Annual Report 2005

RAND

NATIONAL SECURITY RESEARCH DIVISION

NSRD Research Sponsors—2005

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For over 20 years, the RAND National Security Research Division (NSRD) has addressed key issues at the top of the national and international security policy agenda. This work continued during the past year. Here are some lessons learned from NSRD's 2005 research:

The 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.

Short-Term Security Demands Should Not Eclipse the Need for Long-Term Institution-Building in Iraq

During its one year of existence, the Coalition Provisional Authority had a mixed record in building sustainable institutions that would contribute to the emergence of a secure and democratic Iraq. NSRD research identified important lessons to be learned from this experience for building security institutions in future stability operations (page 8).

U.S. Carrier Air Power Demonstrated New Capabilities in Afghanistan and Iraq; More Is Yet to Come

Since the first Gulf War in 1991, U.S. carrier air power has greatly improved its warfighting capabilities to support land operations in far-flung corners of the world. These gains were impressively demonstrated during Operations Enduring Freedom and Iraqi Freedom. The future promises even further improvements (page 10).

The Ongoing, Worldwide Technology Revolution Will Play Out Differently Around the Globe— with Important Implications

The world is in the midst of a technology revolution that shows no sign of abating in the near to mid term. By 2020, this revolution could bring important changes in economic development, health, environmental quality, and military power. This technology revolution, while extensive, will play out differently around the globe, with many important implications (page 14).

There May Be a Better Way to Modernize the Navy Carrier Force

Currently, the U.S. Navy plans to refuel its existing *Nimitz*-class carriers at mid-life and build a new class of aircraft carriers, designated CVN 21, at intervals of four years. This new design will incorporate numerous capability and efficiency improvements over that of the *Nimitz*, resulting, among other things, in a decrease in operating costs. An NSRD study proposes a more rapid modernization plan: building new carriers more often and retiring the last five or six *Nimitz*-class ships at mid-life (page 16).

Most Guard and Reserve Personnel Serving in Iraq Are Not Losing Money

Contrary to the widespread perception that most Guard and Reserve personnel suffer an earnings loss when activated to serve in Iraq, NSRD research shows that such earnings losses are relatively uncommon and that, in fact, average earnings gains are substantial (page 20).

Frequent Deployments Affect Service Members Both Positively and Negatively; Proper Policies Can Accentuate the Positive and Minimize the Negative

NSRD research shows that service members value deployments as an opportunity to use their training in real-world missions and to participate in meaningful operations, giving them a sense of accomplishment. However, unusually long deployments or uncertain deployment schedules can adversely affect satisfaction with the military life and possibly decrease retention. This research suggests a number of ways to offset the negative aspects of frequent, long deployments (page 22).

The Reshaping of U.S. Intelligence Has Just Begun; Much More Needs to Be Done

The Intelligence Reform and Terrorism Prevention Act of 2004 began the reshaping of U.S. intelligence, establishing the Director of National Intelligence (DNI). But that was only a beginning. NSRD has laid out an agenda of issues that will arise as the DNI takes the next steps to reshape intelligence (page 26).

China's System of Export Controls for WMD-Related Goods Is a Work in Process, Requiring More Consistent and Effective Implementation

Since the early 1980s, Chinese export controls for goods related to weapons of mass destruction have evolved from highly underdeveloped and ineffective administrative procedures to a comprehensive collection of provisions incorporating international standards for export control. However, NSRD research shows that the Chinese government's inability to *consistently* and *effectively* implement and enforce these controls is a persistent and glaring weakness of the current system (page 28).

Security Must be the Cornerstone of a Successful Palestinian State, but Investment in Infrastructure Can Facilitate Needed Economic Development

NSRD, in conjunction with RAND Health, has issued a comprehensive set of recommendations for the success of an independent Palestinian state. The proposals—including a landmark infrastructure corridor linking West Bank cities and Gaza that would open the door to dramatic new development—would give Palestinians new access to jobs, food, water, education, health care, housing, and public services (page 32).

An Information Revolution in Russia Remains in the Distance

NSRD research found that instead of catalyzing change, information technology within Russia has largely mirrored or reinforced ongoing business, government, social, and political developments. The future of the information revolution in Russia is uncertain, depending not on technology development but on policy issues, such as the foreign investment climate and the regime's commitment to transparency and free speech (page 34).

These and the many other research activities and results reported on in the following pages have informed policy decisions facing NSRD's many national and international research sponsors. In addition to these 2005 efforts, work carried out by NSRD during previous years also had major policy impacts during the past year. For example:

- **Nation-Building.**[1] NSRD's two-volume study of the nation-building experiences of the United States and United Nations, together with numerous other derivative research products, helped lead to changes at the departments of State and Defense. Using recommendations and ideas about organization from RAND, the State Department created a new office to manage stability and reconstruction operations, and the acting Deputy Secretary of Defense signed a directive making postconflict stabilization and reconstruction a core mission for the U.S. military.

- **NASA's Wind Tunnels.**[2] NASA's wind tunnel and propulsion test facilities continue to play important roles in research and development of new or modified aeronautic systems and in the test, evaluation, and sustainment of developmental systems. NSRD's assessment of the range of facilities NASA has and its determination of which facilities are needed to meet future needs was cited in the text of H.R. 3250 (NASA Appropriations), which stated that no facilities identified as necessary by the NSRD study should be closed down without concurrence from a new, independent study by the Office of Science and Technology Policy.

Another major NSRD effort, started during the past year and being greatly expanded during the coming year, is focused on minimizing the threat of improvised explosive devices in Iraq. NSRD analysts in Iraq and in the continental United States are addressing this problem (the entire constellation of insurgent actors and activities, and coalition vulnerabilities and responses), looking for changes in U.S. operational activities and organizational structures to better cope with the threat (p. 6).

This volume provides further details on the projects highlighted above, along with references to source documents. To give a broader view of the NSRD research agenda, paragraph-length summaries describe other projects, most of them ongoing.

As the research efforts reported on in this annual report illustrate, NSRD has built the resources necessary to conduct research on the most complex national and international security problems. We will continue applying those resources to such problems in the coming year and those that follow.

Eugene C. Gritton

Eugene C. Gritton
Vice President, RAND Corporation
Director, National Security Research Division
Director, National Defense Research Institute

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[1] For more information, see *The RAND History of Nation-Building*, James Dobbins, Keith Crane, Seth G. Jones, John G. McGinn, Andrew Rathmell, Rollie Lal, Brett Steele, Rachel M. Swanger, Richard Teltschik, Anga Timilsina, MG-304/1-RC, 2005.

[2] For more information, see *Wind Tunnel and Propulsion Test Facilities: An Assessment of NASA's Capabilities to Serve National Needs*, Philip S. Antón, Eugene C. Gritton, Richard Mesic, Paul Steinberg, MG-178-NASA/OSD, 2004.

The RAND National Security Research Division (NSRD) conducts research on complex national security problems with an emphasis on the most pressing and difficult strategy and policy concerns of high-level defense policymakers and their staffs. NSRD provides independent and objective, high-quality, authoritative analytical support to decisionmakers in the Department of Defense (DoD) and elsewhere in the national security and intelligence communities by

- developing innovative solutions to complex problems using multidisciplinary teams of researchers
- providing practical guidance and clear policy choices while also addressing barriers to effective implementation
- meeting the highest research standards using advanced empirical methods and rigorous peer review
- maintaining independence and objectivity by scrupulously avoiding partisanship and vested interests
- serving the public interest by disseminating widely its research publications (subject to the constraints of national security) and encouraging staff to participate in public forums.

The RAND National Defense Research Institute

NSRD includes the RAND National Defense Research Institute (NDRI), established in 1984 as a federally funded research and development center (FFRDC) sponsored by the Office of the Secretary of Defense 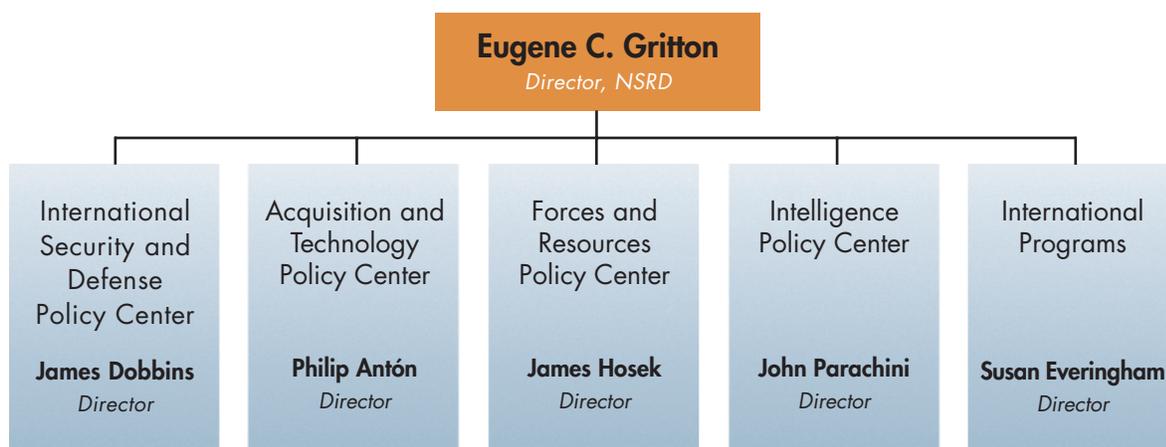(OSD), the Joint Staff, the combatant commands, and the defense agencies. (Through the Office of the Secretary of Defense, NDRI also performs research for the U.S. Navy and the U.S. Marine Corps.) The multiyear FFRDC contract, coupled with NDRI's broad sponsorship and its sponsors' appreciation of its independence, allows the Institute to

- conduct a continuous, integrated research and analysis program with particular emphasis on enduring issues that cut across organizational boundaries
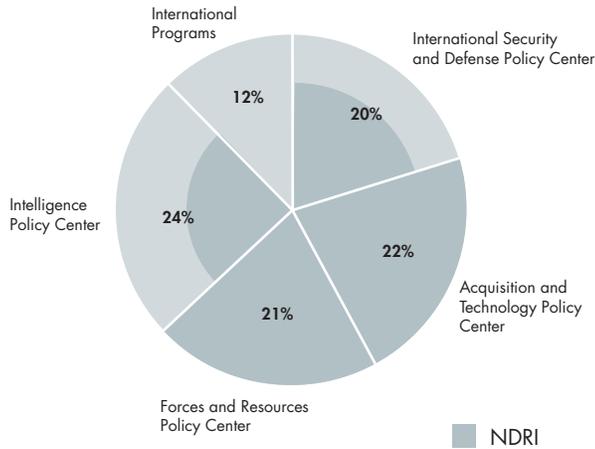- look to the future, maintaining a mid- to long-range focus together with a quick-response capability.

In support of these goals, and by virtue of its 21-year relationship with DoD, NDRI has

- accumulated an in-depth understanding of DoD and its needs
- developed a staff with balanced breadth and depth of technical expertise
- supported the development and sustained the currency of an advanced suite of models and other tools facilitating the analysis of issues across the defense policy spectrum.

It is noteworthy that, as an FFRDC, NDRI stays strictly independent of proprietary interests in order to perform research and analysis requiring access to proprietary and otherwise sensitive information not generally accorded commercial contractors.

Eugene C. Gritton
Director, NSRD

International Security and Defense Policy Center	Acquisition and Technology Policy Center	Forces and Resources Policy Center	Intelligence Policy Center	International Programs
James Dobbins *Director*	**Philip Antón** *Director*	**James Hosek** *Director*	**John Parachini** *Director*	**Susan Everingham** *Director*

NSRD Revenue by Organizational Element, FY 2005

The NSRD Research Agenda Is Balanced Across Major Issue Areas

Research Centers and Agenda

NSRD's research is largely conducted in four centers:

- International Security and Defense Policy Center (see p. 6)
- Acquisition and Technology Policy Center (p. 12)
- Forces and Resources Policy Center (p. 18)
- Intelligence Policy Center (p. 24).

These centers correspond in scope to the purviews of the four under secretaries of defense whom NSRD research has supported most actively. Most of the work undertaken by these centers is carried out within NDRI. However, the centers also perform research for such non-DoD sponsors as the Intelligence Community, the U.S. Coast Guard, the Department of State, allied governments and their ministries of defense, and various foundations and private contributors. NSRD also houses RAND's International Programs (p. 30), which support the development of research conducted at the intersection of international policy with other issues such as transnational trade and investment, education, health care, information technology, and energy and the environment. Research carried out within International Programs is funded principally by allied governments, foundations, and private contributors. RAND also supports some NSRD research through its own discretionary funds, which are derived from fees earned on client-funded research, independent research and development funds provided by DoD, and unrestricted private donations.

The research agenda of NSRD and NDRI emerges from relationships with clients that are long-standing, mutu-

ally reinforcing, and dynamic. NSRD and its FFRDC help their sponsors identify and evaluate new policies, frame alternative ways to implement current policies, and provide other analytical and technical assistance. That assistance includes aid to decisionmakers facing such difficult challenges as developing political and technological responses to evolving terrorist threats, sustaining a robust all-volunteer force, and reforming intelligence collection and analysis. At the same time, NDRI acts to sustain and invigorate its core investigational, theoretical, and methodological capabilities—the institutional foundations that will enable it to address pressing national security concerns for years to come.
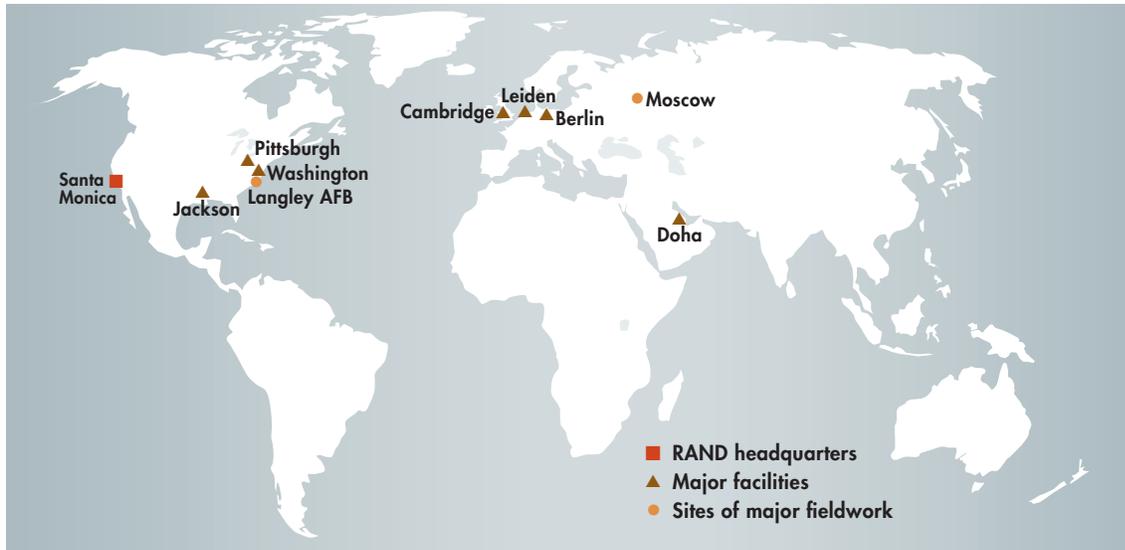
The RAND Environment

The RAND Corporation is a private, nonprofit organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. Since its founding in 1948, RAND has studied the most pressing problems of the day, producing in-depth, objective analyses; basic and applied research; and analytic tools used in government, academia, and the private sector.

