduling;

k. Retain cooperative education students on the PRBs;

l. Improve study scheduling;

m. Avoid understaffing in the Word Processing Center and Reproduction;

n. Distribute initial keying of reports;

o. Allow production of reports with PCs;

p. Automate management/accounting paperwork;

q. Review report distribution policy;

r. Eliminate read-aheads for Analysis Review Boards (ARBs);

s. Reduce Publication approval chain;

t. Clarify role of the data Point of Contact;

u. Develop color graphics capability; and

v. Acquire a scanner/digitizer.[114]

Many of the panel's recommendations were subsequently implemented and had a positive impact on the efficiency of the CAA study and publications processes.

CAA Work Program, FY 1973–FY 1989

From FY 1973 through FY 1989, the annual CAA work program focused on the restructuring of the post-Vietnam Army to meet the perceived threat of a Warsaw Pact attack against U.S. and allied forces in Central Europe. The relative stability of the factors affecting restructuring efforts and of the threat posed by the Soviet Union and its satellites permitted lengthy and detailed studies and analyses of alternative courses of action. Intermittent crises, such as the Arab-Israeli (Yom Kippur) War in 1973 and the seizure of the U.S. embassy in Teheran in 1977, called for shorter, more sharply focused analytical work, but the resources available to CAA meant that for the most part, the CAA work program could be planned well in advance and executed without significant modifications other than those imposed by changes in technology and shifts in the opponent's force structure and perceived intentions.

The principal products of CAA's analytical efforts in the period FY 1973–FY 1989 were major "studies"—typically "large-scale and sometimes protracted efforts" that addressed "a broad range of complex issues within relatively stable global environments."[115] As shown in Table 7–5, CAA productivity remained rather stable until the mid-1980s when the number of major projects completed each year began to rise.

Until 1979, CAA worked almost exclusively for the HQDA DCSOPS. After 1979, the DCSOPS remained the principal sponsor of CAA studies and analyses, but the other elements of the Army Secretariat and Army Staff, notably the DUSA

(OR), the DCSPER, and the DCSLOG, also became important clients, and gradually CAA services were extended to other DOD elements.[116]

The topical focus of CAA studies changed over time in response to the changing needs and priorities of the Army. When CAA was created on 15 January 1973, STAG had some thirty significant projects under way, including the FOREWON Army Strategic Operations Plan Exercise–1972; support of the Joint Strategic Capabilities Plans, 1972–1973 and 1974; a Joint OSD/DA NATO Land Forces Requirements and Methodology Review (FOREM); the development of nuclear options concepts (NOC II); work on Mutual and Balanced Force Reduction (MBFR); a study of weapons effectiveness indicators/weighted unit values (WEIs/WUVs); user testing of the AFFORD System; a review of ongoing studies and projects; and continuing review and improvement of in-house methodology, war-gaming techniques, and databases.[117] CAA assumed responsibility for most of those projects, and soon developed its own list of priority projects.

Except for the addition of personnel and logistical issues after 1979, the nature of the CAA work program did not change appreciably until after David C. Hardison became the director in late 1982.[118] In FY 1983, the CAA work program was realigned to emphasize completion of "a larger number of smaller studies and to introduce efficiencies and improved study techniques."[119] As a result, CAA was able to increase the number of completed major studies from twenty-three in FY 1982 to thirty-five in FY 1983, while continuing to maintain the timeliness and analytical excellence of the studies themselves. CAA was also able to achieve a better balance in the allocation of its resources and to increase support to the DCSLOG, DCSPER, and major Army commands while continuing to support DCSOPS at an acceptable level. Considerable improvements were also made in the development, maintenance, and application of the models, simulations, and war games for which CAA was responsible.

E. B. Vandiver III became the director of CAA on 1 October 1984 and found that

> Dave had pretty much doubled the number of studies on-going. They were doing about twenty-five studies a year, but Dave had got it up to in the forties. This was sort of the legacy of an earlier age when you had a small number of large studies, and computing capacities were such that that was what it took. The studies were very manpower-intensive . . . we had basically good people, fairly good issues to deal with at the headquarters, good relations with customers. However, we also had dirty databases, cumbersome techniques, and inefficient processes. I think that was true of the whole analytical world at that time. I don't mean to single out CAA on that.[120]

And, as Vandiver stated in his first *Report of Stewardship* in December 1984,

> the period covered by this report was characterized by improvements in CAA's ability to accomplish its primary mission of providing analytical support to Headquarters, Department of the Army. During FY 84, the Agency continued its efforts to improve the quality of its study products and to increase the number of studies completed in support of external sponsor—this

Table 7–5—Major CAA Studies Completed, FY 1974–FY 1989

Fiscal Year	*Major Projects Completed*
1974	27
1975	31
1976/T*	27
1977	21
1978	23
1979	19
1980	19
1981	24
1982	23
1983	35
1984	44
1985	49
1986	54
1987	57
1988	62
1989	65
TOTAL	580

Source: Compiled from CAA annual reports and other sources.

* T = Transition. The year 1976 was when the end of the fiscal year was changed from 30 June to 30 September. Thus, 1976 is indicated as 1976/T to include the extra three months.

> despite the fact that a reduction in professional staff was imposed on the Agency. Additionally, improvements in staff skills, analysis models, facilities, and study program management were accomplished to enhance mission performance.[121]

The FY 1984 CAA work program was designed to exceed the output level achieved in FY 1983 while "maintaining excellence of analysis in all projects."[122] Similar goals were set for FY 1985. The highlights of the FY 1985 work program included an 11 percent increase in the number of completed projects, up to forty-nine. The fifty-four studies completed by CAA in FY 1986 represented major achievements in the quantity and quality of studies produced. In fact, the number of studies produced increased 10 percent in FY 1986 over FY 1985 even while the authorized strength of CAA declined by 8 percent. CAA increased its analytical support to HQDA by another 10 percent in FY 1987, maintaining the level of excellence while undergoing a major internal reorganization.

The FY 1987 work program encompassed the entire spectrum of conflict, from terrorism and unconventional warfare through minor and major conventional warfare to theater nuclear and chemical war and strategic nuclear warfare and included many "firsts," including:

- The first maritime system study done by CAA (Ultra-Fast Sealift Study);
- The first air defense study in six years and the first air defense simulation to use animation (Air Defense Employment Options Study);
- The first chemical study done at CAA in ten years (Chemical Warfare in NATO);
- The first nuclear requirements study done at CAA in eight years (Theater Tactical Nuclear Requirements–1992); and
- The first study at CAA to make use of the CRAY supercomputer (Mid-Range Force Study–Model Improvement).[123]

In FY 1988, the CAA work program once again exceeded the output level of the preceding year and was notable for many additional "firsts." In FY 1988, the Army Study Program Management Agency (SPMA) established a target of 25 percent of all Army studies to be focused on Army critical issues. The nine critical issues for FY 1988, around which CAA's work program was structured, were the following:

1. Patterns of System Development (Project Management, C3I Hardware/Software Development, Fielding Policies, Life Cycle Management Data, and Rethinking Failures);
2. Management of People and Technology (Research and Development Support Balance, Foreseeing Technology, Rate of Introducing New Technology, Technology and the Troops, Radical Change in the Army's Capability, and Primary Use of a Weapon System);
3. Latin America;
4. Changes in the U.S. Industrial Base, Resulting in Increased Dependence on Foreign Supplies;
5. Role of Automation and Robotics;
6. Mission and Strengths of Active and Reserve Components (Impact of Reserve Component Mobilization on Industrial Mobilization and Domestic Wartime Functions and Most Effective Use of Reserve Component of the Total Army);
7. Status and Role of Chemical and Biological Weapons;
8. Realistic Measures of Military Force Capability (Relation of Information to Force Application, Performance Measures for Other Contributors to Warfighting, Definition of Key Functional Areas); and
9. Recruiting, Development, and Retention of Competent Personnel (Maximum Use of Personnel, Maximum Competitiveness with Other Employers, Cooperation with Other Employers, and Relation of Future Needs to Future Sources).[124]

In FY 1989, the Army's issue assessment process produced a shorter list of five priority issues: (1) Conventional Capability; (2) Interoperability; (3) Sustainability; (4) Explaining the Army; and (5) Supporting the Soldier. Once again, CAA achieved several notable "firsts," including:

- The first attempt by CAA to collect and document information on historical changes in the Army's force structure and the world events that may have influenced the changes (Evolution of US Army Force Structure-EUSAFS);

- The first effort to determine if fighting forest fires causes combat-like stress (Fire Task Force-FIRE);
- The first development of techniques for updating nuclear weapons effects against area targets, allowing the analyst to model the processes of delayed damage, repair over time, and the effects of subsequent nuclear bursts (Nuclear Effects in Theater Models-NUC EFFECTS);
- The first attempt to provide insights to determine the probability of hitting and killing an aircraft with small-arms fire (Small Arms Threat Aircraft-SATA);
- The first analysis conducted to provide insights to support the AirLand Battle scenario development (AirLand Battle-Future, ALB-F); and
- The First "Proof-of-Principle" test to create massively parallel scheduling procedures for enhancing the accuracy of representation and increasing the speed of execution of analyses of intertheater and intratheater transportation systems for the deployment of military force (Massively Parallel Deployment Analysis-MPDA).[125]

During the period FY 1973–1989, CAA also responded to the demand for quick reaction analyses (QRAs)—shorter, more narrowly focused analyses that addressed problems of immediate, often urgent, interests of the Army Staff. For example, in August 1974, CAA responded to an urgent request from the DCSOPS to assist in the analysis of Israeli force requirement projections for 1974, 1979, and 1984. Six military and six civilian CAA analysts participated in the Special Study Group, which concluded its work on 21 August 1974, and presented its findings in a revised assessment completed on 23 August 1974 based on new threat data provided by the Defense Intelligence Agency.

In FY 1987, CAA completed QRAs on the Armored Gun System for the VCSA, the Bradley Fighting Vehicle Capability Analysis for DCSOPS, and the Light Helicopter Study for the DUSA (OR). The following year, QRAs were performed for the VCSA, the DCSOPS, the DUSA (OR), the DCSLOG, and CACDA. Such short, focused analyses would become one of CAA's most sought-after products in the ensuing years.

At the end of FY 1989, the director of CAA, E. B. Vandiver III, summarized the progress of CAA analytical work to date:

> FY 89 represented a period of ongoing progress in the evolutionary process of improving technologies. Through enhanced technological capabilities, the Agency was able to maintain or exceed the level of excellence in all efforts to accomplish its mission of providing analytical support to Headquarters, Department of the Army and other activities. Advances in our Total Quality Management (TQM) program have produced improved Study Director Guidance and an automated Study Director's Advisor. Other knowledge based technologies are being developed to support our internal TQM and to assist in wargaming and other mission essential requirements.[126]

CAA Work Program, FY 1990–FY 1995

The dissolution of the Soviet Union, the emergence of new threats of regional conflict, and reductions in defense spending at home precipitated a substantial change in CAA's workload beginning in FY 1990. The events in Europe and the first Gulf War in 1990–1991 prompted a refocusing of the U.S. National Military Strategy from defeating a Soviet-led attack in Central Europe to dealing with less well-defined global and multiregional threats. As a consequence, CAA's workload expanded to include more varied scenarios and more QRAs. At the same time, efforts to downsize the Army increased the need for analysis to assist Army leaders in restructuring a leaner, more efficient force while challenging CAA itself to do more with less.

The shift to greater concentration on regional threats was foreshadowed by the interventions in Grenada in 1987 and Panama in 1989, but operations DESERT SHIELD/DESERT STORM in 1990–1991 marked the real turning point. As the author of CAA's annual report for FY 1991 noted:

> From a CAA analytical mission perspective, the pivotal events of FY 91 were the Persian Gulf War, end of the Cold War and genesis of disunion of the USSR, and increasing low-intensity threats (narcotics, terrorism, etc.). These still unfolding events, and their ensuing effects have profound implications for the future world order and the emerging global security environment. Since a large portion of CAA analyses focus upon how we plan, structure, posture, and employ forces, these events will likely continue as the primary influences upon the nature and scope of CAA analysis support to sponsors.[127]

Table 7–6—CAA Work Program Summary, FY 1990–FY 1995

Fiscal Year	*Studies*	*QRAs*	*Projects*	*RAAs*	*MMS*	*Total*
1990	26	67	40	21	6	160
1991	23	75	22	19	0	139
1992	27	75	17	19	0	138
1993	36	65	11	28	0	140
1994	30	71	14	40	0	155
1995	—	—	—	—	—	124
					TOTAL	856

Source: Compiled from the tables showing the annual CAA work program summaries in the CAA annual reports for FY 1990–FY 1995.

Note: Details not available for FY 1995

QRA = Quick Reaction Analysis; RAA = Research and Analysis Activity; MMS = Management/Mission Support

The changes in the international security environment and cuts in U.S. defense spending had a profound impact on both the demand for CAA analyses and the types of analyses produced. Of particular note was the increase in the proportion of CAA effort devoted to QRAs as compared to larger, more time-consuming studies and projects. From the beginning of the 1990s until the middle of the decade, the ratio of QRA to deliberate studies completely reversed—from about 1:2 to 2:1.[128] As a consequence, CAA had to do more and do it more quickly. Ironically, despite greater demand and a sharp decrease in personnel and funding, CAA's productivity continued to improve throughout the period FY 1990–FY 1995, as shown in Table 7–6.

Throughout the period, the HQDA DCSOPS remained CAA's largest single customer. For example, in FY 1990, 65 percent of CAA's studies and 72 percent of the QRAs performed were for DCSOPS. CAA support to MACOMs and other than HQDA customers expanded during the period, and the high percentage of DCSOPS support fell after the Gulf War, but DCSOPS remained the biggest user of CAA's analytical services. Table 7–7 shows the distribution of the CAA work program by sponsor between FY 1990 and FY 1994.

From August 1990 through March 1991, the entire U.S. defense establishment was preoccupied with the planning and execution of operations Desert Shield/Desert Storm. Accordingly, CAA's analytical capabilities were focused on assisting Army decision makers to deal with the complex problems of mobilizing, deploying, employing, and sustaining the buildup of a large coalition ground force in Saudi Arabia, Kuwait, and southern Iraq to expel the Iraqi forces of Saddam Hussein from Kuwait. Working principally for the HQDA DCSOPS, CAA analysts used near-real-time intelligence data and friendly force information to develop model inputs and performed theater analysis around the clock, briefing the results at the highest levels and ultimately preparing and presenting more than 100 briefings.[129] In all, more than 500 full-scale theater simulations were developed and analyzed. The quantity, quality, and timeliness of that effort exceeded by far anything CAA had undertaken previously.

In 1990–1991, CAA's analytical efforts were dominated by "an extensive and continuous series of quick reaction analyses of the evolving Persian Gulf situation" for HQDA, HQ ARCENT and HQ FORSCOM.[130] Between August 1990 and the end of February 1991, CAA prepared eighty-four separate QRAs in support of operations Desert Shield/Desert Storm. As stated in the FY 1991 CAA annual report:

> These analyses addressed issues concerning deployment, logistics, supportability, combat service support structure requirements, casualty assessments and replacement personnel requirements, ammunition and other materiel requirements, and development and assessment of numerous concepts of operation for both friendly and opposing forces. Most of these analyses were done on a

Table 7–7—CAA Annual Work Program by Sponsor, FY 1990–FY 1994

Sponsor	*Studies*	*QRAs*	*Projects*	*RAAs*	*Total*
DCSOPS	66	199	31	10	306
DCSPER	6	15	1	1	23
DCSLOG	9	17	2	1	29
DUSA-OR	8	4	31	1	44
Other DA Staff	12	34	10	40	96
MACOM	25	61	11	5	102
CAA Internal	2	0	2	20	30*
Other Army	9	16	10	11	46
DOD and Joint Service	0	5	2	0	7
Other Sponsors	5	2	4	38	49
TOTAL	142	353	104	127	732*

Source: Compiled from the tables showing the annual CAA work program summaries in the CAA annual reports for FY1990–FY 1995.

* Includes six Management/Mission Support efforts

time urgent basis, and some required results within 72 hours to influence critical planning decisions.[131]

Specific topics addressed by the eighty-four QRAs included:

> Estimates of requirements for ammunition and major items of equipment in support of various campaign analyses; sensitivity analyses to assess the impact of varying equipment replacement policies; estimating the number of air defense units required to provide an adequate defense against both a mass air raid and a tactical ballistic missile attack on Saudi Arabia; analysis of the capability of the PATRIOT missiles to defense major Israeli population centers against SCUD missile attacks and to determine proper location of firing batteries to provide maximum coverage; two analyses to estimate the requirement for PATRIOT and STINGER missiles, given varying lengths for the Southwest Asia conflict.[132]

In broader perspective, the FY 1990 CAA work program focused on four special interest areas, each of which had a number of subpriorities. The four principal areas of special interest were: (1) support to commanders in chief (CINCs), particularly in the Middle East and Korea; (2) arms control and force reductions; (3) support to advance planning and integration; (4) support to special DA programs, such as the Army Model Improvement Program (AMIP) and the Simulation Technology Development Program (SIMTECH). Overall, CAA's FY 1990 work program was characterized by "a broader range of planning and operational issues; an increase in demand for CAA analysis with more sponsors seeking support; more comprehensive and sophisticated analysis capabilities; innovative methods to quickly bring the right combination of skills and tools to bear on the issue; and greater responsiveness resulting in higher productivity."[133]

The issues addressed in FY 1991 were much the same as those addressed in FY 1990, and the FY 1991 work program was characterized by an extraordinary level of analytical support to HQDA planning and operational support for operations Desert Shield And Desert Storm; a comprehensive series of analyses supporting the development of a new operations plan for U.S. forces in Korea; a predominance of QRA efforts; an increasing variety of sponsors; a growing program of operationally and strategy-oriented efforts; an increasing focus on strategic options, appraisals, forecasting, and scenario development; and greater productivity.[134]

The dramatic events of FY 1990 and FY 1991 had a profound impact on the Army's analytical community. At the end of FY 1991, the full extent of the changes in the global security environment remained uncertain, but it was clear that they involved "a decreasing threat to US and Allied interests in Central Europe; a declining threat of high-intensity conventional conflict between superpowers; an increasing threat of low- and mid-intensity regional conflicts and terrorism; widespread emergence of nationalism; and a rapidly increasing threat posed by the worldwide proliferation of weapons of mass destruction."[135] Thus, the major challenges facing the U.S. Army were those of "establishing the proper strategic force balance; adjusting capabilities to successfully address diverse regional threats on a global scale; structuring a leaner, more agile force while maintaining adequate strategic and regional power projection capabilities; and reducing time required for partial and full mobilization."[136]

The implications of the changing defense environment for CAA were quite clear. As E. B. Vandiver III noted:

> The striking events of FY 90 underscored the important part CAA analyses play in supporting the Army's global mission. The end of the post–World War II political-military era, the Middle East crisis, and budget reductions had major impact on the scope of CAA activities. These and other events, and their implications for the traditional analytical approach, presented a multitude of new issues and challenged CAA to produce more analysis for more sponsors within shorter timeframes. . . . As this era of remarkable change continues to unfold, the Army's strategic force posture will adjust to a more regional focus. This dynamic environment is expected to generate requirements for more analysis which address a growing number of regional scenarios, issues, and potential contingencies. Responsive, expert analysis will be an increasingly vital element in successfully executing the Army's global mission and in preparing it for the future. To this end, CAA's near-term (1 to 3 years out) future objectives concentrate on evolving the analytical capabilities and sustaining the robustness needed to support the Army's emerging analysis needs.[137]

The Gulf War of 1990–1991 underscored the need for CAA to maintain a full range of responsive theater-level analysis capabilities, and the continued improvement of those capabilities remained a priority in the war's aftermath. From CAA's perspective, the potential demands of the future imposed a requirement for greater flexibility, greater comprehensiveness, greater sophistication, greater responsiveness, and greater efficiency. Already in FY 1990, CAA began to reorient itself to better deal with emerging HQDA analytical needs. By the end of FY 1991, CAA was postured to focus its analytical capabilities on the following priority areas: global strategies and broad military options; theater- and regional-level analysis in nontraditional areas; joint and combined issues; arms control, disarmament, and force reductions; special operations and low-intensity warfare; nuclear, chemical, and biological warfare; contingencies and online QRAs; support to other national objectives (e.g., narcotics interdiction), and economic analysis.[138]

The emphasis on downsizing military forces and cutting back on the resources allocated to them that emerged after FY 1989 also focused the attention of CAA on "identifying, evaluating, and supporting actions promoting the Army's fullest combat potential in a downsized force," efforts "vital for minimizing the risks of downsizing and assisting in mapping the way to the most efficient and effective Army for the future."[139] By the end of FY 1992, CAA was fully engaged in shifting its analytical focus to support the Army's transition to a "leaner, more agile strategic force."[140] To best perform that task, CAA's near-term objectives were defined as the following:

- Maintaining the highest quality work force and productivity level possible within reduced staffing levels
- Developing scenarios which incorporate the political aspects of military operations
- Sustaining a balanced program of advancements in methodologies, techniques, modeling, and professional development activities that will promote future analysis capabilities
- Expanding theater-level analysis expertise to more fully encompass regional planning scenarios
- Refining and institutionalizing improved analysis support to the Army Planning, Programming, Budgeting, and Execution System
- Sustaining and reorienting capabilities for dynamic planning and combat analysis to areas impacted by the evolving National Military Strategy; continuing capabilities for responsive crisis and contingency analysis
- Evaluating mobilization, regional power projection, and reconstitution capabilities and requirements
- Maintaining a total quality management program
- Identifying promising avenues for achieving economies of operation through inter-Agency resource sharing
- Conducting research and development aimed at identifying and evaluating advanced analytical techniques and technologies for potential use.[141]

At the same time, in the face of continued resource cutbacks the CAA leadership determined the core analytical capabilities that CAA had to maintain in the future.[142] Those priority capabilities included reorienting the force; analyses of threat, downsizing, retrograde, mobilization, and reconstitution issues; identifying and assessing emerging global security issues; economic analyses for Army personnel, materiel acquisition, and retrograde planning and programming; theater- and regional-level warfare analyses; operational and contingency planning assessments; analyses of joint and combined issues; arms control, disarmament, and force reduction assessments; special operations and low-intensity conflict analyses; assessments of nuclear, chemical, and biological warfare issues; QRAs of pressing issues; and support to other national objectives and military operations (e.g., narcotics interdiction and disaster assistance).[143]

FY 1993 marked the completion of CAA's transition from "a long term studies and wartime planning agency dominated by one major theater of operations (USSR) to a quick reaction, wartime and peacekeeping planning agency, spread across multiple theaters and scenarios."[144] While addressing the "Four Major Threats" identified by secretary of defense Les Aspin (the spread of nuclear weapons; regional threats such as Iraq and Iran; the failure of democratic reform in the former Soviet Union; and the perceived U.S. economic decline), the FY 1993 CAA work program focused on one overarching issue, the downsizing of the Army.

The resource constraints of the early 1990s impacted CAA as well. Nevertheless, by the end of FY 1995, CAA could claim a 78 percent increase in productivity over the previous five years, a gain in productivity "borne out of necessity to overcome severe cuts in manpower, made worse by a sudden diversification of our workload, and hastened by a proactive Total Quality Management program."[145] The FY 1995 CAA work program focused on the basic questions of "How would our Army fight today? What will we need 5, 10, 15 years from now to defend our national interests? Moreover, how can we best afford to do so?"[146] As E. B. Vandiver III noted in his annual report for FY 1995:

> As the U.S. Government, the Army, and by extension CAA reinvent themselves, we look for new ways to answer these questions largely borne out of a societal trend to be more inward looking at serious domestic issues and as a consequence, more frugal with defense dollars. In keeping with this movement, CAA sought and was duly designated an Army Reinvention Laboratory in FY 95 with all of the attendant responsibilities of this special status. . . . Continuing along this shifting course of changing threats and national priorities, we have redoubled our efforts to build new analysis tools which will serve our sponsors well into the future.[147]

CAA Models, Simulations, and War Games, 1973–1995

CAA's studies and analyses relied on the use of a wide variety of models, simulations, war games, and special-purpose ADP software. Such analytical tools ranged from simple spreadsheets to complex theater-level simulations. Developed and used at various times from 1973 to 1995, they addressed a wide variety of issues, but the more important ones focused on the analysis of general concepts (e.g., the Concepts Evaluation Model, or CEM); the analyses of general Army force structure and readiness (e.g., the Total Army Analysis [TAA] and the Force Readiness Analysis System [OMNIBUS]); contingency operations (e.g., the Contingency Force Analysis System, or CFAS); and the mobilization, deployment, employment, and sustainment of Army forces in overseas campaigns (e.g., the Force Evaluation Model, or FORCEM).

Some of the models, simulations, and war games used extensively by CAA predated the establishment of CAA in January 1973 or were initially developed outside CAA and then taken over.[148] Chief among these were the Automated Force Planning System (FOREWON), TAA, and OMNIBUS. FOREWON was first developed by the Research Analysis Corporation to aid in the analysis of Army force structure requirements. FOREWON was a collection of models (computer programs) designed to assist the analyst in determining a future modernized force structure in terms of the types and quantities of major items of equipment required.[149] As taken over by CAA, FOREWON consisted of five separate but integrated models: a lift model deployed units to a theater of operations and provided arrival dates; a war game (ATLAS) employed combat units against an assumed enemy as the units arrived in the theater; a logistics, or force round out, model determined the units required to support the combat forces; a force aggregation model provided a single force structure that was able to support all of the theaters when troop lists were developed for more than one theater; and, finally, a consolidated force cost model computed the costs of raising current forces to the proposed level and for maintaining that force in peacetime.[150] Using the FOREWON system, force planners could look at a theater over time and determine not only what units were required, but also when each was required.

FOREWON was the forerunner of what came to be called the Total Army Analysis (TAA), one of the principal CAA analytical tools. E. B. Vandiver III played a major role in the initial development of TAA.[151] At the end of the Vietnam War, in late 1973, many Army leaders perceived that the Army's force structure was out of line with post-Vietnam requirements and planning. The HQDA ACSFOR was tasked to look into the problem but passed it to Abraham Golub, then the technical adviser to the DCSOPS. Golub in turn passed it on to Vandiver, then one of his subordinates. Vandiver worked with the forerunner of CAA, the Strategy and Tactics Analysis Group, to modify the FOREWON planning system to come up with force structure requirements. Using the two major Army Operations Plans (OPLANs) of the time, which covered a potential conflict in Germany and another in Korea, STAG ran theater-level war games with the ATLAS campaign model and then used the Force Analysis Simulation of Theater Administrative and Logistical Support (FASTALS) model to generate the supporting force structures. A comparison of the combined results with the existing force structure revealed some 600,000 structure spaces "out of balance"—that is to say, the Army had structure for which there was no requirement and requirements for which there was no structure.

Vandiver spent about three months organizing and conducting the study, which was called the Total Force Analysis (TFA) and which was completed at the end of January 1974. TFA was approved and partially implemented by the end of FY 1974. The TFA process subsequently became an annual one that defined "the minimum essential force for performing Army missions and the proportioning of the force among the various components."[152]

Immediately after the completion of the first TFA, the process was turned over to CAA for further development and annual execution and later became the Total Army Analysis (TAA).[153] Originally, TAA covered only those forces required to execute the two principal OPLANs, but subsequently the process took in more and more parts of the overall Army force structure. Eventually, contingency operations were added, as were the TDA Army, individuals, and contractors, albeit in somewhat less detail.[154] The TAA process was used to determine the force structure of the Army. CAA did the requirements analysis, which was then reviewed and sourced by HQDA, which then issued the annual Force Structure Message (ARSTRUC) in December of each year that prescribed the Army force structure for the next Program Objective Memorandum (POM).[155]

FOREWON was also the starting point for a number of other models, simulations, and war games used by CAA. As E. B. Vandiver III explained the subsequent evolution:

> As part of FOREWON, one of the things that you had to have was a theater campaign model. The model that was brought in was ATLAS. That had been started some years earlier in RAC as an outgrowth of a model they had called "Theater Quick Game." But at the same time, in 1968 or 1969, they started a new model, called the "Theater Combat Model" [TCM]. That went on for a couple of years, and the AVICE wanted to divest himself of model development tasks, so that went to ACSFOR and I ran that project (TCM) for the headquarters. When CAA stood up, I transferred TCM (Theater Contingency Model) over to them, and they changed the name to CEM [Concepts Evaluation Model] because they were the Concepts Analysis Agency. The idea was first used as part of the CONAF [Conceptual Design of the Army in the Field] study in 1974–1975, and it evolved from there.[156]

The Army's OMNIBUS was developed about the same time as TAA. In December 1974, the Army's vice chief of staff directed the Army Staff to "analyze the operational readiness of the Army and to find out what should be done to reach prescribed readiness goals."[157] That analysis, Army Readiness Analysis 76, involved "an examination of the Army's force structure and its ability to mobilize, deploy to Europe, and sustain itself in combat."[158] It later evolved into an annual computer-assisted OMNIBUS that assessed the Army's readiness and recommended ways to improve it, those recommendations being incorporated with those of TAA in each publication of the POM.

