Annual Report 2003

RAND NATIONAL DEFENSE RESEARCH INSTITUTE

NDRI Research Clients—2003

CLIENT	POLICY CENTER			
	Acquisition and Technology	Forces and Resources	International Security and Defense	Intelligence
Assistant Secretary of Defense (Networks and Information Integration)	▲		●	
Defense Information Systems Agency	▲			
Defense Intelligence Agency				◆
Defense Logistics Agency		■		
Department of Veterans Affairs		■		
Deputy Secretary of Defense	▲		●	
Director of Net Assessment			●	
Joint Staff			●	
National Defense University			●	
National Geospatial-Intelligence Agency				◆
National Security Agency				◆
Office of Force Transformation	▲		●	
Under Secretary of Defense for Acquisition, Technology, and Logistics				
Defense Advanced Research Projects Agency	▲			
Defense Modeling and Simulation Office	▲			
Defense Threat Reduction Agency	▲		●	
Director, Acquisition Resources and Analysis	▲			
Director, Defense Research and Engineering	▲			
Director, Defense Systems	▲			
Director, Industrial Base Capabilities and Readiness	▲			
Director, Strategic and Tactical Systems	▲			
Deputy Under Secretary of Defense (Acquisition & Technology)		■		
Deputy Under Secretary of Defense (Industrial Policy)	▲	■		
Deputy Under Secretary of Defense (Installations and Environment)		■		
Deputy Under Secretary of Defense (Science and Technology)	▲			
Missile Defense Agency	▲			
Small and Disadvantaged Business Utilization Office	▲			
Under Secretary of Defense (Comptroller)				
Director, Program Analysis and Evaluation	▲		●	
Under Secretary of Defense for Personnel and Readiness		■		
Principal Deputy Under Secretary of Defense (Personnel and Readiness)		■		
Deputy Under Secretary of Defense for Civilian Personnel Policy		■		
Deputy Under Secretary of Defense for Military Community and Family Policy		■		
Deputy Under Secretary of Defense for Military Personnel Policy		■		
Deputy Under Secretary of Defense for Program Integration		■		
Assistant Secretary of Defense for Health Affairs		■		
Assistant Secretary of Defense for Reserve Affairs		■	●	
TRICARE Management Activity		■		
Under Secretary of Defense for Policy				
Principal Deputy Under Secretary of Defense (Policy)			●	
Assistant Secretary of Defense for International Security Affairs			●	
Assistant Secretary of Defense for International Security Policy			●	
Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict			●	
Principal Director, Strategy			●	
Unified Commands				
U.S. Joint Forces Command			●	
U.S. Northern Command			●	
U.S. Pacific Command	▲		●	
U.S. Transportation Command		■		
U.S. Southern Command			●	
U.S. Marine Corps		■	●	
U.S. Navy	▲	■	●	

This has been an extraordinary year. The invasion of Iraq, its ongoing stabilization and transition to democracy, continuing military engagements in Afghanistan, as well as other military operations supporting the global war on terrorism, underscore how vital America's armed forces are to the United States and the free world. To say that 2003 was a year of action would only state the obvious. Indeed, the scope, duration, and intensity of U.S. military operations this past year are creating significant stresses on the force.

Despite the gravity of present operational demands, the Department of Defense (DoD) has kept one eye trained on future challenges. Investments meant to maintain America's technological superiority on future battlefields are being made. Efforts to create forces that can better adapt to unforeseen threats are being undertaken. Processes meant to improve the linkage among strategy, programs, and budgets are being implemented. And other steps meant to align department objectives and priorities are being adopted.

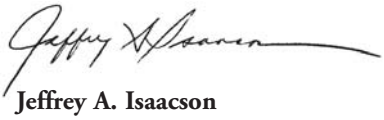
It is against this backdrop that the RAND National Defense Research Institute (NDRI) supported the DoD in 2003. NDRI blends focused, fast-turnaround analytical support on current-day issues with broader, relatively comprehensive research on longer-term policy problems. While quite diverse in the aggregate, the NDRI research agenda can increasingly be distilled down to three key, overarching lines of inquiry, as evidenced this past year:

- Understanding and adapting lessons learned from recent wars, including research on combat and stability operations, force basing, and the impact of deployment on retention;
- Transforming U.S. military forces, including the development of network-centric capabilities, achieving joint and combined interoperability, and revamping personnel management for the 21st century; and
- Transforming U.S. intelligence, including improvements to intelligence community business practices and processes, increasing horizontal integration, and exploiting new technologies.

The following pages provide more specifics on 2003 NDRI research, grouped according to the Institute's four main core competencies: international security and defense policy, acquisition and technology policy, forces and resources policy, and intelligence policy. Like most annual reports, the descriptions herein mean to illustrate NDRI's analytical capabilities rather than demonstrate its technical depth.

The fruits of these analytical efforts may not be realized for some time. But insofar as past studies helped improve military actions in 2003, so too we hope that present studies will improve future actions. Such analyses are crucial to ensuring robust, adaptable, and unrivaled military capabilities now and into the future.

RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world.



Jeffrey A. Isaacson
Director
RAND National Defense Research Institute

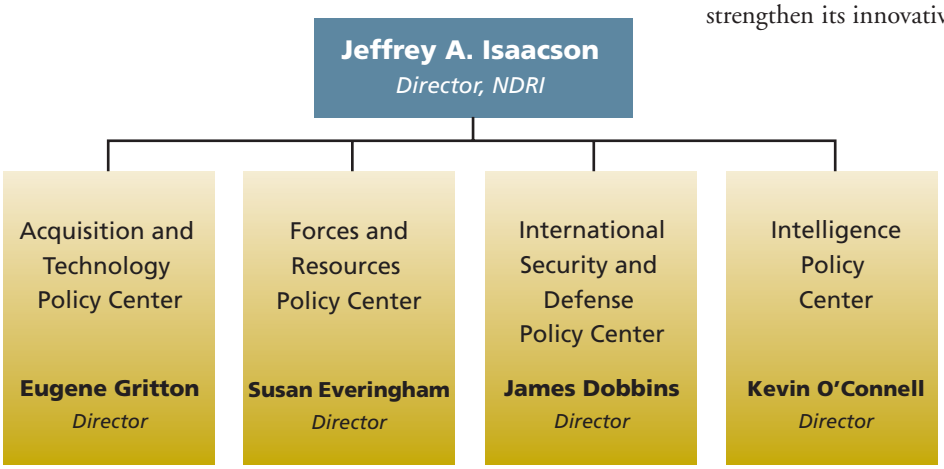
The RAND National Defense Research Institute (NDRI) is a federally funded research and development center at the RAND Corporation that provides studies and analyses to policymakers in the Office of the Secretary of Defense (OSD), the Joint Staff, the Unified Combatant Commands, the U.S. Navy and Marine Corps, the defense agencies, and other clients. It brings science, analytical rigor, and an understanding of world and national security affairs to the study and choice of policy.

NDRI's primary function is research on policy, strategy, and complex problems, where multidisciplinary capability, objectivity, independence, and an explicit national-interest charter are essential. The Institute performed this function in 2003 by carrying out a well-rounded research agenda that corresponded closely to the responsibilities of four undersecretaries in the Office of the Secretary of Defense—Policy; Acquisition, Technology, and Logistics; Personnel and Readiness; and Intelligence—who have been main supporters and consumers of NDRI studies and analysis. This agenda was pursued by NDRI's four well-established research centers—the International Security and Defense Policy Center, the Acquisition and Technology Policy Center, the Forces and Resources Policy Center, and the Intelligence Policy Center.

NDRI's agenda emerges from relationships with clients that are long-standing, mutually reinforcing, and dynamic. In 2003, the Institute's four Centers deepened these connections by helping clients identify and evaluate new policies; framing alternate ways to implement current policies; and providing other analytical and technical assistance, including specific aid to decisionmakers as the United States pursued military operations in Iraq and Afghanistan, expanded the war on terrorism, and extended efforts to defend America's homeland. In so doing, NDRI was able to sustain and invigorate its core investigational, theoretical, and methodological capabilities—the institutional foundations that will continue to enable it to address America's most pressing national security concerns for decades to come.

NDRI's Research Centers in 2003

- The **International Security and Defense Policy Center** explored how the world's security landscape is changing as the United States and its allies prosecute military operations in Iraq and Afghanistan and pursue the global war on terrorism; how America's deepening involvement in nation-building is altering its international roles and responsibilities; how evolving global security and economic conditions affect U.S. interests; and policies, strategies, and terms of engagement that the United States requires to shape the environment and protect vital interests at home and abroad.
- The **Acquisition and Technology Policy Center** addressed opportunities and challenges presented by new technologies, in particular those enabled by the information revolution; assessed ways to identify and thwart technological threats posed by rogue states, terrorists, and other nonstate adversaries; identified ways to preserve the nation's vital military industrial base and strengthen its innovative capabilities; examined acquisition



NDRI in 2003

and production strategies the Department of Defense (DoD) should consider to acquire weapon systems and other capabilities in the future; and developed new modeling and simulation tools required to evaluate future military systems and operational concepts.

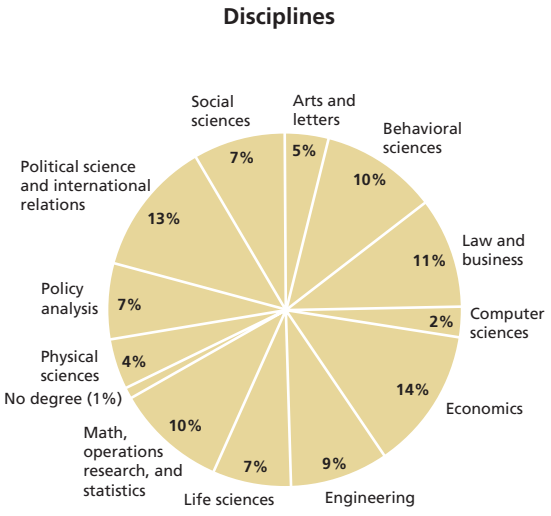
- The **Forces and Resources Policy Center** focused on issues affecting DoD's human resources, including policy options that help ensure that the military services attract and retain high-quality individuals; offer appropriate support services for the families of uniformed personnel; and provide efficient health care to active-duty personnel, reservists, their families, and retirees. The Center studied options for improving the management of the forces the United States needs to execute military strategies; ways the DoD can optimally allocate and use its nonhuman resources; and structures and capabilities the United States needs to effectively meet emerging responsibilities.
- The **Intelligence Policy Center** examined international security, acquisition, manpower, and management issues that affect the collection, evaluation, and dissemination of national security intelligence. It helped clients assess the impact of the information revolution on society and security, evaluate alternative ways to manage and structure their operations, understand key technologies connected with mapping and satellite systems, and analyze strategy and policy issues in key countries around the world.

