RAND ARROYO CENTER

ANNUAL REPORT 2008

For 60 years, decisionmakers in the
public and private sectors
have turned to the RAND Corporation
for objective analysis and effective solutions
that address the challenges
facing the nation and the world.

RAND ARROYO CENTER

ANNUAL REPORT 2008

Letter from the Director

Helping the Army. In a phrase, that is our mission at RAND Arroyo Center. We accomplish that by providing mid- to long-term research on the Army's enduring analytical challenges; in-depth analyses of major policy issues affecting the Army on the near-term horizon; and special, quick-response support on today's most urgent problems. Now in its 26th year of operation, Arroyo delivers products that reflect RAND's broader institutional principles—especially our dedication to high-quality, objective, and nonpartisan research and analysis. But our work also reflects our close, collaborative engagement with the Army's senior leadership. We depend on that engagement to ensure that we are focused on the most pressing issues facing the Army, that we are helping to implement our analytical findings in a manner both practical and efficient, and that we are providing value and utility overall through our varied research efforts.

We have numerous examples from 2008 that demonstrate how we are helping:

- **Countering atrophy in major combat skills.** RAND Arroyo Center research on the atrophy of Army skills for major combat operations has been widely briefed in the Army and is affecting skills training and assessment, with continuing Arroyo involvement. Arroyo is working with the Army's Stryker Warfighting Forum at Fort Lewis, Washington, to assist it in carrying out Army Chief of Staff guidance to develop and evaluate new training techniques to help mitigate skill atrophy.
- **Assuring high equipment readiness.** The Army adopted Arroyo-developed methodologies and recommendations to shift to a centralized organization and process for deciding what repair parts to stock in the Army's tactical-level inventories supporting all units overseas, contributing to high levels of equipment readiness without increases in costs.
- **Improving network development.** Arroyo is quantifying issues for the Army to address early on in the development of its tactical networks, rather than relying on system deployment to iron them out with greater impact on cost and schedule. Such issues include the need for effective protocols for wireless, mobile ad-hoc networks (MANET); adequate bandwidth to meet projected demand; and sufficient network connectivity and redundancy.

Jeff Isaacson, Director, RAND Arroyo Center.

- **Assessing the capacities of foreign armies.** The Army Deputy Chief of Staff, G-3/5/7 and the Commanding General, U.S. Army South adopted an Arroyo-developed tool for assessing the capacities of foreign armies to help develop roadmaps for cooperation with other countries' ground forces.
- **Improving recruitment effectiveness.** Arroyo briefed the Under Secretary of Defense for Personnel and Readiness on its evaluation of an Army program to identify those youths without high school diplomas (so-called Tier Two recruits) who, if recruited, are less likely than others to drop out of the military. The Under Secretary then approved the Army's continuing the Tier Two Attrition Screen program through at least 2010.

- **Reducing air shipment costs to Kuwait.** Through the adoption of Arroyo process, metric, and algorithm recommendations, the Army, Defense Logistics Agency, and General Services Administration improved their implementation of Arroyo's concept to stock large quantities of big, heavy, frequently ordered items in Kuwait to be replenished by sealift in order to avoid the continual expensive shipment of such items by air. The new policy greatly limits additional inventory expense, and it is estimated to save roughly $200 million per year ($750 million to date) while assuring effective support.
- **Improving communication with soldiers.** The Army's Office of the Chief of Public Affairs adopted metrics on strategic communications recommended by Arroyo to evaluate how well the Army leadership is communicating with soldiers.
- **Determining war reserve sustainment stocks.** The Army adopted a new Arroyo-developed approach to determine what repair parts and supplies it should have in war reserve sustainment stocks, which should be forward positioned, and which should be centralized in the United States, and applied it to guide FY08 procurements for stocks held in Korea and the United States.
- **Redesigning and relocating the Human Resources Command.** Arroyo research on the redesign and relocation of the Army's Human Resources Command (HRC) under BRAC is being used to help deal with the challenges of recruiting and developing new staff for the command from the labor force in the Lexington/Louisville area of Kentucky.
- **Selecting ROTC sites for new programs.** The Commanding General, U.S. Army Cadet Command used Arroyo recommendations to select ROTC sites for new programs to improve the diversity of the officer corps and increase the number of ROTC commissions.

There are other examples, some of which are described in the pages that follow. This annual report also describes RAND Arroyo Center's research activities during FY08 and provides a comprehensive overview of the full range of our research products and services. It features short summaries of noteworthy studies and highlights the contributions and achievements of selected researchers. Among them are Army officers who served for a year with RAND as visiting analysts through our Army Fellows Program.