In addition to conducting studies that addressed matters of force structure, readiness, and materiel requirements, CAA also became involved in the mid-1980s with contingency force analysis involving the evaluation of operations plans to be executed by the JCS and the unified commanders. In 1983, CAA cooperated with the Army War College and United States Readiness Command in sponsoring a contract with the Jet Propulsion Laboratory to develop the McLintock theater model into a new Joint Theater Level Simulation (JTLS).[159] JTLS included the Contingency Force Analysis Methodology (CFAM) model as a resource allocation tool to a series of linear programs that allowed the user to look at different alternatives under realistic constraints.[160] The existing McLintock theater model had both strengths and weaknesses. It was easy to play, restart, change values during the game, and capture data for postgame analysis; it was engrossing to players; and it allowed simultaneous play of both large and small-scale maps.[161] However, it also had major problems, including unrealistic attrition of ground, artillery, and air defense forces; limited order input; relatively unfriendly player-computer interface; unrealistic echelon of control; and much of the data was "hidden and hard-wired."[162] Similarly, CFAM had both strengths and weaknesses. Among the former were its well-designed problem definer and an analysis package that allowed rapid changes to the problem under solution.[163] The faults of CFAM included the fact that it used a large amount of main memory; its software had not been sufficiently tested; its syntax rules required considerable operator training; and the degree of sophistication of its analysis package was relatively low.[164]

CAA subsequently developed a comprehensive system for contingency force analysis. Work on that system, the Contingency Force Analysis System (CFAS), was completed in FY 1985, and in October 1985, the two models comprising CFAS—the Contingency Force Analysis Methodology (CFAM) and the Contingency Force Analysis Wargame (CFAW)—began to be used in studies supporting the War Plans Division of ODCSOPS. CFAS was fully implemented in FY 1986 and broadened CAA's ability to identify and analyze issues across the spectrum of conflict. CFAM was used to analyze issues of strategic deployment, logistical support requirements, and aggregated combat assessments. CFAM was also used as a reference tool to ascertain intra-theater transportation requirements. CFAW was used to analyze both U.S. and non-U.S. forces in potential conflicts worldwide. CFAW was also expanded into CAA's first political-military war game.

There were also a number of other important developments at CAA in the models, simulations, and war-games field in FY 1985. They included:

- The formation on 12 July 1985 of a special OMNIBUS/FORCEM Task Force to complete the final phase of the FORCEM theater-level model development and to apply FORCEM in the conduct of the OMNIBUS-85 Study, the first application of FORCEM in a study environment;
- The development of the FORCEM Gaming Evaluator (FORGE) as an interruptible war game for use as a tool for the analysis of operations plans for large-scale operations;
- The use of the Support Forces Requirements Analysis (SRA) 1992, the CAA portion of the Total Army Analysis (TAA) 1992, to develop a quantitatively derived support force to serve as the entering year for the 1988–1992 POM;
- The development and testing of the Mobilization Base Requirements Model (MOBRE) for DCSOPS;
- The preparation of the Mid-Range Force Study—1985 (MRFS-85) involving the simulation of combat of the 1994 Planning Force in three theaters using the Concepts Evaluation Model (CEM);
- The application of the MICAF (Measuring the Improvement in Capability of Army Forces) methodology, developed at CAA in 1982–1984, to measure, report, and monitor the Army's improving combat capability for a series of studies for ODCSOPS and the Army leadership; and
- The undertaking of several new initiatives to broaden CAA's base for conducting integrated warfare analyses, notably the Nuclear and Chemical Assessment Data (NUCAD) Study and the Chemical Assessment Model and Data (CAMAD).[165]

As of September 1985, CAA also was working on two other important methodological developments. The first was the Force Evaluation Model (FORCEM), "the first in-house theater-level simulation development within the Army."[166] FORCEM was first applied to the 1985 version of the OMBNIBUS study of current force capabilities. The model incorporated major improvements, particularly in command and control and combat service support. The second important methodological development that CAA worked on in 1985 was the Army Force Potential measure, which enhanced the Army's readiness status reporting system by providing "a measure of how capability increases as modernized systems are introduced within the Army."[167]

The 1985 RAAEX study group examined the CAA work program and zeroed in on the work performed by CAA in the logistics field, noting that "such efforts should be those that focus on force structure or force design issues, or those that take advantage of CAA's unique capabilities in theater combat simulation."[168] The RAAEX study group discussed the relationship of TAA and OMNIBUS to the theater combat models used by CAA, particularly the Force Evaluation Model (FORCEM), and concluded: "Given the imminent transition to the use of FORCEM for these processes [on 1 January 1985], and the fact that FORCEM has an extensive treatment of logistics activities, the processes [i.e., the logistical aspects of TAA and OMNIBUS] should be examined and possibly revised."[169]

The study group noted, for example, that "It is likely that the OMNIBUS process can be streamlined to take advantage of the treatment of logistics in FORCEM and to insure that FORCEM and subsequent computations are consistent."[170] The RAAEX study group also enjoined greater cooperation between the Joint Analysis Directorate of the Office of the Joint Chiefs of Staff and CAA in the development of models and databases, particularly those related to theater campaign models.[171]

In FY 1986, CAA continued to make major contributions to the Army Model Improvement Program (AMIP). FORCEM received emphasis as a theater-level simulation and was used to support the annual OMNIBUS study, and CAA also took the lead in perfecting the new interim corps- and division-level war game, Vector-in-Commander (VIC). In FY 1987 and FY 1988, CAA achieved a number of "firsts." They included the following:

- The first artificial intelligence expert system built for the Army (Expert System Initiative in Logistics Readiness Study);
- The first use of the new theater model, FORCEM (for the OMNIBUS-86 Study);
- The first theater study to use graphical animation to aid in analysis and presentation of results;
- The first arms control analysis game (Conventional Arms Control Wargame, or CAC);
- The first war game performed with a foreign country (TROMSO);
- The first attempt to validate a model at CAA by predicting the outcome of an actual field exercise using the COMO model (COMO HAMMER Validation Study);
- The first development of an operational expert system (Equipment Readiness Code Rule System-ERCULES); and
- The first mixed-integer linear program model (Army Aviation Modernization Trade-off Requirement, or AAMTOR).[172]

By FY 1990, CAA had a panoply of significant models, simulations, and war games that could be used to support its studies and analyses. Some of the more prominent models of interest to CAA in FY 1990 are listed in Table 7–8.

CAA Accomplishments

The United States Army Concepts Analysis Agency played a major role in the two most important restructurings and reorientations of the United States Army in the last quarter of the twentieth century. In the first instance, between 1973 and 1990, CAA analysts assisted Army decision makers in reviving, reshaping, and reorienting the Army to face the Soviet threat in Central Europe after the long and debilitating diversion in Southeast Asia. CAA provided the analytical basis for important decisions on materiel requirements, force structure, contingency planning, and campaign strategy (including mobilization, deployment, employment, and sustainment planning), which led to restoration of the Army's morale, confidence, and capabilities. While CAA's sister analytical organizations (AMSAA, OTEA/OPTEC, and TRAC) dealt with the fundamental issues of materiel design, performance, testing, and evaluation and the development of organization and doctrine, CAA studies integrated

Table 7–8—Models of Interest to CAA, FY 1990

Acronym	*Name*	*Origin*	*Comment*
AFP	Analysis of Force Potential	CAA 1983	Used to estimate the combat potential of actual combat at division level via detailed engagement of various weather/visibility conditions.
CAMP	Computer-Assisted Match Program	STAG 1972–1973	Data processing system that interrelates FASTALS output with information from other databases to generate unit movement requirements.
CASMO	Combat Analysis Sustainability Model	BDM Corp./Vector Research, Inc. 1989	Represents the maintenance base required to support combat operations within a division.
CAS STRAT	Casualty Stratification Model	Soldier Support Center (SSC)	A table-driven computation algorithm that uses factoring techniques to stratify casualties by grade, category, and MOS.
CEM VII	Concepts Evaluation Model, Version 7	CAA 1983	A two-sided, fully automated, deterministic model capable of aggregating conventional land and air warfare results as a series of four-day theater-level cycles.
CFAW	Contingency Force Analysis Wargame	Army War College (AWC)	Two-sided, interactive, single echelon of command model designed to simulate one or more corps in a theater-level war game played on a hexagonal map network.
COMO IAD	COMO Integrated Air Defense Model	SHAPE Technical Centre 1981	A stochastic, critical-event-stepped Monte Carlo simulation model that can represent ground-to-air, air-to-air, and air-to-ground combat.
CORBAN	Corps Battle Analyzer	BDM Corp.	A time-stepped stochastic simulation of combat between a Blue corps and Red armies; used as a tool to evaluate changes in operational concepts, doctrine, force structure, and major combat systems.
COSAGE	Combat Sample Generator	CAA 1978–1980	Two-sided, stochastic, high-resolution, division-level model that simulates twenty-four to forty-eight hours of combat to generate consumption and equipment loss data.
C-REM	Cohort Replacement Model	CAA 1987	A planning tool used to determine the average sizes of COHORT replacement packages required over time to replace losses to companies/batteries in either the FORSCOM or European theaters.
FASTALS	Force Analysis Simulation of Theater Administrative and Logistical Support	RAC 1969–1970 Major upgrades by CAA	A one-sided requirements model that computes administrative and logistical workloads for a theater campaign simulation and then generates the support force structure necessary to sustain the theater combat force.
F-CAP	Force Closure Analysis Program	CAA 1987	Tool for operational planners that automates determination of the air transportation requirement and the closure time for a specified unit.
FDM	Force Design Model	CAA 1987	Time-phased model that uses various factors to design a deployable Army force in terms of its theater-level combat, combat support, and combat service support forces.
FORCEM	Force Evaluation Model	CAA 1987	An average value, two-sided, time-stepped representation of theater-level activities.
MICRO-FASTALS	Micro Force Analysis Simulation of Theater Administrative and Logistical Support	CAA 1987	PC version of FASTALS.
MICRO-PFM	Micro Patient Flow Model	CAA 1988	PC version of PFM.

Table 7–8—Models of Interest to CAA, FY 1990—Continued

Acronym	*Name*	*Origin*	*Comment*
MOBREM	Mobilization Base Requirements Model	CAA 1980	Used to identify the workloads that will be placed on the CONUS base during mobilization.
NUFAM	Nuclear Fire Planning and Assessment Model	CAA 1976	Two-sided, stochastic combat simulation that includes target acquisition, nuclear fire planning, and nuclear fire execution with subsequent damage assessment down to section/battery/company or battalion-level units within a division or corps scenario.
PFAM	Personnel Flow Model	CAA	A Q-Gert network model used to simulate the flow of personnel and units within a specific regiment in accordance with the policies of the movement plan.
PFM	Patient Flow Model	HQDA Surgeon General	An expected-value model used to simulate medical workloads required to support both combat and noncombat casualties.
Phoenix	Phoenix	CAA 1988	A planning tool used to answer certain strategic and operational questions pertinent to helicopter fleet acquisition and management.
POLICON	POLICON	POLICON Corp.	A political assessment model that uses the concept of expected utility to arrive at a prediction of a group decision.
PRISM	Army Prisoner Management Model	CAA 1983	A network simulation model constructed within the context of Q-Gert and used to assess the impact of various changes in confinement policy decisions and environmental conditions in the criminal justice system.
SITAP	Simulation for Transportation Analysis and Planning	Computer Science Corp. (SCS) 1968	A deterministic model of an intratheater transportation system used to determine the throughput of airports, seaports, and the intratheater transportation network.
SOTACA	State of the Army Contingency Analysis Model	Science Applications International Corp. (SAIC) for Joint Analysis Directorate, Office of the Joint Chiefs of Staff, 1986	A computer-based analytical aid intended for use in crisis action planning by planners at both the JCS and joint/unified command levels.
TARMS II	TRASANA Aircraft Reliability Maintainability Simulation (CAA Version II)	CAA 1983	A large-scale, stochastic model that describes the impact and interaction of reliability and vulnerability parameters on the availability of current or future Army aircraft.
TADER	Target Acquisition Detection Routine	CAA 1985	A deterministic expected-value model that computes susceptibility to detection of generic military units that are scanned by opposing arrays of sensors of various types over a fixed scan period.
TRANSMO	Transportation Model	CAA 1973	An intertheater strategic mobility model that identifies movement requirements by tonnage and cargo type.
VIC	Vector-in-Commander	TRASANA 1986	Two-sided, deterministic simulation of integrated land and air combat at the battalion maneuver level.
WAFF	Wartime Fuel Factors Postprocessor	CAA 1973–1975	Uses output from other CAA models to develop fuel factors used in calculating war fuel reserves.
WARF	Wartime Replacement Factor System	CAA 1973–1975	Produces materiel war reserve factors by combining historical loss rates and rates from combat simulations of other CAA models.
WARS	Wartime Ammunition Rates System	CAA 1989	Uses data from CEM and COSAGE to compute ammunition requirements in a theater-level conflict.

Source: Based U.S. Army Concept Analysis Agency, *United States Army Concepts Analysis Agency FY 90 Annual Report* (Bethesda, Md.: USACAA, December 1990), app. B (Tabulation of Models of Interest to CAA).

the results of those efforts into a coordinated whole focused on theater-level operations and the design of the overall Army force structure needed to meet the complex demands of the National Military Strategy and domestic and international political, economic, and technological trends.

With the major changes in the international security environment in the early 1990s brought about by the collapse of the Soviet Union, the evaporation of the Warsaw Pact threat in Central Europe, the first Gulf War of 1990–1991, and the emergence of new threats to U.S. national security in the form of regional conflicts, terrorism, nuclear proliferation, and drug trafficking, CAA quickly and smoothly reoriented its analytical capabilities to address the emerging issues of most importance to the Army and the nation. Chief among these were the restructuring of the United States armed forces to meet the challenges of regional conflict and nontraditional missions, such as counterterrorism and drug interdiction, under severe constraints in manpower and funding.

CAA managers and analysts, both military and civilian, met every challenge with skill, enthusiasm, and dedication. Even as CAA resources fell after 1989, productivity continued to rise as a result of good management, improvements in analytical techniques, and hard work. As a result, E. B. Vandiver III, the director of CAA, was able to write in the cover letter to his annual report for FY 1996:

> 1. This year's report portrays CAA as a partner with change, a change that has made it all the more important that we stay in the loop with Army and DOD decision making processes; processes which are approaching "real time" in terms of response time. Changes in technology, threats, operations, programs, and staffing pushed by changing values, economic realities, and processes in society at large make this problematic and possible at once.
>
> 2. By staying ahead of this wave of change, we have statistically stayed productive, but more importantly we are fully engaged in Army and DOD processes as they rapidly evolve.[173]

Chapter Seven Notes

[1] The principal sources for the history of CAA during the period 1973–1995 are the yearly historical narratives, variously called the CAA *Annual Historical Summary*, *Annual Historical Report*, *Report of Stewardship*, or *Annual Report*. The following account is based almost entirely on those reports, and, unless otherwise noted, statements of fact can be attributed to one or another of the CAA annual reports, the date of which can be determined easily from the context. Thus, only direct quotations or unique interpretations taken from the annual reports are cited in the text. As a matter of convenience, all CAA annual reports, regardless of their actual title, are cited in the form *CAA AR FY 19[xx]*. Other sources are cited in the usual manner.

[2] E. B. Vandiver III, "CAA: Over a Decade of Support to the Army," *Phalanx* 18, no. 3 (September 1988): 1.

[3] U.S. Army Concepts Analysis Agency, *United States Army Concepts Analysis Agency FY 90 Annual Report* (Bethesda, Md.: USACAA, December 1990), p. I-5 (cited hereafter as CAA AR FY 90).

[4] U.S. Army Concepts Analysis Agency, *United States Army Concepts Analysis Agency FY 91 Annual Report* (Bethesda, Md.: USACAA, December 1991), p. I-9 (cited hereafter as CAA AR FY 91).

[5] As E. B. Vandiver III noted in his FY 1991 *Annual Report*: "The events of FY 91 were catalysts in achieving a new plateau in CAA productivity and operating intensity" (see CAA AR FY 91, p. I-9).

[6] The steps leading to the establishment of CAA on 15 January 1973 are outlined in U.S. Army Concepts Analysis Agency, *Annual Historical Summary (RCS CSHIS–6 [R2]), US Army Concepts Analysis Agency, 15 January 1973 to 30 June 1973* (Bethesda, Md.: USACAA, 30 November 1973), Chapter I, with citations to the primary documents (cited hereafter as CAA AR FY 73).

[7] Edgar B. Vandiver III, *Second Oral History Interview with Dr. Charles R. Shrader, Fort Belvoir, Virginia, 25 October 2005*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2006), p. 5 (cited hereafter as Second Vandiver Interview).

[8] Ibid.

[9] CAA AR FY 73, p. I-2.

[10] The name of the proposed organization was later changed to the United States Army Concepts Analysis Agency (CAA) at the suggestion of Lt. Gen. William E. DePuy. For convenience, I have used the CAA title throughout.

[11] Subsequently, about the end of August 1972, General DePuy asked the ACSFOR, Lt. Gen. R. R. Williams, to prepare a more detailed explanation of the force development process as it would exist following the proposed reorganization. Again, the task was passed down to E. B. Vandiver, who spent the month of September 1972 wrestling with a description of a process that had not been documented previously. Vandiver's vision of how the force development process should work was subsequently adopted (see Second Vandiver Interview, p. 5).

[12] CAA AR FY 73, p. I-3. A member of the Special Planning Group included Brig. Gen. Hal. E. Hallgren, who became the first commander of CAA.

[13] The idea was for the two organizations to share certain support facilities, such as a library and a graphics section.

[14] CAA AR FY 73, p. I-8.

[15] Ibid., p. I-4.

[16] Ibid., p. I-11. The approval of the CAA TDA was actually achieved on 9 March 1973.

[17] Ltr, Secretary of the Army (DAAG-ASO-D [M] [11 Jan 73] DAFD) to Assistant Chief of Staff for Force Development and Deputy Chief of Staff for Military Operations, Washington, 12 Jan 73, sub: Establishment of the US Army Concept Analysis Agency.

[18] STAG had been established as a Class II field activity under the staff supervision of the DCSOPS in August 1960, with the mission, prescribed in *Army Regulation (AR) 15–14*, of supporting DA theater-level operational planning and evaluation activities by war-gaming and allied techniques (see U.S. Department of the Army, *Army Regulations No. 15–14: BOARDS, COMMISSIONS, AND COMMITTEES—United States Army Strategy and Tactics Analysis Group* [Washington, D.C.: HQDA, 11 September 1961], par. 2). The history of STAG from August 1960 to January 1973 is discussed in Volume I, Chapter 3, and Volume II, Chapter 7. On STAG, see in particular, U.S. Army Strategy and Tactics Analysis Group, *Organization and Functions Manual* (Bethesda, Md.: USASTAG, 1 November 1962).

[19] U.S. Army Center for Army Analysis, *Overview of Center for Army Analysis Capabilities and Activities*, Briefing (Fort Belvoir, Va.: USACAA, n.d. [c. 2003–2005]), p. 4 (cited hereafter as CAA Overview).

[20] Most of the CDC Systems Analysis Group went to TRADOC.

[21] U.S. Army Strategy and Tactics Analysis Group, *Information Brochure* (Bethesda, Md.: USASTAG, June 1972), p. 2. The "allied techniques" referred to in paragraph b included inventory theory, linear programming, dynamic programming, queuing theory, sequencing theory, replacement theory, simulation, game theory, and Monte Carlo techniques.

[22] CAA AR FY 73, p. I-4.

[23] Ibid., p. I-5, Figure 1 (CAA Mission).

[24] U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 October 1977 to 30 September 1978* (Bethesda, Md.: USACAA, 1979), pp. I-1, I-2 (cited hereafter as CAA AR FY 78).

[25] U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: U.S. Department of the Army Special Study Group, April 1979), p. 6-1 (cited hereafter as RAA I).

[26] Ibid., p. 6-2.

[27] Ibid.

[28] Ibid., pp. 6-3, 6-4.

[29] Ibid., p. 6-3.

[30] The 1985 Review of Army Analysis Extended (RAAEX) study group later found that the recommended actions were completed by August 1979 (see U.S. Department of the Army Special Study Group, *Final Report-Review of Army Analysis Extended [RAAEX], Volume II: Task Reports* [Washington, D.C.: U.S. Department of the Army Special Study Group, March 1985], pp. 2-16, 2-17 [cited hereafter as RAAEX II]).

[31] Joann H. Langston, "Change in the Army Study Community," *Phalanx* 15, no. 3 (September 1982): 4.

[32] RAAEX II, pp. 2-16, 2-17.

[33] U.S. Concepts Analysis Agency, *CAA Annual Report, Fiscal Year 1992* (Bethesda, Md.: USACAA, November 1992), p. I-10 (cited hereafter as CAA AR FY 92).

[34] CAA AR FY 91, p. I-3.

[35] CAA Overview, p. 4.

[36] CAA AR FY 91, pp. I-4, I-5.

[37] Ibid., cover letter, p. 2.

[38] Ibid.

[39] U.S. Army Concepts Analysis Agency, *FY87 Report of Stewardship* (Bethesda, Md.: USACAA, December 1987), p. I-4 (cited hereafter as CAA AR FY 87).

[40] U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 July 1975 to 30 September 1976* (Bethesda, Md.: USACAA, 1977), p. I-8 (cited hereafter as CAA AR FY 76/T).

[41] Ibid., p. I-8.

[42] U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 October 1976 to 30 September 1977* (Bethesda, Md.: USACAA, 1978), p. II-3 (cited hereafter as CAA AR FY 77).

[43] See CAA AR FY 73, pp. I-9, I-11.

[44] STAG Information Brochure, p. 7; CAA AR FY 73, ann. A (Organization Chart, USASTAG, as of 14 January 1973).

[45] In June 1976, control of the Pentagon Coordination Office was transferred from the Project Planning and Control Office (PPCO) to the Command Group (see CAA AR FY 77, p. II-3). On the recommendation of the 1978–1979 RAA study group, the personnel and functions of the Pentagon Coordination Office were transferred to the Study Program Management Office (SPMO) in the Management Directorate of the Office of the Army Chief of Staff (OCSA) on 1 August 1979.

[46] The purpose of these liaison programs was to inform members of the Army and academic analytical communities about CAA ORSA activities and indirectly to recruit ORSA personnel for CAA. See U.S. Army Concepts Analysis Agency, *Annual Historical Summary (RCS CSHIS–6 [R2]), US Army Concepts Analysis Agency, 1 July 1973 to 30 June 1974* (Bethesda, Md.: USACAA, 27 November 1974), p. II-8 (cited hereafter as CAA AR FY 74).

[47] Ibid., p. III-2.

[48] Ibid., p. III-6.

[49] Ibid., p. III-20.

[50] Ibid., p. III-13.

[51] Ibid., p. III-15.

[52] Ibid.

[53] CAA AR FY 77, p. VI-1.

[54] Ibid., p. VII-1.

[55] Ibid., p. V-1.

[56] Ibid., p. IV-1.

[57] Vandiver, "CAA: Over a Decade of Support to the Army," p. 7.

[58] CAA AR FY 87, p. I-5.

[59] The head of the Data Management and Model Validation Office (DMMVO) was the special assistant for model validation (SAMV).

[60] An Advanced Research Projects Office (ARPO) was established in the Research and Analysis Support Directorate in response to an initiative of the DUSA (OR), who decided to create independent research offices in the various Army analytical agencies to keep Army analysis abreast of advances in technology such as artificial intelligence, parallel processing, and voice recognition (see Gerald E. Cooper and Robert D. Orlov, "U.S. Army Concepts Analysis Agency Advanced Research Projects Office [ARPO]," *Phalanx* 21, no. 4 [December 1988]: 7).

[61] Ibid., pp. 1-7, 1-8.

[62] Ibid., p. 1-5.

[63] *CAA Memorandum 10–1*, 1 Apr 87, pp. 1-4, 1-5.

[64] Ibid., pp. 1-8, 1-9.

[65] CAA AR FY 91, cover letter, pp. 2, I-4

[66] Ibid., p. I-3.

[67] Ibid., p. 5-2.

[68] Ibid., p. 5-3.

[69] CAA Overview, p. 9.

[70] The CAA Implementation Plan called for a commander in the grade of brigadier general, but the position was later upgraded to call for a major general.

[71] Former members of the Special Planning Group were Col. Joseph B. Murphy (director of war gaming), Barton R. House (director of systems integration analysis), John H. Onufrak (director of joint and strategic forces), and Col. John R. Brinkerhoff (director of force concepts and design).

[72] As noted, General Hallgren had headed the Special Planning Group. Maj. Gen. Ennis C. Whitehead was the scion of a prominent military family. His father was USAF Lt. Gen. Ennis C. Whitehead, an early airpower advocate and well-known figure in World War II and after. Maj. Gen. Edward B. Atkeson was an intelligence officer and had served as the deputy chief of staff for intelligence in HQ USAREUR. After retiring from active duty he became a well-known and prolific writer on public policy, strategy, and military affairs and a senior fellow of the AUSA Institute for Land Warfare.

[73] A brief biographical sketch of David C. Hardison is included in Chapter Two, above. See also David C. Hardison, *Interview with Dr. Charles R. Shrader, 21 February 2006*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2006). Hardison had followed Dr. Wilbur B. Payne as DUSA (OR) and had headed the 1978–1979 Review of Army Analysis.

[74] Hardison, *Interview with Dr. Charles R. Shrader, 21 February 2006*, p. 34.

[75] Ibid., pp. 34–36.

[76] Edgar Bishop Vandiver III was born on 19 September 1938 in Kennett, Missouri, and received his B.S. and M.S. degrees in physics from the University of Missouri in 1960 and 1962, respectively. He served as a lieutenant in the U.S. Army Chemical Corps from 1962 to 1964 before

becoming an OR analyst with the Combat Operations Research Group (CORG) supporting HQ Combat Developments Command at Fort Belvoir, Virginia, in 1964. While with CORG, Vandiver participated in the Army Combat Operations in Vietnam (ARCOV) study in 1966 onsite in Vietnam. Following a short period in private business after he left CORG in 1967, Vandiver became the chief of the Force Planning Division in the Office of the Scientific Advisor to the ACSFOR in 1970. In 1974, he moved to the Office of the DUSA (OR), and in 1977 he was appointed the technical advisor to the DCSOPS. He also served as the deputy head of both the RAA and the RAAEX study groups. He remained in that position until 30 September 1984 when he was appointed as director of CAA. In the course of a long and distinguished career in the Army analysis field, Vandiver received numerous awards and other recognitions of his meritorious service. He was active in professional societies and served as a member of the Military Operations Research Society Board, as its vice president, and as its president in 1992–1993. In 1995, he was awarded the society's Vance R. Wanner Memorial Award and was elected a fellow of the society the following year. On E. B. Vandiver III's life and career, see his two oral history interviews with Dr. Charles R. Shrader: Edgar B. Vandiver III, *First Oral History Interview with Dr. Charles R. Shrader, Fort Belvoir, Virginia, 23–24 August 2004*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army War College/U.S. Army Military History Institute, 2005); and *Second Oral History Interview*, previously cited. His MORS oral history interviews with Michael W. Garrambone and Robert S. Sheldon are published in Military Operations Research Society, *A MORS Oral History Interview with Edgar Bishop Vandiver III, FS* (Alexandria, Va.: MORS, 16 June 2005).

77 For Vandiver's own account of the evolution of CAA under his direction, see Second Vandiver Interview, passim.

78 The authorized strength of STAG on 14 January 1973 was 155 (77 military personnel and 78 civilians). Most of the civilians were professional ORSA analysts, as were many of the military personnel.

79 CAA AR FY 74, p. I-5.

80 RAAEX II, p. 8-15, Table (SC 49 Personnel [Auth/ODP/On Hand]).

81 Ibid., p. 8-21, Table; p. 8-25, Table.

82 John A. Riente, "Restructuring and Realignment of Analysis Agencies," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium (AORS XXX), Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: USACAA, 1991), Slide 7 (Baseline Organizations), and Slide 15 (Military/Civilian Balance) (cited hereafter as Riente 30th AORS Presentation).