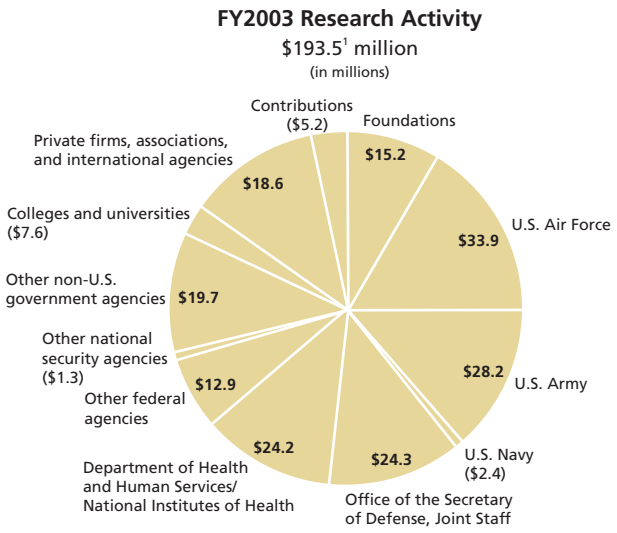
The RAND Environment

NDRI is part of RAND, a private, nonprofit institution whose mission is to improve policy and decisionmaking through research and analysis. Since its founding in 1948, RAND has studied the most pressing public policy problems of the day, producing in-depth, objective policy analyses, basic and applied research, and analytic tools used in government, academia, and the private sector.

Today, RAND studies assist public policymakers at all levels and the public at large in efforts to strengthen the nation's economy, maintain its security, and improve the quality of life of its citizens. Clients rely on RAND for help in analyzing choices and developments in many areas—including national defense, education and training, health care, criminal and civil justice, labor and population, science and technology, community development, international relations, and regional studies. RAND also offers several advanced training programs, including the Pardee RAND Graduate School's doctoral program in policy analysis and its intensive advanced defense analysis seminars geared toward mid-career decisionmakers.

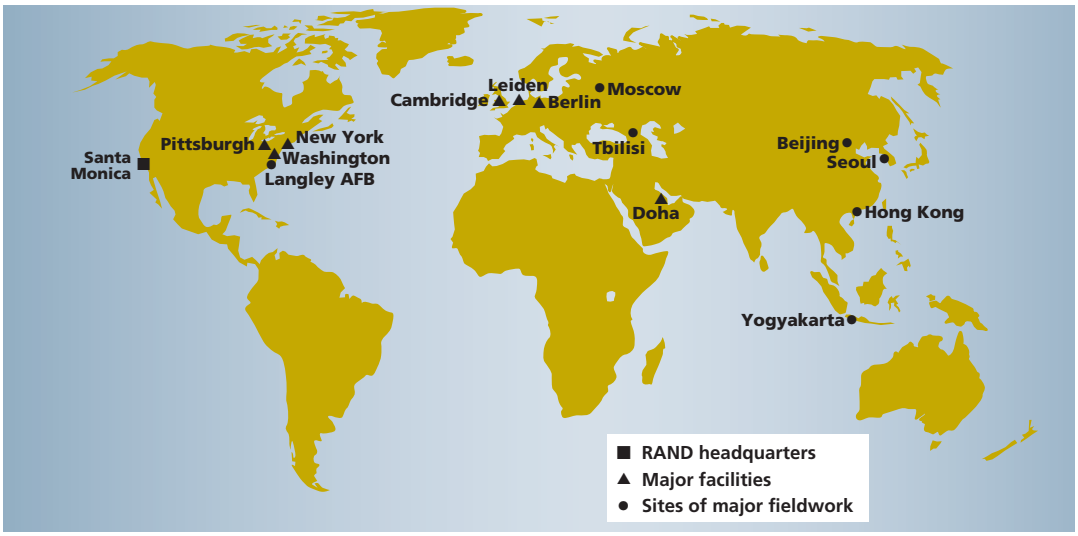
In addition to NDRI, RAND houses two other DoD federally funded research and development centers offering additional analytical resources. RAND Project AIR FORCE—RAND's oldest studies and analysis organization—assists U.S. leaders in determining the size, shape, and missions of the U.S. Air Force. The RAND





[1]Net of subcontracts and RAND-sponsored research

RAND's Multidisciplinary Staff Provide Breadth and Depth to Research Activities



RAND's Worldwide Research Facilities Provide Global Reach and Perspective

Arroyo Center helps policymakers focus on similar mid- and long-range policy questions related to the U.S. Army.

NDRI also draws upon analytical talent working in research units across the organization and in offices in the United States and abroad. Totaling nearly 1,600 full- and part-time employees, RAND's staff is diverse in work experience; political and ideological outlook; race, gender, and ethnicity; and academic training. Eighty-five percent of the research staff holds advanced degrees, with more than 65 percent having earned Ph.D.'s or M.D.'s. Staff disciplines include economics, mathematics and statistics, medicine, law, business, physical sciences, engineering, operations analysis, social sciences, arts and letters, and computer science. RAND possesses analytical depth in psychology, sociology, and demography, all of which NDRI harnesses in conducting studies of personnel or intelligence issues, for example.

RAND Health and the RAND Center for Military Health Policy Research bring crucial insight into questions connected with the provision and management of military medical services, the possible causes of Gulf War Illness, and the clinical implications of the use of weapons of mass destruction (WMD) by terrorists or rogue states. Numerous other RAND research centers provide specialists with skills that prove particularly useful when investigating policy issues. These specialists are in areas such as

- surveys, statistical analysis, and information systems;
- computer modeling and simulations; and
- scenario design, analysis, and testing.

International Programs—comprising the RAND Center for Asia Pacific Policy, the RAND Center for Middle East Public Policy, and the RAND Center for Russia and Eurasia—houses additional research talent on security, economic, political-social, and other matters relating to key regions of the world. Work on allied defense issues done in part through RAND's independently chartered European subsidiary, RAND Europe, provides perspective that is relevant to both national security and non–national security work. And RAND's newest research endeavor, the RAND-Qatar Policy Institute, was established in 2003 to be a source of analysis on the most important and difficult issues facing public and private decisionmakers in the Middle East, North Africa, and South Asia.

A broad range of sources, from individuals and charitable foundations to combinations of private firms, supports RAND research. Agencies of the U.S. government are sources of the largest shares of support. RAND also conducts projects for foreign governments, when such work supports U.S. interests. In addition, some RAND research in the public interest is supported by RAND, using discretionary funds made possible by the generosity of RAND's donors, the fees earned on client-funded research, and independent research and development (IR&D) funds provided by the DoD.

International Security and Defense Policy Center

The International Security and Defense Policy Center (ISDP) explores the implications of change—political, strategic, economic, and technological—on the international scene and assists U.S. national security decisionmakers with developing strategies and policies to manage and adapt to such transformations.

Terrorism and the potential proliferation of WMD continued in 2003 as the most pressing challenges to U.S. national security. By helping U.S. policymakers gain an understanding of how terrorism intersects with other emerging threats, ISDP research assisted the U.S. national security community in devising options to protect American and allied interests at home and abroad. These distinct but sometimes intersecting challenges—the continuing spread of WMD and other lethal technologies, the ability of adversaries to access other destabilizing technologies, the growing dependence upon information and information dominance in U.S. military strategy and operations, and the increasing U.S. and allied exposure to unexpected threats at home and abroad—are forcing the United States to rethink near- and long-term strategies. As spelled out below, four themes guided ISDP's research in 2003.

Understanding the New Threat Environment

ISDP continued to explore the implications of the revolutions in warfare; in technology; and in demographic, cultural, and politico-economic affairs that have reconfigured America's national security landscape. It investigated how new threats—not just from terrorists, disaffected ethnic groups, and other nonstate actors, but from mass casualty weapons and technological proliferation—affect America's ability to protect and enhance vital interests at home and abroad. The Center continued to evaluate empirical and behavioral factors that may help U.S. defense policymakers identify whether terrorist groups are likely to seek to acquire chemical, biological, radiological, or nuclear weapon capabilities as well as identify the kinds of insurgency threats in the future that might require significant involvement of U.S. special operations forces. The Center investigated how threats of renewed oil embargoes or supply disruptions might affect current U.S. interests and economic performance at home and abroad.

Developing Strategies to Deal with the New Threat Environment

ISDP explored ways that the United States can mold defense strategies to address emerging threats, shape the international environment, and accommodate new technologies and tactics. Since the attacks on September 11, 2001, the United States has placed heavy emphasis on homeland defense. In 2003, the Center continued to help DoD evaluate the medical resources, capabilities, and protocols it could employ in the event of a chemical or biological weapon attack on the United States. ISDP continued to support the White House Office of Homeland Security via work for the Defense Threat Reduction Agency that is identifying elements of America's critical infrastructure, threats they face, and strategies to help make them more secure. In a joint effort with NDRI's Forces and Resources Policy Center, ISDP supported a congressionally mandated panel assessing the ability of state and local authorities to respond to terrorist threats against America's homeland. And it helped the newly formed U.S. Northern Command assess its roles, missions, and relationships with subordinate commands. Beyond homeland defense, Center analysts reviewed on behalf of the Navy joint air, airborne, and amphibious operations used for forcible entry, and continued to explore policy options that U.S. forces could employ to avoid contamination and restore operations in the

event of chemical, biological, or radiological attack. In addition, the Center continued to directly support DoD in developing joint warfighting studies, modeling, and other experiments regarding the operational availabilities and capabilities of U.S. forces in a range of evolving scenarios. It evaluated lessons learned from joint urban operations in Operation Iraqi Freedom and identified near- and long-term adjustments in capabilities, programs, and overseas posture that the United States should consider in the wake of the Iraq war. The Center also helped the DoD policymakers develop strategies to preserve essential defense functions in the face of future threats from rogue nations or terrorists.