Policymakers rely on RAND for help in analyzing choices and developments in many areas, including national defense, health care, labor and population, education, civil justice, public safety, and the nation's infrastructure and

Percentage of staff with degree in
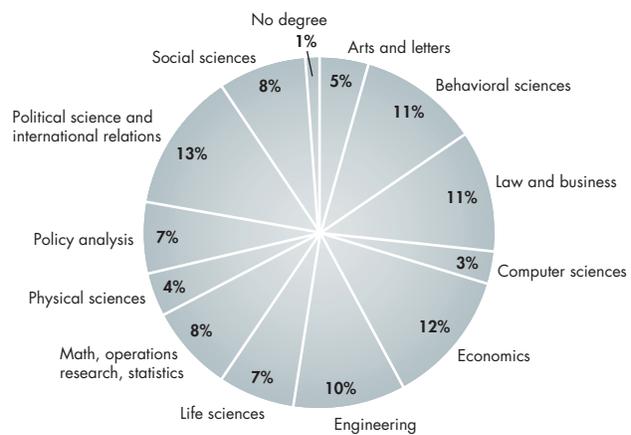
RAND's Multidisciplinary Staff Provide Breadth and Depth to Research Activities

RAND's Worldwide Research Facilities Provide Global Reach and Perspective

environment. RAND also offers several advanced training programs: the Pardee RAND Graduate School's doctoral program in policy analysis; and the military fellows programs, which sponsor one-year tours at RAND by mid-career officers in each of the military services and the Coast Guard.

In addition to NDRI, RAND houses two other FFRDCs offering additional analytical resources to DoD:

- RAND Project AIR FORCE—RAND's oldest studies and analysis organization—assists leaders of the U.S. Air Force in determining that service's size, shape, and missions.

- The RAND Arroyo Center helps U.S. Army policymakers focus on analogous mid- and long-range policy questions.

RAND has a matrix-type organization. Research units such as NSRD administer the research programs; the corporation, through its Staff Development and Management Office, recruits, develops, and evaluates the staff, in consultation with the units. Totaling over 1,500 full- and part-time employees, RAND's staff is diverse in work experience; in race, ethnicity, and gender; and in academic training. Eighty-five percent of the research staff hold advanced degrees, with more than 50 percent having earned doctorates.

NSRD draws on analytical talent in all three RAND offices in the United States and several abroad, and in a broad array of disciplines. For instance, experts in the social sciences—economists, psychologists, sociologists, and demographers—contribute to studies of personnel and intelligence issues. Work on the effectiveness of evolving military technologies draws on staff skilled in engineering, information systems, computer modeling and simulations, and scenario design and testing. Political scientists and experts in military

operations conduct research on the uses and limitations of the application of U.S. military power and alternative forms of leverage in addressing threats to peace and freedom.

NSRD works with other RAND units on topics of mutual interest. For instance, RAND Health—the corporation's largest research unit—brings crucial insight into questions connected with the provision and management of military medical services and with the effects of combat duty on mental health. Research on defense issues for U.S. allies is done in part through RAND's independently chartered European subsidiary, RAND Europe. This work also provides perspective for U.S. national security issues. The RAND-Qatar Policy Institute, founded in 2003, serves as a source of analysis of the most important and difficult issues facing public and private decisionmakers in the Middle East, North Africa, and South Asia.

Leading the Way in Defense Research and Analysis

RAND is an international leader in defense analysis. No other organization has been so uniquely influential. Government officials, academics, and business leaders in the United States, Europe, Asia, and the Middle East rely on RAND's advice. They turn to RAND for assistance with the complex problems they confront. They turn to RAND for the know-how to analyze a problem, place it in the appropriate context, and identify options so that they can make the best-informed decisions. NSRD's programs are a major component of RAND's overall success and reputation in national security research.

U.S. national security decisionmakers must meet the challenge of supporting the governments of Iraq and Afghanistan in combating extremist insurgencies even as they continue to address the broader threats of terrorism and the proliferation of weapons of mass destruction (WMD). Other challenges must also be faced, such as

- the spread of extremist Islamic terrorism to Saudi Arabia and Western Europe
- the growing dependence on information and information dominance in U.S. military strategy and operations
- the increasing U.S. and allied exposure to unexpected threats both at home and abroad.

Because the United States cannot handle these challenges alone, U.S. policymakers will need to continue efforts to maintain and enhance current coalitions and create new ones.

NDRI's International Security and Defense Policy Center explores the implications of such political, strategic, economic, and technological challenges for U.S. and international security. It assists U.S. national security decisionmakers in developing strategies and policies to manage and adapt to such challenges and to protect American and allied interests at home and abroad.

SOME RECENT AND ONGOING PROJECTS

Joint Urban Operations and Insights into Operations Enduring Freedom and Iraqi Freedom

Operations in the villages, towns, and cities of Afghanistan and Iraq have offered the first real test of U.S. joint urban operations doctrine, published in 2002. To draw lessons from that experience, the Joint Forces Command asked NSRD to analyze those operations and prepare an evaluative synthesis of the findings. The NSRD research team reviewed thousands of pages of documentation and conducted interviews with more than a hundred individuals involved in the operations or otherwise having expertise on the topic. Overarching insights related to the prevalence of urban warfare, the need to undertake an array of activities spanning conflict and stability

RAND Analysts Tom Sullivan and Ed O'Connell (second and third from right) with members of Second Marine Expeditionary Force in Fallujah

operations, and the importance of support from civil authorities. The researchers made 18 additional observations related to understanding the nature of the conflict and its context, influencing the strategic setting and the physical and social environment to the advantage of U.S. forces, engaging the hostile force, protecting gains won in battle, and returning control to civilian authorities.

SPONSOR: *U.S. Joint Forces Command*
PROJECT LEADER: *Russell W. Glenn*

Minimizing the Threat from Improvised Explosive Devices (IEDs) in Iraq

IEDs—makeshift bombs, often planted along roadsides—have been responsible for most U.S. casualties in Iraq over the past two years. Defeating this threat has become a high priority for coalition forces. In seeking a solution to this problem, the research sponsor turned to NDRI to conduct a brief, intensive analysis with two objectives: to review the operational and organizational structures orchestrating the counter-IED campaign and to test whether operations analysis could suggest new or modified tactics, techniques, and procedures challenging the threat. The analysis was carried out in the summer and fall of 2005. Two RAND analysts were assigned to Baghdad to provide direct liaison and ground truth (see the photo) on behalf of teams of analysts operating in RAND's two largest U.S. offices. The NDRI effort

has demonstrated the utility of operations analysis and the need for more extensive data collection. As the RAND study drew to a close, the coalition greatly expanded its operations analysis capability by establishing a core analytic group consisting of three FFRDCs—NDRI, the Institute for Defense Analyses, and the Center for Naval Analysis—as well as the U.S. Joint Forces Command.

SPONSOR: *Combating Terrorism Technology Task Force*
PROJECT LEADER: *Walter Perry*

Analysis of DoD Plans and Responses to Three Potential Anthrax Incidents

Since October 2001, concerns about anthrax in the mail have prompted many federal agencies to restructure their mail operations. During March 2005, a series of three potential anthrax-related incidents occurred at DoD mail facilities in the Washington, D.C., area. Although tests and analyses ultimately determined that no anthrax was present, the incidents have provided an invaluable opportunity for learning. The three incidents presented managers with different scenarios and elicited very different responses. NDRI was asked by DoD to examine DoD's responses to, and management of, the incidents and to make recommendations for improvements. Drawing on national standards and guidelines, NDRI analyzed plans and documented actions related to each of the incidents to draw conclusions and make recommendations at both the facility-specific and systemic levels. NDRI identified a number of areas in which plans and actions were aligned with national standards and responses seemed appropriate, as well as areas in which plans and actions were not so aligned. NDRI recommended several improvements to DoD's preparedness and response efforts.

SPONSOR: *Director, Administration and Management, OSD*
PROJECT LEADERS: *Terrence K. Kelly and Terri Tanielian*

Anticipating China's Future

As China continues its remarkable evolution from a centrally planned communist dictatorship to a less authoritarian state with an increasingly market-oriented economy—an incomplete transformation to date—the big question is, What is it evolving into? The United States and China are not necessarily destined for conflict and rivalry. However, China's rising economic clout, its increases in defense expenditures that have outpaced growth in GDP, and its flashes of nationalist rhetoric raise concerns about China's role in Asia and the rest of the world and how its interests might conflict with those of the United States. China's leaders often discuss strengthening "comprehensive national power," which means developing all aspects of national power—political, economic, and military. In this project, NDRI took a similarly broad view of the factors that are likely to influence China's future. The project team identified three possible trajectories for the Chinese state and assessed their security implications.

SPONSOR: *Director, Program Analysis and Evaluation, OSD*
PROJECT LEADER: *Michael Lostumbo*

Asymmetric Cruise Missile Threats and Their Implications for the United States

The proliferation of cruise missiles and lethal unmanned air vehicles is of increasing concern to DoD. The armed services have made significant investments in enhanced defenses to protect their fielded forces against attacks by cruise missiles. However, the potential for cruise missile attack is not limited to conventional combat operations. Cruise missiles could also be used in unconventional or asymmetric ways in both peacetime and wartime environments, at home and abroad. U.S. military systems designed to address even sophisticated military threats may be unavailable or inappropriate in other environments. Moreover, what constitutes a threat of concern may vary depending on the hardness and extent of the target and the intent of the attack, among other things. NDRI is undertaking an assessment of the full cruise missile threat spectrum, as well as of U.S. vulnerabilities in the decade ahead. Researchers will also survey U.S. defense capabilities to identify gaps that adversaries might exploit, and they will identify defense and policy responses to the threat.

SPONSOR: *Defense Threat Reduction Agency*
PROJECT LEADERS: *Robert Button and Michael Lostumbo*

Developing Iraq's Security Sector

In their planning for postwar stabilization and reconstruction in Iraq, the United States and its coalition partners had assumed a benign security environment and an Iraqi police force able to maintain order. Instead, the security environment deteriorated and what police and security forces remained were incapable of responding to rising criminality and political violence. The Coalition Provisional Authority (CPA) was confronted with the challenges of restoring order, rebuilding Iraqi security forces, and building security sector institutions, all on an abbreviated timeline, once the parties agreed in November 2003 to shift power from the coalition to the Iraqis by the end of June 2004. In a study for the U.S. departments of Defense and State,[1] NDRI examined the CPA's attempts to build forces and institutions in Iraq and, insofar as currently possible, draw lessons from that experience. The study's authors served with the CPA during its existence and were involved in policy development and implementation in the Iraqi security sector.

Successes and Failures

How far was the CPA able to advance its aim of building sustainable institutions that would contribute to the emergence of a secure and democratic Iraq? RAND researchers concluded the following:

- The coalition succeeded in helping Iraq's political leaders establish security institutions, most notably the Ministerial Committee for National Security (MCNS), which was continued under the Iraq Interim Government. However, there is little sign yet of the development of true coordination between ministries at working levels.

- In seeking to rebuild the Iraqi Ministry of Defense, the coalition focused on identifying appropriate personnel, which might prove wise if the ministry is allowed to mature. However, there are signs that it will remain weak, which bodes ill for civilian control of the military.

- With the dissolution by the coalition of all other security forces, the Iraqi Police Service became the ensurer of public safety and the lead Iraqi counterinsurgency force. It was not postured, trained, or equipped for these roles. This situation had improved a little by June 2004 and continued to do so into 2005. However, the government institutions in Baghdad and in the provinces that oversee the police remain very weak.

- Critical ministries such as oil and electricity are deploying increasingly professional security forces to protect key facilities. However, the overall regulation of private security forces remains problematic.

- Judicial reforms, including the establishment of an independent judiciary, had made considerable progress under the coalition. However, efforts to fight organized crime and corruption have languished.

- The coalition failed to develop an integrated, coordinated Iraqi intelligence apparatus. Such an apparatus could have been of great importance in the campaigns against the insurgency and organized crime.

- While the coalition instituted a stipend program for former members of the armed forces and appointed "clean" former officers to the security forces and ministries, the effort to reintegrate former combatants was insufficient to keep some former soldiers from joining the insurgency.

The research team summarized the CPA's mixed record by considering it at the levels of individuals, institutions, and integrative tendencies.

- At the level of individuals, the coalition undertook a major effort to remove Saddam-era officers and senior officials.

- Institutional reform has been patchy. Efforts were made to build the managerial capacity and to inculcate reformed practices within the new Ministry of Defense, but the Ministry of Interior was only marginally touched by reform efforts.

- Integration across the security sector and with the wider society is also a mixed story. The MCNS has been partially successful, but in general the coalition failed to overcome the rigid ministerial compartmentalization inherited from Saddam, and limited progress has been made to ensure legislative oversight of the security sector.

What Caused the Shortfalls?

The researchers concluded that the failures identified were the result of several problems underlying the CPA's approach to the Iraqi security sector:

- **A lack of worst-case and contingency planning.** This included, for example, the failure to prepare for contingencies such as the infiltration and intimidation of police forces, which required coalition troops to step back into the front line of security in key urban areas.