83 Ibid., Slide 13 (Resource Allocation [FY90]—Distribution of Analysts to Analysis Categories).

84 CAA AR FY 90, p. 4-3. The CAA share of the Quicksilver cuts became effective on 1 October 1991, but in the end, the number of military and civilian spaces involved in the exchange turned out to be seventeen rather than eighteen.

85 Ltr, Iris Kameny (Chair, Army Science Board Analysis, Test, and Evaluation Issue Group) to Walter W. Hollis (DUSA-OR), Washington, 22 Sep 95, no subject [Report of the Army Science Board Analysis, Test, and Evaluation Issue Group Study of Army Analytical Agencies], app. B (Concepts Analysis Agency's [CAA], Study Information), p. 3.

86 Ibid., app. B, atch. A (CAA Utilization of Additional Spaces, 24 May 1995).

87 Memo, Walter W. Hollis (DUSA-OR) for General Ronald H. Griffith (VCSA), Washington, 17 Aug 95, sub: Health of Concepts Analysis Agency.

88 Ibid.

89 U.S. Army Concepts Analysis Agency, *CAA Annual Report, Fiscal Year 1994* (Bethesda, Md.: USACAA, December 1994), p. 1-4; U.S. Army Concepts Analysis Agency, *CAA Annual Report, Fiscal Year (FY) 1995* (Bethesda, Md.: USACAA, December 1995), p. 1-6 (cited hereafter as CAA AR FY 95).

90 Vandiver, "CAA: Over a Decade of Support to the Army," p. 6.

91 CAA AR FY 87, p. I-9. Dr. Jerome Bracken worked on model validation and verification and Dr. Ben Bauman did research on the education and experience requirements for CAA civilian personnel.

92 Vandiver, "CAA: Over a Decade of Support to the Army," p. 6.

93 Ibid.

94 Ibid., p. 7.

95 U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 October 1982 to 30 September 1983* (Bethesda, Md.: USACAA, 4 September 1984), p. I-3 (cited hereafter as CAA AR FY 83).

96 U.S. Army Strategy and Tactics Analysis Group, *United States Army Strategy and Tactics Analysis Group Annual Historical Summary (RCS CSHIS–6 R2), 1 July 1972 to 15 January 1973* (Bethesda, Md.: USASTAG, 1973), p. 3. On 15 January 1973, the remainder of the FY 1973 STAG budget was transferred to the new Concepts Analysis Agency.

97 CAA AR FY 92, p. 5-2.

98 U.S. Army Concepts Analysis Agency, *CAA Annual Report, Fiscal Year (FY) 1993* (Bethesda, Md.: USACAA, December 1993), p. 5-1 (cited hereafter as CAA AR FY 93).

99 Ibid., p. 5-2.

100 CAA AR FY 95, p. 5-1.

101 Memo, Walter W. Hollis (DUSA-OR) for Mr. John S. Doyle, Jr. and Lt. Gen. John J. Yeosock (Co-Chairmen, Army Management Review Task Force), Washington, 15 Aug 89, sub: Army Management Review, Encl 4 (Analysis Initiative Report), p. 4-11, and Encl 1, p. 1–7 (same as pp. 4-28 to 4-34 of Encl 4).

102 For details of the lease negotiations and the subsequent occupation of the facility by CAA. see CAA AR FY 73, pp. II-13 to II-15, and CAA AR FY 74, pp. I-14 to I-16.

103 Hardison, *Interview with Dr. Charles R. Shrader, 21 February 2006*.

104 CAA's lease on the Bethesda facility was the second-highest in the Army (see Vandiver, MORS Oral History, 80). Ground was broken for Wilbur B. Payne Hall at Fort Belvoir on 3 November 1997, and the new facility was occupied in March 1999 (see E. B. Vandiver III, "A New Name . . . A New Home," *Phalanx* (December 1998): 27.

105 Vandiver, MORS Oral History, pp. 54–55.

106 Vandiver, "CAA: Over a Decade of Support to the Army," p. 7.

107 Ltr, Kameny to Hollis, 22 Sep 95, app. B, p. 3.

108 For a relatively complete listing of CAA analytical efforts from FY 1973 through FY 1995, see CAA AR FY 91, Chapter 6 ("Analytical Efforts Completed Between 15 Jan 73 through FY 91"), and CAA AR FY 95, Chapter 6 ("Analytical Efforts Completed Between FY90 and FY95").

109 CAA AR FY 92, app. B (Definitions of CAA Work Categories), p. 1.

110 As the international security environment entered a period of profound and rapid change at the end of the 1980s, CAA experienced a significant increase in demand for quick-reaction analyses (QRAs) to deal with problems of immediate interest. By FY 1995, the ratio of QRA to deliberate Studies had completely reversed from about 1:2 to 2:1 (see CAA AR FY 92, p. 1-6; Hollis, "Walt Hollis on Army OR: 'The Times, They Are A-Changin!'" p. 7).

111 Second Vandiver Interview, p. 23.

112 U.S. Army Concepts Analysis Agency, Chief of Staff and Study Process Review Panel, *Review of the Concepts Analysis Agency (CAA) Study Process (RCSP) [a.k.a. RECIPE] DRAFT* (Bethesda, Md.: USACAA, October 1988), pp. 1–2.

113 Ibid., pp. 2–3. See also Memo, Maj Michael H. Abreu (Chairman, Ad Hoc Committee) for Chief of Staff CAA, Bethesda, Md., 31 Jul 88, sub: Lessening the Study Director's Burden (app. E to *Review of the Concepts Analysis Agency (CAA) Study Process*).

114 Ibid., pp. 5–13.

115 CAA AR FY 92, p. 1-6.

116 For example, in FY 1989 52 percent of the sixty-five completed projects were sponsored by the DCSOPS, 12 percent by the DCSLOG,

and 7 percent by MISMA and the DUSA (OR). See U.S. Army Concepts Analysis Agency, *Annual Historical Review (RCS CSHIS–6 [R3]), US Army Concepts Analysis Agency, 1 October 1988 to 30 September 1989* (Bethesda, Md.: USACAA, 27 August 1990), p. 2-1 (cited hereafter as CAA AR FY 89).

117 STAG, *Historical Summary, 1 July 1972–15 January 1973*, pp. ii, 5–21. Weapons effectiveness indicators/weighted unit values (WEIs/WUVs) were a methodology originally developed to provide indicators of effectiveness for systems used in the Concepts Evaluation Model (CEM). The methodology was mathematically sound, but when applied by OSD's Directorate of Program Analysis and Evaluation to evaluate modernization programs, it was problematic (Col. [USA Ret.] Brian R. McEnany, e-mail to the author, 12 January 2007).

118 Several years before he became the director of CAA, Hardison had noted a need to "strengthen our approach in the treatment of logistics, manpower and personnel. The approach in some instances is too stylized and lacks coverage of all questions of interest. Additional resources must be provided to seek to improve our performance in this area" (see David C. Hardison, "AORS XVII-Revisited," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Seventeenth Annual US Army Operations Research Symposium [AORS XVII], Fort Lee, Virginia, 6–9 November 1978, Volume I* [Bethesda, Md.: USACAA, 1978], p. 140).

119 CAA AR FY 83, p. I-1.

120 Second Vandiver Interview, p. 21.

121 U.S. Army Concepts Analysis Agency, *Report of Stewardship, FY 84* (Bethesda, Md.: U.S. Army Concepts Analysis Agency, December 1984), cover letter.

122 Ibid., p. I-1.

123 CAA AR FY 87, pp. I-1, I-2.

124 U.S. Army Concepts Analysis Agency, *US Army Concepts Analysis Agency FY 88 Annual Report* (Bethesda, Md.: USACAA, September 1989), pp. 3-1 to 3-4 (cited hereafter as CAA AR FY 88).

125 CAA AR FY 89, pp. 3-1 to 3-4.

126 Ibid., cover letter.

127 CAA AR FY 91, pp. I-8, I-9. Although some aspects of CAA operations in 1990–1991 are discussed here, the contributions of CAA and the other Army analytical agencies to the dramatic victory in the first Gulf War are discussed in greater detail in Chapter Eight, below.

128 Hollis, "Walt Hollis on Army OR: 'The Times, They Are A-Changin!'" p. 7.

129 U.S. Army Model Improvement and Study Management Agency, *Army Study Highlights, Volume XII* (Washington, D.C.: USAMISMA, December 1991), p. 28.

130 CAA AR FY 91, p. 2-1.

131 Ibid.

132 Ibid., p. 2-3.

133 Ibid., p. 1-6.

134 Ibid., p.1-12.

135 Ibid., p. I-9.

136 Ibid., p. 1-16.

137 CAA AR FY 90, cover letter.

138 CAA AR FY 91, pp. 1-14, 1-15.

139 CAA AR FY 92, cover letter.

140 Ibid., p. 1-18.

141 Ibid., pp. 1-18, 1-19.

142 Ibid., p. 1-18.

143 Ibid.

144 CAA AR FY 93, cover letter.

145 CAA AR FY 95, p. 1-5. It should be noted that in FY 1996, CAA exceeded its FY 1995 performance by producing 110 distinct analytical products and completing an additional twenty-nine efforts in support of the main projects, capping a 110 percent gain in productivity over the previous six years (see U.S. Army Concepts Analysis Agency, *CAA Annual Report, Fiscal Year 1996* [Bethesda, Md.: USACAA, November 1996], p. 1-8 (cited hereafter as CAA AR FY 96).

146 Ibid., cover letter.

147 Ibid.

148 For the models used by CAA in FY 1974, see CAA AHS FY 74, p. III-13, Figure III-1 (CAA Models), and p. III-14, Figure III-2 (Model Support of Studies).

149 Abstract of Gerald M. Schultz, "The Force Definition System (FORD)," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twentieth Annual US Army Operations Research Symposium (AORS XX), Fort Lee, Virginia, 5–8 October 1981, Volume I* (Bethesda, Md.: USACAA, 1981), Program 33.

150 Karl E. Cocke, *Department of the Army Historical Summary, Fiscal Year 1974* (Washington, D.C.: USACMH, 1978), p. 23 (cited hereafter as 1974 DAHSUM). A companion system, the Modular Force Planning System, was maintained by U.S. Army Management Systems Support Agency. It consisted of a logistics, or force round out, model that determined the support requirements for a given combat force at a single point in time and also provided the capability, through a linear program, to add or delete support units.

151 See Second Vandiver Interview, p. 3.

152 Karl E. Cocke and Rae T. Panella, *Department of the Army Historical Summary, Fiscal Year 1975* (Washington, D.C.: USACMH, 2000), p. 23 (cited hereafter as 1975 DAHSUM).

153 Second Vandiver Interview, p. 27.

154 Ibid., pp. 27–28.

155 Ibid., p. 28. The process remains essentially the same today.

156 Ibid., pp. 29–30.

157 1975 DAHSUM, p. 10.

158 Ibid.

159 Col. William Heyman, "Contingency Force Analysis Update," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Twenty-Second Annual US Army Operations Research Symposium (AORS XXII), Fort Lee, Virginia, 3–5 October 1983, Volume I* (Bethesda, Md.: USACAA, 1983), p. 4-295.

160 Ibid.

161 Ibid., p. 4-299.

162 Ibid., p. 4-300.

163 Ibid., p. 4-303.

164 Ibid., p. 4-304.

165 U.S. Army Concepts Analysis Agency, *Report of Stewardship, FY 85* (Bethesda, Md.: USACAA, April 1986), pp. I-1 to I-4.

166 Vandiver, "CAA: Over a Decade of Support to the Army," p. 7.

167 Ibid.

168 RAAEX II, p. 13-26.

169 Ibid.

170 Ibid.

171 Ibid., pp. 15-8, 15-26.

172 CAA AR FY 87, p. I-2; CAA AR FY 88, pp. 2-2, 2-3.

173 CAA AR FY 96, cover letter.

CHAPTER EIGHT

The Ultimate Test: The Persian Gulf War of 1990–1991

The Persian Gulf War of 1990–1991 (Operation DESERT SHIELD and Operation DESERT STORM) was the ultimate test of the processes employed by the United States Army for making decisions regarding the allocation of resources, force structuring, theater-level contingency planning, and the development of new weapons systems, equipment, organization, doctrine, and training. Indeed, the outstanding performance of Army forces in Saudi Arabia, Kuwait, and Iraq was a reflection of the constant improvement of Army decision-making processes going back to World War II, improvements in which the Army analytical community had played an important role. Thus, the efficient mobilization and movement of some 540,000 U.S. soldiers, sailors, airmen, and marines and their equipment to Saudi Arabia, the design and execution of an effective operational plan, and the subsequent outstanding performance of both men and materiel reflected the results of nearly forty years of effort by Army ORSA managers and analysts to assist Army leaders in making often complex and difficult decisions.

The Gulf War of 1990–1991 was a massive undertaking involving, on the Coalition side alone, some thirty-eight nations, almost 800,000 personnel, more than 300 combat and combat support battalions, more than 225 naval vessels; and almost 2,800 fixed-wing aircraft.[1] U.S. forces alone totaled around 540,000 personnel and consumed some 95,000 million tons of ammunition and 1.7 billion gallons of fuel. In just forty-three days of offensive operations, Coalition forces destroyed or rendered combat-ineffective forty-two Iraqi divisions, captured more than 82,000 Iraqi soldiers, sank the entire Iraqi navy, and destroyed or forced to flee to Iran some 50 percent of all Iraqi combat aircraft.

Iraqi forces invaded Kuwait on 2 August 1990, and the United Nations Security Council (UNSC) immediately passed UNSC Resolution 660 condemning the invasion and demanding the immediate and unconditional withdrawal of Iraqi forces from Kuwait. The deployment of U.S. forces began on 7 August 1990, and by mid-October the 82d Airborne Division, the 24th Infantry Division (Mechanized), the 101st Air Assault Division, the 3d Armored Cavalry Regiment, the 1st Marine Division, and a wide assortment of combat support and combat service support troops as well as combat and support elements of some thirty-eight allied nations had closed in Saudi Arabia. On 17 January 1991, Coalition forces began execution of the air campaign of Operation DESERT STORM, and thirty-nine days later, on 24 February 1991, the Coalition ground campaign began, only to end a scant 100 hours later on 28 February. On 2 March 1991, the Joint Chiefs of Staff (JCS) issued orders for redeployment of U.S. forces, and on 8 March 1991, U.S. forces began redeploying. On 11 April, the UNSC declared that the requirements of UNSC 660 had been met and Operation DESERT STORM was over.

As two official Army historians of the Gulf War proclaimed, "The Army of 1990 was without a doubt the most proficient and professional military force the United States had ever fielded at the beginning of a foreign war."[2] The same authors also noted:

> The Army that deployed in 1990 to Saudi Arabia, the product of almost twenty years of reform and experimentation, bore little resemblance to the Army that left the Republic of Vietnam in 1972. . . . By the summer of 1990 the U.S. Army was a technologically sophisticated, highly trained, well-led, and confident force.[3]

One of the Army's senior leaders, General Maxwell R. Thurman, also noted:

> The DESERT STORM victory was not the result of a seven-month conflict, or a 44-day air campaign, or even a successful 100-hour ground campaign. Rather, the victory was a result of visionary changes begun in the 1970s by the Army leadership assisted by countless numbers of men and women through the intervening years.[4]

According to General Thurman, the "seeds of victory harvested 15 years later on the battlefield of the Kuwait Theater of Operations" were sown in the mid-1970s in the form of the Total Force policy, which called for the use of reserve as well as active Army components in any conflict; the All-Volunteer Army concept; the modernization of the Army's weapons and equipment; the reformation of Army doctrine; and the transformation of Army training.[5]

Indeed, the outstanding performance of the U.S. Army against the Iraqi forces in operations DESERT SHIELD/DESERT STORM was due to five factors, alluded to in General Thurman's remarks. The five factors were as follows:

1. Superior weaponry and equipment (in particular the so-called Big Five);
2. Superior organization (the heavy and light forces of Division 86, Army 86, and the Army of Excellence);
3. Superior tactical doctrine and operational strategy (AirLand Battle and the concepts of Active Defense and Deep Attack);
4. Superior leadership, soldier skills, and morale, the results of superior training; and
5. Superior overall Army allocation of resources, force structuring, planning, and execution of plans.

What all five factors have in common is that they were the product of a long period of intense activity by Army leaders, aided by the Army's analytical agencies, to design, test, and evaluate the Army's weapons, organization, doctrine, training, force structure, and plans.

Preparing for and Supporting a 100-Hour War

By August 1990, the weapons, equipment, organization, doctrine, and training that would win the 100-hour war in the Persian Gulf were already in place. For nearly twenty years, the United States Army Materiel Command (AMC), aided by its principal analytical organization, the Army Materiel Systems Analysis Activity (AMSAA), and by the United States Army Operational Test and Evaluation Agency/Command (OTEA/OPTEC), had been engaged in the modernization of Army weaponry and equipment. At the same time, the United States Army Training and Doctrine Command (TRADOC), aided by operations research/systems analysis (ORSA) elements in the Army training centers and schools and by the TRADOC Analysis Command (TRAC) and its predecessors, had not only established the materiel requirements for the Army but had also completely transformed the organization and doctrine of Army combat, combat support, and combat service support units and had significantly improved the education and training of Army leaders, individual soldiers, and units. The success of those efforts was to be seen in the events that transpired between 2 August 1990 and 24 February 1991.

Weapons and Equipment

The major contributions of two of the Army's leading analytical organizations, the Army Materiel Systems Analysis Activity and the Operational Test and Evaluation Agency/Command, were made prior to the Iraqi invasion of Kuwait in August 1990.[6] Although both agencies continued to provide important analytical services to the Army forces deployed in Southwest Asia in 1990–1991, the principal contribution of AMSAA and OTEA to the victory in operations DESERT SHIELD/DESERT STORM was the design, development, testing, evaluation, acquisition, fielding, and sustainment of the array of superior weapons and equipment available to Army troops. In particular, AMSAA and OTEA/OPTEC had contributed significantly to the development of the so-called Big Five systems: the M1A1 Abrams tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot air defense missile system.

Designed for use against numerically superior Soviet and Warsaw Pact forces on the plains of Central Europe, the Big Five had not yet been tested rigorously in combat as of 1990.[7] Nevertheless, all five systems proved admirably suited in most respects for employment in the deserts of the Arabian Peninsula against an opponent equipped with Soviet-designed weapons and equipment. And, as Schubert and Kraus have pointed out, "The big five were by no means the only significant equipment modernization programs the Army pursued between 1970 and 1991."[8] Among the many other important Army systems developed in the 1970s and 1980s and employed in the Gulf War of 1990–1991 were the multiple-launch rocket system (MLRS); a new generation of much improved tube artillery; improved small arms; a new family of tactical wheeled vehicles (including a new five-ton truck and the high-mobility multipurpose wheeled vehicle (HMMWV, or "Humvee"); and a family of new command, control, communications, and intelligence (C3I) hardware, all of which had been tested and delivered to the Army by the summer of 1990.

The effect of the successful efforts of AMSAA and OTEA were summarized by Maj. Gen. Richard E. Stephenson, the wartime commander of OTEA's successor command, the Operational Test and Evaluation Command (OPTEC), in his August 1991 end-of-tour report:

> The weapons that we tested went to war. If we had not done our job, weapons we endorsed would have failed in combat. There were no cases of such major failures. The problems reported by the fighting soldiers had been predicted in T&E [test and evaluation] and fixes were in the works. More to the point, the weapons that were supported for acquisition at the time of decision, when they were still short of their potential, performed well. OT&E [operational test and evaluation] was a major contributor to the success of the new materiel. We provided data for source selection. We provided data on maintenance, training, and readiness. We identified the needed fixes. We took part in the decisions to field equipment. Most important, we verified the systems' value to the Army (or delayed acquisition of some systems) when the only useful information on usage was that we generated in testing.[9]

General Stephenson went on to note that

> during Desert Storm itself we continued to collect data. . . . We collected huge amounts of data that will result in a better system. It will also reduce the scope and cost of future testing. The war validated the value of OT&E but we probably haven't done everything right. Besides finding out what to fix about some systems, we made sure that we found out what we need to fix about testing as well. Eleven of my officers participated in AMC's data collection on weapons performance right after the shooting stopped. That data is being compiled and we will compare it with the data from our own tests of the same weapons. We will examine our T&E practices to a level of detail that will yield any lessons to be learned.[10]

As General Stephenson indicated, both AMSAA and OTEA/OPTEC continued to actively support Army forces in the field during operations Desert Shield/Desert Storm by providing experts in Saudi Arabia, Kuwait, and Iraq to collect data on the performance of weapons and equipment and analysts at home to organize and evaluate that data and seek solutions to pressing problems reported from the theater of operations. AMSAA analysts, for example, collected data on performance and operational effectiveness obtained by the Weapon System Combat Performance Assessment Team in Southwest Asia and other sources, including interviews with crews.[11] They analyzed specific system performance data, including that from the Patriot, HAWK, Avenger, Stinger, and Vulcan air defense systems; the Hellfire, TOW (tube-launched, optically tracked, wire-guided), rocket, and 20-mm. and 30-mm. gun systems; and various aircraft used in the combat area. The results of such studies were used for "the design of future combat data acquisition systems to provide more readily usable information for weapon systems evaluation purposes" and to make improvements in the design of current weapons and equipment to make them more effective or easier to use.[12]

Operation Desert Shield began just as OTEA was in the midst of a major reorganization that involved its merger with TRADOC's Test and Experimentation Command (TEXCOM) to form the Operational Test and Evaluation Command (OPTEC). The reorganization, which became effective on 15 November 1990, saw the creation of OPTEC with four principal subordinate mission-oriented elements: the Operational Evaluation Command, the OPTEC Threat Support

Activity, a new Test and Experimentation Command, and several Test and Evaluation Coordination Offices. The new TEXCOM was formed from the former TRADOC Test and Experimentation Command and its subordinate elements—the TRADOC Combined Arms Test Center, the Test and Experimentation Center, and the seven TRADOC test boards, which were reorganized, renamed, and redesignated as TEXCOM test directorates.

The various elements incorporated into the new OPTEC continued to perform their operational test and evaluation functions without interruption during the transition from OTEA to OPTEC. Following the Iraqi invasion of Kuwait in August 1990, OTEA quickly shifted its focus from the reorganization effort to supporting the Army effort in the Persian Gulf, and the ongoing test program was abbreviated as the units and equipment to be tested were mobilized.[13] The launching of Operation Desert Shield in August 1990 compounded the difficulties of reassigning military personnel within TEXCOM and of having available combat troops to conduct tests and experiments, but the focus on operations in the Kuwait Theater of Operations allowed "a fortuitous breather so that test boards could close and move to Fort Hood without degrading their respective missions."[14]

During the course of the Gulf War, OPTEC and its subordinate elements provided data collectors and analysts in theater, and the various OPTEC directorates conducted tests and evaluations in direct support of Army operations in the Persian Gulf.[15] In the winter of 1990–1991, the decision was made to assemble a team of data collectors and evaluators from HQ OPTEC and OEC to test and evaluate systems and equipment in the combat environment in the Gulf, and subsequently two operational assessments were conducted under actual combat conditions: one of the NAVSTAR Global Positioning System and one of the Joint Surveillance and Target Attack Radar System.[16] Meanwhile at home, TEXCOM was engaged in testing several systems for use in the Gulf. The first test conducted by the Armor Test Directorate after its establishment at Fort Hood in FY 1991 was a limited user test of the Missile Countermeasure Device in support of the project manager for survivability systems. The test and evaluation of the Aerial Delivery Rigging Facility being conducted by the Airborne and Special Operations Test Directorate at Fort Bragg, North Carolina, were suspended when the war began, and the equipment and specialized personnel were returned to XVIII Airborne Corps for deployment to Saudi Arabia, but OPTEC personnel remained at Fort Bragg to advise the XVIII Airborne Corps Support Command on the preparation of loads for transport and airdrop. The Airborne and Special Operations Test Directorate was responsible for testing of the Chemical Protective Undergarment in Saudi Arabia, and the Intelligence and Electronic Warfare Test Directorate also conducted a quick-reaction customer test of the Joint Electronic Warfare Center Advanced Development Model Antenna (ADM–230) on 7–10 January 1991. Conduct of the JCS Tactical Missile Defense experiment was terminated due to operations in the Persian Gulf, but following Operation Desert Storm, OPTEC personnel conducted Special Project Torpid Shadow II in Europe from 23 September to 3 October 1991. In one of the better-known test activities of the Gulf War, the OPTEC Infantry Test Directorate was asked by the Natick Research, Development, and Engineering Center to evaluate changes to the desert boot proposed by the commander-in-chief, USCENTCOM, and a quick-reaction test was subsequently conducted at Fort Benning, Georgia. OPTEC also equipped and trained artillery units of both the U.S. VII Corps and the U.S. XVIII Airborne Corps.[17]

In addition to the efforts just mentioned, OPTEC and its subordinate elements provided a number of military and civilian personnel to assist in data collection and operational test and evaluation (OT&E) efforts in theater.[18] Two majors and a captain from the TEXCOM Intelligence and Electronic Warfare Test Directorate were dispatched to support operations Desert Shield/Desert Storm, and the Fire Support Test Directorate (FSTD) provided one officer to serve as a fire support system analyst for the Army Weapon System Performance Assessment Team, which was responsible for evaluating the combat effectiveness of Army fire support systems in the Desert Storm environment. A warrant officer from FSTD was also attached to the 101st Air Assault Division in the Gulf, and OPTEC transferred equipment to various units to augment their available inventories. TEXCOM's Experimentation Center (TEC) deployed eighteen tank crewmen, infantrymen, logistics specialists, and mechanics to the Gulf. The majority were deployed for about nine months and then returned to TEC at Fort Hunter Liggett, California. In all, TEXCOM deployed some seventy-six military and four civilian employees for operations Desert Shield/Desert Storm.[19]

In August 1991, the outgoing OPTEC commander, Maj. Gen. Richard E. Stephenson, made his assessment of the contribution of OTEA/OPTEC to operations Desert Shield/Desert Storm:

> This time we waited too long to start collecting wartime data. OPTEC should be authorized to deploy data collectors with deploying units in any future contingency. This should be an integral part of the Army component contingency planning process and include a grocery list of foreign systems/technology items we want to acquire in the conduct of the contingency, if at all possible, for Foreign System Technology Center exploitation and OPTEC Threat Support Activity utilization. Between contingencies, we should routinely piggy-back data collection on Army materiel involved in JCS exercises. In the meantime it is obvious that across the board Army T&E has met its most significant test by fire since OT&E was begun in 1972 and it proved successful.[20]

Requirements, Organization, Doctrine, and Training

Aiding Army decision makers in the difficult process of developing new weapons and equipment was primarily a responsibility of AMSAA and OTEA/OPTEC, but the TRADOC analytical community also played an important role in assisting Army leaders in establishing the requirements for new weapons and equipment and in developing new organizations, doctrines, and training methods needed to maximize the impact of the new weapons systems.[21] As was the case with AMSAA and OTEA/OPTEC, the principal contributions of the TRADOC centers and schools and the TRADOC Analysis Command (TRAC) and its predecessors in that respect were made before the ground assault phase of Operation Desert Storm began on the morning of 24 February 1991.

The development of weapons and equipment and of organization, doctrine, and training methods were closely related before 1990, just as they are now. As Schubert and Krause have noted,

> weapons modernization encouraged doctrinal thinkers to consider more ambitious concepts that would exploit the capabilities new systems offered. A successful melding of the two, however, depended on the creation of tactical organizations that were properly designed to use the weapons in accordance with the doctrine. So, while doctrinal development and equipment modernization were under way, force designers also reexamined the structure of the field army.[22]

Between 1973 and 1990, TRADOC analysis organizations, aided by other elements of the Army analytical community, focused on the development of new organizations, doctrine, and training methods aimed primarily at the defeat of a numerically superior Soviet/Warsaw Pact force in Central Europe. Spurred on by observations made of the Arab-Israeli War of 1973, TRADOC, led by General William E. DePuy and his successor, General Donn A. Starry, undertook a division restructuring study effort, initiated in May 1976,[23] that resulted in the design of new Army field organizations known under the rubrics Division 86 and Army 86. In August 1983, Army Chief of Staff General John A. Wickham Jr. directed TRADOC to reexamine the entire question of organization with a view to augmenting the proposed heavy mechanized and armored forces with light infantry forces.[24] The resulting Army of Excellence concept of force design recognized the need for smaller, more easily transportable light infantry divisions to fight limited wars while retaining, in somewhat modified form, the heavy divisions concept envisioned in the Division 86 studies.[25]

The development of new organizational structures was of course closely tied to the development of new doctrine for the employment of combat, combat support, and combat service support forces. The period from the end of the Vietnam War to the beginning of the first Gulf War was one of intense activity in the doctrinal development field out of which emerged the new concepts of the Active Defense, the Central Battle, and AirLand Battle and the writing of new versions of the Army's core doctrinal manual, *FM (Field Manual) 100–5: Operations*. Again, the driving force was provided by General DePuy, General Starry, and the other senior leaders of the Army.