Dealing with Failed States and Ungoverned Space

Continuing a focus of the past several years, in 2003 ISDP concentrated on ungoverned space, the territory of failed and failing states, and areas within otherwise minimally functioning states where governance is absent. These territories have become terrain from which recent threats have emerged and upon which conflicts have been waged. ISDP reviewed lessons learned from American-led post-conflict interventions, ranging from Germany and Japan in 1945 to Afghanistan in 2002, and investigated how these might be applied nation-building efforts in Iraq and Afghanistan in 2003. The Korean peninsula remained

another significant area of focus in 2003. The Center examined the military and economic implications of the end of the North Korean regime and of Korean unification. And ISDP helped the Africa Center for Strategic Studies create a counterterrorism training program for military, police, and civilian officials in the Sahel region of north central Africa.

Maintaining Coalitions and Sharing Burdens

As the Iraq war vividly demonstrated, the United States is facing growing strains with some of its traditional defense partners. Building and holding together coalitions has become a major policy priority, not only in relation to Iraq but also with regard to policies addressing Afghanistan, the Middle East, and North Korea. The emerging security environment and the war on terrorism will require the United States to partner more with others more creatively and extensively than in the past for basing, access, overflights, and political and logistic support; for participation in battle; and perhaps in subsequent reconstruction and stability operations. In 2003, the Center evaluated the effect that international aid likely will have on Turkey's economic institutions, its role in NATO, and its prospective membership in the European Union. It examined how alternative economic and development patterns in Egypt, Iran, Iraq, Palestine, and Syria might affect U.S. policies and relationships in the Middle East. Center analysts also helped DoD advise the Taiwan Ministry of Defense on ways to sharpen its ability to conduct cost analyses and advised U.S. Forces Korea on the scope of the North Korean WMD threat.

From Germany to Iraq

Although the combat phase of both Operation Enduring Freedom and Operation Iraqi Freedom went very well and the regimes collapsed much faster than many expected, the United States has been left with the unenviable task of seeking to build democratic, economically viable nations in Afghanistan and Iraq. In both cases the tasks of stabilization and reconstruction have proved more difficult and costly than originally anticipated.

In this study, NDRI researchers attempted to identify the most important lessons learned by the United States in its nation-building efforts since World War II, to apply those lessons to the international community's efforts to reestablish Afghanistan and Iraq as viable nation-states, and to sketch out guidelines that policymakers can use to assess similar undertakings in the future.

Historical Lessons

Defining nation-building as "the use of armed force in the aftermath of a conflict to underpin an enduring transition to democracy," the NDRI team compared the levels of progress toward democracy in the largest and most important cases of nation-building over the past 60 years: Germany, Japan, Somalia, Haiti, Bosnia, Kosovo, and Afghanistan. The team concluded that the current American efforts in Afghanistan and Iraq had yet to reflect some of the hard-learned lessons from either the 1940s or the more recent—and, in some respects, more relevant—nation-building experiences of the 1990s. The most important of those lessons—drawn from the "best practices" of nation-building over the past 60 years—are summarized in the following table.

America's History of Nation-Building

Country/ Territory	Years	Peak U.S. Troops	International Cooperation	Assessment	Lessons Learned
West Germany	1945–1952	1.6 million	Joint project with Britain and France, eventually NATO.	Very successful. Within ten years an economically stable democracy and NATO member.	Democracy can be transferred. Military forces can underpin democratic transformation.
Japan	1945–1952	350,000	None.	Very successful. Economically stable democracy and regional security anchor within a decade.	Democracy can be exported to non-Western societies. Unilateral nation-building can be simpler (but more expensive) than multilateral.
Somalia	1992–1994	28,000	United Nations (U.N.) humanitarian oversight.	Not successful. Little accomplished other than some humanitarian aid delivered in Mogadishu and other cities.	Unity of command can be as essential in peace as in combat operations. Nation-building objectives need to be scaled to available resources. Police may need to be deployed alongside military forces.
Haiti	1994–1996	21,000 (plus 1,000 international police)	U.N. help in policing.	Not successful. U.S. forces restored democratically elected president but left before democratic institutions took hold.	Exit deadlines can be counterproductive. Need time to build competent administrations and democratic institutions.
Bosnia	1995–present	20,000	Joint effort by NATO, U.N., and Organization for Security and Cooperation in Europe.	Mixed success. Democratic elections within two years, but government is constitutionally weak.	Unity of command is required on both military and civil sides. Nexus between organized crime and political extremism can be serious challenge to enduring democratic reforms.
Kosovo	1999–present	15,000 (plus 4,600 international police)	NATO military action and U.N. support.	Modest success. Elections within three years and strong economic growth. But no final resolution of Kosovo's status.	Broad participation and extensive burden-sharing can be compatible with unity of command and American leadership.
Afghanistan	2001–present	10,000	Modest contribution from U.N. and nongovernmental organizations.	Too early to tell. No longer launch pad for global terrorism. But little democratic structure and no real government authority beyond Kabul.	Low initial input of money and troops yields low output of security, democratization, and economic growth.

Applying Historical Lessons to Iraq

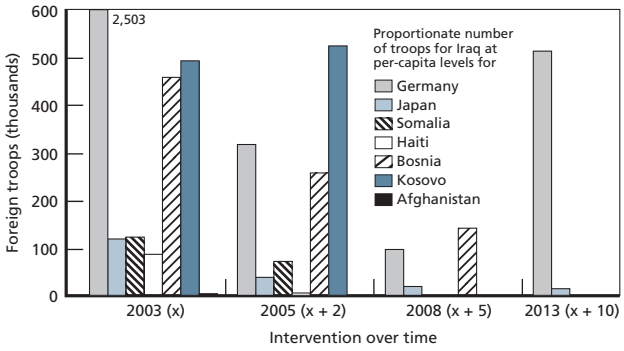
The NDRI team's historical analysis involved a straightforward accounting of the levels of troops, money, and time that have led to either success or failure in the past. The team then applied the historical lessons to Iraq. As for troops, the team found that Iraq might need a stabilization force as large as 500,000 personnel through 2005 to achieve the level of security reached in Kosovo during the first two years of rebuilding efforts there (see figure at right, top). As for money, the team found that Iraq might need as much as $18 billion per year in foreign aid exclusively for civilian reconstruction through 2005 to achieve the level of reconstruction and economic growth reached in Bosnia during the first two years of rebuilding efforts there (see figure at right, bottom). As for time, the team found that none of the historical cases of nation-building has been successfully completed in less than seven years.

Guidelines for Future Nation-Building Efforts

This review of the historical cases led the NDRI to derive a number of overarching conclusions:

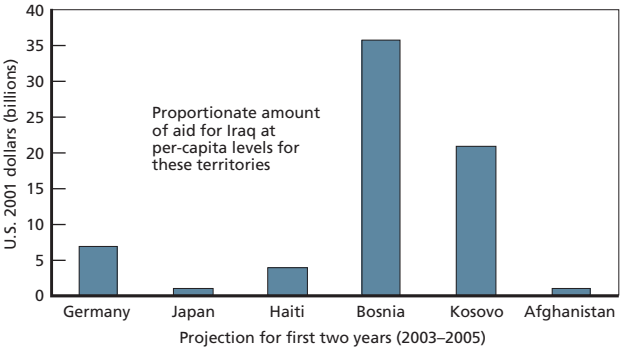
- Many factors—such as prior democratic experience, level of economic development, and social homogeneity— can influence the ease or difficulty of nation-building, but the single most important controllable determinant seems to be the level of effort, as measured in troops, money, and time.
- Multilateral nation-building is more complex and time-consuming than a unilateral approach. But the multilateral approach is considerably less expensive for individual participants.
- Multilateral nation-building can produce more thorough transformations and greater regional reconciliation than can unilateral efforts.
- Unity of command is as essential in peace operations as it is in war. This unity of command can be achieved even in operations with broad multilateral participation when the major participants share a common vision and tailor the response of international institutions accordingly.
- There appears to be an inverse correlation between the size of the military stabilization force and the level of casualties. The higher the proportion of troops relative to the resident population, the lower the number of casualties suffered and inflicted. Indeed, most of the post-conflict operations that were generously manned suffered no casualties at all.
- Neighboring states can exert significant influence, for good or bad. It is nearly impossible to put together a fragmented nation if its neighbors try to tear it apart. Every effort should be made to secure their support.

Based on Kosovo Standards, Iraq Would Need 526,000 Foreign Troops Through 2005



NOTE: Year x = 2003, the year of intervention in Iraq.

Based on Bosnia Standards, Iraq Would Need $36 Billion in Foreign Aid Through 2005



- Accountability for past injustices can be a powerful component of democratization. Such accountability can be among the most difficult and controversial aspects of any nation-building endeavor, however, and therefore should be attempted only if there is a deep and long-term commitment to the overall operation.
- There is no quick fix for nation-building. As noted, none of the cases was successfully completed in less than seven years.

Since the study was published, policymakers in Washington, D.C., Baghdad, and Kabul have used it to define the scope of activities that need to take place in Iraq and Afghanistan. Regardless of the final outcomes in those nations, the NDRI team has provided policymakers in and outside the United States with a useful set of yardsticks by which they can measure progress in future nation-building endeavors.

For more information, see

America's Role in Nation-Building: From Germany to Iraq, James Dobbins, John G. McGinn, Keith Crane, Seth G. Jones, Rollie Lal, Andrew Rathmell, Rachel Swanger, Anga Timilsina, MR-1753-RC, 2003.

In Colombia, a thriving drug trade, a protracted insurgency, and nationwide corruption have long been known to play a role in political instability and violence. The problem of small arms proliferation also has been among the most serious problems of the country, though less known because of difficulty in monitoring and measuring it and because it does not fit the traditional definition of a security threat.

To assess the extent of small arms trafficking in Colombia, NDRI researchers reviewed and cataloged open-source information, including more than 500 articles in newspapers, magazines, and journals, and conducted extensive interviews with individuals in the region. "Small arms" include weapons ranging from handguns to assault rifles to surface-to-air missiles. Such weapons can, for the most part, be used repeatedly in a wide range of climates and circumstances and be purchased in legal, semi-legal, and illegal markets.