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[1] The study was funded by the Department of Defense for the Coalition Provisional Authority. When the CPA was dissolved, sponsorship passed to the State Department.

An Iraqi policeman secures the scene of a car bomb explosion in Baghdad.

- **Structural constraints on rational policy development.** An early, integrated approach to security sector development rapidly unraveled; coordination was subsequently devalued, and incentives to achieve it were not established.

- **Inability to mobilize funding and personnel inputs.** In most nation-building operations, mobilization of nonmilitary resources has been problematic. In Iraq, the scale of the operation and the security situation severely tested established mechanisms, and a reliance on untested mechanisms delayed the deployment of resources.

- **Emphasis on meeting the short-term needs of fielding Iraqi security forces at the expense of the long-term goals of institution-building.** Filling the immediate security vacuum involved rapidly recruiting police and civil defense personnel with minimal vetting and recruitment, as well as relying on tribes and militias, measures that were contrary to the coalition's long-term goal of engineering a sweeping reform of the nation's security sector.

- **Delays in working to ensure Iraqi ownership of the reform process.** Until November 2003, the coalition imported foreign expertise to manage Iraqi security affairs. It was only afterward that the coalition focused on developing Iraqi leadership and capacity. The result was patchy Iraqi ownership of reform, as well as limited capacity in the security sector institutions.

- **Ambiguity in long-term security relationships.** It has not been clear whether the coalition would guarantee protection for Iraqis against external aggression for the foreseeable future, which would allow Iraq to concentrate on building internal security forces.

Implications for the Future

The NDRI team argued that the shortfalls identified must be addressed if the Iraqi security sector is to develop into an effective and accountable part of the nation's governance framework. It will be critical for Iraq's future that Iraqi leaders and their international advisors not become mesmerized by the fielding of large numbers of security forces. While numbers are important, it will be vital to invest in the intangibles that cannot be so easily quantified, such as the following:

- Development of joint judicial and police investigatory capabilities

- Development of national security institutions, including the ministries of Defense and Interior

- Sustained support to the justice sector, including anticorruption programs.

Another important need is for the Iraqi government at the highest levels to develop the capacity to make and implement security policy. Iraq's leaders lack the institutional capacity to formulate and execute policy, to systematically examine options, and to plan for the long term. In particular, the emerging Iraqi polity needs to give serious thought to such large issues as the future of the security sector in terms of center-region relationships, state-society relationships, and the proportion of national resources allocated to security. The United States and its international partners must realize, however, that Iraqi ministers and senior officials are likely in the near term to be more focused on survival; so it will be up to this international partnership to ensure that long-term institution-building remains on the Iraqi agenda.

American Carrier Air Power at the Dawn of a New Century

The terrorist attacks against the United States on September 11, 2001, portended a change of major proportions in the long-familiar pattern of U.S. carrier air operations. Less than a month after the attacks perpetrated by al Qaeda, the nation found itself at war against al Qaeda's main base structure in Afghanistan and against the ruling Taliban theocracy that had provided it safe haven. The U.S. campaign, Operation Enduring Freedom, in no way resembled the open-ocean showdowns between opposing high-technology forces for which the Navy had prepared throughout the preceding three decades. Instead, the attacks required a credible, deep-strike capability in the remotest part of Southwest Asia, where the United States had virtually no access. Air Force heavy bombers flying from outside the theater delivered the vast preponderance of munitions. However, U.S. carrier-based air power, in flying 75 percent of all strike missions, substituted almost entirely for land-based theater air forces because of an absence of suitable forward operating locations for the latter (see the figure).

Barely more than a year later, the Navy's carrier force again played a pivotal role when American forces conducted around-the-clock operations against Saddam Hussein's forces in Iraq. Six of 12 carriers and their air wings were surged to contribute to the campaign, with a seventh carrier battle group held in ready reserve in the Western Pacific and an eighth also deployed at sea and available for tasking. The air wings from the committed carriers flew approximately half the total number of fighter sorties generated by the U.S. Central Command.
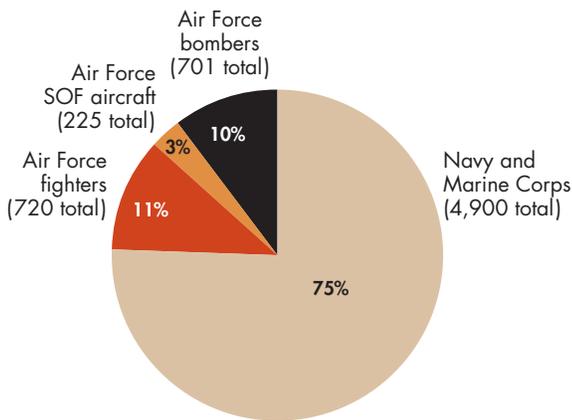
NDRI has been studying U.S. Navy carrier air operations and capability improvements since the end of the cold war. Some of the highlights of that study are as follows.

Recent Gains in U.S. Carrier Air Power

The many gains that have been registered in U.S. carrier air power over the past decade—gains that were demonstrated during Operations Enduring Freedom and Iraqi Freedom—include the following:

- A proven ability to operate not as individual and autonomous air-wing platforms, but rather as a surged and massed force able to conduct coordinated deep-strike missions well beyond coastal reaches and to remain on station for hours, if necessary, providing on-call interdiction and close air support.

- An almost exclusive use of precision-guided munitions by Navy fighters. Of all Navy munitions dropped, 93 percent were either satellite-aided or laser-guided. The principal measure of effectiveness is no longer how many aircraft it takes to neutralize a single target, but rather how many targets a single aircraft can successfully attack. The aircraft were able to attack multiple targets with consistently high accuracy on each combat sortie around the clock, irrespective of weather.

- A pronounced shift from platform-centric to network-centric operations dominated by an ever-tighter fusion of data networks, sensors, platforms, and weapons that will eventually enable a seamless connection of all naval, joint, and coalition combat assets.

- Unprecedented close Navy involvement in high-level planning and command of joint air operations. The six participating carrier air wings had representatives in Central Command's combined air operations center and ready access to a software package aboard ship that automatically searched the complex daily air operations plan for Navy-pertinent sections.

Strike Sorties by Service in Operation Enduring Freedom Through December 2001

Air Force bombers (701 total) — 10%
Air Force SOF aircraft (225 total) — 3%
Air Force fighters (720 total) — 11%
Navy and Marine Corps (4,900 total) — 75%

SOURCE: *Sea Power*, March 2002.
NOTE: SOF = Special Operations Forces.

U.S. carrier air power demonstrated new capabilities in Afghanistan and Iraq.

The Future Promises Further Improvements

Before the September 11 terrorist attacks, the Navy's global presence had been enabled by a highly routinized and predictable sequence of maintenance, training, and unit and ship certification. A new Fleet Response Plan tested and validated during Operation Iraqi Freedom should continue to increase the efficiency of those processes, nearly doubling the number of carriers that can be made available and ready for tasking on short notice in times of urgent national need.

The current *Nimitz* class of aircraft carriers will soon be joined (and subsequently replaced, see p.16) by a newly designed series of ships. This new class, designated CVN 21, will feature electrical power-generation capability three times that of the *Nimitz* design, which will facilitate the removal of steam and hydraulic piping. Four electromagnetic aircraft launch catapults will replace the earlier-generation steam catapults. CVN 21 will have a more efficient flight deck and advanced arresting gear for aircraft recoveries. Most important, it will have an adaptable infrastructure that will allow the incorporation of new capabilities as they develop.

The Navy will continue the process of creating a seamless electronic information network. A new initiative called FORCENet aims to tie together naval, joint, national, and ultimately coalition information grids to achieve a much greater level of battlespace awareness and knowledge management at all levels.

Among other changes in the future will be a reduction in the number of aircraft assigned to each carrier, a goal made possible by the increased reliability and versatility of today's aircraft. The Navy's restructuring of its air assets will include the following improvements:

- Further enhancement and utilization of the Navy's latest combat aircraft, the F/A-18E/F Super Hornet. The Navy will be able to retire older aircraft, leading to cost savings and a leaner, yet more efficient and capable carrier air-wing force structure.

- Introduction of the next generation of naval electronic warfare aircraft in the EA-18G. This aircraft will conduct wide-band electronic support and attack, selective reactive jamming, and active defense suppression. It will permit the transfer of digital, precise threat location and targeting information between it and the strikers.

- Introduction of the E-2D Advanced Hawkeye, offering significantly increased airborne surveillance and battle-management capabilities.

- The long-overdue acquisition of a stealth attack aircraft—the F-35C Joint Strike Fighter. With its un-refueled mission radius of 700 nautical miles, the F-35C will restore to Navy carrier decks the deep-attack reach that was lost when the A-6E was retired.

- The introduction of unmanned aerial surveillance and combat vehicles into the Navy's carrier air-wing complements.

The nation's carrier strike groups have taken on a substantial qualitative improvement in their overall combat leverage, and the future promises further improvement. The United States remains the only country in the world capable of deploying a carrier-based strike force of any significant size. Today, deep-strike carrier aviation is not only a natural concomitant of the nation's status as the world's sole surviving superpower, it also is the one outstanding feature that distinguishes the U.S. Navy unequivocally from all other naval forces around the world.

For more information, see

American Carrier Air Power at the Dawn of a New Century, Benjamin S. Lambeth, MG-404-NAVY, 2005.

Operations in the Balkans, Afghanistan, and Iraq have demonstrated that the United States and its allies possess a wide and unchallenged technological superiority over their adversaries in traditional military combat operations. However, that does not translate into unchallenged or risk-free operations. Adversaries will attempt to apply technologies in urban environments to deny U.S. forces safe haven. They will also explore opportunities to acquire some level of nuclear, biological, or chemical capabilities to effect large-scale threats. In addition, they will try to develop new abilities to compromise the information systems on which U.S. forces are becoming increasingly reliant.

In response, the national security communities will need to develop and acquire defense systems that exploit U.S. technological advantages to address the evolving asymmetric threats to these vulnerabilities. They will need to do so within a stressful environment—one characterized by

- tensions between the need to adapt to new threats and the need to preserve traditional U.S. military superiority
- the need to transform management processes to rapidly plan, acquire, and integrate jointly needed capabilities
- financial constraints and shifting budget priorities
- shorter, less frequent production runs for major system acquisitions
- technological and industrial bases increasingly motivated by global commercial demands.

NSRD's Acquisition and Technology Policy Center helps the defense and intelligence communities achieve and sustain an affordable, responsive technological advantage over this diverse array of current and future threats while coping with these management and fiscal challenges.

SOME RECENT AND ONGOING PROJECTS

Support to the Joint Battle Management Command and Control Roadmap Process

The DoD has long wanted a capability that would enable Joint Task Force commanders, subordinate component commanders, and forces in the field to share information seamlessly, provide real-time situation awareness, and enable the rapid control and deconfliction of long- and short-range weapons. To that end, the U.S. Joint Forces Command, acting with the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L), has developed the Joint Battle Management Com-

mand and Control (JBMC2) Roadmap. The Roadmap specifies the way ahead for achieving JBMC2 systems interoperability and provides a strategy and guidance for transformational JBMC2 capabilities to enable an integrated, interoperable, networked joint force. NSRD assisted in the development of key elements of the first and second versions of the Roadmap, signed in 2005 and 2006, respectively. NSRD helped develop a system-of-systems engineering approach and the overall integration strategy for JBMC2 systems and capability areas. It also assisted in program synchronization reviews.

SPONSOR: *Under Secretary of Defense for AT&L*
PROJECT LEADER: *Daniel Gonzales*

Challenges in Virtual Collaboration

Virtual collaboration is the use of conferring via audio, video, or computer-mediated communications such as e-mail or chat rooms to facilitate interdependent action by geographically dispersed people to achieve a shared objective. Virtual collaboration has become increasingly common, but its shortcomings relative to face-to-face (in-person) collaboration are not widely realized, partly because the research literature on this topic has not been reviewed and synthesized in many years. NSRD conducted such a review and identified an array of potential problems including "us vs. them" divisions and misunderstandings arising by geographic site, as well as shifts toward the espousal of risky options. These need to be weighed against such benefits as broadening the range of available expertise, views, and options. Both problems and benefits vary with the collaboration medium. NSRD constructed a decision tree to relate choice of medium to the task at hand and identified measures to mitigate the problems associated with the medium in the context of each type of task.[1]

SPONSOR: *OSD*
PROJECT LEADER: *Paul Davis*

Navy Heavy-Lift Aircraft Options

The Navy and Marine Corps have used helicopters since the 1940s. As helicopters have gradually become larger and gained cargo capacity, they have been able to carry more and heavier cargo, including vehicles, from a ship to a site onshore and from

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[1] For more information, see *Challenges in Virtual Collaboration: Videoconferencing, Audioconferencing, and Computer-Mediated Communications*, Lynne Wainfan, Paul K. Davis, MG-273, 2004.

A CH-53 Sea Stallion, a current heavy-lift platform, drops a retired AV-8 Harrier on the flight deck of the USS Saipan *(LHA 2).*

ship to ship. A heavy-lift capability would be especially valuable when access to on-shore facilities is limited. But there are other issues, survivability being first among them. The Navy asked RAND to conduct a quick assessment of various heavy-lift aircraft alternatives and their survivability against different threats. NSRD looked at these and related matters and offered the Navy several options: All involve the CH-53X helicopter and some exploration toward a new heavy-lift aircraft. The degree of interest in the new aircraft would be influenced in part by such issues as whether or not its capabilities are really needed and are affordable; whether today's ships can even accommodate such large aircraft; and whether, in a joint environment, more than one service can agree on the design and funding for it.[2]

SPONSOR: *U.S. Navy*
PROJECT LEADER: *John Gordon IV*

Use of Small Business by DoD

Congress has directed that 23 percent of direct federal purchases come from small businesses. Because DoD accounts for most federal purchasing, its achievement of the 23 percent target would be of great help in meeting the governmentwide goal. DoD is concerned about reaching the target, so NSRD conducted an analysis aimed at suggesting industries that DoD could target for outreach to small firms. The NSRD team compared DoD procurement from small businesses with non-DoD federal procurement from such businesses, and it documented the prevalence of small businesses in

industries DoD relies upon. The analysis drew on the Federal Procurement Data System to study government spending and the 1997 Economic Census to analyze small firms in the economy. The NSRD researchers concluded that it is more difficult for DoD to reach the procurement goal than it is for the rest of the federal government because of the nature of the goods it buys, such as aircraft and large weapon systems. However, it was possible to identify some industrial sectors on which DoD might focus if it hopes to raise its percentage of small-business purchases. Those included engineering services, aircraft engine and parts manufacturing, and search and navigation equipment manufacturing.[3]

SPONSOR: *Office of Small Business Programs, OSD*
PROJECT LEADERS: *Nancy Moore, Elaine Reardon*

Why Has the Cost of Navy Ships Risen?