The other critical contribution of TRADOC during the period between the end of the Vietnam War and the beginning of the first Gulf War was the total transformation of Army training methods. New methods of imparting the necessary individual skills and unit training needed to operate the new weapons and equipment and execute the new operational doctrines were designed and implemented. Among the most important training innovations were the Multiple Integrated Laser Engagement System, the Army Training and Evaluation Program, the Battle Command Training Program, and the National Training Center. As Schubert and Kraus have stated, "As the Army entered the summer of 1990 it was probably better trained than at any time in its history and certainly better trained than it had been on the eves of World War I, World War II, and the Korean War."[26]

Aiding Army leaders in the formulation and evaluation of the new organizations, doctrines, and training methods fell largely to the analytical elements in the TRADOC centers and schools, to the TRADOC Systems Analysis Activity at White Sands Missile Range, New Mexico, and the Combined Arms Operations Research Activity at Fort Leavenworth, Kansas, and after 1986 to the TRADOC Analysis Command/Center (TRAC) and its subordinate elements. As Seth Bonder has noted, "Analysis was instrumental in developing and understanding combat dynamics underlying the Active Defense Concept, Central Battle, and AirLand Battle doctrine in the 1980s."[27] As a result, the Army force structure in the summer of 1990—five corps with a total of twenty-eight divisions; the modern weapons systems available in the form of the Big Five; the AirLand Battle doctrine that had evolved from General DePuy's 1976 *FM 100–5* focus on the Active Defense; the divisional structures derived from the 1976 Division Restructuring Study and their subsequent evolution from the Division 86 heavy division to the Army of Excellence concept after 1983; and the many training innovations introduced after 1973 were, in the words of Schubert and Kraus:

> The product of almost twenty years of evolving design that had carefully evaluated the requirements of doctrine for battle and the capabilities of modern weapons. Army leaders now believed that they had found a satisfactory way to maximize the combat power of the division, enabling it confidently to fight a larger enemy force.[28]

That the intense war on the plains of Central Europe for which General DePuy and his successors had prepared occurred instead in the deserts of Saudi Arabia, Kuwait, and Iraq between August 1990 and March 1991 in no way vitiated the accomplishments of Army combat developers since the Vietnam War. Indeed, as Schubert and Kraus have declared, "By 1990 the claim could reasonably be made that the service had arrived at a sound doctrine, the proper weapons, an appropriate organization, and a satisfactorily trained, high-quality force," capable not only of a major conventional war in Central Europe but flexible enough for a major regional conflict in an entirely different physical and military environment.[29]

Force Structure and Campaign Planning

Unlike AMSAA, OTEA/OPTEC, and TRAC, the Concepts Analysis Agency (CAA) had by no means completed its work when the forces of Saddam Hussein invaded Kuwait in August 1990.[30] In fact, by virtue of its focus on overall Army force structure and campaign analysis, CAA's work really began in August 1990. Until that time CAA had focused on questions of overall Army force structure, particularly in view of the drawdown of resources that began in 1989 and campaign planning for a potential conflict in Central Europe against the Soviet Union and Warsaw Pact.[31] CAA subsequently played a central role among Army analysis organizations in the preparation and conduct of operations DESERT SHIELD/DESERT STORM by providing timely and pertinent support to Army leaders during the complex processes of mobilization, deployment, employment, redeployment, and reconstitution.

The limited operations of the U.S. Army in Grenada in 1983 (Operation URGENT FURY) and Panama in 1989 (Operation JUST CAUSE), which preceded the Gulf War, were "fast and furious" and did not provide an opportunity for CAA to conduct any significant force structuring or campaign analyses.[32] However, CAA had been working for several years before 1990 with the Third U.S. Army, the Army component (United States Army Central Command, or ARCENT) of the United States Central Command (USCENTCOM), to prepare scenarios that dealt with potential operations in the Persian Gulf region. In fact, in the spring of 1990, CAA war-gamed a concept for a new operations plan that dealt with an Iraqi invasion of Kuwait and Saudi Arabia.[33] Following the PERSIAN TIGER 89 war game, CAA sent a representative to participate in the Third Army/Army Central Command (ARCENT) command post exercise Internal Look in order to review ARCENT's revised OPLAN in the planned PERSIAN TIGER 90 war game.[34] In the early summer of 1990, as events in the Gulf region began to unfold, USCENTCOM conducted a major exercise using the PERSIAN TIGER war game developed by CAA as its basis.[35] As E. B. Vandiver III, the director of CAA, noted in his annual report for FY 1990: "These efforts, coupled with guidance from the 1 August 1990 Vice Chief of Staff of the Army (VCSA) seminar, served to posture CAA for rapid analytic support before the crisis broke and Operation Desert Shield was initiated."[36] They also facilitated later analysis and war-gaming efforts involving the PERSIAN TIGER 90 series of man-in-the-loop war games using the Contingency Force Analysis Wargame Model to support the Army's senior leadership during the initial defense of Saudi Arabia.[37]

On 7 August 1990, CAA began its initial analytical efforts in support of the coming Army operations in the Gulf region. Those efforts quickly evolved into "a 7-week long interactive war-gaming analysis process that encompassed a series of 12 quick reaction analyses (QRAs) aimed at addressing key operational issues."[38] Around-the-clock analytical operations were initiated to support Army planning and decision making, and CAA provided the results of those analyses in a timely manner to HQDA and to HQ ARCENT to "refine insights and increase confidence in analytic results."[39] As E. B. Vandiver III reported,

> by the third week of August, CAA had developed and employed a data base supporting theater simulation analysis using the Concepts Evaluation Model (CEM) of a wide range of Desert Shield operational issues. By the end of September, CAA had completed a series of eight such analyses which addressed many facets of Army support to Desert Shield and responded to HQDA and ARCENT analysis requests.[40]

As the campaign progressed, the CAA team, working directly for the Army deputy chief of staff for operations and plans (DCSOPS), prepared theater campaign analyses using near-real-time intelligence data and friendly force information to develop model inputs and briefed the results at the highest levels.[41] In all, more than 500 full-scale theater simulations were developed, analyzed, and briefed during the war.[42] As noted in the FY 1991 CAA annual report,

> specific elements of analysis supported force deployment and force structure decisions, and evolving concepts of operations to support the general campaign. Beginning in October 1990, these insights were used to support Operation Desert Storm analyses employing higher resolution models such as CEM.[43]

E. B. Vandiver III later described the procedures employed to initiate and deliver CAA analyses to the theater of operations:

> We supported the Army DCSOPS throughout the war with all kinds of operational planning requirements analysis and answered questions. The DCSOPS was Denny Reimer [then Lt. Gen. Dennis J. Reimer] who was later the Vice and then the Chief of Staff. Unbeknownst to us, we were also supporting General Yeosock [Lt. Gen. John J. Yeosock] at Third Army through General Reimer. He would ask us to war-game whatever the cases were, and then we would bring the charts and show them to him. He would say, "Fine. Now I want you to go do this, that, and the other." Then he would take those charts and "secure FAX" them over to Yeosock who would write his questions and comments on the thing and FAX it back to Reimer, and Reimer would say, "I've got more questions for you." I didn't know about that until a year later. We were supporting both General Reimer and General Yeosock. There were all kinds of questions. How much force is needed? How much munitions? How many vessels? The usual kind of HQDA questions.[44]

In addition to studies, analyses, and war games, the other major activity undertaken by CAA in support of Army forces in the Persian Gulf consisted of QRAs. As noted in the CAA annual report for FY 1991,

> during the period August 1990–March 1991, CAA conducted an extensive and continuous series of quick reaction analyses of the evolving Persian Gulf situation for Headquarters, Department of the Army (HQDA), Headquarters, US Army Central Command (ARCENT), and Headquarters, US Army Forces Command (FORSCOM). These analyses addressed issues concerning deployment, logistics, supportability, combat service support structure requirements, casualty assessments and replacement personnel requirements, ammunition and other materiel requirements, and development and assessment of numerous concepts of operation for both friendly and opposing forces.[45]

Table 8–1—Areas of CAA Analytical Support and Primary Users of Results

Purpose	*Provided to*
Strategic Deployment Assessments	ODCSOPS and ODCSLOG
Operational Assessments	ODCSOPS, ODCSLOG, and ARCENT
Requirements Development	ODCSOPS, ODCSPER, ARCENT, and FORSCOM
Combat Service Support Structure	
Personnel	
Ammunition	
Equipment	
Air Defense/Tactical Ballistic Missile Defense Assessments	ODCSOPS
Allied Force Potential Assessments	ODCSOPS

Source: U.S. Army Concepts Analysis Agency, *US Army Concepts Analysis Agency FY 91 Annual Report* (Bethesda, Md.: Concepts Analysis Agency, December 1991), p. 2-1.

Most of the QRAs prepared by CAA were time sensitive. Some were produced in as little as twelve hours and most required results within seventy-two hours in order to support critical planning decisions.[46] CAA QRAs in support of operations in Persian Gulf included estimates of requirements for ammunition and major items of equipment in support of various campaign analyses; sensitivity analyses to assess the impact of varying equipment replacement policies; estimating number of air defense units required to provide an adequate defense against both a mass air raid and a tactical ballistic missile attack on Saudi Arabia; analysis of the capability of the Patriot missiles to defend major Israeli population centers against Scud missile attacks and to determine proper location of firing batteries to provide maximum coverage; and two analyses to estimate the requirement for Patriot and Stinger missiles, given varying lengths for the Southwest Asia conflict.[47]

Between August 1990 and the end of February 1991, CAA performed a total of eighty-four QRAs, the bulk falling in October 1990 and February 1991.[48] Of the eighty-four QRAs, four dealt with allied force potentials, seven with air defense and theater missile defense, forty-seven with requirements developments, twenty-one with operational assessments, and five with strategic deployment issues.[49] For studies, analyses, and war games as well as QRAs, the general topics pursued by CAA and the primary users of the results were as shown in Table 8–1.

The quantity, quality, and timeliness of CAA analytical efforts in support of the Gulf War "far surpassed any previous CAA analytic effort."[50] A part of that effort was recognized by the presentation of a special Wilbur B. Payne Award made in 1991 to a team from CAA led by Col. Arthur E. Parker III for having played a key role in the successful outcome of Operation Desert Storm.[51] Commenting on CAA's performance during the Gulf War, the deputy chief of staff for operations and plans, Lt. Gen. Dennis Reimer, stated:

> The analytical support you provided for Operations Desert Shield and Desert Storm has been absolutely outstanding. . . . [Your work has been] used by the Army Staff, the Joint Staff, and our Army in Southwest Asia to prepare for war. The Army leadership used it for discussions and briefings with key military and civilian leaders, including the National Command Authority.[52]

Another important task assigned to CAA was the compilation of a comprehensive after-action report (AAR) of HQDA mission performance in support of operations Desert Shield and Desert Storm. On 11 February 1991, less than two weeks before the ground campaign began, Maj. Gen. Jerome H. Granrud, the assistant deputy chief of staff for operations and plans for force development, tasked the director of CAA to form a special study group and prepare an AAR that would "develop strategic lessons learned" during the various phases of Operation

Desert Shield.[53] The purpose of the report, which was extended to include the events of Operation Desert Storm, was as follows:

> To identify observations and issues emanating from HQDA's role in supporting Operations Desert Shield and Desert Storm.
>
> To place these observations within a framework of time, mission, and function.
>
> To identify positive and negative observations warranting detailed review by HQDA.[54]

The team formed by the director of CAA to prepare the HQDA AAR was composed of eight recently retired Army officers chosen for their individual expertise and selectively recalled to active duty to conduct the study.[55] CAA personnel provided analytical, administrative, and automatic data processing support.[56] The study team received input data from the various functional staff areas and validated it from alternative sources then analyzed it for "sufficiency, utility, and applicability."[57] Some 170 observations were organized according to HQDA mission areas and the seven operations Desert Shield/Desert Storm "functional phase applications" (Force Mobilization, Deployment, Employment, Kuwait Reconstruction, Strategic Reconstitution, Redeployment, and Demobilization).[58] Overall, the study group undertook a careful examination of the Army's mission performance in support of operations Desert Shield/Desert Storm (August 1990–August 1991) in Saudi Arabia, Kuwait, and Iraq. In preparing its report, the study group compiled and analyzed a collection of more than 1,000 lessons learned reports, twenty-one individual HQDA Staff after-action reports, and a variety of other relevant documents, and conducted numerous interviews with HQDA staff officers involved with the operations.[59] The focus of the analysis was on the strategic roles and missions of HQDA during the mobilization, deployment, employment, and return of forces phases of the operations, with each functional phase being analyzed in terms of manning, organizing, training, equipping, and sustaining the Army.[60]

Having coordinated its efforts with the special Desert Shield/Desert Storm Study Group headed by Maj. Gen. Thomas Tait at the Center for Army Lessons Learned (CALL) at Fort Leavenworth, Kansas, the Desert Storm/Desert Shield AAR study group completed its task and forwarded its three-volume report to the assistant deputy chief of staff for operations and plans for approval on 27 September 1991.[61] Volume I contained the Executive Summary; Volume II, the detailed discussion by the study team and the narratives received from twenty-one HQDA staff elements; and Volume III, the 1,024 Joint Universal Lessons Learned System (JULLS) reports on issues from the HQDA staff.[62]

Army Management and Resource Allocation

The activities of the Army analytical community before, during, and after the Persian Gulf War of 1990–1991 took place in the context of the processes for overall Army management and resource allocation developed since 1961.[63] For the most part, those processes evolved from the reforms in defense management initiated by Secretary of Defense Robert S. McNamara in the early 1960s and had as a central element the application of scientific management techniques, including operations research and systems analysis, to the problems of how to allocate resources for defense in the most efficient and effective manner. The planning, programming, and budgeting system (PPBS) and methods of cost and operational effectiveness analysis developed during the McNamara era of the early 1960s were key aspects of the Army's management and resource allocation processes. For the most part such processes were developed and applied by ORSA personnel, and by 1990, they had become an ingrained and fundamental part of how Army leaders went about deciding how resources should be distributed and what materiel systems should be funded or discontinued. No weapons system, no organizational or doctrinal concept, and no training method was developed after 1961 that did not pass through the PPBS process or undergo the scrutiny of analysts concerned with the cost-effectiveness equation.

Other Wartime Analytical Support in the Theater of Operations

Although AMSAA and OPTEC provided a small number of analytical personnel in theater for data collection and analysis tasks, CAA had no one in the theater during hostilities and provided all of its support from its offices in the continental United States (CONUS).[64] But in addition to the support provided by Army analytical organizations based in CONUS, several of the Army organizations in the field in Saudi Arabia, Kuwait, and Iraq were supported by their own, usually quite small and ad hoc, ORSA teams, most of which were not deployed until after the fighting was over.[65] One such team was the Combat Analysis Group supporting USCENTCOM headquarters. HQ USCENTCOM took about half of its assigned OR cell to Saudi Arabia, leaving the other half at its permanent headquarters at MacDill Air Force Base in Florida. The small contingent in theater had secure high-volume communications and took the Tactical Warfare Model with them. They were thus able to run the model both at MacDill Air Force Base and in Saudi Arabia, where they did a considerable amount of analysis.[66] The degree to which the support provided by the USCENTCOM Combat Analysis Group and other Army analytical agencies was valued by HQ USCENTCOM was evident from the USCENTCOM after-action report, in which it was stated:

> The availability of a combat analysis capability was invaluable. As a special staff section reporting to the Chief of Staff, the Combat Analysis Group provided an operations research capability to objectively evaluate military courses of action and conducted sensitivity analysis in support of all planning efforts. Using war gaming and simulation models, the Combat Analysis Group performed rapid theater campaign analysis without imparting an organizational bias—this perception was extremely useful in resolving major differences of opinion among coalition planners. Combat analysis capability is a must for planning operations of this nature—the importance of objective analytical support cannot be overstated. The combat analysis element must deploy early and be located in close proximity to the planning team.[67]

The effects of good analytical support were many and varied and were often critical to the success of the enterprise. One particularly significant achievement of OR during the Gulf War was to convince a reluctant Saudi Arabian government to accept Egypt's offer of a second Egyptian division to bolster Coalition combat power in the Northern Area Command after extensive combat analysis and comparisons of courses of action demonstrated the need.[68] At the lower end of the scale, one specific and successful application of OR to the evaluation of courses of action on the ground in the Kuwait Theater of Operations was the creation of the Logistics Release Point resupply concept initiated by the Forward Support battalions of the 1st Infantry Division.[69] The concept grew out of a low-level OR study conducted at Fort Riley, Kansas, by the commander of the 201st Forward Support Battalion and Capt. Richard Staats between October 1989 and January 1990. It involved a new method of organizing the resupply of units in the field using priority queues to alleviate problems of time and security and shortages of transportation assets. The new method proved very successful.

Of course, OSD and the other services as well as several of our Coalition partners took advantage of the support provided by their own OR organizations in the field and at home. The United States Navy, Marine Corps, and Air Force had dedicated ORSA support, as did various DOD agencies. For example, the Defense Nuclear Agency provided a weapons of mass destruction (WMD) effects team that included ORSA analysts.[70] The planning process for operations Desert Shield/Desert Storm was also supported by representatives from the Air Staff, Naval Strike Warfare Center, Defense Intelligence Agency, 513th Military Intelligence Brigade, the USCENTCOM Combat Analysis Group, and numerous other commands and agencies.[71]

Our Coalition partners, notably the United Kingdom and Canada, made good use of OR support. For example, the (UK) Armoured Division was supported by a small (two junior officers and two civilians) operational research team.[72] And in late September 1990, the Canadian Directorate of Land Operational Research (DLOR), the largest single directorate in the Canadian Operational Research and Analysis Establishment, was tasked "to examine various Coalition attack options for liberating Kuwait from Iraqi forces."[73] Using the Theater Analysis Model developed by Booz-Allen and Hamilton, DLOR conducted six war games under the GOLD STANDARD rubric, each of which examined a different approach and force mix for liberating Kuwait.[74] The earlier games concentrated on the direct eastern approach, but the later games looked at progressively more western approaches through Iraqi territory, which would prove the most successful.[75] The last game featured a Blue plan very similar to that actually employed by Coalition forces in Operation Desert Storm. One key factor discovered in the course of the Canadian GOLD STANDARD games was that the U.S. XVIII Airborne Corps would not have sufficient forces by itself to achieve victory and that an additional corps was needed. As a result, an additional 100,000 troops and the U.S. VII Corps headquarters from Germany were deployed to the theater.[76]

Analytical Lessons of the First Gulf War

Although the Army analytical community provided generally excellent support to Army commanders at home and in the field during the first Gulf War, there were many important lessons learned during operations Desert Shield/Desert Storm. One very important effect of the war was that the emphasis in Army analysis shifted back to focus on operations and day-to-day activities, a return to the roots of OR in World War II and a return to analysis based on observation and experience of actual combat operations rather than test data, models, simulations, and war games.[77] As Dr. R. A. Forder has written, "The Gulf War of 1991 was something of a watershed. . . . It encouraged analysts to believe that they had not in fact lost touch with reality. . . . For the UK at least, the Gulf War also breathed new life into the idea of operational analysis to support forces in the field."[78]

There were negative aspects as well. Writing in the June 1991 issue of *Phalanx*, Brian Barr, then the secretary-treasurer of MORS (Military Operations Research Society) and a research staff member of the Operational Evaluation Division of the Institute for Defense Analyses, noted that

> it seems that now, while the Gulf War is fresh in our minds, is the time to ask ourselves how well we did in preparing the forces to fight, how well we supported them during the war, and how well we are prepared to assess the results and prepare for the next war. Now is the time for use to take a serious introspective look at our performance.[79]

Barr went on to list some of the factors contributing to the lopsided coalition victory in Operation Desert Storm. Those factors included:

- A well coordinated and executed sea and air deployment of the forces to Southwest Asia.
- Complete freedom of movement in the air, sea and land.
- Total control of the air space and neutralization of the air defenses in the theater of operations.
- A masterfully designed and skillfully executed air campaign which included the destruction of a large part of the Iraqi armored and artillery forces.
- Time to plan, practice, and refine the battle plans at both the operational and tactical levels.
- Careful intelligence gathering and preparation of the battlefield prior to the ground assault.
- Aggressive and skillful execution of AirLand Battle doctrine.
- The superb performance of high technology weapons.
- The professional and valiant conduct of the Untied States and Allied forces.
- The complete failure of the leadership of the Iraqi forces.[80]

However, Barr cautioned on drawing hasty conclusions from the Gulf War victory and noted that

> the conflict which can be used to resolve a host of issues may, in fact, be just adding mud to the waters. The arguments over what was learned from this war may be rougher and less coherent than the battles themselves; few will be resolved in short order. Resolution of the significant issues will take time for careful gathering and analysis of the available information. We, the professional operations research analysts who support the military forces, can expect to be deeply involved in the ensuing battles.[81]

In fact, Barr raised the question of whether or not Army ORSA elements really provided adequate support to forces once they were deployed in the theater of operations. He noted that the Navy and Marine Corps were well prepared to collect and analyze combat data from the very beginning of Operation Desert Shield in August 1990, primarily because they recognized such collection and analysis as an important secondary mission and had prepared for it beforehand. The Army and Air Force, on the other hand, "were not as well prepared to support the collection and analysis of combat data and did not appear to receive the same support from the Service headquarters. As a result the Army and Air Force were playing catch up."[82] Barr cites the fact that the Army planned to deploy a data-gathering team of ninety-two men that was pared down to only eleven men with a limited mission, and that while war gamers supported USCENTCOM planning, and analysts sailed to the

Gulf aboard ship, the Army analytical community had in some respects not sold itself successfully to the forces in the field: the USCENTCOM scientific advisor was left behind in Florida; damage assessment teams were cut from the troop deployment list; data collectors were denied access to damaged equipment; and although sixty historians deployed to Saudi Arabia to collect historical records, the war started with no historian assigned to USCENTCOM headquarters.[83]

The 59th MORS, held at West Point in June 1991, further highlighted ORSA activities in operations DESERT SHIELD/DESERT STORM with a presentation by E. B. Vandiver III on CAA support of the Persian Gulf War and a presentation by Col. Gary Ware, director of combat analysis for HQ USCENTCOM, on how computer simulation and combat analysis contributed to the planning and execution of DESERT SHIELD and DESERT STORM.[84] And on 9–11 December 1991, MORS conducted a three-day minisymposium on ORSA support in the Gulf War at the Center for Naval Analyses in Alexandria, Virginia.[85] Chaired by Vandiver, the minisymposium sought to derive the lessons learned from the use of analytical methods in operations DESERT SHIELD/DESERT STORM. The participants explored the variety of analytical support provided by the analysis organizations of DOD and the various services and exchanged ideas on analytical support to forces in the field in general with an emphasis on how such support could be improved in future operations. Topical working groups focused on mobilization/deployment; command, control, communications, and computers (C4); planning and operations; sustainment (logistics); and special topics. A Synthesis Group had a member in each working group to filter out those "nuggets in the papers and discussion that revealed *analysis lessons learned*."[86] The Synthesis Group focused on the "where, when, why, what, who, and how" of analysis activities in the Gulf War, and arranged its conclusions in three categories—Class A: "constants" of combat analysis—lessons to be "re-learned"; Class B: "trends"—changing methods and emphases; and Class C: "variables"—conditional lessons to be learned from wars "like" the Gulf War of 1990–1991.[87] Among the lessons learned of Class A were:

- "Have analysts in the field, trusted by the commander and his staff."
- "Be timely, and roughly right."
- "Support decision makers and staff. Expect the unexpected and all kinds of questions."
- "Keep it relevant, fundamental, simple, and transparent."
- "Train in peacetime exercises to prepare for wartime analysis."[88]

The Class B lessons included:

- "Computer influence on analysis is increasingly varied and pervasive."
- "Software analytical tools are increasingly available to all—including 'non-analysts.' "
- "The demand for good data bases is growing more rapidly than the supply."
- "There is growing need for coalition and joint Service analysis."
- "There is increasing analytical interest in operational art and campaign focus."
- "There is less danger of "central" misuse of field analysis and data than formerly."[89]

Finally, the lessons of Class C were:

- "Moderate-to-good planning and modeling were in place before hostilities."
- "Situational peculiarities affected the analysis of attrition, weapon ranges and accuracies."
- "Several often-studied, but still unresolved, issues were of special interest."
- "There may have been unrecognized peculiarities that concealed Class C lessons."[90]

On a far simpler and more direct level, Captain Staats has noted that there were two key lessons for the OR analyst to be derived from operations in the Kuwait Theater of Operations:

> 1. Always look for the simple, robust solution (the complex optimal solutions have a tendency to break down under the worst possible conditions); and 2. the analyst must anticipate, integrate, plan for continuity, be responsible, and be willing to improvise. [91]

There could scarcely be more basic or sounder advice for analysts in any situation.

Conclusion

The outstanding performance of Army forces in the 100-hour ground war against Iraqi forces in April 1991 was the result of two decades of hard work and effective decisions by Army leaders at all levels that produced an integrated system of weapons, organizations, doctrine, and training unmatched by any nation in the world. A good share of the credit for the success of those efforts can be attributed to the support provided to Army decision makers by the Army analytical community. Thus, the stunning victory in operations Desert Shield/Desert Storm represented a high point in ORSA support to the Army up to that time.

Although the support provided by the Army analytical community to Army commanders in the Gulf War was broad and generally effective, Walter W. Hollis, the deputy under secretary of the Army for operations research, nevertheless sounded a note of caution in 1995 when he wrote:

> In many ways analytic support of the Gulf War was not a good test of the new "very dynamic and demanding future." While a number of the Army's analysis groups made contributions to the planning and support of the operations, our work was focused at Army Headquarters. Following the combat operations, Army analysts participated in post-operations analysis, dealing with systems performance. . . . We continue to explore mechanisms to prepare for future military operations by having small, highly skilled field analysis teams ready to deploy with combat and support elements.[92]

Chapter Eight Notes

1 Gulf War statistics are provided in the introductory paragraphs of U.S. Central Command, *United States Central Command Operation Desert Shield/Desert Storm—Executive Summary* ([MacDill Air Force Base (AFB), Fla.]: HQ USCENTCOM, 11 July 1991) (cited hereafter as CENTCOM ExSum). Two excellent general histories of the Gulf War are Frank N. Schubert and Theresa L. Kraus, gen. eds., *The Whirlwind War: The United States Army in Operations Desert Shield and Desert Storm*, CMH Pub 70–30 (Washington, D.C.: U.S. Army Center of Military History, 1995), and Brig. Gen. Robert H. Scales Jr., *Certain Victory: The U.S. Army in the Gulf War* (Washington, D.C./London: Brassey's, 1994).

2 Schubert and Kraus, *The Whirlwind War*, p. 45.

3 Ibid., p. 25.

4 General (USA Ret.) Maxwell R. Thurman, *Today's Victories and Tomorrow's Army* (Arlington, Va.: Institute for Land Warfare, Association of the United States Army, July 1991), p. 1.

5 Ibid.

6 For discussion of the activities of the Army Materiel Systems Analysis Activity (AMSAA) and Operational Test and Evaluation Agency/Command (OTEA/OPTEC), 1973–1995, see Chapters Four and Five above, respectively.

7 Schubert and Kraus, *The Whirlwind War*, p. 42, note 41: "The limited combat in Grenada and Panama did not rigorously test the systems used by Army units in those actions. In Panama, for example, eleven AH–64A aircraft flew a total of 246 combat hours, of which 138 were at night. Other weapon and communications systems were similarly unproven."

8 Ibid., p. 33.

9 Memo, Maj Gen Richard E. Stephenson, Commander, U.S. Army Operational Test and Evaluation Command (OPTEC), for the Vice Chief of Staff of the Army, Washington, 21 Aug 91, sub: End-of-Tour Report, p. 1.

10 Ibid., pp. 1–2.

11 U.S. Army Materiel Systems Analysis Activity, *Annual Historical Review for Fiscal Year 1992* (Aberdeen Proving Ground, Md.: U.S. Army Materiel Systems Analysis Activity, July 1993), p. 15.

12 Ibid.

13 U.S. Army Operational Test and Evaluation Agency/Command, *Annual Historical Review (RCS CSHIS-6 [R-3])—Fiscal Year 1990* (Alexandria, Va.: U.S. Army Operational Test and Evaluation Agency/Command (USAOTEA), [1990]), p. 14 (cited hereafter as OTEA AHR FY 90).