The threat of the small arms trafficking in Colombia may be as deleterious to the region as that of the Colombian drug market. By analyzing small arms trafficking, NDRI helped pinpoint specific weapons flows and networks, many of which mirror emerging zones of conflict, and helped to provide insight on the behavior of particular groups and their intentions. Such examinations of the specific manner by which arms and munitions are acquired and distributed may provide real-time information about the strategies behind a particular conflict and its likely evolution.

Small Arms Users

Among the main users of small arms in Colombia are the Fuerzas Armadas Revolucionarias de Colombia (FARC, or the Revolutionary Armed Forces of Colombia) and the Ejército de Liberación Nacional (ELN, or the National Liberation Army). Both these groups have stated their intentions to seize national power and are preoccupied with consolidating, defending, and, where possible, extending their bases of territorial control. Continuing access to weapons and ammunition is crucial to these objectives and, particularly in the case of FARC, is regarded as proportional to strength, power, and influence. Colombian guerrillas purchase weapons in small quantities, though there are some signs that FARC is doing more "bulk buying."

Paramilitaries organized loosely under the Autodefensas Unidas de Colombia (AUC, or the United Self-Defense Forces of Colombia) constitute a second group of small arms users. The AUC opposes FARC and ELN and operates primarily in areas where state military strength is perceived to be weak. Like the guerrillas, the AUC acquires weapons in small quantities, though there are some signs it is increasing its purchases in general and that of larger-caliber weapons in particular, possibly in response to greater FARC mobilization.

Private citizens constitute the third group of small arms users in Colombia. Citizen demand for arms primarily reflects the endemic civic, political, and criminal violence that plagues the country and a lack of confidence in the state to curb it.

Growing FARC mobilization, AUC countermobilization, and increasing violence prompting private citizens to arm has, in effect, contributed to an internal "arms race" in Colombia. This arms race has resulted in a more intense and dynamic arms trafficking situation than in the past, affecting virtually every aspect of life in Colombia.

External and Domestic Market Sources

Colombia's position between Central and South America, its "porous" borders and access to both the Caribbean Sea and the Pacific Ocean, and the limited extent of effective government authority all facilitate the flow of arms to the nation. This problem is magnified by the availability of Cold War–era weapons stockpiles in Nicaragua, Honduras, and El Salvador and the alleged assistance to guerrillas by regional sympathizers in Cuba and Venezuela.

Most small arms appear to move from external sources into Colombia through black-market routes. Weapons are rarely trafficked or purchased in bulk; rather, they "trickle" into Colombia by ones or twos, sometimes smuggled with legitimate goods. Cumulatively, these shipments can amount to a substantial volume of arms over the course of a year.

Central America represents the single largest source of illegal weapons to Colombia, with five countries—El Salvador, Honduras, Nicaragua, Panama, and Costa Rica—accounting for more than a third of all arms shipped into the country. These nations, and Colombia's other neighbors, also serve as transit routes for other weapons flowing to the nation.

Supplies enter Colombia by several means and via a number of collection and distribution hubs. Land routes provide the guerrillas with their most constant supply of small arms. Weapons shipments by air and sea are generally grouped together in larger bundles than those transported over land.

The shipping routes themselves are becoming the source of conflict between AUC and FARC. Both are currently fighting for control of regions that provide the best access to weapons shipment routes, which are depicted in the map above.

Most of the illegal small arms market originating within Colombian borders comprises weapons stolen from production facilities or sold through the black market by Colombian security forces. Arms may be stolen and sold by factory workers and guards or directly raided from government storehouses. Military personnel sympathetic to the aims of the guerrillas or, especially, the self-defense forces are also known to have illegally distributed assault weapons and ammunition.

Policy Implications

In addition to helping pinpoint new, emerging sites of conflict involving guerrillas and paramilitary forces, this and related analyses of small arms trafficking can help reveal points of vulnerability for these organizations. Specifically, they can help identify sites where those concerned with Colombian security can seek to disrupt the constant stream of weapons to insurgents and others, thereby degrading their military capabilities.

More generally, the role that U.S. funding of Plan Colombia may have played in instigating the recent Colombian small arms race among guerrillas, paramilitary forces, and private citizens points to the need for balanced assistance to the nation. The most recent cycle of violence illustrates how difficult it is to focus on one element of conflict in Colombia, such as drug trafficking in the case of Plan Colombia, apart from other related problems. Future Colombian assistance efforts also should seek to help alleviate the spillover of security threats from Colombia to other countries, which have been revealed by analysis of small arms trafficking patterns.

For more information, see

Arms Trafficking and Colombia, Kim Cragin, Bruce Hoffman, MR-1468-DIA, 2003.

Acquisition and Technology Policy Center

The Acquisition and Technology Policy Center (ATP) addresses how constantly accelerating technological change affects transformation within the U.S. military establishment and throughout the world political scene. Its research agenda—which touches upon U.S. technology, force modernization, industrial base, and acquisition policies—emerges from the application of accelerating advances in information and other technologies that lead to dramatic improvements in military capabilities. These advances bring about novel system developments and innovative concepts of operation that allow U.S. forces to assume new roles and accomplish new missions. U.S. forces have been able to exploit America's technological advantage to great effect—projecting power rapidly from the air, from the sea, and on the ground; waging war from afar and in close quarters with minimal U.S. casualties; thwarting potential terrorist actions both in the United States and abroad; and engaging effectively in peacekeeping and humanitarian operations.

ATP's research agenda in 2003 was comprised of six interrelated themes discussed below.

Conflict in the Information Age

ATP analyzed how conflict in the information age is affecting traditional military engagements and how it could lead to new forms of hostilities. In 2003, ATP continued to support OSD efforts both to gain an overall understanding of key defense-related command, control, and communications issues and to create a road map to guide policymakers as the services acquire and coordinate key joint battle-management command and control systems. ATP also continued to evaluate the role of deception in active information system network defenses and helped the DoD assess the potential for establishing network-centric warfare as the theory of war for the information age and the organizing principle for joint concepts, capabilities, and systems. With America becoming increasingly dependent upon satellites and related platforms, the Center also evaluated the vulnerability of space systems—military, civil, and commercial—that the U.S. employs for national security. Center researchers also continued to analyze legal issues pertaining to information assurance. And the Center helped identify concepts that will aid DoD leaders in developing and adapting counterterrorist strategies.

Understanding the Effect of New Technologies on Future Military Operations

ATP continued to investigate ways to exploit technological advances in military operations. Center researchers in 2003 identified and evaluated alternative strategies that the Navy could employ as it acquires its next-generation destroyer, the DD(X). The Center also helped evaluate how well and under what conditions the Navy could operate ships that employ electric drive propulsion systems.

Assessing Force Modernization and Employment Options

ATP in 2003 continued to investigate force modernization priorities. The Center extended a multiyear effort to evaluate naval force structure options, acquisition and modernization strategies, budget alternatives, and industrial base issues for the Navy and OSD. It began a review of the Navy's and Marine Corps' joint forcible entry operations and evaluated options open to the Navy as it considers a new generation of medical capabilities afloat that could replace the capabilities of the current fleet of aging hospital ships. Center researchers continued several other projects for the senior Navy decision-makers: one that identified major decisions they will need to make in the future (so-called forks in the road); another that compares the costs and benefits of building new aircraft carriers versus refueling carriers currently in service; and a third that examines the implications for shipyard workers of changing the start date or production schedule of the next generation of carriers, the CVN(X). ATP also continued to provide analytic support to the U.S. Pacific Command on interoperability issues. Other ATP researchers evaluated

acquisition strategies that would most effectively enhance the military's abilities to maneuver on and around battlefields and explored how the military translates innovative ideas into operational concepts and fielded weapon systems.

Maintaining Core Defense Technology and Production Bases

With many crucial defense technology industries having merged, restructured, or reduced their operations, the Center for several years has helped the DoD explore how to preserve vital development and production capabilities and to identify where its unique needs might require different solutions. In a major effort, ATP in 2003 published a congressionally mandated analysis that looked into the risks—measured by higher costs or reduced innovation—that further consolidation in the U.S. military aircraft industry might engender. The Center continued to help the Navy identify ways to measure and evaluate the success of its science and technology investments. ATP also investigated actions that would enable the DoD to produce missiles and precision-guided munitions more flexibly and responsively. And the Center, in conjunction with NDRI's Forces and Resources Policy Center, provided ongoing support to Navy efforts to formulate study plans.

Assessing New Acquisition and Management Strategies, Processes, and Organizational Structures

ATP researchers in 2003 helped defense policymakers identify ways to improve acquisition processes and implement meaningful management reforms. On behalf of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USDAT&L), the Center continued to investigate options for the DoD to tap into the private venture capital community to access new technology. The Center began analyzing how statutory and regulatory constraints may affect acquisition programs and schedules. The Center also continued to review processes that the Missile Defense Agency uses to develop programs and allocate resources.

Application of New Modeling and Simulation Approaches

ATP continued to help the DoD fashion a more flexible, robust modeling and simulation (M&S) environment in 2003. The Center continued a multiyear effort to help the Defense Information Systems Agency develop analytic tools to measure the degree to which command, control, and communications capabilities influence joint military operations. Center analysts also continued to evaluate concepts and tools that senior DoD staff can use to develop counterterrorism strategies. ATP analysts began to help the DoD think through how it can build and adapt models and simulations in modules so that the services can compose and tailor them as circumstances require. In addition, the Center helped the Defense Modeling and Simulation Office assess how it can more effectively support DoD clients, particularly those connected to the USDAT&L.

There will be less competition and innovation in the U.S. military aircraft industry and some highly skilled specialists will leave the industry over the next 10 years unless the nation begins additional aircraft development programs.

So concludes an NDRI study of the United States' military aircraft industrial base. Done quickly at the request of the Under Secretary of Defense, this study examined whether a dwindling number of military aircraft suppliers would degrade national security by diminishing the industry's competition and innovation. In 1960 there were 11 U.S. contractors able to design and build military aircraft that met the nation's needs. The number dropped to eight in 1990. Today, as a result of further mergers and other developments, only three companies—Lockheed Martin, Boeing, and Northrop Grumman—are capable of developing and producing major military aircraft systems.