Ship costs have been increasing at a rate significantly greater than the general inflation rate. Consequently, it is becoming more difficult for the Navy to afford the ships it needs. As a step toward resolving this predicament, the Navy asked NSRD to quantify the sources of the cost growth and suggest potential options to reduce it. NSRD identified four sources of cost growth—increasing product complexity, more ambitious standards and requirements, increasing equipment costs, and increasing labor costs—and quantified the cost burdens of each. The research team also characterized a fifth, less quantifiable, but still important, source: the unstable business base for most shipyards. The study concluded that requirements, complexity, and specifications account for most of the real cost growth observed. Labor, material, and equipment costs have together grown at the rate of inflation. The researchers suggested possible options to constrain costs, including restraints on requirements growth, such as construction of smaller, mission-focused ships instead of larger, multirole ships; investments to improve the efficiency of shipbuilding; and improvements to program management and the acquisition process.[4]

SPONSOR: *U.S. Navy*
PROJECT LEADERS: *Mark Arena and Irv Blickstein*

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[2] For more information, see *Assessment of Navy Heavy-Lift Aircraft Options*, John Gordon IV, Peter A. Wilson, Jon Grossman, Dan Deamon, Mark Edwards, Darryl Lenhardt, Dan Norton, and William Sollfrey, DB-472-NAVY, 2005.

[3] For more information, see *The Department of Defense and Its Use of Small Businesses: An Economic and Industry Analysis*, Elaine Reardon, Nancy Y. Moore, DB-478-OSD, 2005.

[4] For more information, see *Why Has The Cost of Navy Ships Risen? A Macroscopic Examination of the Trends in U.S. Naval Ship Costs Over the Past Several Decades*, Mark V. Arena, Irv Blickstein, Obaid Younossi, Clifford A. Grammich, MG-484-NAVY, 2006.

Global Technology Revolution 2020:
Technology Trends and Cross-Country Variation

The world is in the midst of a multidisciplinary technology revolution that shows no sign of abating in the near- to mid-term future. By 2020, this revolution could bring important changes in economic development, health, environmental quality, and military power.

While the technology revolution is extensive, it will play out differently around the globe. That core realization is now quantitatively supported by an NSRD study that has sought to elucidate what factors will influence the potential of the technology revolution in different countries and what general inferences might be drawn about the future of that revolution. The NSRD study was sponsored by the National Intelligence Council as an input to its broader report, *Mapping the Global Future*.

The NSRD research team identified 56 illustrative technology applications that might possibly be developed and implemented by 2020. Of these, the researchers selected for further analysis 16 applications scoring highest in a net assessment combining technical feasibility on a commercial basis, potential marketability, and, most importantly, the number of societal sectors influenced (see the table).

To assess the implications of these technology developments, the research team focused on 29 representative countries selected for variation in size, region of the world, and level of scientific development. The countries were classified into four scientific development categories (advanced, proficient, developing, and lagging) on the basis of how many of the 16 technology applications they could be expected to be able to acquire by 2020. A country was judged to have the capability to acquire an application if it would have the infrastructure and resources to develop it or support its purchase from abroad. Scientifically advanced countries should be able to acquire all the technology applications listed in the table; lagging countries could obtain only the first five.

Just because a country can *acquire* a technology application does not mean that it will be able to *implement* it. That will depend on a variety of social, economic, and cultural factors that might act either as drivers of implementation or barriers to it. The researchers identified ten such factors: cost and financing; social values, public opinion, and politics; infrastructure; R&D investment; population and demographics; laws and policies; use of resources and environmental health; privacy concerns; education and literacy; and governance and stability.

By analyzing the capacity to acquire technology applications together with the presence of implementation drivers and barriers, the project team arrayed the illustrative countries according to their capacity to acquire *and* implement the 16 illustrative applications (see the figure). The figure shows, along the horizontal axis, how many of the ten factors (in percentage terms) act as barriers to technology implementation in each country. Along the vertical axis, it shows the number of factors acting as drivers (also in percentage terms) multiplied by an index of the capacity to acquire the technology applications. This figure helps highlight a number of key trends and relationships that emerged from the NSRD study:

- The technological preeminence of the scientifically advanced countries in North America, Western Europe, and East Asia.
- The emergence of China and India as rising technological powers, with the scientifically proficient countries of Eastern Europe, as represented by Poland, not far behind.

Sixteen Illustrative Technology Applications Scoring Highest in the NSRD Net Assessment
Cheap solar energy
Rural wireless communications
Genetically modified crops
Filters and catalysts for water purification
Cheap housing to provide adaptable shelter and energy
Rapid assays to detect specific biological substances
Green manufacturing
Ubiquitous radio-frequency identification tagging of products and people
Hybrid vehicles
Drug delivery targeted to specific tumors or pathogens
Improved diagnostic and surgical methods
Quantum-mechanical cryptography for secure information transfer
Communication devices for ubiquitous information access
Pervasive sensors
Tissue engineering
Computers embedded in clothing or other wearable items

The Capacity of Selected Countries to Implement the Sixteen Illustrative Technology Applications
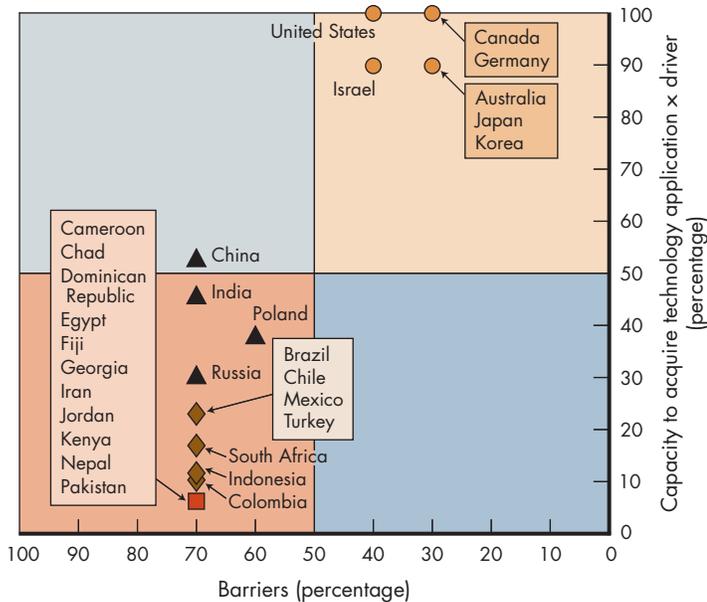
- The relative slippage of Russia as a technological powerhouse.
- The variation in technological capability among the scientifically developing countries of Southeast Asia and Latin America.
- The large technological gap between the scientifically developing countries of Latin America, as well as Turkey and South Africa, and rising technological powers China and India.
- The enormous technological gap between the scientifically lagging countries of Africa, the Middle East, and Oceania and the advanced nations of North America, Western Europe, and Asia.
- The gap that must be filled before the lagging nations can reach the level of proficiency.

Finally, the researchers recognized that a country having the ability to acquire and implement a technology application would not necessarily do so, unless it was motivated by national or market needs.

On the basis of these and other analyses, the NSRD researchers drew the following conclusions:

- **Accelerated technology development will continue.** There is no indication that the rapid pace of technology development will slow in the next 15 years, nor will the trend toward the increasingly integrated nature of technology applications reverse. Most of the 16 illustrative technology applications listed in the table draw from multiple technologies, e.g., biotechnology, nanotechnology, materials and information technologies. The combined effect of further technology development and implementation will be significant, changing lives around the globe.

- **Countries will benefit in considerably different ways.** Because of variations in science and technology (S&T) capacities and in the institutional, human, and physical capacities relevant to implementing technology applications, the global technology revolution will play out differently across nations.

- **Action is required to maintain a high level of S&T capacity.** If the advanced countries are to stay ahead in their capacity to implement technology applications, they will need to make continuing efforts to ensure that laws, public opinion, investment in R&D, and education and literacy are drivers for, and not barriers to, technology implementation.

- **Countries that lack capacity will need to build it.** The challenge faced by scientifically lagging countries and developing countries is not primarily about technology, or even S&T capacity. It is about the lack of institutional, human, and physical capacity, including effective governance. Less-developed countries that hope to benefit from technology applications will have to improve their performance in economic growth, social equity, health and the environment, and public safety and security.

- **Certain technology applications will spark heated public debate.** Several of the illustrative applications will trigger strong reactions and opinions over religious, environmental, or social concerns (including privacy). These reactions could differ dramatically across countries and thus contribute to the international variation in technology implementation.

- **Public consideration can head off problems and maximize benefits.** Public policy issues will need to be debated in an environment that seeks to resolve conflicts. Such public debates, in addition to being based on sound data, will need to be inclusive and sensitive to the range of traditions, values, and cultures within a society.

Should Aircraft Carriers Be Refueled at Mid-Life or Replaced?

The U.S. Navy is currently building the last of the *Nimitz* class of nuclear-powered aircraft carriers. The next carrier to be started will belong to a new class, designated CVN 21. This new design will incorporate numerous capability and efficiency improvements over that of the *Nimitz*. Reductions in personnel and maintenance requirements will contribute to decreases in operating costs. It will thus be advantageous to replace the *Nimitz* class with the CVN 21 class as soon as feasible, resources permitting.

Until recently, the Navy planned to build aircraft carriers at intervals of four years. Ships of the new class would replace those of the *Nimitz* class as the latter reach retirement age. At one ship every four years, it would take decades to transform the carrier fleet.

In a study undertaken for the Navy, NSRD proposes a more rapid modernization plan: building new carriers more often and retiring the last five or six of the ten *Nimitz*-class ships at mid-life, when they would otherwise be refueled. The study team evaluated several variations of this approach in comparison with a reference case approximating the Navy's plan at the time of the research.[1]

NSRD's central finding was that the fleet could be modernized much faster, even twice as fast, for a cost premium no greater than 12 percent. That premium could be reduced by decreasing fleet size by 5 to 10 percent or possibly through aggressive cost reduction efforts. The research team also found that the production base would be adequate to support the higher production rate.

Speed of Modernization

If a new carrier is started every second year instead of every fourth year, the fleet would be modernized twice as fast (compare the upper and lower profiles in Figure 1). The resulting fleet would typically be about half a ship short of the reference fleet, but the number of *operational* ships (those not in the shipyard) would be at least as large as in the reference case (see Figure 2, where the dotted lines represent the reference case). This operational bonus (relative to the size of the total fleet) emanates from the lower maintenance requirements designed into the CVN 21.

Figure 1—Build-New Strategy Can Modernize the Fleet Twice as Fast
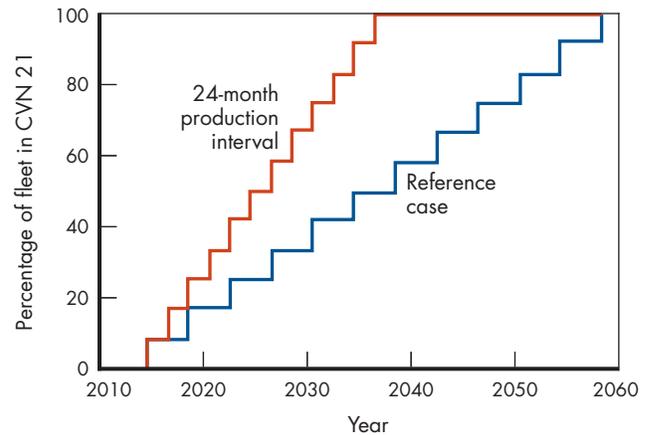
Cost of Faster Modernization

Faster modernization comes at a cost. Although the larger number of CVN 21s in the fleet translates into lower personnel and maintenance costs, the fleetwide savings are not large, particularly for personnel, for two reasons. First, it still takes a number of years for the fleet to evolve from a *Nimitz*-class fleet to a CVN 21 fleet; second, the greater savings many years in the future are worth much less than their nominal value today—that is, they must be discounted. Furthermore, a multibillion-dollar charge is incurred when an extra carrier is built every fourth year. Less than half those charges are offset by avoiding refueling a *Nimitz*-class ship.

If the various costs and savings offsets in the construction, personnel, and operations and maintenance budgets are calculated over 50 years, the net result is a cost premium for the build-new plan. That premium amonts to 12 percent, or $22 billion in present discounted value (assuming an annual discount rate of 3 percent). The extra costs would manifest themselves as an extra $700 million annual budgetary requirement from 2005 to 2015 (plus undetermined budgetary increments beyond that date).

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[1] The reference case assumes the Navy will sustain a 12-carrier fleet, the number it currently has. The Navy now hopes to draw the fleet down to 11 in the near future. Such a reduction would affect both the reference fleet and the fleet options proposed by RAND.

Figure 2—Build-New Plan Sustains at Least as Many Operational Ships and Almost as Many Total as the Navy's Current Plan (Reference Case)
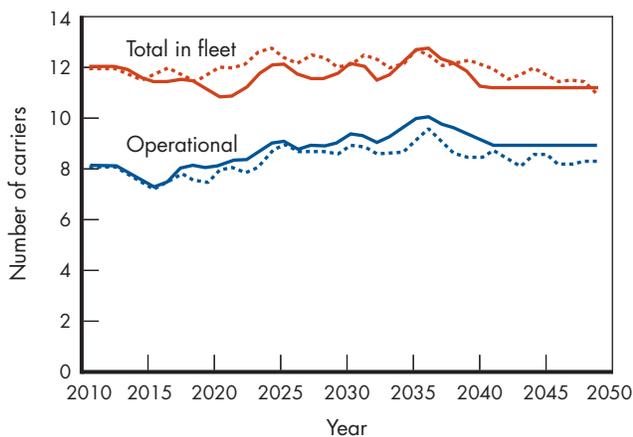
NOTE: Reference case data displayed as dotted lines.