14 Maj. Gen. William C. Page Jr., then the TRADOC's Test and Experimentation Command (TEXCOM) commander, quoted in Wayne Hair, "TEXCOM Input for *OPTEC Magazine*," Draft History of TEXCOM (n.p. [Fort Hood, Tex.]: OPTEC/TEXCOM PAO, 20 March 1995), p. 10; OTEA AHR FY 90, p. ii.

15 For operational test and evaluation efforts (OT&E) conducted by OTEA/OPTEC during the Gulf War, see, in particular, U.S. Army Operational Test and Evaluation Command, *Annual Historical Review—Fiscal Year 1991* (Alexandria, Va.: USAOPTEC, [1991]), pp. 16–17 (cited hereafter as OPTEC AHR FY 91).

16 U.S. Army Operational Test and Evaluation Command, *25th Anniversary Celebration, 19 May 1988, Radisson Plaza Hotel*, Brochure (Falls Church, Va.: USAOPTEC, 1988), p. 8; OPTEC AHR FY 91, p. 16.

17 Memo, Stephenson for Vice Chief of Staff of the Army, 21 Aug 91, p. 2.

18 For the deployment of OPTEC personnel to the Gulf, see OPTEC AHR FY 91, pp. 16–17.

19 OTEA AHR FY 90, p. 14; OPTEC AHR FY 91, p. 16.

20 Memo, Stephenson for Vice Chief of Staff of the Army, 21 Aug 91, p. 2.

21 For discussion of the activities of the TRADOC analysis community in the period 1973–1990, see Chapter 6, above. The evolution of organization, doctrine, and training under TRADOC direction in the period is admirably covered in U.S. Army Training and Doctrine Command, Military History Office, *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command, 1973–1998* (Fort Monroe, Va.: Military History Office, USATRADOC, 1998).

22 Schubert and Kraus, *The Whirlwind War*, p. 33.

23 Ibid., pp. 34–35.

24 Ibid., p. 36.

25 Ibid.

26 Ibid., p. 40.

27 Seth Bonder, "Army Operations Research—Historical Perspectives and Lessons Learned," *Operations Research* 50, no. 1 (January–February 2002): 29.

28 Schubert and Kraus, *The Whirlwind War*, p. 36.

29 Ibid., p. 41.

30 For discussion of the activities of CAA in the period 1973–1990, see Chapter Seven, above.

31 Edgar B. Vandiver III, *Second Oral History Interview with Dr. Charles R. Shrader, Fort Belvoir, Virginia, 25 October 2005*, USAWC/USAMHI Senior Officer Oral History Program, "Operations Research in the United States Army" Project (Carlisle Barracks, Pa.: U.S. Army

War College/U.S. Army Military History Institute, 2006), pp. 21–22 (cited hereafter as Vandiver Second Interview).

[32] Ibid., p. 25.

[33] Ibid., pp. 23–24.

[34] U.S. Army Concepts Analysis Agency, *US Army Concepts Analysis Agency FY 90 Annual Report* (Bethesda, Md.: USACAA, December 1990), p. 2-1 (cited hereafter as CAA AR FY 90).

[35] Vandiver Second Interview, pp. 23–24.

[36] CAA AR FY 90, p. 2-1.

[37] U.S. Army Concepts Analysis Agency, *US Army Concepts Analysis Agency FY 91 Annual Report* (Bethesda, Md.: USACAA, December 1991), p. 2-5 (cited hereafter as CAA AR FY 91).

[38] CAA AR FY 90, p. 2-1.

[39] Ibid.

[40] Ibid.

[41] U.S. Army Model Improvement and Study Management Agency, *Army Study Highlights, Volume XII* (Washington, D.C.: USMISMA, December 1991), p. 28.

[42] Ibid.

[43] CAA AR FY 91, p. 2-5.

[44] Vandiver Second Interview, p. 24.

[45] CAA AR FY 91, pp. 2-1, 2–5.

[46] Ibid., p. 2-1.

[47] Ibid., p. 2-3.

[48] Ibid., p. 2-2, Figure 2-1 (Magnitude and Pace of CAA QRA Support to Persian Gulf Crisis).

[49] Ibid., p. 1-8, Figure 1-7 (Magnitude and Pace of QRAs—Operations Desert Shield/Storm).

[50] *Army Study Highlights, Volume XII*, p. 28.

[51] Ibid.

[52] Ibid. CAA's analytical efforts connected to Army operations in the Persian Gulf did not end with the signing of the ceasefire agreement at the Safwan airfield on 3 March 1991. As E. B. Vandiver III recalled, "The Army component, Third Army/ARCENT, didn't have any analysts in the first Gulf War. So in the mid-nineties, after the Army came home and got sorted out again and started getting back up to strength, I went to Third Army and made a deal with them that CAA would be their analysts. We had an MOU [Memorandum of Understanding], still have it, which says, 'You call and tell us what you want, and we will run down to Atlanta. We will have a cell designated to support you as a TDA augmentation. If you deploy somewhere, you can call and we'll have that cell go with you.' We practiced that. In fact, we went to Egypt twice on exercises over there. We had the whole thing, but when it came time, when we got to the real one [i.e., the 2003 invasion of Iraq], it didn't work that way, because everybody had turned over that summer and then we had that 'trickle deployment' over there. So they didn't know about it, and there was no packing up and going. It was sort of oozing over. It didn't happen as planned, but it ended up happening anyway. It is a long story, and we ended up with analysts in Kuwait and later in Baghdad right afterwards. And they have been in Baghdad ever since, and now they are in Afghanistan as well" (Vandiver Second Interview, p. 26). As of 2005, CAA had two analysts in Afghanistan and two in Iraq. All four analysts were on six-month tours with three-week overlap (see Michael W. Garrambone, Robert S. Sheldon, and Debra R. Hall, *A MORS Oral History Interview with Edgar Bishop Vandiver III, FS* [Alexandria, Va.: Military Operations Research Society, 16 June 2005], pp. 86–87).

[53] Memo, Maj Gen Jerome H. Granrud, ADCSOPS for Force Development, for Director, CAA, Washington, 11 Feb 91, sub: Desert Shield Lessons Learned (DSLL) (included as app. B [Study Directive] in U.S. Army Concepts Analysis Agency for Deputy Chief of Staff for Operations and Plans, *Headquarters, Department of the Army, Desert Shield/Desert Storm After Action Report, Volume I: Executive Summary* [Bethesda, Md.: USACAA, September 1991]) (cited hereafter as HQDA DS/DS AAR ExSum).

[54] HQDA DS/DS AAR ExSum, p. 2.

[55] The team included Col. Daniel M. Evans Jr., as study director, and Col. James L. Wilmeth, Col. Garrett E. Duncan Jr., Col. Michael M. Morse, Col. Harold E. Sprague, Lt. Col. George S. Hatch, Lt. Col. Kenneth J. Strafer, and Lt. Col. James H. M. Malley (see HQDA DS/DS AAR ExSum, app. A [Study Contributors], p. A-1).

[56] HQDA DS/DS AAR ExSum, app., p. A-2.

[57] U.S. Army Concepts Analysis Agency, *Desert Shield/Desert Storm After Action Report—Summary* (Bethesda, Md.: USACAA, 1991), app. B to CAA AR FY 91, p. B-3 (cited hereafter as CAA DS/DS Summary).

[58] CAA DS/DS Summary, p. B-3.

[59] Memo, E. B. Vandiver III, Dir, CAA, for ADCSOPS for Force Development, HQDA, Bethesda, Md., 27 Sep 91, sub: Headquarters, Department of the Army After Action Report for Operations Desert Shield and Desert Storm.

[60] Ibid.

[61] Memo, Vandiver for ADCSOPS, 27 Sep 91; CAA DS/DS Summary, p. B-5; HQDA DS/DS AAR ExSum, p. 24, Figure 5 (Operations Desert Shield/Desert Storm Reporting). Maj. Gen. Thomas Tait's group was tasked to address "combat relevant" lessons for the Total Army, whereas the CAA study group focused on HQDA roles and missions.

[62] CAA DS/DS Summary, p. B-6.

[63] See the discussion of the evolution of overall Army structure and management processes in Volume II, Chapters One, Two, and Three.

[64] Vandiver Second Interview, p. 24.

[65] Eugene P. Visco, "Then and Now," Presentation at International Workshop on Analytical Approaches for the Study of Future Conflict, Pearson Center, Nova Scotia, Canada, 26–29 March 1966, p. 6.

[66] Vandiver Second Interview, p. 25.

[67] CENTCOM ExSum, pp. 16–17.

[68] Ibid., pp. 8–9.

[69] Capt. Richard Staats, "Desert Storm & The Key Role Played by OR," *OR/MS Today* 18, no. 6 (December 1991): 43–56 passim.

[70] Visco, "Then and Now," p. 6.

[71] CENTCOM ExSum, p. 10.

[72] Visco, "Then and Now," p. 7.

[73] Lt. Col. P. R. McCumber and D. G. Brown, "Use of War Gaming During Gulf Crisis to Support High Level Decision Making," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirtieth Annual US Army Operations Research Symposium (AORS XXX), Fort Lee, Virginia, 12–14 November 1991, Volume I* (Bethesda, Md.: USACAA, 1991), pp. I-333, I-335.

[74] Ibid., p. I-333.

[75] Ibid.

[76] Ibid., p. I-335.

[77] Dr. R. A. Forder, *Operational Analysis in Defence—A Retrospect* (n.p.: Defence Evaluation and Research Agency (UK), 2000), p. 21.

[78] Ibid.

[79] Brian Barr, "VEEPS PEEP: Desert Storm – An Examination of Conscience," *Phalanx* 24, no. 2 (June 1991): 10.

[80] Ibid., p. 11.

[81] Ibid.

[82] Ibid., p. 12.

[83] Ibid.

[84] "MORS 59th Symposium to Highlight Desert Storm," *Phalanx* 24, no. 2 (June 1991): 19.

[85] E. B. Vandiver III, Clayton Thomas, and Col. Joseph E. Stull, "Lessons Are Learned from Desert Shield/Desert Storm," *Phalanx* 25, no. 1 (March 1992): 1, 6–8.

[86] Ibid., p. 6.

[87] Ibid., pp. 6–7.

[88] Ibid., p. 7.

[89] Ibid., pp. 7–8.

[90] Ibid., p. 8.

[91] Staats, "Desert Storm & the Key Role Played by OR," p. 56.

[92] Walter W. Hollis, "Walt Hollis on Army OR: 'The Times, They Are A-Changin!' " *Phalanx* 28, no. 1 (March 1995): 6.

CHAPTER NINE

ORSA and the Army, 1942–1995—An Assessment

Between 1942 and 1995, the United States Army adopted the new "science" of operations research/systems analysis (ORSA) as a principal aid to Army leaders in making the ever more complex and difficult decisions regarding management and the allocation of resources, the weapons acquisition process, and the development of organization, doctrine, and training methods. The history of how Army leaders incorporated ORSA analysts into the decision-making structure and used ORSA techniques to aid decision makers is, like the story of any human endeavor, one of both strengths and weaknesses, both progress and setbacks, both triumphs and failures. On balance, however, the experiment must be judged a success. In a little more than fifty years, Army leaders at all echelons came to rely on the Army analytical community for assistance in making effective decisions on a broad range of complex problems, and the use of ORSA methods as well as Army analysts moved from the periphery to the center of the Army decision-making process. By 1995, it seemed they would remain there for some time to come.

Thus far we have followed the development of the Army analytical community on a chronological basis and have seen that from 1942 to 1995 the application of ORSA methods to Army decision making grew steadily in terms of the numbers of personnel involved, the analytical focus, advances in methodology, and acceptance by the decision makers. Chronologically, the history of ORSA in the Army in the period 1942–1995 can be divided into five main periods: World War II Era, 1942–1945; Post–World War II Era, 1946–1960; McNamara/Vietnam War Era, 1961–1972; Post–Vietnam Era, 1973–1990; and Post–Cold War Era, 1990–1995. Each period manifested its own unique character in terms of the resources applied, the personnel involved, the scope of analyses, the methodologies employed, and the level of acceptance by decision makers. Thus, the chronological history of ORSA in the Army, 1942–1995, can be conveniently, if sketchily, summarized as shown in Table 9–1. However, the organization of the story on a chronological basis tends to fragment the discussion of continuing themes, themes involving both the difficulties encountered and the successes achieved. For that reason, a summary discussion of the story on a thematic basis may be useful.

Despite a half-century of steady progress and refinement, in 1995 the Army analytical community faced a number of challenges, the most immediate of which was the transitory (one hopes) problem of dealing with the severe cuts in manpower and funding for analytical activities that began in 1989. Many of the challenges that Army ORSA managers and analysts faced between 1942 and 1995 were met and decisively overcome. Of course, there were failures and setbacks along the way, and there were some persistent issues involving the quality and responsiveness of the Army's analytical program, the effective management of Army ORSA personnel, and the efficacy of ORSA methods that, despite constant efforts to resolve them, continue to be of concern even today.

On the positive side, between 1942 and 1995 Army ORSA managers and analysts contributed a great deal to the development of the United States

Table 9–1—The Evolution of Army ORSA, 1942–1995

Period	*Resource Level*	*Personnel*	*Analytical Focus*	*Methodology*	*Acceptance Level*
World War II Era, 1942–1945	Slim	Civilians in uniform; management ad hoc and difficult	Immediate operational questions; weapons performance	Basic mathematical and statistical methods	Questioned
Post–World War II Era, 1946–1960	Adequate; growing	Principally contractors (ORO, SORO, HumRRO, CORG)	Expanding; weapons design; strategy, economics, nuclear warfare	Growth of models, simulations, and war games (Carmonette); primitive computers and ADP equipment; development of new methods (Monte Carlo)	Growing; but resistance common
McNamara/ Vietnam War Era, 1961–1972	Generous; growing	Growing in-house capability (AMSAA, STAG); contractors remain important (ORO/RAC, CORG); career management programs introduced	Expanding; management; cost-effectiveness; combat developments	Introduction of systems analysis; growth of more sophisticated models, simulations, and war games; faster, more capable computers; PPBS; COEA	Accepted with qualifications
Post-Vietnam Era, 1973–1990	Generous; growing	Growing; principally in-house (AMSAA, CAA, OTEA/OPTEC, TRAC, and its predecessors); reliance on contractors greatly reduced; formal career programs	Organization, tactics, and training; weapons design and acquisition process	Growing importance of computer-driven models, simulations, and war games; quantum improvement in computer capabilities; AMIP	General acceptance
Post–Cold War Era, 1990–1995	Constrained; declining	Declining; mainly in-house (CAA, AMSAA, TRAC, and ATEC); formal career programs	Tactical doctrine; force structure; strategy; policy; weapons acquisition	Dominance of computer-driven models, simulations, and war games	Seen as essential

Army and to the advancement of ORSA as a discipline. The application of ORSA methods to Army decision making transformed the Army's management processes, improved the weapons acquisition process and the processes by which organization, doctrine, and training methods were developed, and provided the solution to many operational problems. At the same time, Army analysts also made major contributions to the development of ORSA methodology and the growth of military ORSA as a profession. More important, between 1942 and 1995, the Army analytical community assisted Army leaders in transforming the entire Army decision-making process.

The outstanding performance of the United States Army in operations Desert Shield/Desert Storm in 1990–1991 clearly demonstrated just how much had been achieved by Army leaders with the aid of the Army analytical community since 1942. However, as of 1995 there remained much to be achieved in the future, and Army decision makers would continue to rely on Army analysts as they faced new and even more difficult decisions in the twenty-first century.

A Half-Century of Challenges

Between 1942 and 1995, the number of analytical organizations serving the United States Army increased dramatically, and the use of ORSA methods expanded into new fields in response to changing Army interests and priorities even as significant progress was made in the development of new and more effective ORSA techniques. By 1995, the Army's ORSA program had reached maturity. Army analysts had proven themselves in a wide variety of areas, and ORSA was generally accepted as a useful, even necessary, tool for the military decision maker. In general, Army leaders were eager to receive the recommendations of the Army analytical community regarding the Army's management, weapons acquisition, and combat developments processes.

Throughout the period, the Army ORSA program exhibited many strengths, but Army ORSA managers and analysts also faced a variety of challenges.[1] In some cases, those challenges went back to the earliest days of Army ORSA; others were more recent in origin, having been generated by advancing technology, the evolution of analytical methods, and changes in the political, economic, and social environment. Some of them were transient, being quickly and decisively met; others proved more persistent and, despite the best efforts of all concerned, continued to be of concern throughout the period. Such challenges, in only slightly different forms, were as familiar to Bart Leach and Ellis Johnson in the 1940s as they were to Army ORSA managers in the mid-1990s.

Along the way, there were many setbacks. There were a few lazy, inept, and cantankerous analysts, and there were poorly conceived and badly executed study projects, analytical dead ends, aborted studies, and faulty recommendations. Some are described in this study; others are best consigned to oblivion. Despite many successes, some persistent problems of management and methodology were never entirely resolved. They did not appear in every study project, but they recurred, and their importance was such that they were frequently commented upon and were the object of strenuous efforts to overcome them and thereby improve the performance of the Army analytical community. Among the most important persistent challenges to Army ORSA managers and analysts were proper design and execution of individual ORSA study projects (including proper definition of the problem, the selection of apt and well-defined criteria for evaluation of alternatives, sufficient and accurate data, and the clear and concise presentation of study results and recommendations to the decision maker); the challenge of quality control of Army ORSA products; the tendency toward overreliance on models and computer-driven simulations; the tendency toward complexity and lack of realism in analyses and models; the need for coordination of Army analyses, models, and simulations; and the challenge of effectively managing Army ORSA personnel, both military and civilian.

The failures, setbacks, and unresolved issues encountered in over a half-century of intense analytical effort did little to dampen the productivity of Army analysts or the growth in importance and acceptance of ORSA as a means of supporting Army decision makers. Indeed, it is important to note that there were no catastrophic failures, no analytical recommendations that, once adopted, led the Army and the nation into serious difficulties. By its very nature, scientific analysis contained safeguards against such an eventuality. Having encountered a problem along the road, Army ORSA managers and analysts had either resolved it on the spot or found a way around it. In either case, they simply pulled up their socks and moved forward.

A Half-Century of Achievements

From 1942 to 1995, the achievements of the Army analytical community were many and varied, and most were duly recognized and applauded by Army leaders and the ORSA community at large. Indeed, the number of important contributions of the Army analytical community to the development of the Army, to the defense of the nation, and to the development of ORSA as a discipline is far too great to list all of them here. However, five major contributions stand out: (1) restructuring of the Army management process; (2) improvement of weapons design and of the weapons acquisition process; (3) improvement of the combat developments (organization, doctrine, and training) process; (4) solution of operational problems; and (5) advancement of ORSA methodology. At the same time, Army ORSA managers and analysts played a major role in assisting Army leaders to completely transform the process by which complex and difficult decisions were made.

Restructuring of the Army Management Process

The United States Army first began to use OR methods to solve knotty problems of administration and financial management in World War II, but the general application of ORSA methods to Army management came later. In the late 1950s and early 1960s, Army analysts shifted their attention from weapons performance and operational issues to problems of broader scope and complexity, such as the weapon systems acquisition process as a whole, overall Army force structure, and planning for future programs. By the mid-1960s, their efforts were refocused on responding to the changes in defense management promoted by Secretary of Defense Robert S. McNamara and his "Whiz Kids" in the Office of the Secretary of Defense (OSD). The introduction of cost-effectiveness analysis, the planning, programming, and budgeting system (PPBS), and other advanced management tools based on ORSA principles transformed Army management. In particular, Cost and Operational Effectiveness Analyses (COEAs) became a dominant activity for Army analysts. As Seth Bonder has observed,

> the move toward more centralized management and defense decision-making in 1961 required the military services to learn and use systems analysis as a means of quantitatively justifying their share of the defense budget systems analysis to be an intellectual activity rather than a scientific one. [2]

Improvements in Army management continued long after Secretary McNamara left office. The challenge for Army ORSA managers and analysts in the 1970s and 1980s became how to apply their skills and methods to help Army leaders reorganize, revitalize, and reorient an Army that had all but disintegrated under the pressures of rapidly developing technology, the continued threat of the Soviet Union, budgetary constraints, and the loss of confidence and focus resulting from the long and contentious war in Vietnam. Army leaders and analysts set their sights on rebuilding the "hollow army" and, as a result, the Army that won the 100-hour ground war in the Gulf in 1991 was a profoundly different institution from what it had been a decade earlier.

After 1991, the management problems facing Army decision makers became even more multifaceted and demanded even more analytical support. The primary focus was on questions of what force structure was needed to meet the challenges of a changed international environment in a time of domestic budgetary constraint. The Army was asked to do more and more with less and less, and only scientific analysis could help Army leaders to sort out the complex choices and trade-offs. Consequently, there was more emphasis on high-level, policy-type analyses. Such analyses dealt with major management issues such as the force structure required to meet the National Military Strategy, feasible and effective forward-stationing policies, and the response to international terrorism. Because of the severe budget cuts, there were more OR studies that considered trade-offs between major components of warfighting capability (e.g., force structure versus modernization, prepositioning versus rapid deployment). Many of the analyses involved consideration of joint and coalition assets, were conducted at theater level, and considered multiple theaters of operation. That Army leaders were able to cope with such a difficult decision-making environment at all was due in large part to the use of ORSA methods.

Improvement of Weapons Design and of the Weapons Acquisition Process

The use of what we now consider to be ORSA methods to assist in the design and performance evaluation of weapons and other equipment actually predates World War II. But during and after World War II, the use of ORSA methods became fundamental to the design, development, production, and fielding of new weapons systems, both in time of war and in time of relative peace. Scientific methods replaced military experience and intuition as the principal means of determining what weapons and equipment were needed and what their performance characteristics and design parameters should be. Indeed, every weapons system and piece of major equipment used by the Army since 1945, notably the so-called Big Five systems currently in use, have been the product of a process that has ORSA at its core and at every stage of development.[3] Engineering design, production, follow-on support, and performance evaluation are all informed by ORSA methods.

At the same time, the use of ORSA methods has transformed the weapons and equipment acquisition process itself. Every stage of the process from concept to product improvement is subject to rigorous analysis. Engineering testing and evaluation, research and development testing and evaluation, and operational testing and evaluation are essentially ORSA processes, and the acquisition of new systems is no longer subject to the whims of Army leaders or the unsolicited proposals of arms manufacturers. In World War II, OR focused primarily on the analysis of existing military systems with a view to improving their operating effectiveness, but in the post–World War II period, more emphasis was placed on the determination of military requirements as the individual services redefined and negotiated their roles and missions in the defense establishment.[4] As Seth Bonder has written, "If the 1960s instigated this tyranny of numbers, the 1970s has formalized it. The weapon system acquisition process was institutionalized into a long complex management system."[5] Even so, a more efficient process and better management helped the Army to achieve savings that were reinvested to strengthen the Army's fighting potential. Indeed, more than one observer has noted that the Soviet Union lost the Cold War due to an inability to properly reconcile military expenditures with economic power, and that "US efficiency in buying deterrent power is what has brought us to the new era in world politics."[6]

Improvement of the Combat Developments (Organization, Doctrine, and Training) Process

The path taken in the development of OR in the United States in World War II diverged somewhat from its British model. The differences between operational research in Britain and operations research/operations analysis in the United States can be explained mainly by the fact that the British effort was largely directed toward finding how to do the best they could with limited resources, while the American effort, once the American war machine got rolling, was directed more toward how to integrate new technology and new techniques into the fighting forces effectively. In the post–World War II period weapons design and performance remained important topics, but the Operations Research Office (ORO) and other Army analysis agencies began to take up broader questions of strategy, policy, manpower utilization, and force structuring. Army analysts applied OR techniques to the key questions of the day, particularly the role to be played by the Army in the new nuclear age and in the Cold War conflict with the Soviet Union. Air defense, the employment of tactical nuclear weapons, the organization of the Army for the nuclear battlefield, and, in the 1960s, the role of the Army in counterinsurgency, all became grist for the analyst's mill.

While the Army Materiel Systems Analysis Activity (AMSAA) and the Operational Test and Evaluation Agency/Command (OTEA/OPTEC) led the weapons development process after 1973, the newly established United States Army Training and Doctrine Command (TRADOC) assumed responsibility for stating the requirements for new weapons and equipment and for developing new organizational structures, new doctrinal concepts, and new training methods for Army forces. ORSA methods were essential to the combat developments process, and the use of ORSA-based models, simulations, and war games became key parts of that process. Accordingly, TRADOC developed its own coterie of analysts. The TRADOC integrating centers and the Army service centers and schools had assigned analytical personnel, and the TRADOC Analysis Command (TRAC) and its pre-1986 predecessors—the TRADOC Systems Analysis Activity (TRASANA), the Combined Arms Operations Research Activity (CAORA), and the TRADOC Operations Research Activity (TORA)—led the way in developing the new organizations and new doctrine as well as the new methods of training necessary to meeting the demands of a rapidly changing operational environment.

One important impact of the McNamara "revolution" in defense management in the 1960s was to integrate the weapons design and acquisition processes with the development of organization, operational doctrine, and training into a nearly seamless whole. A prime example of the integrated combat development process initiated in the 1960s was the development of the armed helicopter and the airmobile doctrine so characteristic of the Vietnam War and of prime importance thereafter. After 1973, the focus turned to the recovery from Vietnam and to the problems of defeating a Soviet Bloc attack in Central Europe. As a consequence, the Army's analytical effort was centered on the development of suitable weapons for European battlefield (the Big Five); the combat organizations best suited to the task (the heavy division, the light division, Army 86); effective doctrinal concepts (the Active Defense, the Central Battle, and AirLand Battle); and the training methods (the Multiple Integrated Laser Engagement System, or MILES; National Training Center) needed to bring it all together. All of these were the products of TRADOC analysts working in cooperation with the other elements of the Army analytical community and employing advanced ORSA methods, particularly computer-assisted models, simulations, and war games.

The fall of the Berlin Wall in November 1989, the reunification of Germany in October 1990, and the disintegration of the Soviet Union in December 1991 left the United States as the sole world superpower, but new threats to American national security began to emerge in the Middle East and in Southwest Asia. Accordingly, the period from 1991 to 1995 saw yet another reorientation of Army organization and doctrine to meet the emerging threats of regional conflict, militant Islamic fundamentalism, and global terrorism, a reorientation that once again relied on Army analysts.

Solution of Operational Problems

Operations research was introduced into the United States armed forces during World War II as a method for solving operational problems of an immediate nature. Navy analysts applied OR to the solution of problems of mine and countermine warfare, antisubmarine and convoy security operations, and torpedo performance. The Army Air Forces used OR to improve bombing accuracy and effectiveness, air defense, aerial gunnery, maintenance procedures, and aerial attack of surface ships and submarines. The use of OR by Army service forces and Army ground forces was more limited, but OR methods were applied to problems of inventory control, transportation, weapons design and performance, signal operations, the use of radar, and other pressing operational issues.

After World War II, the use of OR to solve operational problems remained a principal use. Although most operational issues amenable to OR methods tended to occur during periods of active combat operations, OR Army analysts applied methods in peacetime to solve problems of supply and transportation management, stationing, and personnel management. Although the use of OR techniques quickly expanded to broader areas of concern, it remained an important means of solving those problems of immediate concern to commanders in the field.

In the Korean War (1950–1953), in the Vietnam War (1963–1973), and again in the first Persian Gulf War (1990–1991), Army analysts took to the field to assist commanders in meeting the challenges of new enemies and new combat environments as well as the problems associated with new weapons, tactics, and logistical methods. In Korea, OR was applied to combat methods, logistical methods, and even psychological warfare. In Vietnam, Army analysts resolved problems of base camp defense, tactics, and disease control. Army analysts in the Persian Gulf worked on problems of controlling the movements of large combat and combat service support forces over great distances and of defeating Iraqi defensive measures. And today, Army analysts are working around the clock to solve the most pressing problem of operations in Iraq, the threat of improvised explosive devices. In short, the scope of Army ORSA has expanded tremendously since 1945, and ORSA has been applied to a wide range of nonoperational issues, but a central mission of the Army analytical community remains the solution of pressing operational problems facing the commander in the field.

Advancement of ORSA Methodology

Between 1942 and 1995, Army analysts, individually and collectively, were among the leaders in devising new analytical methods and tools and the adaptation of those new methods and tools to military problem solving. The use of ORSA methods was extended to new areas, new methods were developed, and old methods were refined and adapted to address new problems. The methodological contributions made by members of the Army analytical community served to advance the art and science of military ORSA significantly and provided the basis for additional progress after 1995.