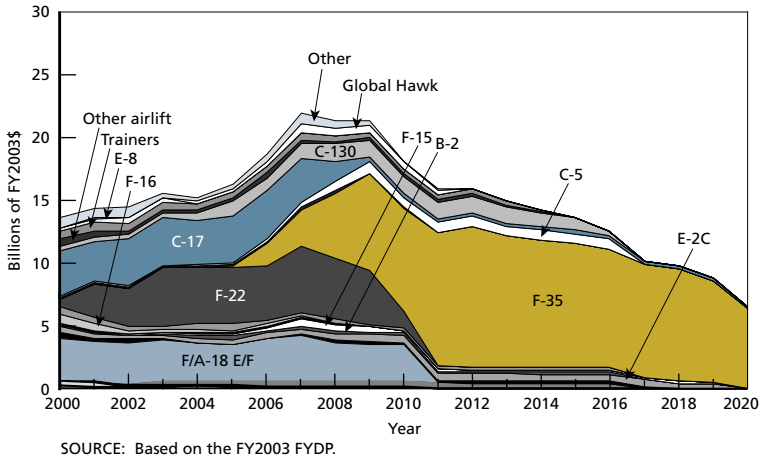
The number of military aircraft contractors could shrink further because the nation has only one major new aircraft project in development and no others planned. Without some additional development programs, business practices could dictate that the companies reassign their talent to other areas. And, because military aircraft designers have unique skills that are needed only for the specialized aircraft—such as designing pilot and weapon system interfaces—once those skills are lost, they cannot be easily replaced.

Concern about the future capability of the U.S. fixed-wing military aircraft industry increased after the DoD chose Lockheed Martin as the prime contractor to develop and build the Joint Strike Fighter (JSF)—the F-35. The JSF is expected to be one of the largest acquisition projects in history, worth some $300 billion. It is the only new fighter aircraft program the U.S. military has planned for the next 30 years. Different versions of the plane will be used by the U.S. Air Force, Navy, and Marines, as well as by the United Kingdom and other U.S. allies. By 2026, some 3,000 of the F-35s are planned to be integrated into U.S. and UK forces. Under past practice, each version of the JSF would have been designed and developed separately, whereas development of different versions of the F-35 for each service is being integrated to reduce production and maintenance costs.

The accompanying figures graphically portray the policy concern. The first shows total dollars (measured in total obligational authority, or TOA) that the DoD expects to spend each year to procure fixed-wing military aircraft between 2000 and 2020. The second figure depicts the percentage shares of that spending that will go to Lockheed Martin, Boeing, and Northrop Grumman under the DoD's current, "base case" procurement plans. By 2011, spending on the F-35 dominates the picture and Lockheed Martin's share of total spending will hit 70 percent.

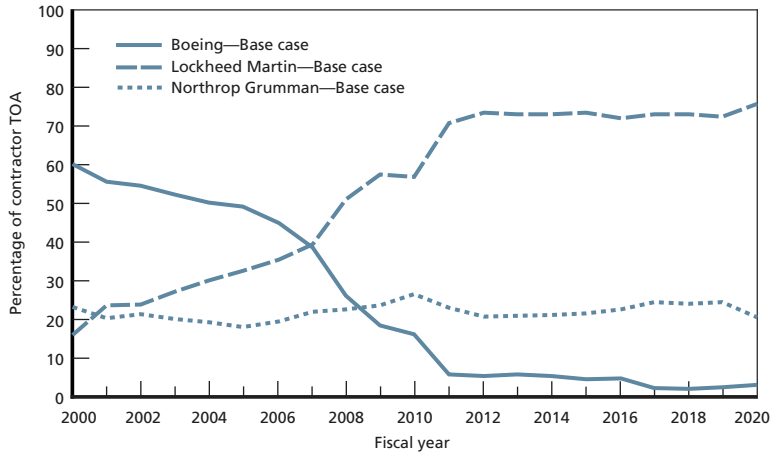
NDRI reviewed the history of U.S. military aircraft manufacturers to give policymakers a view of how the industry became the world leader and how it has evolved over time. The study team found that competition has been a key

DoD Fixed-Wing Military Aircraft Procurement Obligational Authority, 2000–2020



SOURCE: Based on the FY2003 FYDP.

Prime Contractor Share of DoD Fixed-Wing Military Aircraft Procurement Obligational Authority, 2000–2020



part of the technological success of the U.S. military aircraft industry over the past century, with most innovations being made by smaller companies that were working to gain a larger role in the industry.

While the competition over the F-35 is over, there are several smaller projects being planned that will provide work for military aircraft designers. But work on a planned air tanker; on a new Unmanned Combat Air Vehicle; and on a new intelligence, surveillance, and reconnaissance airplane will only sustain design teams through the end of the decade, the study concluded. Moreover, spreading production of the F-35 among the major military aircraft manufacturers, which has been suggested as a way to support industry competition, is not a viable alternative. An earlier NDRI study found that course of action would be expensive and do little to directly support the design skills that are the most critical to preserve.

A better and less-expensive option, NDRI concluded, would be to fund a continuing series of advanced design studies and development of experimental concept demonstrators. This would yield a range of new technologies and system concepts to support future military capabilities, while sustaining a vigorous and competitive design and development capability in the industry. This approach would cost less and could motivate manufacturers to keep their prized design teams intact.

While policymakers can act to encourage competition and innovation in the military aircraft industry, the NDRI study urged them to consider whether it is in the country's best interest to preserve the current industry structure and capabilities for the military aircraft. The industry already has undergone fundamental changes and is evolving toward a different posture in response to a changing demand. New developments such as the growing role for unmanned combat aircraft are likely to alter the military's requirements in the future. Instead of preserving the current systems, researchers say, policymakers may want to consider new types of aircraft research and development programs that could do a better job of meeting the U.S. military's future needs.

For more information, see

Competition and Innovation in the U.S. Fixed-Wing Military Aircraft Industry, John Birkler, Anthony G. Brower, Jeffrey A. Drezner, Gordon Lee, Mark Lorell, Giles Smith, Fred Timson, William P.G. Trimble, Obaid Younossi, MR-1656-OSD, 2003.

In modeling and simulation (M&S), "composability" is the ability to assemble an M&S needed for some particular problem from components developed previously, quite possibly for other purposes. When composability is readily feasible, components can be "reused" in different applications, with possible savings of time and money, and perhaps with reduction of risk. Composability is fairly common in software development and some have been enthusiastic about extending it to models and simulation. Past DoD efforts to achieve it, however, have had decidedly limited success. NDRI was asked to do an independent study of prospects and ways to improve the likelihood of success.

Variables Affecting Composability

Work began by systematically identifying the factors affecting composability. As shown in the accompanying figure, these were identified as the complexity of the system being modeled; the difficulty of the modeling objective; the strength of underlying science and technology for the modeling effort; and human considerations, such as the quality of management and the skill and knowledge of the workforce. Unfortunately, there is no single Gordian knot to address in improving composability. All of the factors are important.

Related to difficulty is the *risk* of an effort to develop a "composable system." Such an effort may suffer large cost overruns or simply fail altogether. The risk of failure rises with size and complexity of the system being modeled. It rises extremely fast if any of several danger factors are present, including poor management, the crossing of many military or cultural boundaries in attempting the composition, and a poor understanding of what is being modeled, worsened by a weak treatment of uncertainty. In these cases, the risk of failure is high even if expenditures are increased; these shortcomings cannot be overcome by simply throwing money at the problem.

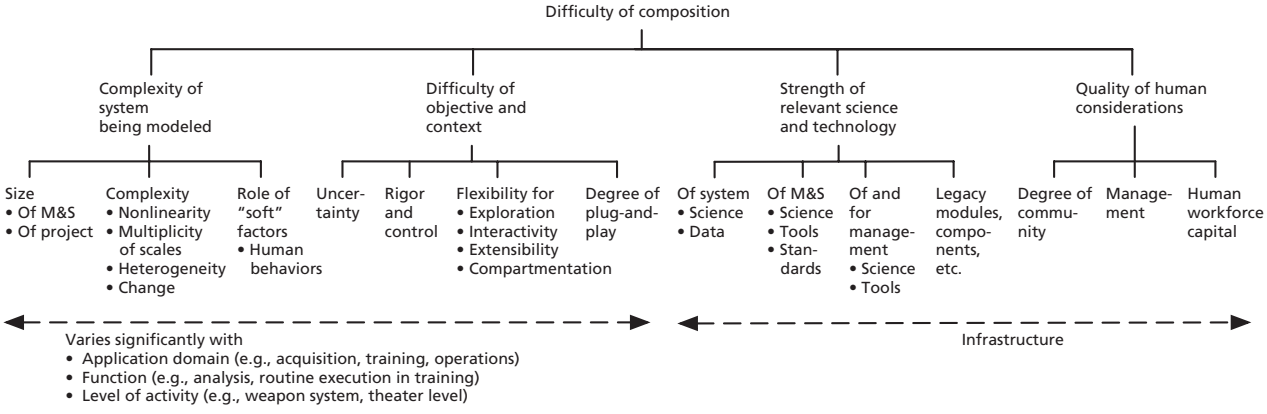
Those who pay for and hope to use composability-driven efforts for practical purposes—such as weapon acquisition, training, or warfighting—need realistic expectations and assistance in establishing those expectations and related requirements. While "plug-and-play" of different components is an appealing image often advertised in Vu-Graphs, it is fatally flawed for complex *models* even with adherence to the standards of DoD's high-level architecture. Model composition is much more difficult than the composition of pure software or of software components that provide straightforward and readily compartmentalized services. Composability efforts based on connecting modules designed in different times and places and for different purposes can ill serve users. The DoD should focus its efforts not on composability for its own sake but on domains and circumstances where it makes the most sense, including from a "business" perspective such as weapon system acquisition.

Targets for DoD Composability Efforts

What can be done to improve composability efforts? Because there is no single stumbling block, a "systems approach" is needed. The NDRI study focused its suggestions on "targets," objective system elements for which specific measures can be taken. These include the following:

- Science of the subjects being modeled and of M&S activities. In many instances, there is not a "software problem," but rather a need for demanding, in-depth inquiry in military science. DoD typically pursues military science unsystematically; it needs to mount military science programs to ensure a strong base of knowledge in key domains.