Figure 3—Build-New Strategy Requires Managing a Labor Demand Peak Until 2017
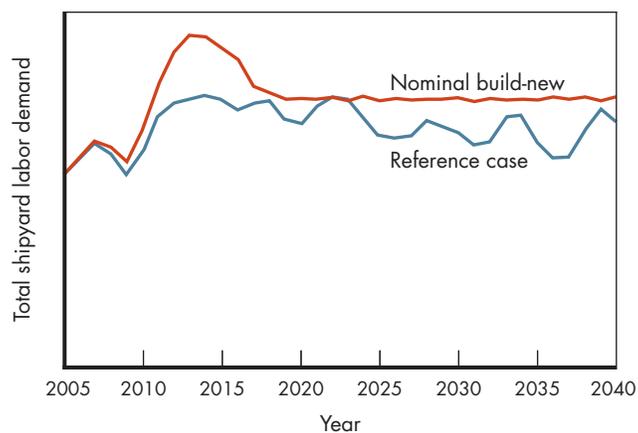
Ways to Reduce the Cost Premium

The 12-percent premium might be viewed as modest, but there are ways it can be reduced.

- First, some of the specifics of the build-new strategy might be altered. For example, stretching the build interval from 24 to 30 months eliminates the cost premium but cuts the operational fleet by an average of half a ship.

- Second, the premium could be halved at the same fleet size if aggressive cost reduction measures are taken. For example, multiship buys could lower costs for engineering and for materials and equipment, and the Navy might be able to reduce crews further than planned. The faster build schedule might also lead to enhanced learning-related cost reductions.

- Third, the RAND team assumed that the first five *Nimitz*-class ships would be refueled. If the fifth were retired instead, the cost reduction measures just specified might drive the 12-percent premium close to zero, with a one-ship drop in total fleet size but very little change in the operational fleet.

Industrial Base Capability for Faster Modernization

If the 12-percent premium were viewed as acceptable, or if it could be reduced to an acceptable level, the following question arises: Is the U.S. naval industrial base capable of building aircraft carriers twice as fast as planned? The researchers answered this question in the affirmative. The coincidence of a higher carrier production demand with other major shipbuilding programs would result in a substantially increased requirement for shipyard production workers over the next 12 years (see Figure 3). Eventually, that peak would stabilize at a lower level. Some facilities upgrades would be needed at the shipyard, but these should not be problematic. Upgrades at facilities contributing to the nuclear propulsion plant, however, must begin promptly if a schedule pairing accelerated production with mid-life retirement is to get under way soon enough to keep the operational fleet at the current level.

U.S. military forces are operating under conditions of stress and uncertainty far greater than ever before experienced in the era of the all-volunteer force. Active-duty service members have had repeated tours of duty, and reserve forces have also been heavily used. Is the current operational environment having a negative impact on recruiting and reenlistment? Does DoD offer the kind of careers, compensation, and benefits that will allow it to attract and keep the personnel it needs?

The question of the appropriate mix of active and reserve forces has reemerged, as the role of the reserves evolves and reserve units face immediate demands in Iraq and Afghanistan. How should roles and missions be allocated across the active components, the reserve components, DoD civilians, and contractors? What policies will support integration of the active and reserve forces and of uniformed, civilian, and contractor personnel?

As it is for private-sector employers, health care is an area of increasing DoD concern. Providing quality care at minimal cost has become a major policy challenge, given the changing composition of military families and the growing number of aging military retirees tapping into DoD health benefits. Is the DoD health care system adequately flexible to meet these changing needs? In this environment, can the quality of care be improved while cost growth is restrained?

NSRD's Forces and Resources Policy Center has been intimately involved for more than three decades in helping the United States create and preserve the all-volunteer force. The Center continues a varied program of research intended to help DoD adapt its organizations, policies, and processes to current and evolving manpower and other resource challenges.

SOME RECENT AND ONGOING PROJECTS

Special Operations Forces (SOF): Challenges in Manning the Force

Special Operations Forces (SOF)—rapidly deployable, flexible forces for war and peacetime activities—will be needed in larger numbers in future years. However, the SOF face some critical current and near-future manning issues: shortfalls in some specialties, a large number of personnel approaching retirement eligibility, and the consequent need to recruit a large number of younger individuals. NSRD conducted expert interviews and focus groups with SOF personnel to analyze current and projected SOF manning and to identify SOF operators' views of their profession and factors affecting their decisions to enter and stay in the SOF. The researchers also conducted a Web-based survey of SOF personnel to determine the relative strength of their views toward their profession and whether they vary by either demographic characteristics or military experience and skill attributes. These analyses were placed in the context of overall recruiting and retention, the projected need for SOF in future missions, and the likely future SOF manning. The study's recommendations result from explicit knowledge of how SOF operators think and feel about certain issues and pertain to SOF general management and use, compensation, career management, and local management and leadership.

SPONSOR: *Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict*

PROJECT LEADERS: *Margaret Harrell and Laura Castaneda*

A Strategic Approach to Joint Personnel Issues

Over the past 15 years, successes in Iraq, Bosnia, and Afghanistan testify to the effectiveness of joint military force and its warfighting potential. However, the results of recent studies point to a need for DoD to revisit joint manpower matters and develop a strategic approach to joint officer management and joint professional military education. For instance, the Government Accountability Office recommended that DoD establish clear goals for officer development in joint matters and link joint officer development to DoD's overall missions and goals. For the past two years, NSRD has been working on such a strategic approach. The first published report from this research frames an approach for joint officer management in the active components.[1] The project team is now analyzing the data necessary to operationalize that framework and modeling the likely outcomes of policy and management change to joint officer management. The products of this analysis will include a ranking of surveyed officer billets according to the "jointness" of the experience they provide, an assessment of billets with respect to the degree to which they require previous joint education or experience, and a revised process to acknowledge the joint qualifications of officers. Concurrently, NSRD is developing a strategic approach to joint officer management for the reserve components.

SPONSOR: *Deputy Under Secretary of Defense for Military Personnel Policy*

PROJECT LEADERS: *Margaret Harrell and Harry Thie*

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[1] For more information, see *Framing a Strategic Approach for Joint Personnel Management*, Harry Thie, Margaret C. Harrell, Roland J. Yardley, Marian Oshiro, Holly Ann Potter, Peter Schirmer, Nelson Lim, MG-306-OSD, 2005.

Support for the Quadrennial Defense Review

Held in the first year of each presidential term, the Quadrennial Defense Review (QDR) is a principal forum for advising the Secretary of Defense on needed changes in policy domains that he selects as the most pressing topics for review. At the request of the Under Secretary of Defense for Personnel and Readiness, NSRD contributed substantially to the current QDR. NSRD prepared papers and presented briefings on a broad set of manpower-related topics. These included ensuring that active/civilian comparisons accurately computed the cost of defense manpower, in particular, allowing for the cost of retirement and health benefits; reforming the military retirement benefit system both in the active duty components and the reserve components, including a consideration of past attempts at reform and obstacles to reform; rethinking the active/reserve mix, with consideration given to the anticipated increase in the supply cost of reservists in view of their greater expected usage; describing the factors that are likely to result in a successful civilianization of active-duty billets or the shift of defense activities from the uniformed services to defense civilian agencies; and providing greater variation in officer career lengths, including extending officer careers beyond the current limit of 30 years of service. In addition, NSRD worked closely on the crafting of the QDR human capital strategy report, taking part in meetings and participating in the drafting of the report. These efforts were followed by a small workshop in human capital strategy issues for the defense acquisition workforce, and by the inception of RAND-sponsored research to develop a formal model of the active/reserve force mix.

SPONSOR: *Under Secretary of Defense for Personnel and Readiness*
PROJECT LEADER: *James Hosek*

Review of Military Health Benefit Design

DoD health care costs have been rising more rapidly among retirees under age 65 than have typical civilian employee health benefits. Since TRICARE premiums are often much lower than premiums charged by employers, there is strong incentive for retirees under 65 to take up TRICARE. Based on previous literature and ideas generated by RAND experts, NSRD has research under way to define some options for reducing health costs and to simulate their effects. The researchers are considering the likely impact of increased cost-sharing in the DoD health benefit plan, as well as that of restructuring the TRICARE benefit by adding a consumer-driven health plan or by providing incentives for beneficiaries to choose employer health insurance. It appears that DoD would need to impose a considerably greater share of the costs on recipients to substantially reduce its health care costs under the current benefit regime. Restructuring the TRICARE benefit has a larger potential to reduce costs, but careful design is needed to make sure the desired results are achieved. Further work in the project will address the implications of health benefit modification for recruiting and retention.

SPONSOR: *Assistant Secretary of Defense for Health Affairs*
PROJECT LEADERS: *Susan D. Hosek and Dana Goldman*

Assessing the Needs of the Families of Deployed Service Members: A Research Design

Despite the importance of quality-of-life issues, various DoD panels and reviews over the years have pointed out the lack of research and evaluation tools to quantify the effects (if any) of family support and other quality-of-life programs. Of particular interest with respect to the DoD mission are effects on the retention of service members and the readiness of the armed forces. NSRD is developing a valid, reliable research design for collecting and analyzing information to assess the performance of family support programs. To aid in developing the design, the NSRD research team is interviewing service members returning from deployment and their families, as well as staff in charge of family support programs at bases receiving the returning personnel. The objective is to determine what kind of data would be helpful to collect, how the data should be collected (focus groups, surveys, etc.), and how large and costly the data collection effort would have to be. In support of this objective, the project team is translating current retention theory into an approach to measure program effects on retention. The researchers will also suggest a statistical model appropriate for analyzing the problem.

SPONSOR: *Deputy Under Secretary of Defense for Program Integration*
PROJECT LEADERS: *Bernard Rostker and Laura Miller*

How Activation Influences the Earnings of Reservists

The more intensive use of the reserves since 9/11 has been accompanied by concerns that many reservists suffer substantial financial losses when they are activated—concerns that are reinforced by survey-based evidence that suggests a large fraction of activated reservists[1] suffer a decline in earnings when activated and that those earnings losses can be substantial. This evidence, in turn, has stimulated legislative proposals to improve the financial position of reservists and a congressional requirement for the DoD to survey reservists about earnings loss.

But such surveys have limitations that can lead to misleading results. First, the surveys instruct reservists to report pretax earnings, which understates military pay relative to civilian income because neither military pay received while serving in a combat zone nor military allowances are subject to federal taxes. Second, survey responses are self-reported and are thus likely to measure earnings changes with substantial error. And third, survey and item response rates in the most recent surveys are low, raising the possibility that only a selected sample of reservists is responding to the earnings loss questions.

NSRD research presents new evidence on how activations affect earnings; this evidence is based on grouped administrative data from the Defense Manpower Data Center and the Social Security Administration that allow researchers to avoid the problems inherent in survey-based estimates. The research focuses on how activation influenced the earnings of reservists activated in 2002 and 2003. However, it also provides preliminary estimates of the impact of activation in 2004 and on the impact of activation on earnings following the period of activation.

Do Activated Reservists Suffer Large Earnings Losses?

While the policy debate has been driven by the perception that a large fraction of reservists suffers an earnings loss when activated, the NSRD study's results suggest that such earnings losses are relatively uncommon and that, in fact, average earnings *gains* are substantial. The researchers' estimate of the gross effect of activation is based on the change in earnings between a base year with minimal active-duty days (i.e., 0–30 days)—in this case, 2000—and other years with more than 30 active-duty days. The figure shows the estimated gross effect.

In this group, average earnings were $42,235 in 2000, whereas the earnings of these same reservists averaged $55,774 in the activation year (2002 or 2003). Thus, average earnings increased by $13,539 between the base and activation years, an increase of 32 percent. As shown in the figure, additional military pay more than compensates for the loss in civilian pay, with an additional benefit coming from the preferred tax treatment.

Despite the aggregate gains, about 17 percent of these reservists did experience a loss in earnings; 6 percent experienced a loss of more than $10,000, and 11 percent experienced a loss of more than 10 percent of their base-year earnings. However, 40 percent of reservists who were *not* activated in either 2000 or 2002–2003 also experienced an earnings loss.

Thus, the net effect of activation is to reduce the probability of experiencing an earnings loss by 23 percentage points (40 percent minus 17 percent). This does not mean that no reservist experienced an earnings loss because of activation, but simply that activation makes it less likely, on average, that a reservist will experience such a loss.
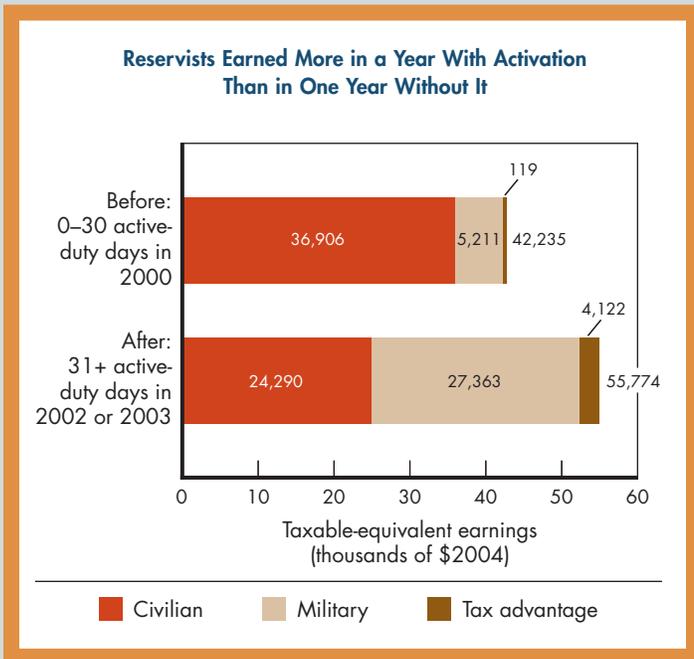
Finally, although only military earnings data were available for 2004, the researchers were able to demonstrate that the pattern of large earnings gains and few reservists with earnings losses is likely to hold when civilian earnings data for 2004 become available.

These findings differ greatly from those based on available survey evidence, but they are consistent with research showing that full-time military pay compares favorably to the full-time pay of civilians with similar education and experience. Moreover, reservists serving on active duty often receive special pays and tax breaks, which the researchers found to be important.

Do Activated Reservists Suffer Large Losses After Activation Ends?