The pressures on World War II "OP Annies" to produce solutions to practical problems in minimal time left little time or effort for developing the theoretical aspects of OR much beyond the basic formulas and rules worked out by the British early in the war. Fortunately, most of the problems faced by World War II–era analysts were limited in scope and complexity and could be solved by relatively simple analytical methods. In most cases, common sense backed by the existing mathematics, statistics, and probability theory sufficed. But there were some exceptions. The British work on density method and on "planned flying" and "planned maintenance" and American work on search theory and bombing accuracy constituted significant advances in OR techniques.[7] Perhaps the development with the most significance for the future was the discovery that OR could be used not only to solve immediate problems of optimizing existing equipment and procedures but also to predict "the results that may be expected from adopting proposed courses of action"—predictions that could then be used as "guides to the development of future strategies, tactics, and weapons."[8]

The period from the end of World War II to the mid-1970s was one of constant innovation and change in OR methods. During the 1950s, ORO's Basic Research Division under Nicholas Smith was the source of many new developments in military OR methodology, such as the pioneering work on nonlinear programming and optimization theory of two young ORO mathematicians, Garth P. McCormick and Anthony V. Fiacco. Other ORO analysts, including James Johnson and Eugene P. Visco, developed so-called quick-gaming methods in the form of sets of algorithms and nomograms that could be substituted for more complex and time-consuming war-gaming methods.[9] Such quick-gaming methods were subsequently used to support field exercises, to study nuclear warfare problems, and in early attempts to model insurgency and counterinsurgency operations. One of the more important contributions was that of Richard E. Zimmerman and others, who developed the first small-scale Monte Carlo tactical simulation, Carmonette, which became a mainstay of Army combat analysis for many years.[10] Other Army contractors and in-house Army ORSA analysts made similar contributions.

The 1950s also saw more extensive application of the high-speed electronic digital computer to OR work. The two areas in which computers proved most useful were in linear programming and simulation. Until 1952, most linear programming had been done using punch card calculators, but beginning in 1952, W. Orchard-Hays and George Dantzig developed linear programming computer code that enabled linear programming to become a practical OR tool. By the late 1950s, it was possible to solve sizable linear programming problems by computer, and attention shifted to the development of matrix generators for improving data input and report writers for producing understandable output.

During the 1960s, the use of high-speed electronic digital computers became commonplace in the Army analytical community, compressing the time required to do certain types of analyses and making possible more complex models, simulations, and war games. As a consequence, the Army invested greater resources and greater reliance in such methods. As of 1963, about 25 percent of the 3,000 reports produced annually by military OR groups in the United States either used simulation/war-gaming as a basic tool or relied on the results of simulation/war-gaming for their conclusions.[11] Although the increased use of computers as an aid to operations research was generally accepted, the use of mathematical models and simulations, including war-gaming, raised some concerns. For one thing, the new mathematical and statistical techniques, the use of high-speed digital computers, and complex war-gaming made operations research more effective but also increased the need for extensive and sophisticated training. Many OR practitioners also expressed concern that the increased emphasis on simulation/war-gaming caused operations researchers to loose sight of the importance of getting hard data on which to base the simulation/war-game decisions. Others warned that the danger in the use of simulations as "large automatic systems for military control and decision, is that they get out of hand."[12]

During the 1960s, the application of ORSA methods to Army programming and budgeting and to force structure decision making also increased significantly. The techniques of Cost and Operational Effectiveness Analysis (COEA) were greatly improved and used extensively in the weapons acquisition and combat developments processes. After the mid-1970s the pace of innovation in military ORSA slowed, although important innovations in methodology and new tools continued to be introduced. In the late 1970s and early 1980s, simulation techniques were applied to the COEA process with some success, at company/battalion level by TRASANA, at division/corps level by TRAC, and at theater/Army level by the United States Army Concepts Analysis Agency (CAA). In the 1980s, CAA applied linear and dynamic programming methods to the force development process. During the 1980s, Army analysts contributed to the development of SIMNET (simulation network) methodology, interactive gaming, and the integration of high-quality graphics in the simulation and war-gaming field.

In the late 1980s and early 1990s, the international geopolitical situation changed dramatically, and the challenges presented to the Army analytical community were much different than they had been during the Cold War. New methods and tools were called for, and Army analysts continued to provide them. In particular, Army analysts developed new decision support methodologies that were used extensively in support of the critical programming, budgeting, and force development decisions required by the changing threat and the constraints on resources introduced after the first Gulf War.

From its rather primitive beginnings in World War II, military operations research/systems analysis progressed over five decades to include a substantial body of very sophisticated theory and methods based on advanced mathematics. In general, the ORSA techniques developed after 1942 have taken the following forms: (1) the use of analysis to aid in force composition and development as well as operations decisions; (2) a great increase in number of interdependent factors considered; (3) the explicit treatment of problems of uncertainty; (4) the explicit treatment of enemy reactions; (5) the explicit treatment of time phasing; and (6) a broader concept of objectives and criteria appropriate to the broader and longer-range problems of decision being analyzed.[13]

Over time, ORSA techniques were applied a very wide variety of problems, including those related to inventory control, allocation of resources, waiting time (queuing and sequencing), competition (gaming theory and bidding), replacement, information management, search, and decision making.[14] Among the specific OR techniques most heavily used by Army analysts have been (1) Monte Carlo techniques (random sampling, stochastic process); (2) models (physical, abstract, symbolic, and mathematical); (3) value theory; (4) symbolic logic (Boolean algebra, sentential calculus); (5) linear programming; (6) nonlinear programming; (7) dynamic programming; (8) comparison method; and (9) war-gaming.[15]

Over the years, Army analysts also achieved a number of "firsts" in Army analysis. A short list of those contributions would include the advances shown in Table 9–2.

The Transformation of the Decision-Making Process

By far the most significant achievement of the Army analytical community since 1942 has been the transformation of the decision-making process itself. Before World War II, decisions on Army weapons, organization, doctrine, training, and management were based on the intuition of Army leaders informed by their training and experience. With the introduction of operations research techniques during World War II, the decision-making process began to change, and since that time, the acceptance of scientific analysis by Army decision makers has grown, slowly but inexorably. In

Table 9–2—Notable "Firsts" in Army ORSA

Year	*"First"*
1961	Carmonette analytical model used in COEA in support of the materiel acquisition process, feasibility studies of alternative weapons systems, sensors, and tactics in multiple scenarios
1968–1970	Application of simulations to force development (ATLAS and the Concepts Evaluation Model, or CEM)
1974	Army begins transition from manual board simulations to full-scale computer-assisted games (DUNN-KEMPF, PEGASUS, FIRST BATTLE) that eventually evolve to full-fledged, integrated, interactive simulations
1974	Army Tactical Training Battle Simulations System (ARTBASS) model/system fielded
1974	JANUS Model developed at Lawrence Livermore Labs and subsequently adapted at TRASANA and TRAC
1974	UH–1H, CH–47, and AH–1 Cobra flight simulators fielded
1974	First-generation Multiple Integrated Laser Engagement System (MILES) training system fielded
1975–1986	Use of simulations in support of COEAs at TRASANA, TRAC (VIC), and CAA (CEM)
1976	Army Training Support Center (ATSC) stood up as the major controlling agency for Army training aids, devices, simulations, and simulators; followed by major efforts to support data collection and training reviews
1980	Conduct of Fire Trainer/Unit Conduct of Fire Trainer developed and fielded to support the M1 tank
1980s	Support to Army Staff in acquisition and force development areas through use of linear and dynamic programming at CAA; continued development of CEM in support of Total Army Analysis process
1984	Development of SIMNET technology and interactive gaming approaches
1987	First field training exercise driven by Joint Exercise Support System (JESS)
1988	Army adopts JESS/Corps Battle Simulation (CBS) as standard simulation for corps- and division-level training
1990s	Introduction of mobilization and time-phasing simulations in support of force planning
1990s	Extensive use of decision support methodologies in support of programming and budgeting; improvements in integration of graphics outputs for simulations
1992	First interservice linking of models (Corps Battle Simulation plus Air Warfare Simulation)

Source: Lt. Col. Scott J. St. Clair, "Barriers to Using Models and Simulations (M&S) in Training Forums," Modeling and Simulation Information Analysis Center (MSIAC) M&S Journal Online, at http:www.msiac.dmso.mil/ journal/ltc44l.html (accessed 3 October 2005). I am indebted to Brian R. McEnany for additions to the list.

1942, few Army decision makers had ever heard of OR and fewer still were prepared to accept the results of OR analysis without at least a few qualms. Since the early 1960s, no significant decision has been made by Army leaders without the assistance of scientific analysis. By 1995, both the advantages and limitations of ORSA were comparatively well understood by most Army leaders, and ORSA was fully accepted as a necessary part of the decision-making process. Over the years, Army ORSA has taken many forms, from straightforward studies and analyses to complex models, simulations, and war games, but in every case the speed and effectiveness of the decision-making process have been enhanced by ORSA methods.

The spread of operations research in U.S. Army service forces and Army ground forces during World War II was limited, both by the press of operations and the ignorance of field commanders regarding the benefits that might be derived from the use of civilian operations analysts. Nevertheless, Army analysts were part of many of the teams led by service force and ground combat commanders, and they contributed their bit to winning the war. And although Army service forces and Army ground forces lagged behind the Navy and Army Air Forces in the integration of OR into the decision-making process, even the limited exposure of Army civilian leaders, commanders, and staff officers had an impact. In the post–World War II period, the Army closed the gap, and OR became an integral part of the Army decision-making process, not only for the design and improvement of weapons and other military equipment but also for the development of tactical doctrine and strategic planning as well.

During World War II, OR was in its infancy, and most Army decision makers were unfamiliar with its benefits and limitations. Many military officers did not understand fully the purpose of the civilian analysts in their midst, in some cases considering them spies sent to inform or regulate the performance of the uniformed personnel. Higher-level commanders were usually sufficiently aware of the purpose and value of their civilian analysts, but lower-level commanders and staff officers frequently threw obstacles in the way of the operations research teams assigned to their commands, blocking the analysts' access to crucial classified operational information and restricting their communications with their counterparts in other commands and in the broader scientific community. From the civilian analyst's perspective, the restrictions of military life and tradition could be annoying and apt to inhibit the work they were trying to do. The differences between the "military mind" and the "scientific mind" provided ample occasion for misunderstanding and even conflict. Fortunately, the friction between the two cultures tended to abate as time passed and the assignment of civilian specialists to operational units became more common. Eventually, military personnel learned to understand and even value the work of civilian analysts, and civilian analysts learned to understand and tolerate the military way of doing things. In the end, they were able to form "a successful and continuing partnership," one that would endure far beyond World War II.[16] Such a partnership proved not only fitting, but also essential, since the Cold War with its threat of nuclear annihilation introduced greater complexity of decisions, increased costs of trade-offs, and more dangerous consequences of failure due to wrong decisions.

The acceptance of OR by Army decision makers improved substantially between 1945 and 1960, but some resistance continued to be encountered. In 1951, for example, Army leaders rejected a recommendation that the use of OR agencies in major Army commands be increased, and there remained a number of Army leaders convinced that military experience rather than systematic analysis should be the basis for decisions on weapons, organization, and doctrine. Although until the Korean War, experienced men shaped the Army, thereafter scientific analysis began to dominate. By the mid-1960s, most Army decision makers had come to believe that scientific analysis was indispensable. Even so, there continued to be a few who blamed ORSA, unjustly, for such unfortunate aspects of the Vietnam War as the body count and the attempt to quantify every aspect of warfare.

The efficacy of Army ORSA was proven in the development during the 1970s and 1980s of the weapons systems, organization, doctrine, and training methods that made possible the stunning victory in the Gulf War of 1990–1991. Although by 1991, ORSA had long since been accepted as an important and necessary tool in the decision maker's kitbag, some Army leaders still failed to fully understand the limitations of hasty, ill-designed analysis, the outcome of which the client was likely to have prescribed in advance. Although good, careful analysis was essential to meeting the multiple challenges of the day, some decision makers continued to insist on "quick and dirty" studies to support their already determined decisions. But the number of Army leaders who failed to understand the application of ORSA to military decision making was few, and they were clearly swimming against the tide. Army decision making had become almost synonymous with operations research/systems analysis.

Conclusion

One need neither to belabor the contributions of the Army analytical community to the Army and the defense of the United States during the period

1942–1995 nor to recite ad infinitum the accolades received for those contributions. From the battlefields of World War II to those of the Persian Gulf in 1991, Army analysts have provided outstanding support to Army decision makers and have at the same time advanced the state of the art of operations research/systems analysis. The new science of operations research played an important role in the winning of World War II and must be reckoned with the other major scientific discoveries of that era—radar, sonar, rockets and guided missiles, the proximity fuse, and the atomic bomb. In the ensuing half-century, ORSA techniques have been applied to the solution of a broad range of complex problems, and Army leaders have come to rely on ORSA analysts to assist them in the development of weapons, organization, tactics, training, management, and indeed all the fields of military endeavor.

The success achieved by Army ORSA managers and analysts in their appointed task is amply demonstrated by the rapid buildup of forces in the Persian Gulf in 1990–1991 and the victory of U.S. and allied forces in the 100-hour ground war against Iraqi forces that followed in February 1991. That victory was the product of nearly fifty years of steady progress in the application of operations research/systems analysis to Army decision making, as Dr. David. S. C. Chu, then the director of program analysis and evaluation in the Office of the Secretary of Defense, noted in the September 1991 issue of *Phalanx*:

> Your profession—the military operations research profession—can take great pride in the outcome of recent events both in the Gulf and on the continent of Europe—the withdrawal, really, of the Soviet Union from its Cold War positions. This profession played a significant role in helping DoD organize its thoughts about how best to confront the problems presented by the Soviets and how best to use the technologies available to us and to our forces. Your profession helped to build the intellectual infrastructure from which particular doctrines, weapon system choices, and employment decisions then flowed. You—who have over the years contributed to those dialogues and debates—should look with great pride on the outcome of this long, 40-year contest, which was a favorable one for our country. It was due in no small measure to efforts of individuals like yourselves. In the recent Gulf war, we saw the culmination of the explicit operational and doctrinal choices you helped make. The profession can take enormous satisfaction from that set of outcomes.[17]

Of course, the story of ORSA in the Army does not end in 1995, and scientific analysis remains today just as important to the Army is it did in World War II, Korea, Vietnam, and the Persian Gulf. Army analysts continue to face many challenges, and they will no doubt continue to make significant contributions. And the leaders of the Army analytical community continue to focus their efforts on ensuring that their organizations are up to the task, as E. B. Vandiver III, the director of CAA, told attendees at the Army Operations Research Symposium (AORS) XXXVI in November 1997:

> Recent experience has shown that the tools in our kit bag that were so useful since the early days of operations research and throughout the Cold War, while not ready for retirement, may not be enough for the challenges in the next century. While we will continue to look to the educators and trainers of our institutions for the basic training of our trade, we must enhance our own capabilities by learning and applying new or non-traditional methods if we are to continue to accomplish our mission of supporting the army leadership at all levels. The American values and way of life that so many people strive for every day are no longer threatened by the large, powerful forces we analyzed during the Cold War. Instead, current threats to world peace and stability are now from smaller nations and extra-national groups who use unconventional means to accomplish their objectives. In order to fully understand and posture our forces to counter these threats while at the same time insuring that any re-emergent former threat can be deterred, our leaders will need our analytical support even more than ever before.[18]

Chapter Nine Notes

1 Both the 1978–1979 Review of Army Analysis (RAA) study group and the follow-on 1985 Review of Army Analysis Extended (RAAEX) study group addressed the strengths and weaknesses of the Army analytical community in some detail. Many of the facts and perceptions recorded by the two study groups were specific as to their own time, but some reflected the long-standing challenges that continue to be of concern even today. See U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: United States Department of the Army Special Study Group, April 1979), Chapter 4 ("Perceived Strengths and Weaknesses of the Army Studies and Analysis Community and Its Products") (cited hereafter as RAA I); U.S. Department of the Army Special Study Group, *Final Report—Review of Army Analysis Extended (RAAEX), Volume II: Task Reports* (Washington, D.C.: U.S. Department of the Army Special Study Group, March 1985), Chapter 4 ("Quality Assurance and Research") (cited hereafter as RAAEX II); and app. C, below.

2 Seth Bonder, "Keynote Address—Changing Army OR," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Sixteenth Annual US Army Operations Research Symposium (AORS XVI), Fort Lee, Virginia,*

12–14 October 1977, Volume I (Bethesda, Md.: USACAA, 1977), pp. 3–4.

[3] The "Big Five" weapons systems (M1A1 Abrams tank, the M2/M3 Bradley infantry fighting vehicle, the AH–64 Apache attack helicopter, the UH–60 Black Hawk utility helicopter, and the Patriot air defense missile system) were developed in the 1970s and 1980s and were the principal tools of victory in the Persian Gulf War of 1990–1991. They remain the Army's principal weapons systems today.

[4] Bonder, "Keynote Address—Changing Army OR," pp. 3–4.

[5] Ibid.

[6] Stan Erickson, "How Military Operations Research Won the Cold War," *Phalanx* 22, no. 3 (September 1989): 3.

[7] Joseph F. McCloskey, "U.S. Operations Research in World War II," *Operations Research* 35, no. 6 (November–December 1987): 923.

[8] Florence N. Trefethen, *The History of Operations Research* (Baltimore: Johns Hopkins University, 1952), p. 17.

[9] Eugene P. Visco, personal communication with the author, 15 December 2006.

[10] Richard E. Zimmerman, "A Monte Carlo Model for Military Analysis," in Joseph F. McCloskey and John M. Coppinger, eds., *Operations Research for Management, Volume II* (Baltimore: Johns Hopkins University Press, 1956).

[11] E. W. Paxson, Comments in Session XI, in U.S. Army Research Office-Durham, *Proceedings of the [Second] U.S. Army Operations Research Symposium, 26, 27, 28 March 1963, Durham, North Carolina, Part I*, ORTAG–25 (Durham, N.C.: U.S. Army Research Office-Durham, 30 September 1963), pp. 321–22.

[12] Ibid.

[13] Charles J. Hitch laid out the six basic categories in "An Appreciation of Systems Analysis," *Journal of the Operations Research Society of America* 3, no. 4 (November 1955): 467, but they seem to be equally valid for the entire period up to 1995.

[14] U.S. Army Quartermaster Combat Developments Agency, *Operations Research Methods* (Fort Lee, Va.: U.S. Army Quartermaster Combat Developments Agency, May 1962), ann. A (Types of Operations Research Problems), p. A-1.

[15] Ibid., ann. A, p. A-2.

[16] Donald W. Meals, "Trends in Military Operations Research," *Operations Research* 9, no. 2 (March–April 1961): 252.

[17] David S. C. Chu, "World Change and Military Operations Research: The View from OSD," *Phalanx* 24, no. 3 (September 1991): 10.

[18] E. B. Vandiver III, "Letter of Greeting to Attendees at AORS XXXVI," in U.S. Army Concepts Analysis Agency, *Final Proceedings of the Thirty-Sixth Annual US Army Operations Research Symposium (AORS XXXVI), Fort Lee, Virginia, 12–14 November 1997, Volume I* (Bethesda, Md.: USACAA, 1997).

Epilogue

As 2007 began, the greatest threat to United States and Coalition forces in Iraq—and a growing threat in Afghanistan as well—was the ubiquitous roadside bomb, or improvised explosive device (IED). From April 2003 to July 2008 more than 1,000 U.S. and Coalition soldiers, sailors, airmen, marines, and civilian contractors were killed or wounded in Iraq by IEDs.[1] Designated the "No. 1 killer of American troops in Iraq," IEDs caused nearly 90 percent of all the U.S. Army's casualties in Iraq in January 2006.[2] The number of IED attacks against Coalition and Iraqi forces and Iraqi civilians nearly doubled from 5,607 in 2004 to 10,593 in 2005, and thus offset the measures taken to defeat them.[3] As of April 2006, only 30–40 percent of the devices were being found and disarmed before exploding.[4] Most IEDs are homemade bombs assembled from artillery shells, missiles, or other explosives with a variety of detonating devices, including pressure switches, timers, infrared beams, cell phones, and even garage-door openers.[5] IEDs are cheap, easy to make, and deadly. Recently, Coalition forces have encountered more sophisticated, shaped-charge devices filled with high-quality explosives, probably supplied to Iraqi Shiite militias by the Iranian government.[6]

In an effort to deal with the growing problem of IEDs in Iraq, in October 2003, the Army established a twelve-person organization dedicated to finding ways to defeat IEDs.[7] In July 2004, the Army anti-IED unit was absorbed by the Joint Improvised Explosive Device Defeat Task Force (JIEDD-TF), organized by the deputy secretary of defense.[8] Since then, the DOD budget aimed at defeating IEDs has grown from some $600 million in 2004 to $1.2 billion in 2005 and then to $3.5 billion in 2006.[9]

On 5 December 2005, Secretary of Defense Donald H. Rumsfeld appointed retired Army General Montgomery C. Meigs to head the JIEDD-TF, effective 12 December 2005.[10] General Meigs replaced Brig. Gen. Joseph Votel, who had commanded the JIEDD-TF from its inception in 2003. An engineer—like his distinguished ancestor of the same name, who served as quartermaster general of the Union Army during the Civil War—General Meigs is a graduate of the United States Military Academy. He served in Vietnam and rose to four-star rank and command of the United States Army, Europe, from October 1998 to December 2002 prior to his retirement from active duty in January 2003.

The appointment of General Meigs coincided with the decision to significantly increase DOD's counter-IED efforts, including the establishment of a "center of excellence" at the National Training Center at Fort Irwin, California, to train selected service personnel in defeating IEDs prior to their deployment to Iraq and Afghanistan.[11] In a further move to bolster the effort to find a solution to the IED problem, DOD announced on 14 February 2006 that the JIEDD-TF was to be reorganized and renamed the Joint Improvised Explosive Device Defeat Organization (JIEDDO).[12] DOD Directive 2000.19E restated the mission, responsibilities, functions, relationships, and authorities prescribed by DOD Directive 2000.19, dated 27 June 2005; made the secretary of the Army the DOD executive agent for JIEDDO; and established a number of related JIEDD committees and boards to coordinate and supplement the effort.

To date, the DOD counter-IED campaign has focused on improving training and developing new technology to defeat IEDs. The technological effort in 2006 involved some eighty contractors working on some one hundred initiatives to counter the insidious devices.[13] Improved vehicle armor, detection devices, jamming devices, and other technological solutions have been or are being tried. Although American military and civilian leaders are generally enthralled by technological solutions to problems, one officer responsible for helping to defeat IEDs, Brig. Gen. R. Mark Brown, the deputy commanding general for system integration of the Army Research, Development, and Engineering Command at Fort Belvoir, Virginia, has estimated that "technology is only 10 to 20 percent of the solution."[14] In announcing the appointment of General Meigs to head the JIEDDO, Secretary Rumsfeld alluded to the nontechnological aspects of the problem when he stated: "The challenge we face from IED's is in part technological, but goes beyond that to encompass the manner in which our forces operate, their tactics and their procedures."[15]

It is perhaps not coincidental that General Meigs is the author of a book, based on his University of Wisconsin doctoral dissertation, titled *Slide Rules and Submarines: American Scientists and Subsurface Warfare in World War II*, which examines in detail the effort of Allied scientists and operations researchers to find a solution to the serious threat to Allied shipping posed by German U-boats in the Atlantic.[16] Between September 1939 and mid-1943, German submarines constituted perhaps the most serious threat to the Allied war effort, nearly strangling the movement of critical supplies by sea from Canada and the United States to England. But by the late summer of 1943, the Battle of the Atlantic had been won by the Allies, based in large part on the contribution of British and American operations research analysts. Slowly, through a combination of code breaking, new technology (such as the escort carrier and better radar and sonar devices), and convoy defense procedures developed through the use of the new science of operations research, Allied scientists, engineers, and operations research analysts found solutions to the challenges of searching for and attacking enemy submarines, organizing and protecting convoys, enhancing the operating capabilities of U.S. and Allied equipment, and developing countermeasures for German submarine radar and acoustic torpedoes.[17]

Often cited as "the classic operations research problem," the World War II U-boat threat is analogous to the threat posed by IEDs to Coalition and indigenous forces in Iraq and Afghanistan.[18] Both threats have caused immeasurable loss of life and materiel and have disrupted operations to a significant degree, and both have certain common characteristics, among which are their unpredictability as to time, location, and intensity; their tendency to evolve over time in response to countermeasures; and their susceptibility to intelligence and operational improvements as well as technological solutions.

The JIEDD-TF and its successor, the JIEDDO, have naturally focused on technological and training solutions to the IED problem. But there is also considerable effort being devoted to finding an operations research solution to the threat, and the JIEDDO includes a number of ORSA analysts from the Army, the other services, and other government agencies. Thus, military operations research has come full circle, back to a focus on immediate operational problems. Whether or not these latter-day "OP Annies" will be as successful in their search for a solution to the threat of IEDs as their World War II–era counterparts were in helping to eliminate the U-boat menace remains to be seen, but it is an end eagerly desired.

Epilogue Notes

1 Jim Garamone, "No Silver Bullet to Counter Explosive Devices, Head of Anti-IED Office Says," *American Forces Information Service News Articles* (Washington, D.C.: American Forces Information Service, 7 September 2006), at http://www.globalsecurity.org/military/library/news/2006/09/mil-060907-afps03.htm (accessed 8 December 2006). As of the beginning of May 2006, 823 Coalition deaths were directly attributed to IEDs (see Michael Goldfarb, "Improvised Explosive Disaster: An inside look at the Pentagon's inadequate response to the IED threat in Iraq," *Weekly Standard*, 3 May 2006, at http://www.findarticles.com/p/articles/ mil_m0RMQ/ is_2006_May_3/ai_n16359773 (accessed 8 December 2006).

2 Eric Schmitt, "Pentagon Widens Program to Foil Bombings in Iraq," *New York Times*, 6 February 2006, at http://www.nytimes.com/2006/02/06/politics/06military.html (accessed 8 December 2006).

3 Ibid.; Goldfarb, "Improvised Explosive Disaster."

4 U.S. Department of the Army, "Joint Improvised Explosive Device Defeat Organization-April 11 2006," *Stand-To!* 11 April 2006, at http://lists.army.mil/pipermail/stand-to/2006/April/000051.html (accessed 8 December 2006).

5 Schmitt, "Pentagon Widens Program to Foil Bombings in Iraq."

6 Ibid.

7 U.S. Department of Defense, Office of the Assistant Secretary of Defense (Public Affairs), *News Release No. 1260–05: Rumsfeld Appoints Retired Four-Star to Lead IED Effort* (Washington, D.C.: Office of the Assistant Secretary of Defense [Public Affairs], U.S. Department of

Defense, 5 December 2005), at http:www.defenselink.mil/releases/2005/nr20051205-5186.html (accessed 8 December 2006).

[8] Ibid.

[9] Schmitt, "Pentagon Widens Program to Foil Bombings in Iraq."

[10] DOD News Release No. 1260–05. General Meigs actually assumed command of the JIEDD-TF on 16 December 2005.

[11] Ibid.

[12] U.S. Department of Defense, *DoD Directive 2000.19E: Joint Improvised Explosive Device Defeat Organization (JIEDDO)* (Washington, D.C.: U.S. Department of Defense, 14 February 2006), "Summary," at http://www.dtic.mil/whs/directives/corres.html/200019.htm (accessed 8 December 2006).

[13] Schmitt, "Pentagon Widens Program to Foil Bombings in Iraq."

[14] Stew Magnuson, "Improvised Explosive Threat Reaches Global Scale," *National Defense*, July 2006, at http://www.nationaldefensemagazine.org/issues/2006/july/ImprovisedExplosive.htm (accessed 8 December 2006).

[15] DOD News Release No. 1260–05.

[16] Montgomery C. Meigs, *Slide Rules and Submarines: American Scientists and Subsurface Warfare in World War II* (Washington, D.C.: National Defense University Press, 1990).

[17] See, inter alia, Keith R. Tidman, *The Operations Evaluation Group: A History of Naval Operations Analysis* (Annapolis, Md.: Naval Institute Press, 1984), pp. 61–71; and Meigs, *Slide Rules and Submarines*, passim.

[18] General Meigs has certainly recognized the analogy (see Garamone, "No Silver Bullet to Counter Explosive Devices").

APPENDIX A

Army Operations Research Symposia, 1962–2007

The use of operations research spread rapidly throughout the Army research and development establishment during the 1950s. This growing interest led to a series of occasional conferences sponsored by the Army Ordnance Corps. Meetings were held at Rock Island Arsenal (Illinois), Redstone Arsenal (Alabama), and other venues. At the end of the conference at Redstone Arsenal in 1961, the participants adopted the suggestion of Lt. Col. Griff Callahan, who was then the executive officer to the commander of the Army Research Office (ARO), that the Army's chief of research and development sponsor the conferences and that the logical venue would be the Army Research Office on the campus of Duke University in Durham, North Carolina.