Factors Affecting the Difficulty of Modeling and Simulation Composition



- Technology, including standards for composability. DoD has achieved much success with its high-level architecture and related instruments such as run-time infrastructure. Nevertheless, the time is ripe for DoD to revisit its standards and protocol. In particular, DoD should realign its standards with those of the commercial marketplace, rather than merely patching its high-level architecture and run-time infrastructure.
- Understanding of pitfalls, best practices, relevant metrics, and what can reasonably be achieved. To help accomplish this, DoD should commission independent and objective lessons-learned studies on past composability-related efforts, such as those of JSIMS (joint simulation system), JWARS (joint warfare system), and One SAF (entity-level battalion and below constructive simulation with semi-automated forces).
- Quality of management, including setting of goals and metrics, team building, and collaborative efforts. A systematic effort is needed to define requirements and methods for developing first-rate managers, educated at the appropriate time in their careers about the special needs of complex M&S projects.
- Quality of the workforce, including education, talent, and experience. In the past, those building large-scale M&S systems have seldom been trained to do so. Even system engineers are often poorly prepared to deal with the subtleties of *model* composition. As with management, there is a need for related systematic education, selection, and training. Much could also be done while training with other agencies and industry groups.
- Health and vitality of the M&S community. Ultimately, the future of composability depends on having a favorable environment including a strong industrial base, incentives promoting sensible development, and mechanisms that support technically sound and fair competitions among ideas and proposals.

Implications

To improve prospects for composability in its M&S, DoD must recognize that models are different from general software components and that model composability needs to be based on the science of M&S, and a solid understanding of subject-area phenomena, not just on software. DoD should back away from earlier excesses and develop realistic expectations, and it should seek improvements through actions and investments in multiple areas ranging from science and technology to education and training.

For more information, see

Improving the Composability of Department of Defense Models and Simulations, Paul K. Davis, Robert H. Anderson, MG-101-OSD, 2003.

Forces and Resources Policy Center

The Forces and Resources Policy Center (FRP) helps defense policymakers address personnel and other resource implications of changes in the structure of the U.S. and global economy, the emergence of new security challenges, and the rapid progress of technology. Its research delves into the array of issues affecting America's military personnel and their families. It also helps determine forces needed to execute U.S. military strategies; ways to recruit, manage, and retain those forces; optimal use of DoD resources; rational structuring of DoD organizations; and efficient interactions between federal, state, and local authorities across a range of responsibilities, including homeland defense.

FRP analyzed these issues in 2003 along five interconnected themes outlined below.

Ensuring Appropriate Supply of Personnel

Though defense transformation will change the way DoD conducts its business, it will not lessen the criticality of maintaining a skilled, productive force. Success in this regard will require the development of new, creative tools for recruiting, retaining, compensating, and motivating individuals. The DoD will need to identify the recruiting practices that are most cost-effective in today's labor market, practices that will allow them not only to compete with the private sector for high-quality enlistees—without unnecessary competition between the services for the limited pool of talent—but also to increase enlistment of youth in certain specific populations from which it has not traditionally drawn recruits. In this regard, FRP researchers in 2003 helped OSD policymakers identify factors underlying the underrepresentation of Hispanics in military accessions. FRP researchers began work on developing and updating models of, and metrics for measuring, retention. Other FRP researcher teams examined whether greater use of indefinite reenlistments is advisable; looked at ways the DoD can simplify and add flexibility to the military compensation system; reviewed and evaluated alternative retirement systems for active-duty and reserve forces; and explored pilot "up-and-stay" programs that the services could consider as alternatives to current "up-or-out" management policies. The Center also helped OSD identify practices for recruiting civilian DoD workers more effectively.

Assessing and Improving Military Quality of Life

FRP has for a number of years helped the DoD assess policies and practices designed to directly improve military quality of life. In 2003, Center analysts continued analysis of issues surrounding military spouse employment, an area of concern that emerged from the 2001 review of military morale and quality of life supported by FRP. The Center also continued its work on the DoD child care system, focusing on measuring the demand for child care and the factors that affect that demand. Other FRP analysts in 2003 examined the feasibility and advisability of providing greater options for extended leave to officers in general, as well as examining some specific options for the naval surface warfare fleet officer community.

Improving the Military Health Care System

The DoD military health care system is the largest health care operation in the United States, and health care expenses are the fastest-growing fraction of the DoD budget. Not surprisingly, DoD faces numerous issues related to the management of its health care system. In 2003, FRP analysts

continued to evaluate aspects of TRICARE—the system that provides health care to military members, dependents, and retirees—studying the use of pharmaceuticals by Medicare-eligible military retirees, as well as the impact of co-pays and deductibles on demand for military medical services. And an FRP research team continued its work on mental health care provider options.

Shaping the DoD's Workforces

The DoD continually reassesses whether it has the human resources it needs to accomplish its mission. A major aspect of this involves making estimates of how manpower requirements will evolve and what the optimal experience profile in the defense workforce might look like. The Center in 2003 initiated research into how to more effectively link and synchronize manpower, personnel, training, resource, and other systems. Other FRP researchers are helping the Navy identify both the skills that its senior uniformed and civilian personnel will need in the future and the number of individuals with those skills that it will require. And FRP continued to help the DoD examine whether its existing officer personnel management practices are appropriate for the defense environment it will face in the 21st century. Another FRP project began to develop strategic guidance for DoD on how to best manage the process of assigning officers to joint positions.

Managing Other Resources

As in previous years, FRP in 2003 continued to help DoD managers improve their business practices, identify new ways to organize their operations, and embrace new approaches to budgeting and strategic planning. The Center continued to evaluate what potential effects would result if changes were made to the infrastructure associated with the education and professional development programs provided by DoD. In the logistics area, FRP analysts continued to investigate how logistics providers could use proven process improvement methods to more effectively supply and support U.S. forces based at home and abroad, and continued to explore options to more quickly and reliably provision and service Trident submarines. The Center also looked at ammunition manufacturing in Canada to assess whether and to what extent U.S. Army arsenals and ammunition plants should be privatized. And in a joint effort with ISDP, the Center provided continuing support to a congressionally mandated panel assessing the ability of state and local authorities to respond to terrorists wielding devastating weapons on U.S. soil.

Senior members of the DoD have expressed concern that general and flag officers (GFOs)[1] change jobs too frequently and, consequently, do not spend enough time in an assignment to be as effective as they could be, develop the skills they need for subsequent assignments, or remain long enough to be accountable for their actions. Furthermore, policymakers are concerned that the careers of the most-senior officers are too short to reap all the benefits of their extensive experience. However, the military services need to ensure a constant flow of promotions through all officer ranks, O-1 through O-10, and must avoid any clogging of the promotion system that would cause any stagnation in the officer corps.

What, then, are the appropriate practices for assigning and developing GFOs? If current practices change, what would the effect be? To answer these questions, NDRI researchers examined how the current system manages GFOs, reviewed the literature regarding private-sector management of senior executives, and developed models on different ways of managing the most senior military officers.

Current Management and Private-Sector Comparisons

There are around 900 GFOs in DoD. About 50 percent are O-7s, 35 percent O-8s, and 15 percent O-9s and O-10s. Although the GFO positions span the career fields of DoD, NDRI researchers, at the request of the OSD sponsor, focused on the approximately 600 line officers, because they are the officers historically promoted to the most senior ranks.

Most GFO assignments last less than 30 months. Officers who eventually reach O-10 are promoted rather quickly, spending about 3 years as an O-7 (usually in two assignments), 2–2.5 years as an O-8, and 2.5 years as an O-9. Their civilian counterparts tend to become CEOs at the same age that O-10s get promoted, but their tenure in the most senior job differs substantially, as the accompanying table shows. The average O-10 serves for 3.5 years, and almost 90 percent of O-10s retire voluntarily before reaching age 60. The average CEO serves for almost 8.5 years, and less than a third of CEOs depart before reaching age 60.

Senior Executives' Job Tenure and Retirement Age (in years)

	0–10s	CEOs
Mean age when appointed	54.1	53.5
Mean tenure	3.5	8.4
Length of tenure (25th–75th percentile)	2.3–4.1	5–12
Departing under age 60	87%	31%

Optimal Career Paths for Developing Senior Military Leadership

Analysis of senior officer personnel data suggests that one can differentiate between "developing" jobs and "using" jobs. "Developing" jobs are those in which candidates for future senior positions are expected to acquire skills necessary for advancement, while "using" jobs are those in which organizations take advantage of the skills that candidates acquire. (The literature suggests that this distinction is generally recognized in the civilian sector as well.) Freshly minted O-7s were assumed to be entering a new developmental phase of their careers, albeit at a relatively high level, that will prepare some of them to become the most senior leaders in the military. For the purpose of modeling senior officer career paths, all O-7 positions were assumed to be "developing" assignments, as were O-8 and O-9 jobs appearing frequently on the resumes of higher-ranking officers. Other O-8 and O-9 jobs and all O-10 jobs were considered to be "using" assignments.

The best approach to developing senior military leadership, or the one maximizing stability and accountability without sacrificing promotion opportunity, appears to be one with "developing" assignments of two years and "using" assignments of four years. The tenure of the "developing" assignments would be about the same as GFO assignments are now, but the "using" assignments would be longer. Compared with the current system, such a system would have the effect of generally promoting more officers to O-7, an equal or greater number to O-8, and a generally greater number to O-9. Promotions to O-10 would decrease because the length of time that officers would serve at that level would increase.

[1] GFOs comprise officer ranks O-7 through O-10, i.e., brigadier general or rear admiral (lower-half) through general and admiral ranks.

Conclusions and Recommendations

With a few exceptions, the current system does not determine assignment length based on the inherent nature of the job or the way the job is used to develop officers. It should. Distinguishing between "developing" assignments and "using" assignments would allow the tenure of some senior assignments to be lengthened, mitigating the aforementioned concerns of senior defense officials, without congesting the promotion system. The management changes suggested by the model on the best approach to developing senior military leadership could be implemented largely within existing legislation. The Title 10 authority permitting 40-year careers for O-10s and 38 years for O-9s coupled with a mandatory retirement age of 62 is sufficient to permit longer careers, though legislative change could give the services more flexibility to implement a new personnel management approach. Additional changes, such as to the compensation and retirement system, are also warranted.