As reservists return from long periods on active duty, policy interest will shift to the effect of active-duty service on earnings following the activation. The lack of data on civilian earnings beyond 2003 limited the research team's ability to analyze the effect of activation on post-activation earnings. Nonetheless, for reservists activated for 0–30 days in 2000 and 2003 and more than 30 days in 2001 and 2002, there was little evidence that activated reservists suffered significant earnings losses following activation. On average, net earnings increased between 2000 and 2003 for reservists

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[1] The term *reservists* here is intended to include members of the National Guard.

**Reservists Earned More in a Year With Activation
Than in One Year Without It**

Before: 0–30 active- duty days in 2000	Civilian: 36,906	Military: 5,211	Tax advantage: 119 → 42,235
After: 31+ active- duty days in 2002 or 2003	Civilian: 24,290	Military: 27,363	Tax advantage: 4,122 → 55,774

Taxable-equivalent earnings
(thousands of $2004)

■ Civilian   ■ Military   ■ Tax advantage

activated for more than 30 days in 2001 and 2002, and the net probability that a reservist would experience an earnings loss declined slightly. Note, however, that these results apply to a select group of reservists and should thus be viewed with caution.

Policy Implications

Inasmuch as the findings accurately characterize earnings loss from activation, they weaken the equity argument that underlies congressional proposals to compensate reservists with losses. That equity argument posits that reservists should not suffer serious financial harm as a result of their reserve service and so should be compensated for their financial loss. Also, efforts to replace earnings of reservists who experience an earnings loss while activated will inevitably compensate some reservists who would have experienced an earnings loss even if they had not been activated. Doing so would not be perceived as fair to other reservists who did not experience an earnings loss simply because their base-year earnings happened to be relatively low. Earnings replacement

also would fail to compensate reservists whose earnings would have grown by an even larger amount had they never been activated.

This is not, however, an argument against compensating activated reservists for other reasons. Reservists' income gains might still not be sufficient to compensate for the hardships of activation (e.g., expenses associated with being away from one's family and the emotional cost of family separation).

More broadly, enlistment and retention will likely be positively correlated with potential earnings gains or losses. Thus, reservists who stand to suffer large losses (e.g., the self-employed or those with high civilian salaries) may not be a good match in the aggregate for a reserve force that DoD expects to use with considerable frequency over the next few years. Then again, if such individuals possess specific valued skills, additional targeted compensation may be appropriate. Earnings replacement, however, is not likely to be the most targeted and cost-effective means of compensating those reservists. Future research should consider what kind of compensation reforms are likely to be most cost-efficient in attracting and retaining reservists in an era in which the probability of activation is substantially above historic norms.

How Deployments Affect Service Members

Recent developments in the national security environment have led to unprecedented strains on the all-volunteer force. Personnel are sometimes deployed for 12 months in nontraditional, hostile conditions, with only six months at home before their next deployment. One question on the minds of decisionmakers in DoD is how the changed nature of service affects service members and influences their reenlistment intentions.

To help answer this question, researchers from NSRD took a multidisciplinary perspective, reviewing the literature in economics, sociology, and psychology, the last with a focus on the relationship between stress and performance. They also developed an expected-utility model of deployment and reenlistment. The expected-utility model shows how home time, deployed time, pay, and other factors can be portrayed in a cohesive framework describing service members' satisfaction and willingness to stay in service. With this foundation, the researchers conducted focus groups of service members that explored expectations and experiences of military life, including those related to deployment. They also analyzed DoD's Status of Forces Surveys of Active Duty Personnel—surveys of military personnel conducted by the Defense Manpower Data Center from March and July 2003—regarding work hours, deployment, preparation, and their relationship to higher-than-usual stress and reenlistment intention. Taken together, the literature review, model, focus groups, and data analysis provide insight into the effect of deployment on military personnel and permit drawing several policy implications.

- **Service members value deployments as an opportunity to use their training in real-world missions and participate in meaningful operations.** They realize a sense of accomplishment from deployments, which contribute to positive attitudes among personnel and help explain why deployment had not decreased many survey respondents' intention to stay. But service members have preferences and expectations for deployment frequency and duration, and deployments exceeding those parameters—e.g., unusually long deployments or uncertain deployment schedules—can adversely affect satisfaction with military life. Because service members value deployments and yet do not appreciate unexpectedly long deployments, deployments should be spread widely across service members, subject to overall mission requirements.

- **Deployment pay helps to offset negative aspects of deployment.** Deployment pay may need to be higher to compensate personnel who have an unusually high amount of deployment, and DoD is looking into such compensation. Increasing deployment pay depending on the member's deployment history could offset some of the negative effects of long and frequent deployments on morale and reenlistment. In addition, high current and future deployments may deter some prospective recruits, and the military may need to compensate for this greater perceived risk—e.g., through enlistment bonuses.

- **It is worth considering additional pay and recognition for nondeployed personnel who are often called on to work longer than the usual duty-day.** Like deployed personnel, many nondeployed personnel frequently work long days to support the heightened pace of military operations. Survey data showed that frequently working long days caused higher-than-usual stress (see the figure) and a lower intention to stay—for both nondeployed and deployed personnel. Nondeployed service members in the focus groups said such hours created both work stress and family stress, and left little time for their personal life. Service members receive no additional pay for frequently working longer than the usual duty-day. One option for introducing such pay would be to extend the eligibility for Special Duty Assignment Pay, which is payable to personnel in specific jobs as defined by the Secretary of Defense, to include certain personnel who do not deploy but who fill positions that prove to require many long days.

**Percentage Reporting a Given Level of Work Stress
by Number of Times Worked Longer Than Usual Duty Day
in the Preceding 12 Months**

Percentage reporting stress

Times worked longer than duty day

■ Much more than usual stress   ■ More than usual stress
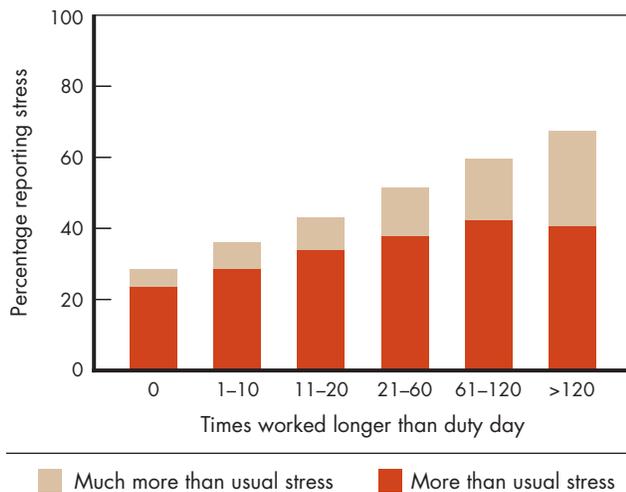
■ **Family separation, high operations tempo, long work hours, and uncertainty surrounding deployments are some of the more negative aspects of deployment and ones that affect stress and intention to stay most significantly.** These aspects could be addressed through various means. Comments in our focus groups implied that effective, accessible, inexpensive communication home while on deployment helps to reduce the stress of family separation. A predictable rotation cycle could aid in offsetting the adverse effects caused by uncertainty in the deployment schedule. When deployment times are not predictable, it would be useful to advise members of this uncertainty so that they and their families can plan around it. To address long hours, certain tasks might be eliminated or postponed, personnel might be temporarily reassigned to assist with tasks, and, as mentioned, pay might be increased. Expanded family programs might also play a role.

■ **Training and preparation are important to improving the ability of personnel to respond effectively in challenging and unfamiliar circumstances.** The survey analysis showed that service members who felt well prepared and believed their unit was well prepared had lower-than-usual stress

and higher reenlistment intentions. Focus group members also mentioned the importance of training, and they added that training needed to be continuously revised to keep up with nontraditional tactics, counterinsurgency, and peacekeeping operations. The military is, in fact, adapting its training to include lessons learned in Iraq and Afghanistan.

■ **Many service members cope with combat-related stressors informally by turning to their peers for support.** The researchers found that involvement in combat operations in Afghanistan and Iraq in 2003 was unrelated to the survey measures for stress and intention to stay. However, some focus group participants reported that they felt combat stress, and they most frequently turned to their buddies rather than seeking professional help. Among the reasons given for doing so were that their buddies had shared the same experiences and "understood," and that visiting a mental health professional would be entered in their personnel file and might be perceived as a sign of weakness. Military health officials are aware of stress-related mental-health risks and now mandate screening for post-traumatic stress disorder among returning personnel. Mandatory screening eliminates the stigma an individual might feel in seeking help. Also, the services now offer counseling to departing and returning personnel, helping them cope with stress from family separation and reintegration. In addition, because soldiers rely on their buddies, it might be useful to train soldiers in how to help other soldiers handle stress.

Further research on the issue of how deployments affect reenlistment seems warranted. Analysis of more-recent Status of Forces surveys and personnel data would show whether outcomes such as higher-than-usual stress, reenlistment intention, and reenlistment itself worsened as deployments grew longer, more frequent, and, in some ways, riskier—even though the underlying relationships described here might have remained the same.

For more information, see

How Deployments Affect Service Members, James Hosek, Jennifer Kavanagh, Laura Miller, MG-432-RC, 2006.

America's intelligence enterprise is in an intense state of flux. In recent years, the U.S. Intelligence Community's abilities to track terrorists, locate weapons of mass destruction, and conduct meaningful counterintelligence programs have been repeatedly called into question. The Intelligence Community's success in rebuilding public confidence will depend heavily on how well it can demonstrate improvement in those missions while simultaneously rising to cultural challenges posed by a new Director of National Intelligence (DNI) and changes in the workforce. Remedial efforts are under way. On the collection side, the Intelligence Community is working to transform human intelligence functions and modernize signals and imagery capabilities. With regard to analysis, the community is striving to improve the way it identifies and trains analysts and to enhance its ability to mine large sets of data.

But there are drawbacks to responsiveness. The exigencies of the global war on terrorism, coupled with heightened public scrutiny, are likely to increase pressures to focus on tomorrow's potential crisis. One of the Intelligence Community's analytic strengths, however, has been its ability to illuminate breaking events in the context of longer-term trends. Seeing that urgent needs are not satisfied at excessive cost to long-term capabilities will be an imperative not fully appreciated by many external stakeholders.

NSRD's Intelligence Policy Center supplements the Intelligence Community's own capabilities by analyzing evolving threats so that the implications of potential U.S. actions may be more fully understood. The IPC provides senior leaders with crucial understanding of the state of intelligence analysis today and options for enhancements for the future. All in all, the IPC is becoming a center of transformational thinking for the Intelligence Community, a place to turn for innovative concepts and unconventional solutions.

SOME RECENT AND ONGOING PROJECTS[1]

Indications and Warning of Terrorist Groups Seeking Weapons of Mass Destruction

The longtime U.S. nightmare proliferation scenario is terrorist acquisition of chemical, biological, radiological, or nuclear (CBRN) weapons. Fears are directed in particular toward groups such as jihadists, whose ideology, means, and resources make them possible acquirers of such weapons and—if they do so—likely users. Aside from such obvious examples, what terrorist groups are most likely to be CBRN weapon seekers? The Intelligence Community could use a tool or protocol to aid in this determination. NSRD developed a model for categorizing groups according to their propensity to seek and use CBRN weapons. The model orders a broad set of descriptors—capabilities and motivations, endogenous and exogenous—according to their explanatory powers. The research team rated dozens of extremist groups according to each of these descriptors. With this input, the model classified the groups as seeking, strongly seeking, or not seeking CBRN weapons.

PROJECT LEADER: *John Parachini*

Early History of al Qaeda

Al Qaeda's origins can be traced to the Soviet Union's invasion of Afghanistan in 1979. Although the broad outlines of the group's subsequent evolution are well known, scant attention has been paid to the specifics of that process. That is unfortunate, because more in-depth knowledge could shed light on the growth and maturation of like-minded successor groups today. NSRD has assembled a team of scholars with expertise in history, linguistics, political science, organizational behavior, and terrorism to review documents and conduct interviews in the Middle East with the goal of developing a more complete historical profile. The researchers are interested in al Qaeda's decisionmaking processes, e.g., how tasks and responsibilities were assigned. They are also attempting to learn how early recruitment was carried out, the extent to which bin Laden applied his training in economics to running a terrorist organization, and the roles of theoreticians and

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[1] Projects summarized in this section are sponsored by the Intelligence Community, unless stated otherwise.

The destruction of the Golden Mosque in Samarra exemplifies the potential for religious conflict with important implications for U.S. security interests.

religious scholars vis-à-vis warriors. They want to know how relations between al Qaeda and like-minded terrorist groups were managed, how decisions on the allocation of funds were made, and where bin Laden and his colleagues expected to see themselves some years in the future. From all this, the research team expects to draw lessons regarding al Qaeda's strengths and vulnerabilities.

PROJECT LEADER: *Bruce Hoffman*

Religious Conflict

Policymakers concerned with national security, as well as intelligence agencies, have traditionally found it difficult to address issues of religion and religious motivation, which are too easily seen as incidental manifestations of "real" social or economic grievances. In the post–9/11 world, however, religious issues must be addressed directly. To that end, NSRD and an Intelligence Community sponsor organized a board of experts on religious matters, who have met with intelligence analysts in several carefully prepared day-long workshops held over the course of three years. The goal of the workshops was to provide analysts with background information and frames of reference relating religion, politics, and violence. The first year's workshops focused on the origins of religious violence and on how states have sought—not very successfully—to manipulate or mitigate it. The second year's workshops sought to understand why violent religious groups sometimes move away from violence, whereas other religious movements choose to be apolitical, nonviolent social groups. The final workshop of the second year took up the role of leaders and leadership in religious movements. This year's workshops will deal with "followership" and with the rise of other religious groups, such as evangelical Christians in China, Latin America, and Africa.

PROJECT LEADER: *Gregory Treverton*

Massive Scenario Generation and Decision Support

The 1990s and the early years of the current decade have arguably been marked by a paradigm shift in how to approach strategic planning. In place of optimizing and prioritizing so as to focus on a best-estimate scenario, the preference now is to find strategies that are flexible, adaptive, and robust enough to ensure effectiveness in a broad range of circumstances and under a range of possible futures. To enable such planning in situations that could involve dozens of important variables, it may be useful to generate very large numbers of scenarios so as to explore the "possibility space." Doing so meaningfully, however, requires both theory and technology. NSRD is developing and testing an approach and related tools that will permit the generation of massive numbers of scenarios and the distillation of those possibilities in a way that allows the formulation of flexible, adaptive, robust strategies. Some of the work involves understanding how to define the possibility space, i.e., how to define a scenario generator. Other aspects of the work involve actually generating scenarios covering the possibility space and then using advanced methods of visualization and abstraction to understand the "landscape" of that space, define candidate strategies, and then evaluate them. Experimental applications are under way involving counterterrorism and anticipating challenges associated with future use of nuclear weapons.