The first Army Operations Research Symposium (AORS) was held at the end of March 1962 at the ARO facility in Durham. There were two days of presentations and discussions, all held in a plenary format. After extensive discussion, at the end of the symposium the participants agreed that there was probably enough material to hold one more such conference. Thus, AORS II was held the following year (1963) with the same timing, format, and venue. The participants at AORS II concluded that AORS should become an annual event, which it did indeed become.

For the next three years—1964, 1965, and 1966—the symposium was held at different venues (Rock Island Arsenal, Redstone Arsenal, and Fort Monmouth, respectively) and was sponsored by different commands, but in 1967 it was again held under ARO auspices at Duke University, where it remained until 1973. That year saw two major changes. First, sponsorship of AORS passed from the Army's Chief of Research and Development to the Office of the Assistant Chief of Staff for Force Development, who moved the date of the symposium to the autumn. The change in official sponsorship reflected recognition of the growing belief that operations research was a discipline that supported every function in the Army and was no longer focused just on the research and development function.

The second change was that the 1973 AORS was the last one held at ARO on the campus of Duke University. In the antiwar fervor following the Vietnam War, Duke University administrators refused to allow ARO to remain in the campus facility it had occupied for so many years. A new AORS venue was needed because ARO was moving to a temporary facility completely unsuitable for hosting a large and complex symposium.

In 1974, two changes occurred which established AORS as the professional event that it has been ever since. The first of these involved sponsorship of the meeting. While Headquarters, Department of the Army (HQDA) sponsorship of AORS shifted with the periodic reorganizations of the headquarters, the actual conduct of the meeting was delegated on a rotating basis to one of three major organizations: HQDA itself and then delegated to either the supporting analysis agency, Concepts Analysis Agency (CAA), or the operational test agency, originally the Operational Test and Evaluation Agency (OTEA); the U.S. Army Training and Doctrine Command

(TRADOC); or the U.S. Army Material Command (AMC). That practice has continued down to the present.

The other change resulted in a permanent venue for AORS. The Army Logistics Management College (ALMC) at Fort Lee, Virginia, hosted the symposium in the fall of 1974, and has been the venue for all subsequent AORS. ALMC has an academic department that teaches operations research, the kind of facilities needed to host a meeting of this kind, and the capability to support either classified or unclassified meetings.

The Army Operations Research Symposium held in November 2007 was the forty-fifth and represented a significant accomplishment of continuity despite changing sponsorship, formats, timing, and venue. Symposiums today retain the essence of that first symposium held so long ago by bringing together Army practitioners of operations research to share their experience and knowledge. Table A–1 lists the dates, themes, and agency sponsors of the Army Operations Research Symposia.

AORS I (1962), AORS II (1963), and AORS VI through AORS XI (1967–1972) were held in Durham, North Carolina. AORS III (1964) was held at Rock Island, Illinois; AORS IV (1965) was held at Redstone Arsenal, Alabama; and AORS V (1966) was held at Fort Monmouth, New Jersey. AORS XII (1973) was held in Washington, D.C. Since AORS XIII (1974), AORS has been held at Fort Lee, Virginia.

The published proceedings of early AORS (1962–1973) do not generally list the "theme" of the symposium outright. For example, the proceedings for AORS III (1964) contain a symposium critique by Dr. Robert Thrall that strongly suggests that "special warfare" was the major theme of AORS III. Proceedings of later AORS often refer to the theme by way of the sponsor's preface or a slogan on the cover. The published proceedings for some AORS are very rare. For example, the proceedings for AORS XXXIII (1994), AORS XXXIV (1995), AORS XXXVII (1998), AORS XL (2001), and AORS XLII through AORS XLV (2003–2006) are neither in the Center for Army Analysis Research Center nor the Defense Technical Information Center.

From the beginning, AORS sponsors, hosts, and planners have emphasized six objectives to be achieved by every symposium:

1. Emphasizing the role of operations research in the improvement of military operations.
2. Acquainting key personnel of the Army with the Army's operations research projects and in-house capabilities.
3. Providing a forum for presentation and discussion of Army problems amenable to solution through operations research.
4. Informing Army operations analysts of new technological developments in operations research.
5. Increasing the applicability of results obtained in operations research studies.
6. Affording Army Operations analysts an opportunity to become acquainted with the colleagues and with nationally known leaders in operations research.

Table A–1—Army Operations Research Symposia, 1962–2007

AORS No.	*Date*	*Theme*	*Sponsor*
I	27–29 Mar 1962	Improving Operations Research in the Army	OCRD, HQDA
II	26–28 Mar 1963	No Announced Theme	OCRD, HQDA
III	25–27 May 1964	Special Warfare	OCRD, HQDA
IV	30 Mar–1 Apr 1965	Cost Effectiveness	OCRD, HQDA
V	29–30 Mar 1966	Life Cycle Management of Materiel	OCRD, HQDA
VI	24–26 May 1967	Operations Research in Counterinsurgency	OCRD, HQDA
VII	22–24 May 1968	Army Force Planning and OR	OCRD, HQDA
VIII	21–23 May 1969	Data Collection	OCRD, HQDA
IX	20–22 May 1970	Simulation	OCRD, HQDA
X	26–28 May 1971	The Next Decade	OCRD, HQDA
XI	15–18 May 1972	Risk Analysis	OCRD, HQDA
XII	3–5 Oct 1973	No Announced Theme	OACSFOR, HQDA
XIII	29 Oct–1 Nov 1974	The Impact of ORSA on the Army	CAA
XIV	17–20 Nov 1975	Operations Research—Applications to Real Army Problems	AMSAA
XV	26–29 Oct 1976	The Complexity Crisis and How to Avoid It	TRASANA
XVI	12–14 Oct 1977	Operations Research Support to the Army of the 80's	OTEA
XVII	6–9 Nov 1978	Readiness—The Key to a Credible Combat Capability	AMSAA
XVIII	13–16 Nov 1979	Army Priority Problem Areas	TRASANA
XIX	14–17 Oct 1980	Interaction With External Agencies	CAA
XX	5–8 Oct 1981	Army OR—Supporting the Process of Rational Choice for the Army Today and Tomorrow	AMSAA
XXI	6–7 Oct 1982	AirLand Battle 2000	CAORA
XXII	3–5 Oct 1983	Integration of Modeling and Simulation with Testing to Efficiently Resource the Acquisition Process	OTEA
XXIII	2–4 Oct 1984	Excellence in Army Analysis	AMSAA
XXIV	8–10 Oct 1985	Army Analysis of the Future	TRASANA
XXV	8–9 Oct 1986	Joint Aspects of Army Operations Research	CAA
XXVI	13–15 Oct 1987	Army Analysis Lighting the Way	AMSAA
XXVII	11–13 Oct 1988	Analysis in Support of Army Decisions	TRAC-FLVN
XXVIII	10–12 Oct 1989	Maximizing Army Effectiveness	OTEA
XXIX	9–11 Oct 1990	Analysis: Meeting Changing Requirements and New Challenges (Cancelled due to Desert Shield/Desert Storm)	AMSAA
XXX	12–14 Nov 1991	Army Analysis: The New Realities	TRAC-LEE
XXXI	16–18 Nov 1992	Analysis in Support of a Rapidly Changing Strategic Environment	CAA
XXXII	12–14 Oct 1993	The Expanding Role of Modeling and Simulation in Military Operations Research	AMSAA
XXXIII	7–9 Nov 1994	Analytical Relevance Through Change	TRAC-WSMR
XXXIV	10–12 Oct 1995	Force XXI: Changing the Way We Change	OPTEC
XXXV	12–14 Nov 1996	Responsive, Relevant, Real World Analysis	AMSAA
XXXVI	12–14 Nov 1997	Building an Analytical Bridge to the 21st Century	CAA
XXXVII	12–13 Oct 1998	Discovery Through Operations Research	TRAC-FLVN
XXXVIII	18–20 Oct 1999	Reshaping Army Operations Research for the 21st Century Operational Challenge	AMSAA*

Table A–1—Army Operations Research Symposia, 1962–2007—continued

AORS No.	*Date*	*Theme*	*Sponsor*
XXXIX	10–12 Oct 2000	Shaping the Transformation Force	ATEC
XL	9–11 Oct 2001	Meeting Millennium Challenges Through Analysis	TRAC-LEE
XLI	15–17 Oct 2002	Analysis in Support of the Global War on Terror (GWOT)	CAA
XLII	14–16 Oct 2003	Army Analysis—Supporting the Objective Force	AMSAA
XLIII	19–21 Oct 2004	Operations Research to Support an Army at War	AEC
XLIV	11–13 Oct 2005	The Future Ain't What It Used to Be	TRAC
XLV	7–9 Nov 2006	Meeting the Challenges of Traditional, Irregular, Catastrophic, and Disruptive Warfare	CAA
XLVI	13–15 Nov 2007	Operations Research—Meeting the Challenges of the Warfighter	AMSAA

Note: I am most indebted to Michael F. Bauman and E. B. Vandiver III for additions and corrections to this table.
* Indicates a change in the sponsor rotation policy.

APPENDIX B

Extract from Final Report—Review of Army Analysis, Volume I: Main Report, *Chapter 15*

The following item is a verbatim reproduction of Chapter 15 ("Proposed Actions") of United States Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: United States Department of the Army Special Study Group, April 1979).

Chapter 15
Proposed Actions

15-1. INTRODUCTION. This chapter presents a summary of actions proposed as a result of the study.

15-2. ARMY STUDY PROGRAM AND STUDY SYSTEM. a. Establish an Army Study Council to review and approve study guidance and programs. Council should be chaired by VCSA and be composed of HQDA principals, TRADOC and DARCOM commanders, and representatives of other MACOM.

b. Establish a Study Program Allocation Committee to review and balance programs and recommend to Army Study Council. The committee should be chaired by Director of Management (OCSA) with appropriate HQDA and MACOM representation.

c. Expand the mission and resources of the current Study Management Office (SMO) to form a Study Program Management Office (SPMO).

(1) Increase the office size to 6 to 10 professionals from the present 3. The office should have a super grade chief reporting to the Director of Management.

(2) SPMO should executive all current SMO functions plus assist in development of guidance, serve as secretariat for Study Council and Program Allocation Committee, and serve as functional program manager.

d. Require the budget process to capture study data on-line. Eliminate program elements for HQDA and TRADOC studies and include these funds in budgets of operating agencies. Revise AR 5–5 to align definition of studies with OSD and Congressional requirements.

15-3. STUDIES OF FORCES AND CERTAIN FORCE-WIDE ISSUES. a. Define integrated family of strategic and force level studies and the interface with combat developments studies. Require that the studies be performed and the results provided in form suitable for use in a hierarchy of studies using a heirarchy [*sic*] of models.

b. Increase CAA capability to analyze all aspects of forces (e.g., operations, structure, logistics, manpower, personnel) and to support all elements of HQDA, especially in conducting analysis of Army-wide manpower and personnel issues. Add personnel and contract resources to CAA. Assign Commander, CAA, to Director of Army Staff. Provide HQDA principals a "line-of-credit" to CAA capability.

15-4. STUDIES OF COMBINED ARMS AND SUPPORT ORGANIZATIONS—BRIGADES, DIVISIONS, AND CORPS. a. Increase analytical spaces at CACDA to about 150 professionals. The Study Group recommends these be concentrated in a TRASANA field office in direct support to CACDA.

b. Initiate development of techniques suitable to analyze the design of alternative brigades, divisions, and corps.

c. Establish actual interface of CACDA with TRADOC centers and schools, TRASANA, and CAA. This is essential to provide the linkages necessary to mission accomplishment of these agencies.

d. Require development and use of major organization models be coordinated with hierarchy of Army models. Require that command group training simulations be part of the hierarchy.

15-5. STUDIES OF FUNCTIONAL SYSTEMS, UNITS, AND REQUIREMENTS FOR ITEM SYSTEMS. a. Fill the SC 49 authorized positions in TRADOC schools and centers with qualified SC 49 officers. Plans should be developed for improving the quantity and utilization of SC 49 officers.

b. Place more emphasis on analysis of the control functional area.

c. Establish a continuing study program in each functional area to underpin item level system requirements.

d. Increase the portion of TRADOC analysis resources that are applied to analyses of training. Reduce effort on COEA.

e. Require development and use of models of functional systems to be coordinated with Army hierarchy of models.

15-6. STUDIES OF ITEM LEVEL SYSTEMS. a. TRADOC should describe and define a full set of conditions of usage, incorporate them into requirements documents. HQDA should incorporate into DCPs [Decision Coordinating Papers] as they are updated.

b. DARCOM should develop data regarding the performance of systems under the real conditions of usage.

c. DARCOM, especially AMSAA, should develop capability to develop data regarding performance of C^3I systems under expected conditions of usage.

d. DARCOM should monitor efficiency of ongoing efforts to remedy problems in developing vulnerability data and take appropriate action.

e. DARCOM should develop data regarding the manpower/personnel ramifications of item systems.

15-7. MODELS, DATA, AND DATA BASES. a. TRADOC should continue efforts to produce statements of requirements which fully characterize the conditions of use of systems.

b. Require that threat trends be analyzed to project threat systems characteristics and performance.

c. Require the assessment of system capabilities/limitations, vulnerability, and lethality to be made over the full range of conditions of use.

d. A hierarchy of Army models and supporting integrated data bases should be developed as follows:

(1) On an interim basis, establish:

(a) An Army Model Committee with a draft statement of purpose and objectives.

(b) Model Resource Groups at CAA, CACDA, TRASANA, and AMSAA.

(2) Begin a series of meetings to establish the structure and interfaces of an hierarchical set of models.

(3) Draft an Army model management instrument which formally establishes and defines the authority and responsibilities of:

(a) The Army Model Committee.

(b) The Model Resources Groups (for each level of analysis).

(c) The Data Base Management Group.

e. Maintain and improve the current models until replaced.

f. Support the ongoing combined computer procurement action aimed at placing compatible, large, state-of-the-art mainframes at CAA, TRASANA, and CACDA by 1980, study the feasibility of internetting the DPIs at the earliest practicable date, and assess feasibility of including AMSAA in any internetting arrangement.

15-8. PERSONNEL QUALIFICATIONS. a. When staff vacancies occur, analysis agencies should seek first-rate candidates having relevant advanced degrees, and strong efforts should be made to insure proper balance of skills within each agency.

b. Each analysis organization should encourage each member of its professional staff to continue to grow and maintain currency of knowledge. To the extent permitted by policies and fund availability, agencies should assist the staffs by helping with costs of continuing education.

c. Each of the analysis organizations being staffed by professionals has a high potential for and should explore "bootstrap" practices which can be very beneficial to members of its analysis staff. Internal courses, seminars, colloquia, and invited guest speaker programs are but a few of the possibilities.

d. Each analytical organization should participate in an intern program either by support of a local program or, in the case of smaller activities, by cooperative programs with larger organizations such as TRASANA and AMSAA which do train interns.

15-9. QUALITY ASSURANCE. a. Agencies and MACOM should insure that programs are partly self-initiated (at least 10 percent) and provide adequate resources (at least 15 percent of program) for methodology development.

b. Assure that agency/activity label is affixed to study reports and that principal authors and significant contributors are identified by name on the reports.

c. Continue (or initiate) prepublication internal peer review.

d. Institute program of sampled, external peer review. SPMO should administer.

e. Institute measures for study sponsor to feed back to study doer information on strengths, weaknesses, utility of study products.

f. Each major analytical organization should make use of a distinguished Board of Visitors, with members from both within and outside the Army to periodically review its work program and operations.

g. Hold periodic conferences of the senior members of the Army analytical community to identify problems within the community and suggest corrective action.

h. Orient the Army Operations Research Symposium so as to foster communication, exchange studies, and, especially, recognize work of high quality.

15-10. USE OF OPERATIONS RESEARCH IN OPERATIONAL COMMANDS. Initiate discussions with all interested parties with the goal of establishing an analytical activity in USAREUR in general accordance with the conceptual scheme by end FY 79.

APPENDIX C

Extract from Final Report—Review of Army Analysis, Volume I: Main Report, *Chapter 4*

The Review of Army Analysis (RAA) study group collected the perceptions of about one hundred individuals in the Office of the Secretary of Defense, the Army, the other services, and industry regarding the strengths and weaknesses of the Army analytical community around 1978–1979. The following item is a verbatim excerpt from Chapter 4 ("Perceived Strengths and Weaknesses of the Army Studies and Analysis Community") of United States Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume I: Main Report* (Washington, D.C.: United States Department of the Army Special Study Group, April 1979). Both the strengths and weaknesses of the Army analytical community were discussed in greater depth in United States Department of the Army Special Study Group, *Final Report—Review of Army Analysis, Volume II: Appendices C–M* (Washington, D.C.: United States Department of the Army Special Study Group, April 1979), Appendix C (Perceptions). The perceived strengths of the Army analytical community fell into three main categories and the perceived weaknesses were listed in seven categories.

(1) *Perceived Institutional Strengths*
- (a) Continuity of commitment including resources.
- (b) Size/maturity of in-house study organizations.
- (c) Decentralization of initiatives.
- (d) Balance of user/developer interest.
- (e) Growing capability to anticipate, not just react.

(2) *Perceived Personnel Strengths*
- (a) Integrity.
- (b) Enthusiasm.
- (c) High quality of military OR analysts.
- (d) Sheer capacity and willingness to work.
- (e) Willingness to tackle tough problems.

(3) *Perceived Community Strengths*
- (a) Availability of data bases.
- (b) Spirit of openness.
- (c) "Character" of institutions.
- (d) Communications within the community.
- (e) Access to experimentation.
- (f) Versatility—width of experiences.
- (g) Inventory of evaluation models.
- (h) Respect for counter-example.

*****

(1) *Perceived Program Formulation/Presentation Weaknesses*
- (a) No way to know whether the right problems are being studied.
- (b) Study program fragmented, not orchestrated.
- (c) Study program has little central guidance.
- (d) Study program poorly presented to Research and Development Advisory

Committee (RDAC), Office of the Secretary of Defense (OSD), Congress.

(2) *Perceived Management Weaknesses*
- (a) Army corporate level needs direct access to first-rate think house.
- (b) ARI [Army Research Institute] mal-attached to DCSPER.
- (c) Contractual process prohibitive.
- (d) Interfaces between study agencies ill-established.

(3) *Perceived Lack of Emphasis on and Lack of Capabilities for*
- (a) Requirements analysis.
- (b) Logistic sustainability studies.
- (c) Maintenance concepts.
- (d) Personnel studies.
- (e) Implications of women in the Army.
- (f) Cost or benefits of Enhancement of Life in Europe (ELIFE) program.
- (g) True cost of civilian manpower.
- (h) Effects of variation in compensation.
- (i) Training research—cost or effectiveness of training alternatives.
- (j) Implications of changing rotation base.
- (k) Base structure implications.
- (l) Force planning.

(4) *Perceived Analysis Methodology Weaknesses*
- (a) Takes too long—reports too thick.
- (b) Uses overly complex—opaque—tools.
- (c) Tries to simulate too much.
- (d) Too little use of history and field test results.
- (e) Modelers work beyond competency.
- (f) Model anarchy.
- (g) Oversearch for materiel solutions.
- (h) Use of scores such as weapons effectiveness indicators/weighted unit values (WEI/WUV) mislead.
- (i) Biases – Countermeasures not analyzed enough.
  - Too high estimate of dollars.
  - Cost too low; time too short.
- (j) Fixation on Fulda area in scenarios.
- (k) Inadequate sensitivity.

(5) *Perceived Staffing Weaknesses*
- (a) Civilian staffs at certain agencies not first rate.
- (b) Analyst quality program weak.
- (c) Aging of analysts.

(6) *Perceived Study Product Quality Control Weaknesses*
- (a) In-house work below better contractor work.
- (b) Inconsistent assumptions—study to study.
- (c) Threat tailoring.
- (d) Suppressed alternatives.
- (e) Overly driven by doctrinaire military assumptions.
- (f) Fails to show out-year affordability problems.
- (g) Lack of objectivity in staff studies.
- (h) Lack of "peer review."
- (i) Lack of standards for study product quality.

(7) *Other Perceived Weaknesses*
- (a) Analysis capability at TRADOC schools and centers below needs.
- (b) Division-level tradeoffs among branch systems weak-to-negligible.
- (d) Force level analysis too narrow and not adequately inclusive.*
- (e) Too little use of contractors vice in-house.
- (f) Vulnerability data—late and incomplete.

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*N.B.: Item (c) omitted in original

APPENDIX D

Illustrative TRADOC Branch School ORSA Cell Analyses, Produced by the U.S. Army Field Artillery Center, 1973–1995

Between 1973 and 1995, the ORSA cells of the U.S. Army Training and Doctrine Command (TRADOC) branch schools produced a diverse body of studies and analyses to identify mission needs, establish new requirements, explore and mature operational and organizational concepts, assess force design and force structure, enable trade-offs, evaluate training, and determine the cost-effectiveness of alternative options, often revisiting programs as they progressed through the acquisition decision processes. While Fort Sill's ORSA cell was more prolific than most, their body of work is characteristic of that produced by TRADOC's other branch school ORSA cells. The work produced by the Fort Sill ORSA cell included:

1. ***Legal Mix IV*, 1973:** Fourth of a series of in-depth functional analyses (originally named Redleg studies) that reexamined field artillery structure and systems, especially target acquisition, and influenced the nuclear and non-nuclear-weapon system mix for Europe.
2. ***General Support Rocket System (GSRS) COEA*, 1974:** Underpinned the program that resulted in the development and fielding of the multiple-launch rocket system (MLRS).
3. ***Legal Mix V*, 1976:** Evaluated the mix of fire support systems, weapons, and target acquisition that resulted in the force structure strategy for the European theater and changed the design of cannon batteries from six guns to eight.
4. ***Fire Support Mission Area Analysis*, 1982:** Examined the complete fire mission area to determine battlefield deficiencies for fire support platforms, munitions, target acquisition, and command, control and communications.
5. ***Direct Support Weapon System (COEA)*, 1983:** Supported the program decision to develop a new fire support cannon system for direct support, paving the way for the Advanced Family of Armored Systems–Cannon (AFAS-C), which later became Crusader.
6. ***Field Artillery Ammunition Requirements Study*, 1983:** Developed the requirements for a more robust mix of munitions for existing field artillery systems and led to munitions-centered *vice* platform-centered analyses thereafter.
7. ***Legal Mix VI*, 1984:** Assessed extensive changes in fire support to advance artillery-delivered smart munitions, i.e., Sense and Destroy Armor (SADARM), and to transition the general support (GS) system from the M110 cannon to the MLRS.
8. ***SADARM Requirements Analyses and COEAs*, 1984, 1986, and 1991–1995**: Underpinned requirements definition; supported the program decisions to begin low-rate and then full-rate production and to transition SADARM from MLRS/8-inch to 155-mm. cannon munitions; and validated its product-improvement program.

9. ***Fire Support Modernization Plan,* 1986**: Extensively studied and analytically underpinned the modernization of the Field Artillery which influenced combat developments throughout the 1990s.
10. ***Remotely Piloted Vehicle COEA,* 1987**: Supported the program decision for remotely piloted vehicles, resulting in the fielding of the AQUILA, the first field artillery unmanned aerial system.
11. ***Firefinder Block III COEA,* 1988**: Supported the program decision to develop and field an advanced counter-battery/counter-mortar tactical radar system.
12. ***Howitzer Improvement Program (HIP) Analyses and COEA,* 1988 and 1989**: Supported the need for the HIP howitzer (also known as the M109A6 Paladin) and the program decision to enter limited and then full-rate production.
13. ***Advanced Field Artillery Tactical Data System (AFATDS) COEAs,* 1989 and 1995**: Underpinned the requirements definition, system development, and then the full rate production decision that fielded the next generation command and control system for the field artillery.
14. ***Field Artillery Accuracy Improvement Analysis (FAAIA),* 1990**: As the first comprehensive operations analysis of the accuracy of field artillery systems and munitions, laid the foundation for advancing the accuracy of cannons (projectile tracking system and GPS fuzing) and rockets.
15. ***Legal Mix VII,* 1991**: Reexamined field artillery force structure in light of emerging technologies, changing threat environment, and Army downsizing and validated established and new requirements.
16. ***High Mobility Artillery Rocket System (HIMARS) Analysis,* 1991**: Established the cost and operational effectiveness of a wheeled (*vice* tracked) multiple-rocket launcher.
17. ***Paladin Force Structure Trade-off Analysis,* 1993**: Established for first time the quantities and organization of the M109A6 Paladin batteries and battalions and reaffirmed the 3x8 battery configuration.
18. ***Advanced Family of Armored Systems – Cannon/Field Artillery Rearm Vehicle (AFAS-C/FARV) Requirements and Trade-Off Analyses and COEAs,* 1992–1995**: Underpinned requirements definition and trade-offs and supported the program decisions to continue AFAS-C, which later became Crusader.
19. ***Army TACMS Block-II COEA,* 1994**: Supported its program decision to enter low-rate initial production.
20. ***Bradley Fire Support Team (BFIST) Vehicle COEA,* 1995**: Examined the BFIST basis of issue to support maneuver forces and its required target location error (TLE) to support a program decision to field the system. The TLE results have influenced most, if not all, ground-based acquisition systems except radars.
21. ***Modular Artillery Charge System (MACS) Study,* 1995**: Instrumental in the development of MACS as a replacement for bag powder charges and the transition of Crusader and now Non-Line of Sight Cannon (NLOS-C) from a liquid propellant to MACS, the primary charging system for cannons for the foreseeable future.
22. ***Advanced Towed Cannon Artillery System (ATCAS) JCOEA,* 1995**: As a joint study with the U.S. Marine Corps, supported a joint program decision and validated the operational value added of a new lightweight towed cannon system for the Marine Corps and light Army forces to replace the M198 howitzer. ATCAS became the M777 towed howitzer in the field today.
23. ***Legal Mix VIII,* 1995–1996**: Focused on mixes of systems and munitions for light forces, specifically precision and smart munitions for 105-mm. howitzers, as well as various options for direct support using 120-mm. mortar to an ultra-lightweight 155-mm. howitzer, and underpinned the decision to retain the 105-mm. howitzer as the direct support artillery weapon system and validated the need for additional munitions.
24. ***"3x6" Versus "3x8" Cannon Study,* 1995–1996**: By direction of the Chief of Staff of the Army, examined the feasibility of changing cannon batteries from eight guns to six and supported the six-gun option if emerging enablers are fielded. Crusader was later cancelled, and SADARM quantities were reduced, resulting in today's six-gun batteries for 155-mm. cannon.

APPENDIX E

Operations Research and Systems Analysis Awards 1980–2007

The Department of the Army Systems Analysis Award was originally established by the Secretary of the Army in 1980 to acknowledge excellence in Army operations research and system analysis. Beginning with the Nineteenth Army Operations Research Symposium (AORS XIX) in 1980, the award was presented each year at AORS in two categories: Best Individual Analysis and Best Group Analysis. At the urging of the Deputy Under Secretary of the Army for Operations Research Walter W. Hollis, Secretary of the Army John O. Marsh Jr. changed the name of the award in 1991 to honor Dr. Wilbur B. Payne, the first Deputy Under Secretary of the Army for Operations Research and one of the Army's most outstanding ORSA analysts and managers. The Wilbur B. Payne Memorial Award for Excellence in Analysis has been presented at AORS each year since 1991 in three categories. One acknowledges the best individual or small group analysis done during the previous year; one acknowledges the best group or large group analysis done during the same period; and one acknowledges exceptional analysis that falls into a special category, such as work undertaken by a cartel of Army analytical agencies.

Table E–1 lists the project title and institutional sponsor of award-winning individual and group analyses from AORS XIX in 1980 to AORS XXIX in 1990. Table E–2 lists the same information for the annual winners in the three categories of the Wilbur B. Payne Memorial Award for Excellence in Analysis from AORS XXX in 1991 through AORS XLVI in 2007. It has proven impossible to obtain some of the necessary information in the time available, and it has not been possible at this time to supply the names of the individual award winners or of the members of the group awards. The titles of the various award-winning analyses give a fair idea of the breadth and depth of the best Army analysis.