For more information, see

Aligning the Stars: Improvements to General and Flag Officer Management, Margaret C. Harrell, Harry J. Thie, Peter Schirmer, Kevin Brancato, MR-1712-OSD, 2004.

Intelligence Policy Center

The Intelligence Policy Center (IPC) assists clients as they confront today's rapidly evolving intelligence environment. The Center helps decisionmakers identify and define emerging threats, such as terrorism and the proliferation of WMD, which are more fragmented than the threats of the past. The Center's research provides a strong foundation on foreign political, cultural, and military developments. It also helps defense policymakers understand the changing role of intelligence in warfighting. In addition to its traditional role supporting other instruments of American power, intelligence today has an ability to create conditions to prevent, preempt, and deter adversaries. A whole new slate of intelligence instruments—including sensors, analysis tools, and fusion tools—will have the potential to transform warfighting, but only if they are considered as an integral part of U.S. warfighting strategy and tactics and tailored carefully to operational needs and conditions.

At the same time, intelligence agencies—pressured by the needs to balance modernization and operations, adjust to increased oversight, and pursue transformation—are changing in significant ways. Effective management of these agencies requires not only a complex set of tradeoffs and links between requirements, resources, and capabilities, but also a willingness to accept risk and technological innovation.

With a focus that cuts across international security, acquisition, technology, and manpower issues, the Center in 2003 conducted studies and analyses along the four themes outlined below.

Identifying New Security Threats and Risks

In 2003, the IPC helped the DoD define early indications and warnings of future threats and modeled the behavior of potential adversaries, both state and nonstate. Using a combination of open sources, gray literature, and classified sources, the Center provided a broad spectrum of analytical support to the China East Asia Office of the Defense Intelligence Agency (DIA). For the National Geospatial-Intelligence Agency (NGA), the Center explored whether and to what degree geospatial information that is publicly available from government and commercial sources affects U.S. homeland security.

Identifying New Intelligence Sources and Methods

The Center in 2003 continued to help clients develop new approaches to intelligence collection and analysis, especially those that drive an intelligence advantage over U.S. adversaries. This work involved providing assistance to intelligence agencies as they considered how to more effectively obtain unique access to intelligence information, array data in ways that provide more detailed and comprehensive pictures of given situations, and portray data in more understandable formats for decisionmakers. Along these lines, IPC continued to help NGA assess the goals and strategies it has established to transform its mission, structure, and processes. And it helped NGA decisionmakers identify and evaluate security, organizational, and analytic issues the agency will confront as its operations increasingly will require its managers to understand, coordinate, and synchronize multi-INT—intelligence from multiple sources. The Center also began an overarching study on the future of U.S. intelligence analysis, involving all of the defense intelligence agencies.

Improving Intelligence Support to the Warfighter

As warfighting becomes more complex, so does the volume and diversity of intelligence information that will be required to support it. Among these are new types of intelligence information related to foreign cultural, medical, infrastructure, and other unique contextual information. Along these lines, the IPC in 2003 conducted a study for the National Cryptologic School in the National Security Agency (NSA) on how to rebuild analysis given the complex signals intelligence environment and an increasing set of demands related to warfighting. Also in 2003, the IPC—on behalf of the Armed Forces Medical Intelligence Center in DIA—continued to investigate the capabilities of Islamic nongovernmental organizations to deliver combat and public health services to participants in rural and urban insurgencies around the globe.

Improving Strategic Decision Processes

DIA, NGA, and the NSA—like other U.S. intelligence agencies that hold both operational and acquisition responsibilities—place a premium on strategic management and decision processes. IPC in 2003 continued to help those agencies' decisionmakers think through acquisition reform, workforce management, systems engineering, outsourcing, and other strategic management topics. On behalf of the NSA, the Center helped develop and institutionalize a coherent and integrated strategic planning process; defined ways the organization can better oversee, manage, and structure acquisitions; and continued to identify tools and processes the agency can use to manage its distributed computer networks more effectively. For NGA, the Center continued to provide analytic support and assistance on strategic planning and acquisition reform efforts, contributing to the realignment of NGA's strategic organizations and resources.

NDRI in 2003 developed an analytical process that can assist U.S. federal policymakers and others in assessing the homeland security implications of geospatial information that is publicly available.

In the wake of the September 11 attacks, federal government agencies restricted public access to some information sources, such as Web sites, that they feared could be used for planning and carrying out attacks against U.S. homeland locations, including critical infrastructure and other key assets. Policymakers face a major analytical challenge in assessing whether and how potential attackers, including terrorists, could exploit geospatial information from diverse formats, including maps, overhead images, geographic information systems databases, Web sites, and textual documents, which are often available from a range of federal and nonfederal sources. To help federal policymakers in making sound decisions, NDRI used a methodology that assessed both the "demand" that potential attackers have for targeting information and the "supply" of potentially relevant geospatial information sources, with particular attention to U.S. federal sources.

Gauging Adversaries' Demand for Information

To gain insights on the adversaries' interest in geospatial information, NDRI analyzed the key information needs of potential attackers based on a series of postulated attacks on a spectrum of U.S. critical infrastructure, military targets, and cultural locations. Two key information needs were identified: what information attackers need for *selecting a target* (i.e., which target, where is it located), and what information they need for *planning an attack* (i.e., what are the target's layout, vulnerabilities, security measures, etc.). The analysis revealed that in targeting U.S. homeland locations, potential attackers have substantial flexibility because they usually have a broad of range of choices about why, where, and how to attack.

Although publicly accessible geospatial information has the potential to be somewhat helpful in selecting and locating a target, potential attackers are likely to need more reliable, detailed, and up-to-date information. Such information often can be obtained by directly accessing or observing a target or by a host of other means. In addition, planning for specific attacks requires very detailed information, most of which can be gleaned from non-geospatial sources, such as direct observation or engineering textbooks, or from discussions with individuals familiar with the operations of a particular type of facility.

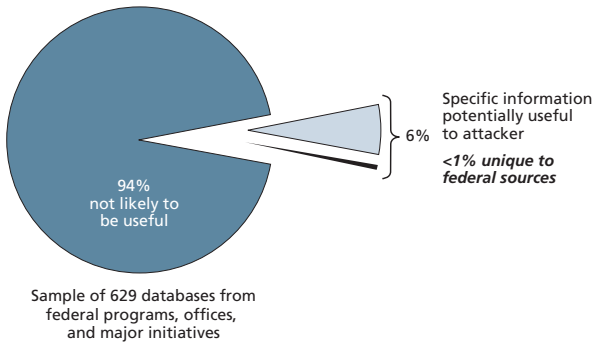
Evaluating the Federal Sources of Geospatial Data

To analyze the supply of geospatial information, NDRI focused on two key questions: what federal geospatial information is publicly available, and how significant is it to attackers' needs given the usefulness and uniqueness of the information? To answer them, the research team

- conducted a structured survey to identify and assess publicly available geospatial information about critical sites at 465 federal data sources, which involved searching more than 5,000 federal Web sites.
- sampled geospatial datasets from these federal sources. A selected sample of 629 federal datasets was identified for closer examination because they appeared most likely to contain geospatial information about U.S. critical sites.
- sampled alternative geospatial information sources. A sample of more than 300 nonfederal sources (e.g., private, state, and local governments, academic institutions, non-governmental organizations, and foreign geospatial data sources), involving a search of more than 2,000 Web sites, was undertaken to assess the availability nonfederal sources of geospatial information.

The figure below depicts NDRI's findings from examining these samples. Fewer than 6 percent of the 629 federal geospatial information datasets examined appeared as though they could be useful to meeting a potential attacker's information needs. Furthermore, the study found no publicly available federal geospatial datasets that might be considered critical to meeting the attacker's information needs (i.e., those that the attacker could not perform the attack without). Additionally, most publicly accessible federal geospatial information appears unlikely to provide significant information for satisfying attackers' information needs (i.e., less than 1 percent of the 629 federal datasets examined appeared both potentially useful and unique). Moreover, since

Less Than 1 Percent of Federal Datasets Appear Potentially Useful and Unique



Initial Framework for Assessing the Homeland Security Sensitivity of Publicly Available Geospatial Information

Filter	Key Questions
Usefulness	Is information useful for target selection or location purposes? Is information useful for attack-planning purposes?
Uniqueness	Is information readily available from other geospatial information sources? Is information available from direct observation or other non-geospatial information types?
Societal Benefits/Costs	What are the expected security benefits of restricting public access to this source? What are the expected societal costs of restricting public access to this source?

the September 11 attacks these information sources are no longer being made public by federal agencies.

In many cases, diverse alternative information sources exist. NDRI's review of nonfederal information sources suggests that identical, similar, or more useful data about critical U.S. sites is available from industry, academic institutions, nongovernmental organizations, state and local governments, foreign sources, and even private citizens.

However, despite the few cases identified, the NDRI study results do not rule out the possibility that potential attackers could exploit existing or future geospatial information that is publicly available from federal sources. Thus, U.S. policymakers need an analytical process for assessing the homeland security implications of geospatial information.

Recommendations

NDRI recommended that the federal government be proactive in making the process of reviewing publicly available geospatial information more coherent and consistent among a wide range of federal agencies and relevant nonfederal organizations. This NDRI study proposed that U.S. policymakers use a framework consisting of three filters in assessing the homeland security implications of geospatial data and information: the usefulness of the information for an attacker, the uniqueness of the information, and the societal benefits and costs of restricting public access to a particular geospatial information source (see the table above). Given the diverse nature of information sources available to potential attackers, policymakers would benefit from weighing these key factors in identifying potentially sensitive geospatial information and in making decisions on whether and how to restrict public access to certain pieces of geospatial information. NDRI also recommended that the U.S. government eventually go beyond this first-step framework by developing a more comprehensive and formal model for establishing the desired protection levels of diverse U.S. critical sites, including information protection policies.

As the primary government agencies that produce and distribute geospatial data and information, the NGA and the U.S. Geological Survey (USGS) of the Department of the Interior should play a substantial role in applying their special expertise to help the Department of Homeland Security, the Office of Management and Budget, and other organizations in developing policy guidelines for identifying sensitive geospatial information, the NDRI study noted.

For more information, see

Mapping the Risks: Assessing the Homeland Security Implications of Publicly Available Geospatial Information, John C. Baker, Beth E. Lachman, David R. Frelinger, Kevin M. O'Connell, Alexander C. Hou, Michael S. Tseng, David Orletsky, Charles Yost, MG-142-NGA, 2004.