PROJECT LEADERS: *Paul Davis and Steven Bankes*

The Next Steps in Reshaping Intelligence

The shock of September 11 and the tenacity of the national commission that investigated the disaster yielded what decades of previous blue-ribbon panels could not—the beginnings of a real reshaping of U.S. intelligence by way of the Intelligence Reform and Terrorism Prevention Act of 2004. Yet the emphasis is on "beginnings." The law created new boxes on the organization chart and moved others. However, some of the authorities it gave to the person in the main box, the Director of National Intelligence, are ambiguous. The challenge for the DNI is to turn those ambiguities into real authority. To do so, the focus must shift from how the Intelligence Community is organized to how it does its business. In 2005, RAND funded an analysis of some of the issues that will arise as the next steps are taken to reshape intelligence.

Building Capacity to Manage

The Intelligence Community and the Pentagon compete over whose needs are more important. This competition has become more salient because, as the capabilities of national collection systems have improved, they have become increasingly important to warfighters, blurring the distinction between "strategic" and "tactical." Ultimately, the military will want intelligence systems it can count on, i.e., its own systems integral to operational units. The challenge for the DNI, working with the Secretary of Defense, will be to provide a strategic framework for the argument over needs. The starting point will be to begin building the analytic clout to fashion an intelligence program and budget that is compelling both to other administration decisionmakers and to Congress.

The DNI will find his management challenges complicated by his second job—serving as the principal intelligence advisor to the President. Balancing the two duties will be no easy feat. A DNI who tilts more toward management would risk losing the credibility to advise. Tilting too far toward advice would risk losing the time to manage.

Shaping Intelligence by Mission

The most sweeping change in the law was the creation of national intelligence centers organized around issues or missions instead of around intelligence sources or agencies, as had been the case. The centers would be analogous to the military's "combatant commands"—looking to the CIA, the Defense Intelligence Agency, the National Security Agency, and other organizations to acquire the technological systems, train the people, and execute the operations that the centers plan.

The DNI will have to decide which centers to create and, more important, begin to change the culture to accommodate them. The CIA and other agencies will resist the shift from "doers" to "force providers," and will argue, with some reason, that the centers will focus only on hot near-term issues.

Improving Analysis

The need to reshape analysis is dramatic. Threats to the United States are global and adaptive, blurring distinctions among crime, terrorism, and war. Furthermore, that adaptiveness means that U.S. security planners need to understand the implications of the actions of Americans—including private-sector organizations—and that need runs against powerful norms not to collect intelligence on Americans.

Today's analysis is dominated by the urgency of the immediate, but intelligence also needs to provide deeper understanding attainable only over the long term. The groups that are thinking beyond the immediate—the National Intelligence Council, for instance—must be reinforced. The centers will have to implement a wide range of innovations in analysis—to reach out beyond classified material; to make much wider use of methods for aggregating expert views; and to search data for what seems out of the ordinary, not just for confirming evidence.

Taking Advantage of a Very Different Workforce

All the intelligence agencies have grown dramatically since September 11. The young recruits are computer-savvy and unlikely to stand for the information environments—compartmented, slow, and source driven—that current intelligence provides.

The Intelligence Community will soon lose its recruits if it does not accommodate how these recruits think and learn. The community might take advantage of demographics and build "gray-green" teams as some Wall Street firms have, combining savvy veterans with bold newcomers. The community will also have to wean itself away from the luxury of having a large percentage of recruits stay for an entire career, as has been the case. Many young professionals, seeking challenges, will want to move on, perhaps returning later.

The influx can be an opportunity to build real "jointness" in the Intelligence Community by making a greater commitment to training at the strategic level, for example, via the newly created National Intelligence University. But intelligence agencies have not had the slack in their ranks to permit officers to depart for several months of training. Therefore, either some short-term manpower sacrifices will have to be made, or staff will have to be increased to cover losses to training.

Targeting Collection

Much of the architecture for the collection of imagery and signals intelligence is quite well understood by would-be adversaries, who camouflage sensitive activities when they know satellites are overhead. As a result, U.S. intelligence produces too many data and too little information.

Thus, the long-term challenge for U.S. intelligence is to move away from passive surveillance toward more directed collection and to shorten the innovation process so surveillance becomes less predictable. That means adapting faster than the targets do—e.g., by making greater use of smaller satellites, drones, or stealth technology. It also means using new parts of the spectrum, like hyperspectral imagery, to identify effluents from manufacturing and processing facilities. Greater adaptability is also required in the collection of human intelligence, where every blue-ribbon commission has called for improvements.

The DNI should develop the ability to make trade-offs across the collection modes: How do ground stations compare with satellites for particular missions? Can a mission be accomplished more cheaply through human intelligence? The Commission on Weapons of Mass Destruction suggested that the DNI create an "integrated collection enterprise" to coordinate planning new systems, developing strategies for deploying current systems against targets, and exploiting the information that is produced. The existing Collection Concepts Development Center would be a good place to start.

Updating the Culture of Secrecy

Finally, and most important, the intelligence culture of secrecy and "need to know" is out of date. That culture is designed to protect information, not share it, which ultimately frustrates almost all reform efforts. Analysis of terrorist threats, for instance, would be improved by consulting people who have no traditional or recurring "need to know" but who bring a different perspective and might see patterns that the ostensible experts do not.

For more information, see

The Next Steps in Reshaping Intelligence, Gregory F. Treverton, OP-152-RC, 2005.

Assessing China's System of Export Controls for WMD-Related Goods and Technologies

Over the past 25 years, the Chinese government's system of export controls on sensitive equipment, materials, and technologies for producing weapons of mass destruction (WMD) and WMD delivery systems has evolved significantly. As China becomes more integrated into the prevailing rules, norms, and institutions that govern international security, its ability and willingness to comply with its nonproliferation commitments serve as an important indicator of its future role as a major power. NSRD examined the Chinese government's controls, including the relevant laws and regulations, key organizations involved in export control decisionmaking, and the interactions among government organizations involved in screening sensitive exports. The research revealed that the central government has recently tried to improve interagency coordination on export control decisions, but it is still unable to consistently and effectively implement and enforce these new controls. Further improvements may be slow, unless the Chinese government devotes more resources and political capital to enhancing its export control practices.

Several Factors Have Influenced China's Export Control System Since the 1980s

China's controls on sensitive WMD-related exports have grown substantially since the early 1980s. Twenty-five years ago, China had just begun to trade more actively with the international community but had extraordinarily weak export controls. The system began to change in the late 1980s when the government came under international pressure to better regulate exports of conventional military and WMD-related goods and technology to potential proliferators, especially in the Middle East and South Asia. In the late 1990s, Chinese leaders also began to recognize the negative impact on China's international image of being a supplier of WMD-related goods and technologies, especially to unstable regions. In response, China slowly began to create laws and regulations

that established government procedures for vetting pending exports of sensitive nuclear, chemical, missile, and conventional military goods and technologies.

Several factors have affected the evolution of China's system of WMD export controls, some hastening and others slowing the pace of development. First, the specific requirements of international nonproliferation treaties that China signed led it to adopt explicit export controls in response to these treaty commitments. Second, the government initially lacked the institutional capabilities to make decisions on WMD exports, and it took years to develop these capabilities. Third, international pressure, mainly from the United States, played an important role in shaping China's policies on export regulation of sensitive goods and technologies. Finally, changing Chinese views on the role of nonproliferation in China's national security interests further influenced the policies.

Stronger Implementation and Enforcement of Export Controls Are Needed

China's implementation and enforcement of its nonproliferation export controls serve as a key indicator of Beijing's willingness and ability to fulfill its nonproliferation pledges. The nation has made greater strides in implementation (translating policies into practical actions) than it has in enforcement (monitoring behavior, identifying violations, and holding violators accountable). However, continued improvements in both areas are needed.

The Chinese government has taken several steps in recent years to improve implementation of WMD export controls. It has

- created a system of laws and regulations
- established a process of formal interagency coordination to vet possible exports of WMD-related goods and technologies
- developed detailed policy standards to determine whether to license sensitive exports
- developed an internal "watch list" of countries and enterprises to monitor
- tried to enforce end-user controls, although with limited success.

Container ship at Xiamen, Fujian province.

The government's ability to detect, catch, investigate, and penalize violators is significantly underdeveloped, however, and the limited enforcement of export controls is the weakest link in the export control system. As of April 2005, only two cases of penalizing enterprises for export control violations had been made public, but Chinese officials claimed that there were more in the pipeline. Although the government's capabilities are better than they were a few years ago, it needs to do much more to enforce its export-control regulations.

Future Challenges for China's Export-Control System

Although China has made substantial progress over the last two and a half decades, it is still several steps away from a fully functioning export control system capable of regularly policing the activities of exporters involved in selling WMD-related goods and technologies. Developing such a system will require devoting more resources to institutional development and defeating entrenched interests. To move forward, the Chinese government will need to create incentives for better compliance with export regulations, significantly increase enforcement of the regulations, and clearly communicate the cost of violations to state-owned and private enterprises. As it increases its capabilities in these areas, it will need to keep up with the pace of rapid enterprise privatization to educate new companies about their obligations, and it will need to monitor the increased opportunities for foreign enterprises to obtain controlled items by exploiting the weaknesses in China's current export control system. Throughout this process, it must also deal with the issues that typically accompany structural changes in government operations. The effort China devotes to all these challenges will serve as a key indicator of the Chinese government's ability to fulfill its stated goal of acting like a "responsible major power" in global affairs, especially as related to WMD nonproliferation.

In addition to the four policy research centers described above, NSRD houses RAND's International Programs, which administer studies addressing international affairs but funded by sponsors outside DoD and the Intelligence Community and typically outside the U.S. government. This research lies at the intersection of international policy and other issues, such as transnational trade and investment, education, health care, information technology, and energy and environment. These issues often have important implications for U.S. national and international security. International Programs include three centers:

- The RAND Center for Middle East Public Policy (David Aaron, director), which has examined the impact of the growth in the Internet, along with demographic and labor market trends in Islamic countries. Its most important recent effort was a landmark study on building a successful Palestinian state.

- The RAND Center for Asia Pacific Policy (William Overholt, director), which has addressed issues such as China's economic transformation, the debate in South Korea over reunification with the North, science and technology in Korea, and terrorist networks in Southeast Asia.

- The RAND Center for Russia and Eurasia (Jeremy Azrael, director), which assists political and economic change within those countries, particularly through the RAND Business Leaders Forum, an organization of leading corporate executives from Russia, the United States, and Western Europe.

SOME RECENT AND ONGOING PROJECTS

The Cost of Combating Terrorism

Increasingly, rich countries look toward poorer nations as potential sources of, or harbors for, international terrorism or as venues for conflicts that require intervention to preserve stability. They confront these threats with layers of defense: increases in development assistance, law enforcement and intelligence cooperation, military actions to root out terrorist threats, policies to control international flows of people and finance, and homeland security activities. These policies impose direct and indirect costs on the rich countries as well as on the targeted poorer countries—costs that have not been fully understood or estimated. NSRD has taken a first step in determining the costs of rich countries' responses to terrorist movements and civil wars in developing countries. The principal focus has been on the United States, including the activities of state and local governments and those of the private sector, but the research team has supplemented these estimates with available data from other countries.

SPONSOR: *World Bank*

PROJECT LEADER: *Gregory Treverton*

Korean Science and Technology Choices in the Era of a Rising China

As China's economy becomes more powerful, many Koreans see it as presenting a formidable threat as well as an opportunity. It is uncertain, for example, whether Korea can maintain its position in both Chinese and world markets as China becomes more competitive in many industries where Korea currently has a relative advantage. What should Korea do to confront these uncertainties and maintain its economic dynamism? What would be appropriate strategies and policies for Korea to pursue, particularly in science and technology? NSRD developed a simple model of the Korean economy and four alternative science and technology strategies that Korea could follow. The researchers showed how those strategies may affect Korean prosperity, explicitly considering the many uncertainties that Korea confronts. Using the metric of average annual growth rate in per-capita gross domestic product for Korea until 2015, the research team assessed each strategy for performance across 100 future scenarios. The analysis indicated that, under optimal conditions, the current growth strategy would have great potential for sustained growth. However, this strategy is vulnerable to such shocks as a drop in China's growth rate. A strategy focusing on research and development would be more robust.[1]

SPONSOR: *Korean Institute of Science and Technology Evaluation and Planning*

PROJECT LEADERS: *Somi Seong, Steven W. Popper*

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[1] For more information, see *Strategic Choices in Science and Technology: Korea in the Era of a Rising China*, Somi Seong, Steven W. Popper, and Kungang Zheng, MG-320-KISTEP (English); MG-320/1-KISTEP (Korean), 2005.

China and Globalization

In 2005, RAND staff testified before Congress on 19 occasions. In some of these instances, researchers presented the results of specific sponsored projects with implications for congressional deliberations. In other cases, RAND staff spoke from their accumulated expertise on a topic. An instance of the latter was the testimony last spring by the Director of the RAND Center for Asia Pacific Policy (CAPP).[2] This testimony was given against the background of concern by some members of Congress regarding the rise of China as an economic competitor—one that does not always "play fair." CAPP's director asserted that China's entry into the global marketplace should be viewed as a triumph for the international economic institutions that the United States was instrumental in creating. China has converted from a critic and disrupter of these institutions to a committed member of them. Neighboring states have learned the advantages of a more open economy, their trade and foreign investment has been stimulated, and American companies have found new markets in China. This has not been without drawbacks: The U.S. trade deficit with China has soared and U.S. companies have suffered losses from Chinese misappropriation of intellectual property. China has its own adjustment problems, however. Banking, demographic, and other challenges are likely to stem its economic growth before it comes close to achieving the kind of economic and geopolitical dominance that some fear.