Table E–1—Department of the Army Systems Analysis Award, 1980–1990

AORS No.	*Year*	*Individual Award (Sponsor and Title)*	*Group Award (Sponsor and Title)*
XIX	1980	ARRCOM, "Ammunition Distribution System"	None
XX	1981	AIRO, "SESAME"	OTEA, "FIREFINDER Artillery Locating Radar Study"
XXI	1982	CAA, "Unit Replacement System Analysis (URSA II)"	None
XXII	1983	CAA, "Econometric Model for Optimizing Troop Dining Facility Operations"	ODCSLOG and AMSAA, "Unit Productivity—Transportation Study"
XXIII	1984	CAA, "Resource Constrained Procurement Objectives for Munitions (REPCOM) Study"	None
XXIV	1985	CAORA, "Anti-Helicopter Study"	AMSAA, CECOM, and TRADOC, "Why Three Radios Study"
XXV	1986	FSTC, "Systems Technical Capabilities Assessments of Field Artillery, Eurasian Communist Countries"	USAIC, "G-2 Workstation"
XXVI	1987	MILPERCEN, "The Impact of Joint Re-Organization on Army Officer Career Management"	AMCCOM, "A Management and Decision Tool for Ammunition Acquisition (The Ammunition Plant Job Scheduling Model)"
XXVII	1988	CAA, "PHOENIX: Developing and Evaluating Army Aviation Modernization Policies Using Mixed Integer Linear Programming"	TRAC, "Development of M1A1 Section and Platoon European Training Scenarios"
XXVIII	1989	CAA, "Updating Nuclear Effects in Theater Models"	TRAC, "Armor/Anti-Armor Master Plan Support Analysis"
XXIX	1990	AMSAA, "Economic Analysis for the M-1 Tank Inspect and Repair Only as Necessary (IRON) Program"	TRAC, "Apache Procurement Strategy Analysis"

Note: I am much indebted to Michael F. Bauman and E. B. Vandiver III for the preparation of this table.

Table E–2—Wilbur B. Payne Memorial Award for Excellence in Analysis, 1991–2007

AORS No.	*Year*	*Individual and Small Group Category (Sponsor and Title)*	*Group and Large Group Category (Sponsor and Title)*	*Special Category (Sponsor and Title)*
XXX	1991	U.S. Army Natick Research, Development, and Engineering Center, "Front End Analysis for Prepositioned War Reserve Materiel Stock Policy"	TRAC, "Forward Area Air Defense System (FAADS) Line-of-Sight (LOS-R) and Line-of-Sight Forward Heavy (LOS-F-H) Model-Test-Model (M-T-M) Study"	CAA, "Desert Storm Campaign Analysis—Five"
XXXI	1992	TRAC, "Scenario Analysis for Combat Systems"	Data Unavailable	No Award
XXXII	1993	No Award	CAA, "Renewables and Energy Efficiency Planning Study (REEP)"	No Award
XXXIII	1994	CAA, "Equitability of Treatment in Army Judicial Proceedings"	TRAC, "Early Entry Analysis: Division Ready Brigade (DRB)"	No Award
XXXIV	1995	TRAC, "Force Tailoring Tools"	TRAC, "Reserve Component (RC) Mobile Close Combat Tactical Training (M-CCTT) Training Integrated and Deployment Study"	No Award
XXXV	1996	AMSAA, "Statistical Comparison of Multi-Dimensional Distributions."	USMA, "Measuring Information Gain in Tactical Operations"	CAA, TRAC, AMSAA, TRADOC-ODCSINT and DCSCD, and MTMC, "Anti-Armor Requirements and Resource Analysis (A2R2)"
XXXVI	1997	CAA, "Statistical Analysis for Land Disposal Restrictions – Utah Group (STALDRUG)"	OPTEC, "Task Force XXI Advanced Warfighting Experiment Assessment Report"	No Award
XXXVII	1998	TRAC, "Tactical Unmanned System Integrated Report"	CAA, "Stochastic Analysis for Deployments and Excursion (SADE)"	TRAC, "Division XXI Advanced Warfighting Experiment (DWE)"
XXXVIII	1999	USMA, "Life or Death in a Second: A Bayesian Decision Model for Aggregation of Combat Identification Evidence"	TRAC and TEC, "Effects of Vegetation on Line-of-Sight (LOS) for Dismounted Infantry Operations"	No Award
XXXIX	2000	AMSAA, "Bradley Linebacker: Bradley Fire Control Computer Physics of Failure Reliability Assessment"	EPDC, "Stands-Based Movement and Aggregation Methodology in Theater-Level Simulation"	CAA, "Analysis of Strategic Responsiveness Force Alternative Study"
XL	2001	CAA, "Cargo Lifter Aerial Transport System (CATS)"	CAA, "Enabling Strategic Responsiveness (ESR)"	No Award
XLI	2002	CAA, "Planning Army Recapitalization Investment Strategies (PARIS)"	TRAC, "Interim Division Design Analysis (IDIV)"	No Award
XLII	2003	USAAC, "Army Advertising LEADs Prioritization Analysis"	AMSAA, "Characterizing Target Location Error (TLE) and the Impact on Artillery Effectiveness"	TRAC, AMSAA, CAA, CEAC, DCSDEV, USAMBL, DCSINT and TRADOC, "Future Combat Systems (FCS) Milestone B Analysis of Alternatives (AoA)" CAA, "Analysis Conducted in Support of Operation Iraqi Freedom"

Table E–2—Wilbur B. Payne Memorial Award for Excellence in Analysis, 1991–2007 (cont.)

AORS No.	*Year*	*Individual and Small Group Category (Sponsor and Title)*	*Group and Large Group Category (Sponsor and Title)*	*Special Category (Sponsor and Title)*
XLIII	2004	TRAC, "Advanced Experimental Designs for Military Simulations"	CAA, "Air Ambulance Analysis–Iraq"	No Award
XLIV	2005	ATEC, "Counter-Rockets, Artillery, and Mortars Capability and Limitations Report"	AMSAA and ARL, "Vice Chief of Staff, Army, Combat Helmet Study"	CAA, "2005 Base Realignment and Closure (BRAC) Analysis Support for the Army Basing Study" CAA, "2005 Base Realignment and Closure (BRAC) Analysis Support for the Headquarters and Support Activities, Joint Cross Service Group"
XLV	2006	CAA, "Total Afghan National Security Force Analysis"	TRAC, "Precision Munitions Mix Analysis"	No Award
XLVI	2007	TRAC, "Rapid Equipping Force Analysis Support" USMA, "Predicting Remaining Effective Life in Small Arms Weapons"	TRAC, "Army Unmanned Aircraft Systems Mix Analysis"	No Award

Note: I am much indebted to Michael F. Bauman and E. B. Vandiver III for the preparation of this table. The table was constructed from historical materials held by CAA, TRAC, AMSAA, and MORS as well as Internet resources.

Selected Abbreviations and Acronyms[1]

7th ATC	Seventh Army Training Center
AAF	Army Air Forces
AAR	After-Action Report; After-Action Review
AAR 90	Army Analysis Requirements for the Nineties (study)
ACSFOR	Assistant Chief of Staff for Force Development
ACSI	Assistant Chief of Staff for Intelligence
ADCSOPS	Assistant Deputy Chief of Staff for Operations and Plans
Admin Center	United States Army Administration Center, Fort Benjamin Harrison, Indiana
ADMINC	See Admin Center
ADMINCEN	See Admin Center
ADP/E	Automatic Data Processing/ Equipment
AEC	Army Evaluation Center/ Command
AERB	Army Education Requirements Board
AHS	Annual Historical Summary
ALARM	AirLand Research Model
ALMC	United States Army Logistics Management Center/ College
AMARC	Army Materiel Acquisition Review Committee
AMC	See USAMC; see also DARCOM
AMETA	Army Management Engineering Training Agency
AMIP	Army Model Improvement Program
AMMO	Army Model Improvement Management Office
AMORE	Analysis of Military Organizational Effectiveness (model)
AMRTF	Army Management Review Task Force
AMSAA	See USAMSAA
AMSO	Army Models and Simulation Office
AORS	Army Operations Research Symposium
APG	Aberdeen Proving Ground, Maryland
AR	Army Regulation; Annual Report
ARB	Analysis Review Board
ARCENT	United States Army, United States Central Command
ARI	Army Research Institute
ARO	Army Research Office

[1] This list of abbreviations and acronyms is highly selective. All acronyms used in the text are expanded fully at first use in each chapter. Commonly used abbreviations and acronyms, such as those for Army ranks, Army branches, months, and states, are not included here. For terms and acronyms not found here, the reader should consult United States Department of the Army, *Army Regulations No. 320–5: Dictionary of United States Army Terms* (Washington, D.C.: U.S. Government Printing Office, April 1965); or United States Joint Chiefs of Staff, Office of the Chairman, *Joint Publication 1–02: Department of Defense Dictionary of Military and Associated Terms* (Washington, D.C.: Office of the Chairman, Joint Chiefs of Staff, 23 March 1994).

ARO-D	Army Research Office, Durham, North Carolina
ASAC	Army Study Advisory Committee
ASARC	Army Systems Acquisition Review Committee
ASB	Army Science Board
ATEC	See USATEC
AVCSA	Assistant Vice Chief of Staff, Army
AWC	See USAWC
Bde	Brigade
BDM	BDM Corporation
Big Five	M1A1 Abrams tank; M2/M3 Bradley infantry fighting vehicle; AH–64 Apache attack helicopter; UH–60 Black Hawk utility helicopter; and Patriot air defense missile system. The multiple-launch rocket system is sometimes incorrectly listed instead of the UH–60 Black Hawk utility helicopter.
Big Four	The four major Army analytical organizations: AMSAA, OTEA/OPTEC/ATEC, TRAC, and CAA
Bn	Battalion
BRL	Ballistics Research Laboratories
C&GSC	See USACGSC
C2E	Continuous and Comprehensive Evaluation
C3I	Command, Control, Communications, and Intelligence
C4	Command, Control, Communications, and Computers
C4I	Command, Control, Communications, Computers, and Intelligence
CAA	See USACAA
CAC	Combined Arms Center
CACDA	Combined Arms Combat Developments Activity
CALL	Center for Army Lessons Learned
CAORA	Combined Arms Operations Research Activity
CASAA	Combined Arms Studies and Analysis Agency
CASTFOREM	Combined Arms and Support Task Force Evaluation Model
CATRADA	Combined Arms Training Development Activity
CBR	Chemical-Biological-Radiological
CBRS	Concept-Based Requirements System
CBS	Corps Battle Simulation
CD	Combat Developments
CDC	See USACDC
CDEC	See USACDEC
Cdr	Commander
CEAC	United States Army Cost and Economic Analysis Center
CEM	Concepts Evaluation Model
CENTCOM	See USCENTCOM
CFAM	Contingency Force Analysis Methodology
CFAS	Contingency Force Analysis System
CFAW	Contingency Force Analysis Wargame
CG	Commanding General
CGSC	See USACGSC
CINC	Commander in Chief
CMH	See USACMH
CNA	Center for Naval Analysis
COA	Comptroller of the Army
COE	Chief of Engineers
COEA	Cost and Operational Effectiveness Analysis
CONARC	See USCONARC
CONUS	Continental United States
COR	Contracting Officer's Representative
CORBAN	Corps Battle Analyzer
CORDIVEM	Corps Division Evaluation Model
CORG	Combat Operations Research Group

COSAGE	Combat Sample Generator
CPX	Command Post Exercise
CRD	Chief of Research and Development
C-REM	Combat Replacement Model
CSA	Chief of Staff, Army
CSM	Chief of Staff Memorandum
CSR	Chief of Staff Regulation
CY	Calendar Year
DA Pam	Department of the Army Pamphlet
DAHSUM	Department of the Army Historical Summary
DARCOM	United States Army Materiel Development and Readiness Command (see USAMC)
DAS	Director of the Army Staff; Defense Analysis Seminar
DCG-CA	Deputy Commanding General for Combined Arms
DCP	Decision Coordinating Paper
DCS-A	Deputy Chief of Staff for Analysis
DCS-CD	Deputy Chief of Staff for Combat Developments
DCS-DOC	Deputy Chief of Staff for Doctrine
DCSIM	Deputy Chief of Staff for Information Management
DCSINT	Deputy Chief of Staff for Intelligence
DCSLOG	Deputy Chief of Staff for Logistics
DCSOPS	Deputy Chief of Staff for Operations and Plans
DCSPER	Deputy Chief of Staff for Personnel
DCSRDA	Deputy Chief of Staff for Research, Development, and Acquisition
DCSRM	Deputy Chief of Staff for Resource Management
DCS-SA	Deputy Chief of Staff for Simulations and Analysis
DCS-TE	Deputy Chief of Staff for Test and Evaluation
DDRE	Director of Defense Research and Engineering
Desert Shield	U.S. Operation in Persian Gulf, August 1990–February 1991
Desert Storm	U.S. Operation in Kuwait and Iraq, February–March 1991
DF	Disposition Form
Div	Division
DM	Director of Management
DMIS	Director of Management Information Systems
DOD	Department of Defense
DSARC	Defense Systems Acquisition Review Committee
DT&E	Developmental Test and Evaluation
DUSA (OR)	Deputy Under Secretary of the Army (Operations Research)
EAC	Evaluation Analysis Center
EM	Enlisted Men (Enlisted Personnel)
ESC/G	Engineer Studies Center/Group
EUCOM	United States European Command
FA	Functional Area
FA 49	Functional Area 49: Army Officer ORSA Specialty
FASTALS	Force Analysis Simulation of Theater Administrative and Logistical Support
F-CAP	Force Closure Analysis Program
FCR	Functional Chief's Representative
FCRC	Federal Contract Research Center
FDM	Force Design Model
FDT&E	Force Development Test and Evaluation
FFRDC	Federally Funded Research and Development Center
FM	Field Manual
FOA	Field Operating Agency
FORCEM	Force Evaluation Model

FORSCOM	See USAFORSCOM
FTX	Field Training Exercise
FY	Fiscal Year
FYTP	Five Year Test Program
GAO	Government Accounting Office [now Government Accountability Office]
GOSC	General Officer Steering Committee
HEL	United States Army Human Engineering Laboratory
HMMWV	High-Mobility Multipurpose Wheeled Vehicle, or "Humvee"
HumRRO	Human Resources Research Office
Humvee	See HMMWV
IAP	Issue Assessment Process
IDA	Institute for Defense Analyses
IED	Improvised Explosive Device
ILW	Institute for Land Warfare
INSCOM	United States Army Intelligence and Security Command
IPR	In-Process Review
IRO	Inventory Research Office
JAD	Joint Analysis Directorate, Office of the Joint Chiefs of Staff
JAO	Joint Analysis Office/Directorate
JCIM	Joint Contingency Integration Model
JCS	Joint Chiefs of Staff
JESS	Joint Exercise Support System
JIEDDO	Joint Improvised Explosive Device Defeat Organization
JIEDD-TF	Joint Improvised Explosive Device Defeat Task Force
JPL	Jet Propulsion Laboratory
JSTARS	Joint Surveillance and Target Attack Radar System
JT	Joint Test
Jt	Joint
JTCG/ME	Joint Technical Coordination Group for Munitions Effectiveness
JTLS	Joint Theater Level Simulation
JUST CAUSE	U.S. Operation in Panama, December 1989–January 1990
LANTCOM	United States Atlantic Command
LCA	Logistics Control Activity
LEA	Logistics Evaluation Agency
Log Center	United States Army Logistics Center, Fort Lee, Virginia
LOGC	See Log Center
LOGCEN	See Log Center
LOI	Letter of Instruction
LSO	Logistics Studies Office
Ltr	Letter
MAA	Mission Area Analysis
MACOM	Major Command
MASSTER	Mobile Army Sensor System Test, Evaluation, and Review; Modern Army Selected Systems Test, Evaluation, and Review
MDM	Management Decision Memorandum
MICAF	Measuring the Improvement in Capability of Army Forces
MILES	Multiple Integrated Laser Engagement System
MILPERCEN	United States Army Military Personnel Center
MIS	Management Information Systems
MISMA	Army Model Improvement and Study Management Agency
MLRS	Multiple-Launch Rocket System
MMS	Management/Mission Support
MOE	Measure of Effectiveness
MORS	Military Operations Research Symposium/Society
MPA	Military Pay and Allowances (appropriation)
MSC	Major Subordinate Command
Msg	Message
NATO	North Atlantic Treaty Organization

NBC	Nuclear, Biological, Chemical
NCO	Noncommissioned Officer
NDU	National Defense University
NPS	Naval Postgraduate School
NTC	National Training Center
O	Office (preceding another acronym)
O&F	Organization and Functions
O/WO/EM	Officers/Warrant Officers/ Enlisted Men
OA	Operations Analysis
OAC	TRAC Operations Analysis Center
OCA	Office of the Comptroller of the Army
ODP	Officer Distribution Plan
OEC	Operational Evaluation Command
OEM	Officers and Enlisted Men (Personnel)
OMA	Operations and Maintenance, Army (appropriation)
OMNIBUS	Operational Readiness Analysis; Force Readiness Analysis System
OPLAN	Operations Plan
OPM	Office of Personnel Management
OPMS	Officer Personnel Management System
OPTEC	United States Army Operational Test and Evaluation Command
OR	Operations Research; Operational Research
OR/SA	See ORSA
ORO	Operations Research Office
ORSA	Operations Research/Systems Analysis; Operations Research Society of America
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
OTEA	United States Army Operational Test and Evaluation Agency
PA&E	Program Analysis and Evaluation
PACOM	United States Pacific Command
PFAM	Personnel Flow Model
PFM	Patient Flow Model
PL	Public Law
PM	Project Manager
PMY	Professional Man Year
POL	Petroleum, Oils, and Lubricants
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
PRB	Project Review Board
PRO	Procurement Research Office
PSM	Professional Staff Month
PSY	Professional Staff Year
QRA	Quick-Reaction Analysis
Quicksilver	Army Study on Reduction of TOE Army (1989)
QWG	Quadripartite Working Group
R&D	Research and Development
RAA	Review of Army Analysis (1978–1979); Research and Analysis Activity
RAAEX	Review of Army Analysis Extended (1985)
RAC	Research Analysis Corporation
RAM	Reliability, Availability, and Maintainability
RAND	RAND Corporation, Santa Monica, California
RDAISA	Research, Development, and Acquisition Information Systems Agency
RDT&E	See RDTE
RDTE	Research, Development, Test, and Evaluation
REDCOM	See USREDCOM
RFP	Request for Proposal
ROK	Republic of Korea
ROTC	Reserve Officers Training Corps
S&A	Studies and Analysis
SA	Secretary of the Army; Systems Analysis

SAC	TRAC Studies and Analysis Center
SAG	Science Advisory Group; Systems Analysis Group; Study Advisory Group
SC 49	See FA 49
SciA	Science Advisor
SELCOM	Select Committee
Series 1515	Career Management Series in Career Program 16 for OR Analysts
SES	Senior Executive Service
SIMLAB	Simulation Laboratory
SIMNET	Simulation Network
SIMTEC	Simulation Technology Development Program
SMO	Study Management Office; System Methodology Office
SOUTHCOM	United States Southern Command
SPG	Study Planning Guidance; Special Planning Group
SPMA/O	Study Program Management Agency/Office
SSA	Staff Support Agency
SSC	Soldier Support Center; Senior Service College
SSI	United States Army Strategic Studies Institute
STAG	United States Army Strategy and Tactics Analysis Group
STEADFAST	1973 Reorganization of the Army
STRICOM	See USSTRICOM
SWC/G	TRAC Scenarios and Wargaming Center/Group
T&E	Test and Evaluation
TAA	Total Army Analysis
TAM	Theater Analysis Model
TASP	The Army Study Program
TASS	The Army Study System
TCATA	TRADOC Combined Arms Test Activity
TCM	Theater Combat Model
TD&E	Test Design and Evaluation
TDA	Table of Distribution and Allowances
TDP	Test Design Plan
Tech	Technical
TECO	Test and Evaluation Coordination Office
TECOM	United States Army Test and Evaluation Command
TELL	TRADOC Research Element-Lawrence Livermore National Laboratory
TEMA/O	Test and Evaluation Management Agency/Office
TEXCOM	United States Army Test and Experimentation Command
TF	Task Force
TFA	Total Force Analysis
TMM	Technical Man Month
TOA	Total Obligation Authority; Trade Off Analysis
TOE	Table of Organization and Equipment
TORA	TRADOC Operations Research Activity
TOW	Tube Launched, Optically Tracked, Wire Guided
TQM	Total Quality Management
TRAC	TRADOC Analysis Command/Center
TRAC-FBHN	TRADOC Analysis Command-Fort Benjamin Harrison
TRAC-FLVN	TRADOC Analysis Command-Fort Leavenworth
TRAC-LA	TRADOC Analysis Command-Los Alamos National Laboratory
TRAC-LEE	TRADOC Analysis Command-Fort Lee
TRAC-LL	TRADOC Analysis Command-Lawrence Livermore National Laboratory
TRAC-MTRY	TRADOC Analysis Command-Monterey
TRAC-WSMR	TRADOC Analysis Command-White Sands Missile Range
TRADOC	See USATRADOC
TRANSMO	Transportation Model

TRASANA	TRADOC Systems Analysis Activity
TRELA	TRADOC Research Element at Los Alamos National Laboratory
TRELL	TRADOC Research Element at Lawrence Livermore National Laboratory
TREM	TRADOC Research Element-Monterey
TRP	TRAC Reimbursable Program
TSARC	Test Schedule and Review Committee
TSM/Y	Technical Staff Month/Year
UK	United Kingdom
Urgent Fury	United States Operation in Grenada, October 1983
USACAA	United States Army Concepts Analysis Agency; United States Army Center for Army Analysis
USACC	United States Army Communications Command
USACDC	United States Army Combat Developments Command
USACDEC	United States Army Combat Developments Experimentation Center/Command
USACGSC	United States Army Command and General Staff College
USACMH	United States Army Center of Military History
USAFORSCOM	United States Army Forces Command
USAISC	United States Army Intelligence and Security Command
USAMC	United States Army Materiel Command
USAMHI	United States Army Military History Institute
USAMSAA	United States Army Materiel Systems Analysis Activity
USANCA	United States Army Nuclear and Chemical Agency
USAOPTEC	United States Army Operational Test and Evaluation Command
USAOTEA	United States Army Operational Test and Evaluation Agency
USAREC	United States Army Recruiting Command
USAREUR	United States Army, Europe
USASAC	United States Army Security Assistance Center/Command; United States Army Security Affairs Command
USATEC	United States Army Test and Evaluation Command
USATRAC	United States Army TRADOC Analysis Command/Center
USATRADOC	United States Army Training and Doctrine Command
USAWC	United States Army War College
USCENTCOM	United States Central Command
USCONARC	United States Continental Army Command
USGPO	United States Government Printing Office
USMA	United States Military Academy
USMC	United States Marine Corps
USN	United States Navy
USREDCOM	United States Readiness Command
USSTRICOM	United States Strike Command
Vanguard	Army Study on Reduction of TDA Army (1990)
VCSA	Vice Chief of Staff, Army
VIC	Vector-in-Commander (model)
VRI	Vector Research, Incorporated
WSL	Weapons Systems Laboratory

A Note on Sources

This volume, like the preceding two volumes of this history of operations research in the United States Army, is based on a variety of sources, ranging from official letters, memorandums, and studies to articles published in historical and professional journals. For Volume I, and to a lesser extent for Volume II, a limited but useful body of official documents was found in the National Archives and Records Administration (NARA). Such is not the case with this volume. Dealing as it does with the period after 1973, there is almost nothing available in NARA. Either the pertinent materials were not properly transferred to the NARA system or they have not yet been accessioned, catalogued, and made available to the public. In fact, the bulk of any official documents pertaining to the period 1973–1995 are probably either in the Washington National Records Center (and thus for all practical purposes unavailable), remain in the files of the office of origin, or have been destroyed. Nevertheless, this volume is based on a large number of original official documents, including letters, memorandums, disposition forms, e-mails, and other items. Such items are not listed separately in the "Selected Bibliography of Works Cited" that follows.

In most cases, I have obtained such official documents directly from the organization that created them, particularly those pertaining to the so-called Big Four Army analytical agencies: the Army Materiel Systems Analysis Activity (AMSAA); the Army Test and Evaluation Command (ATEC), formerly the Operational Test and Evaluation Agency/Command (OTEA/OPTEC); the TRADOC Analysis Command (TRAC); and the Center for Army Analysis, formerly the Concepts Analysis Agency (CAA). In each case, I have benefited enormously from the assistance provided by the director or commander of the agency in question and by their administrative assistants, command historians, and public affairs officers.

The staff of the United States Army Center of Military History was most helpful in locating materials, and Walter W. Hollis, the former deputy under secretary of the Army for operations research, who is the sponsor of this work, and his staff were equally solicitous. Unfortunately, most of the historical documents on file in the Office of the Deputy Under Secretary of the Army (Operations Research) were destroyed in the tragic events of 11 September 2001.

David J. Shaffer, then director of AMSAA, and his staff loaned me copies of AMSAA's annual historical reports and other original materials and answered my queries on specific items. The same is true of Michael F. Bauman, the director of TRAC, and his staff. Fortunately, a large number of original documents pertaining to the establishment, organization, and operations of TRAC and the other elements of the TRADOC analytical community have been preserved. Many remain in the files of Headquarters TRAC or in the historical files of Headquarters TRADOC. Others are to be found in the archives of the Combined Arms Center (CAC) at the Combined Arms Research Library (CARL), Fort Leavenworth, Kansas. The staff of the CAC archives was very helpful. The CAC Historian's Office also contains a good deal of useful historical information on TRAC and its predecessors, and I am indebted to Dr. William G. Robertson, the CAC historian, and his staff, as well as the staff of CARL, for their assistance in locating the data needed. Of particular value was the "TRAC

History" file in the CAC Historian's Office and the listing of TRAC historical documents compiled by Christina Fishback in 2003.

The history of OTEA and its successors, OPTEC and ATEC, is exceptionally well documented. Although OTEA/OPTEC/ATEC has never employed a staff historian, the staffs of the ATEC Public Affairs Office and Technical Library have done an impressive job of selecting and preserving the key historical documents needed to prepare an adequate history of the organization. Items of particular value to the historian include the annual OTEA/OPTEC historical reviews/summaries and the original documents archived in the ATEC Technical Library. The ATEC Public Affairs Office has also assembled key OTEA/OPTEC/ATEC historical documents in two CDs: United States Army Test and Evaluation Command, *Historical References: Evolution of OTEA–1979* (Alexandria, Va.: Public Affairs Office, U.S. Army Test and Evaluation Command, [November 2005]); and United States Army Test and Evaluation Command, *Historical Policy Documents, 1970–1984* (Alexandria, Va.: Public Affairs Office, U.S. Army Test and Evaluation Command, [November 2005]). The two CDs contain most of the items required to compile a history of that organization from its origins in 1972 to the present. I am much indebted to Brian Barr, then the ATEC technical director; Thomas Rheinlander, the ATEC public affairs officer, and his deputy, Warren Field; and Jennifer Kellerman, the ATEC technical librarian, for access to the OTEA/OPTEC/ATEC materials.

Throughout the compilation of this history of OR in the Army, E. B. Vandiver III, the director of CAA, has assisted me in many ways. He and his staff facilitated access to CAA historical materials and made available to me the resources of the CAA Technical Library, which contains a wealth of material on the Army analytical community and OR in the Army.

Four other categories of original materials have proved of immeasurable value in the preparation of this volume. First, the annual historical reports/summaries of the Department of the Army and of the various Army analytical agencies are of prime importance. Second, the papers presented at the annual Army Operations Research Symposium (AORS) since 1962, particularly the keynote and banquet addresses, are of high value to any historian attempting to tell the story of OR in the Army. Third, this volume could not have been written without access to the two major official studies of the Army analytical community conducted during the period: the 1978–1979 Review of Army Analysis (RAA) and the 1985 Review of Army Analysis Extended (RAAEX). And finally, I am most grateful to those leaders of the Army analytical community who agreed to oral history interviews. Those interviews are being transcribed by the United States Army Military History Institute at Carlisle Barracks, Pennsylvania, and will become a part of the United States Army War College/United States Army Military History Institute Senior Officer Oral History Collection under the rubric "History of ORSA in the US Army."

All of the materials just mentioned are cited fully upon first mention in the notes to each chapter. If not specified in the note, the source (AMSAA, ATEC, TRAC, CAA, or other) of the document should be clear from the context. Full citations are provided for all items published in the proceedings of the various AORSs upon first mention, but subsequent references to any given AORS proceedings are identified simply by the number of the AORS and the year—for example, "AORS I, 1962," or "AORS XIII, 1974." Such items are also identified in the abbreviated form in the following "Selected Bibliography of Works Cited."

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[1] In preparing this bibliography I have been very selective. It contains only those works frequently cited in the text or essential to an understanding of the topic. All works used in the preparation of this volume are cited fully at first mention in the notes for each chapter.

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