Crosscutting Research

Numerous issues that NDRI addresses—many of which touch on some of today's most critical and complicated U.S. defense challenges—transcend the particular interests of individual DoD clients or cut across multiple areas of inquiry and expertise within the Institute.

The need for such integrated analyses has grown in the post–September 11 era, as demonstrated by the launch of military operations in Afghanistan and Iraq and by the ongoing war on terrorism in other parts of the world. The concurrent warfighting, counterterrorist, and homeland security roles that the DoD shoulders are raising policy questions that both fall well outside of neat organizational and intellectual domains and require answers that emerge from synthesized, joint, and non-compartmentalized lines of inquiry.

NDRI has been involved with integrated approaches and solutions to complex national security problems for decades. Over the years, the Institute has helped policymakers assess options and put forth policy recommendations on a series of broad, integrated examinations of defense issues—the Bottom-Up Review, the National Defense Panel, and the Quadrennial Defense Review, among others. Each called upon policymakers to anticipate and adjust to uncertain threats in the 21st century by cutting through specific strategy, technology, personnel, and bureaucratic jurisdictions.

The RAND National Defense Research Institute Advisory Board annually establishes and endorses some crosscutting studies. Other studies that involve research cutting across more than one NDRI research center emerge from requests by specific clients. One study that NDRI finalized in 2003 is outlined on pages 28–29.

Past and Ongoing Crosscutting Research

Planning Future Forces focused on new directions in defense planning and helped the DoD conceptualize its "Shape, Respond, Prepare" strategy.

Manpower in Strategic Defense Planning explored whether and to what degree the DoD's new approach toward deployments—in which the Pentagon has relied repeatedly on certain units and individuals to handle numerous diverse missions since the Gulf War—has had an unintended consequence: lower retention rates.

Developing New Concepts for Military Operations looked at ways to help the DoD envision and put in place crucial technologies.

Meeting Future Critical Skill Requirements built on past work relating to databases, estimates of personnel quality, measures of perstempo, models of retention, and projections of alternative compensation policies to create a framework for in-depth studies of skill requirements in particular occupational areas, such as information warfare.

Defense Information Revolution work has focused on information superiority, which has enabled the United States and its allies to employ new operational concepts and thereby gain a distinct advantage over future adversaries. However, such superiority depends on a mix of C4ISR capabilities linked across forces, weapon systems, and networks. NDRI has helped improve DoD policymakers' capabilities to assess how C4ISR contributes to the success of military operations.

Transforming Forces for the New Era analyses identified concrete near- and far-term steps DoD policymakers can take to transform U.S. forces to meet emerging military challenges.

The Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction project has provided analytic support to a high-level national panel gauging how well prepared the United States is to respond to terrorist threats to its homeland. Created by Congress in 1998, the panel has assessed federal efforts to enhance domestic preparedness, spotlighted deficiencies, and recommended strategies to better coordinate federal, state, and local efforts. The White House relied on the panel's recommendations in creating the Office of Homeland Security in the days following the September 11 attacks.

Nuclear Weapons and the Future of Strategic Warfare research outlined a spectrum of possible long-term nuclear futures for the United States—ranging from maintaining today's force totals to cutting them to 300 strategic and tactical warheads—and defined global political and arms control conditions that would be needed to achieve each different end state. It also investigated changes to U.S. targeting strategy that would be needed to adjust to these different end states.

Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation research suggested ways that the DoD can clarify tradeoffs involved in implementing capabilities-based planning by identifying portfolios of modular capabilities that can accomplish a range of missions.

Deterrence and Influence in Counterterrorism research laid out a framework for devising strategies to thwart and defeat al Qaeda and other terrorists. NDRI suggested that influence, rather than deterrence, is the primary strategic principle in the current environment, that terrorist groups should be construed as systems, not single entities, and that they need to be confronted simultaneously across many fronts.

In the final years of the 1990s, private-sector demand for information technology (IT) workers seemed insatiable. IT unemployment was practically nonexistent, pay was high and rising fast, and the Bureau of Labor Statistics forecast—and still forecasts—a far faster growth in IT jobs over the next decade than in any other occupational area. Leaders in the national security community began to doubt that the military, intelligence agencies, and public organizations would be able to compete for IT workers in such an increasingly tight labor market. This concern was intensified by the evolving nature of the military services and intelligence agencies and their increasing dependence on information technology.

A recent study sponsored by the NDRI Advisory Board, the Office of the Under Secretary of Defense for Personnel and Readiness, and the Office of the Assistant Secretary of Defense for Networks and Information Integration focused on a component of this issue, namely, the factors affecting the supply of IT personnel to the active-duty enlisted force.

The scramble for IT workers has ceased, but it lasted long enough to jolt state and federal agencies into modifying their personnel policies in order to attract and keep IT personnel, e.g., through altered job classification systems, increased pay levels, and enhanced professional development opportunities. The IT boom also caused national security planners to question whether future force structures would be vulnerable to shortages of IT personnel.

Policymakers' concerns were spawned by the higher pay, enhanced on-the-job training opportunities, flexible work hours, and support for career development that private firms offered IT workers in the late 1990s. Their concerns also grew out of a sense that the military faced increasing challenges to recruit and retain personnel while the economy was booming, while IT was growing rapidly as an occupational field, and while private-sector unemployment was falling to record lows. To compound matters, these challenges were surfacing just as the military services undertook initiatives to employ IT in a host of ways on the battlefield, in intelligence, and in support activities.

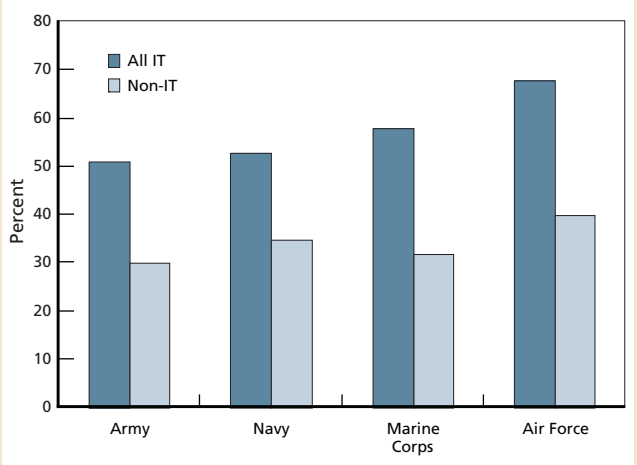
Pay disparities also fed policymakers' concerns. On the one hand, civilian pay increases in the 1990s generally were outpacing those in the military. On the other hand, wages for civilian IT occupations were rising more quickly than those for civilian non-IT slots. This resulted not only in an overall decline in the military/civilian wage ratio, but in an even more pronounced decline in that ratio for IT occupations.

NDRI addressed this issue by surveying literature on managing and compensating IT workers in private firms and in government, conducting field interviews on selected IT occupations in the Army and the Air Force, studying data on military personnel in IT and non-IT occupations, and comparing military pay with civilian wages in IT and non-IT occupations. The study team also developed a dynamic, stochastic theoretical model of IT personnel supply. The model provided a cohesive framework for exploring factors that affect the enlistment and retention of IT versus non-IT personnel and for absorbing and rationalizing the observations drawn from our surveys and regressions.

Services Have Been Successful in Attracting and Keeping IT Personnel

NDRI found that each service—despite facing obstacles—succeeded in recruiting and retaining IT personnel. In fact, as shown in the accompanying figure, the study found that compared with non-IT recruits, IT recruits were of higher quality, signed on for somewhat longer terms, had lower attrition, and had similar rates of reenlistment (except in the Army, for which the IT reenlistment rate was lower).

IT Specialties Attract Recruits with High Armed Forces Qualification Test (AQFT) Scores



AFQT category I-II = top one-third of test score distribution
Data are averages for FY 1993-2001

IT Training Appears to Be Central to the Attractiveness of Military IT Positions to Potential Recruits

Prospective recruits who are not already in IT will be drawn to the military not only by the challenge of military service, but by the opportunity to learn IT skills they later can use in civilian jobs. While the services use enlistment incentives—bonuses and educational benefits—to attract recruits to IT or other specialties, the study found only minor differences in bonus and benefit usage between IT and non-IT specialties. This suggests that the value of IT training reduced the need for higher enlistment incentives in IT.

The study results indicate that military IT training, by virtue of its ability to attract IT personnel, is an important ingredient in successfully fulfilling IT manpower requirements. The study results also indicate that because the private sector values IT training so highly, service members with that training may have a higher incentive to leave the military for civilian jobs with higher wages. This implies that keeping trained IT personnel may be more of a challenge than recruiting them. Yet while trained IT personnel may have more of an incentive to leave the military, NDRI found a mixed reenlistment picture: IT reenlistment rates were slightly lower than non-IT reenlistment rates in the Army and the Navy, about the same in the Air Force, and slightly higher in the Marine Corps. Although the study team suspected that reenlistment behaviors were influenced by reenlistment bonus usage and/or bonus amounts, which were found to be higher in IT than in non-IT occupations in several services, it additionally argued that reenlistment also was influenced by the expectation of receiving still further valuable IT training and career growth.

Even If Future IT Manning Requirements Change, the Military Should Be Able to Meet IT Needs

Manpower requirements for IT and non-IT personnel change over time as weapon systems and doctrines adjust to new circumstances. The study found that the services have processes in place to define the manpower requirements for these changes and planning cycles that are generally long enough to allow manpower supply to adjust. As a result, if IT manpower requirements continue to change at a gradual pace, and if military IT training continues to be valued in civilian jobs, there is reason to believe that the services will be able to meet their future IT manpower requirements.

The study cautioned that large, abrupt increases in IT manpower requirements will decrease this likelihood. But this may not be likely—not only have the number and percentage of IT recruiting slots declined over the past 20 years, but the services also have taken advantage of enormous increases in the productivity of information technology to do more with fewer people or to outsource some IT tasks. However, because success in IT recruiting has depended on the value of military IT training in civilian jobs, a softening of the civilian demand for IT workers can only reduce that value and increase the difficulty of recruiting into IT. Enlistment and reenlistment incentives such as bonuses can help to compensate for such a loss in value.

For more information, see

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