PROJECT LEADER: *William Overholt*

Dissemination of RAND Research to International Audiences

Because RAND is a global organization, it seeks to reach important international audiences with the broad spectrum of its research messages. For example, at a conference in Shanghai cosponsored by the RAND Center for Asia Pacific Policy and the Center for National Security Studies at Shanghai Jaotung University, RAND staff presented talks on a range of "nontraditional" security issues, i.e., those relating to the supply chain, health, education, aviation, and energy. RAND also hosts numerous visitors from abroad, including, in 2005, the ambassadors of Pakistan, the Netherlands, and New Zealand to the United States; the former ambassador of the People's

His Royal Highness Prince Turki Al-Faisal, Saudi Arabia's ambassador to the United States (center), with David Aaron, director of the RAND Center for Middle East Public Policy.

Republic of China to the United Nations; and members of the South Korean National Assembly. RAND research briefed to such visitors covered topics ranging from building security forces in Afghanistan and making science and technology choices to various education issues.

RAND Business Leaders Forum

The RAND Business Leaders Forum is a member organization that facilitates in-depth discussions among leading corporate executives from Russia, the United States, and Western Europe regarding strategic opportunities and challenges in the development of economic and business relations. Its purpose is to help executives understand and influence each others' responses to opportunities for and challenges to economic growth in the 21st century, particularly as they relate to Russia. By fostering free-wheeling but purposeful private-sector dialogue, the Forum seeks to promote mutually beneficial commercial relations, to overcome obstacles to economic cooperation, to strengthen political and security ties, and to prevent conflicts of interest from escalating into major confrontations. To fulfill its mission, the Forum holds two plenary meetings per year—one in New York and one in Moscow. The November 2005 meeting in Moscow covered trends in the Russian economy, the economic roles of government, the effect of globalization on Russian business and the latter's response to it, Russia's energy strategy, and economic and political developments in Ukraine. The Forum's activities are funded by the participating corporations.[3]

PROJECT LEADER: *Jeremy Azrael*

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[2] For more information, see *China and Globalization*, William H. Overholt, CT-244, 2005.

[3] For more information, see http://www.rand.org/nsrd/cre/happen/blf.html.

Building a Successful Palestinian State

The United States, Russia, the European Union, and the United Nations, as well as many Palestinians and Israelis, are committed to the establishment of an independent Palestinian state. Bringing such a state into existence, however, may not be as much of a challenge as getting it to succeed. Effective governing institutions, rapid economic growth, health care and education systems, and security—all these will have to be established. A nation must be built, and U.S. and UN experience has taught that nation-building can only benefit from detailed planning.

NSRD collaborated with RAND Health to take the first step in that planning. The RAND efforts, which assumed the achievement of a peace settlement with Israel, covered three important domains: the range of political, social, economic, and environmental challenges that a new Palestinian state would face; security of the new state from external threats; and the state's physical infrastructure. The work was funded by gifts from private individuals and by RAND, using discretionary funds.

Formula for a Successful State

A Palestinian state would be regarded as successful if it is secure, well governed, capable of ensuring the social well-being of its population, and economically viable. A new state is more likely to succeed if it has a high level of territorial contiguity (apart from the separation of Gaza and the West Bank) and relatively open borders, allowing free flow of people and goods between Palestine and its neighbors.

- **Internal Security.** An independent state must be secure within its borders and must provide for the routine safety of its inhabitants. Internal security services will need to be restructured and will need monitoring, training, and analytical support. Public safety, law enforcement, and the administration of justice will need to be put on a sound footing as quickly as possible.

- **Governance.** Palestinians will need to view their leaders as legitimate and effective. The government will have to fight corruption, promote the rule of law and empower the judiciary, encourage parliamentary democracy, promote meritocracy in the civil service, and delegate power to local officials.

- **Social Well-Being.** Among the basic services the Palestinian state will have to guarantee will be the water supply, health care, and education.

Water. Adequate supplies of clean water will be required for domestic consumption, commercial and industrial development, and agriculture. Today Palestinians have access to only half the minimum daily amount of water per person established by the World Health Organization. One way to meet the WHO standard is for Israel and Palestine to renegotiate the allocation of existing water resources to a more even per-capita use. Removing water from aquifers beyond sustainable limits must be halted to avoid exacerbating shortages. More efficient water use could also help address the water shortfall.

Health Care. Palestine has a relatively healthy population, many highly qualified health care professionals, national plans for health system development, and a strong base of governmental and health care institutions. However, the health care system is poorly coordinated, many providers are underqualified, systems for licensing and continuing education are weak, and there are considerable financial deficits. Key priorities include better integration of health system planning with policy development, updated and enforced licensing and accrediting standards, an updated immunization program, comprehensive micronutrient fortification and supplementation, improved prevention and treatment of diseases, and improved diagnosis and treatment for developmental and psychosocial conditions.

Education. The future state's education system begins with strong foundations regarding access, quality, and delivery. To build on those strengths, the education system should be open to reform, enroll more students in secondary schools, expand early childhood programs, and make special education available. Vocational education should be redesigned and expanded to produce workers with needed skills. Universities should place more emphasis on science and engineering. These improvements will require increased funding, higher quality standards, better-paid teachers, and new and renovated facilities.

- **Economic Viability.** All these governmental services and functions will be necessary if the Palestinian economy is to grow, and the reverse is true as well. Security arrangements sufficient to allow open borders would permit Palestinian access to the Israeli labor market. Economic development will also depend on human capital and on improvements and investment in the transportation, water, power, and communications infrastructure of Palestine. RAND estimated the capital investments required to enable robust economic growth at approximately $33 billion over ten years. This is similar, on a per-capita basis, to the aid provided to Bosnia over its first two post-conflict years. The lengthier commitment envisioned for Palestine would require concerted international cooperation.

External Security

The RAND project team sought to formulate a set of useful guidelines for enhancing the security of a Palestinian state against external threats following the achievement of a peace settlement with Israel. The analysis suggested that Palestine should agree not to constitute regular military forces, although it should have border guards, police, and other domestic security forces. A U.S.-led international peace-enabling force should be deployed along the Palestinian borders with Egypt, Jordan, and Israel, subject to agreement by Israel and Palestine. And for maximum security, Israeli settlements would need to be withdrawn from Palestinian lands after the creation of a Palestinian state, except in areas contiguous to Israel that are incorporated into Israel through negotiations.

The Arc: A Formal Structure for a New State

Palestine's crumbling infrastructure presents a major challenge for a new state. Yet it also provides an opportunity to plan for sustainable development and to avoid the environmental cost and economic inefficiencies that might otherwise result from the need to accommodate a rapidly growing population. The Arc, RAND's concept for developing Palestine's physical infrastructure, provides such a plan.

The plan's premise is that the principal West Bank cities represent an area small enough with a population density large enough to support a common, connecting urban infrastructure. An interurban rail line following the path of an arc might link the main cities of the West Bank and Gaza, where an airport and seaport might be located (see the figure).

The rail stations, located several miles from historic urban centers, would serve as focal points for new development and would be connected to these historic centers via new transit boulevards and an advanced form of rapid bus transit. Development incorporating sustainable systems along each boulevard would pump economic activity into the centers of Palestinian cities and ensure their preservation and revitalization. Construction of the transportation lines would invite parallel construction of lines for electricity, natural gas, telecommunications, and water. RAND estimated that constructing the core transportation-oriented elements of the Arc would cost about $6 billion.

No single construction project could address all the issues that a new Palestinian state will face. However, infrastructure development of this scope and scale is a necessary condition for the success of a new Palestinian state over its first decade.

Concept for Palestinian Interurban Rail Line, with Transit Boulevards Connecting Stations to Historic City Centers (black dots)

For more information, see

Building a Successful Palestinian State, The RAND Palestinian State Study Team, MG-146-DCR, 2005.

Building a Successful Palestinian State: Security, Robert E. Hunter, Seth G. Jones, MG-146/2-DCR, 2006.

The Arc: A Formal Structure for a Palestinian State, Doug Suisman, Steven N. Simon, Glenn E. Robinson, C. Ross Anthony, Michael Schoenbaum, MG-327-GG, 2005.

Helping a Palestinian State Succeed: Key Findings, MG-146/1, 2005.

Russia and the Information Revolution

When the Soviet Union collapsed in 1991, Russia did not possess an internationally competitive, business-oriented, or market-driven information technology (IT) sector. Rather, the nation's considerable human-capital assets in mathematics, engineering, microelectronics, communications, and computing were embedded in its military-industrial enterprises and to a lesser extent in government and research facilities. Many hoped that these resources would be used to advance economic reform and development, democratization, and Russia's integration into the global mainstream. Over a five-year period beginning in 1999, a grant from the Carnegie Corporation of New York allowed NSRD to examine the use of information and communications technology in Russia to determine the impact of IT on Russia's business, government, social, and political developments. The researchers found that instead of catalyzing change, IT within Russia has largely mirrored or reinforced ongoing developments. Therefore, a Russian information revolution remains in the distance.

IT Has Not Yet Reached Its Potential to Benefit the Russian Economy

Since the early 1990s, Russia has developed a vibrant, market-oriented, decentralized IT industry, which encompasses telecommunications, hardware assembly, packaged software, IT systems design and integration, and software research and development. In 2004, Russia's telecommunications industry revenues were about $19 billion, and information technology goods and services totaled about $10 billion. The table summarizes key economic facts about Russia and its population's use of IT.

Private companies have fueled growth in the IT sector through investments to better manage their operations, develop new business opportunities, and improve competitiveness. This process began in the mid 1990s and accelerated around 2001, when rising energy and mineral prices boosted the Russian economy. Since then, businesses' demand for technology and communications goods and services has grown 25–30 percent annually, and it had reached $9.3 billion annually by early 2005. Large Russian firms are using IT to improve accounting and recordkeeping, monitor and coordinate operations and logistics, and impose management oversight and discipline, especially over geographically disparate locations. Many companies also consider adopting modern information systems to be a key to attracting foreign investors.

Russia at a Glance, 2004	
Population	143.4 million
Literacy rate	99.6 percent
Average annual economic growth rate, 1999–2004	6.5 percent
Gross domestic product per capita (purchasing-power parity)	$9,800
Gross domestic product by sector Agriculture Industry Services	4.9 percent 33.9 percent 61.2 percent
Federal budget revenues	$106.4 billion
Mobile phone accounts	37 million
Adult population browsing the Web or using e-mail at least once a week	10.3 million

SOURCES: Central Intelligence Agency, *World Factbook,* Langley, Va., 2005; International Telecommunication Union, *Europe's Telecommunication/CT Markets and Trends, 2003–2004,* Geneva, 2005; Public Opinion Foundation, *The Internet in Russia Survey,* Issue 10, Moscow, March 22, 2005.

Despite these investments, IT has failed to reach its full potential because of both internal and external factors. Within Russia, many business owners and managers downplay the need for IT, choosing to prioritize other restructuring efforts. IT industry representatives attribute this lack of enthusiasm to managers' reluctance to relax controls on information flows and to decentralize decisionmaking. On the international front, the Russian IT market is limited further by its concentration on high-end IT services, making it a "boutique" player in the global marketplace.

Government Use of IT Reflects the Flaws of Russia's Public-Sector Culture

The Putin administration has devoted substantial resources to improving government performance though IT. In 2004, the Russian federal government spent more than $640 million on technologies and services, an amount projected to double in 2005. As a result, government became the largest single purchaser of IT hardware, software, and services, accounting for nearly a quarter of all IT purchases in 2004. Today, the gov-

ernment provides a range of information online—including laws and draft legislation, economic data, agency activities, and points of contact. The government also increasingly uses IT to administer social services, taxes and customs, banking, and purchasing.

Although the rhetoric surrounding IT initiatives—dubbed "electronic government" and "e-Russia," for example—focuses on improving public-sector service delivery, responsiveness, and transparency, the efforts do not conform to models of e-government familiar in the West. First, efforts to implement e-government programs in Russia have been hampered by poor design, resistance to change, and a pervasive culture of secrecy without accountability. Second, Russia's electronic government initiatives originate from state-centric goals: to enhance the image of government and officials and to strengthen the state's control over the economy and society. In fact, many of the problems IT might ameliorate—such as secrecy, corruption, waste, and the unresponsiveness of public officials—appear to have worsened under the Putin administration despite large investments in IT. This suggests that if an information revolution in government implies the ready availability of information that promotes transparency, accountability, and responsiveness, such a revolution will not occur until the public-sector culture changes.

IT Use in Society Has Increased Rapidly—Within Cultural Limitations

IT—in the form of telecommunications and the Internet—has changed the lives of Russian citizens in striking ways. Whereas in the Soviet era citizens waited years to get a telephone in their apartment, they now wait only a few minutes to get a telephone in their pocket. Telegrams, which were a principal means of long-distance communication just a decade ago, have been replaced by email and mobile-phone text-messaging. Because Russia has a highly educated population, the uptake and use of technology has been rapid. Since 1999, regular Internet usage has been rising at about 30–40 percent annually, reaching an estimated 10.3 million, or about 9 percent of the adult population, by early 2005. Internet use is highest among Russian youths because of the access and training provided in schools and colleges.

Although online access includes the global Internet, Russian Internet users tend to rely on domestic Web resources.

The Russian Internet—or "RuNet"—provides the general population with many informational resources, including news and weather reports and information on consumer goods, financial markets, and recreation. But while the Internet in the West is commonly seen as a force for globalization, there is little indication that information from abroad is having much impact on anything in Russia beyond pop culture and consumer preferences.

Notably, the RuNet has remained largely apolitical. Russian users, still wary from the political upheavals and rhetoric of the 1980s and 1990s, have demonstrated little interest in online activism. Those with political inclinations have tended to censor themselves online or limit their communications to specific like-minded individuals in Russia or abroad. In 2005, however, a number of dissident voices emerged on the RuNet, perhaps in response to the IT-enabled political activism witnessed in such nearby countries as Serbia, Ukraine, and China. The Russian government appears to be taking these developments seriously, and it is widely anticipated that it will clamp down on Internet and mobile phone freedoms, as it has done with broadcast and print media.

Looking Ahead

It has taken decades of investment, integration, use, and learning for institutions and individuals in the West and elsewhere to realize the impact of the information revolution. Given Russia's late start and the tendency of Russian IT to reflect rather than lead social and political developments, it will probably take many years for information technologies to become widely used and deeply embedded in Russian government and society.

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NOTE: MG stands for monograph; CF for conference proceedings; CT for congressional testimony; DB for documented briefing; OP for occasional paper; and TR for technical report.

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