Helping the Army. I hope this report makes clear our continuing commitment to that mission. As the Army strives to rebalance current wartime demands and long-term institutional requirements, RAND Arroyo Center stands ready to provide the objective insights necessary to make rational choices among imperfect, uncertain, and often competing options.

We are grateful for the opportunity to contribute. ■

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SECTION 1

RAND Arroyo Center Overview

Mission and Contributions

Founded in 1982, RAND Arroyo Center is the United States Army's sole federally funded research and development center (FFRDC) for studies and analysis.[1] As an FFRDC, Arroyo enables the Army to maintain a strategic relationship with an independent, nonprofit source of high-quality, objective analysis that can sustain deep expertise in domains of direct relevance to perennial Army concerns.[2] Accordingly, RAND Arroyo Center's mission is to:

- Conduct objective analytic research on major policy concerns, with an emphasis on mid- to long-term policy issues.
- Help the Army improve effectiveness and efficiency.
- Provide short-term assistance on urgent problems.
- Be a catalyst for needed change.

In carrying out its mission, Arroyo investigates the full range of Army issues and aims to:

- Adapt to change and get out ahead of some of the changes in the world affecting the Army.
- Define innovative and different ways of operating.
- Maintain objectivity and balance in addressing controversial and sensitive subjects.
- Make unique contributions to the Army's key areas of interest.

RAND Arroyo Center provides Army leadership with research products and services in four major categories, as listed in Table 1.1: research projects, training and education, subject matter experts, and research documents.

This annual report provides information on four types of these products and services. Section 2 provides lists of selected research projects conducted in fiscal year 2008, and Section 3 provides summaries of five studies. Section 4 describes training and education opportunities for mid-level Army officers and identifies the officers participating in 2008/09. Section 5 highlights honors awarded to members of the research staff in 2008. The final section of the report lists selected research documents published in 2008.

Oversight and Management

The Army's oversight and management of RAND Arroyo Center is stipulated by Army Regulation 5-21.[3] The regulation establishes a governing board of Army leaders known officially as the Arroyo Center Policy Committee (ACPC). The ACPC is co-chaired by the Vice Chief of Staff of the Army and the Assistant Secretary of the Army (Acquisition, Logistics and Technology); current members are listed on page 9. One member of the ACPC, the Director for Program Analysis and Evaluation, serves as Executive

Table 1.1
RAND Arroyo Center Research Products and Services

Research Projects	Training and Education
• DA-funded annual studies	• Army Fellows Program
• DA-funded quick-response studies	• Temporary assignments
• Sponsor-funded studies	• RAND Ph.D. in policy analysis*
Subject Matter Experts	**Research Documents**
• Pentagon briefings	• Announcements of new research
• Annual logistics seminars	• Publications and summaries
• Tailored briefings and seminars	• Web site (www.rand.org/ard/)

*The doctoral program is available through the Pardee RAND Graduate School, a separate unit of the RAND Corporation; Army officers enrolled as graduate students commonly receive on-the-job (OJT) training working with RAND analysts on policy studies, including Arroyo studies. DA = Department of the Army.

[1] Originally established at the Jet Propulsion Laboratory in Pasadena, California, the Arroyo Center was moved to RAND in 1984 at the request of the Chief of Staff of the Army.

[2] One framework used by the Army to organize these domains is DOTMLPF (doctrine, organization, training, materiel, leadership, personnel, and facilities).

[3] http://www.armystudyguide.com/content/publications/army_regulations/ar-521.shtml

Agent for the Arroyo Center, charged with oversight of its daily operations.

The ACPC meets at least twice a year with Arroyo management to provide overall guidance, review the annual research plan, and approve individual projects. Additionally, each project is sponsored by at least one Army senior leader, either a general officer or a member of the Senior Executive Service. The sponsor has responsibility for helping to formulate the project, providing access to needed data and other information, monitoring its progress, reviewing its publications for accuracy, utilizing its findings, and implementing its recommendations.

Tim Bonds, Deputy Director, RAND Arroyo Center, and Marcy Agmon, Director of Operations.

At RAND, Arroyo is managed within the Army Research Division, one of the largest of RAND's research units.

Arroyo organizes its work for the Army into four research programs representing broad policy areas:

- Strategy, Doctrine, and Resources
- Force Development and Technology
- Military Logistics
- Manpower and Training

The organizational chart on page 10 identifies the current Arroyo management team. ■

Dave Oaks, Pentagon liaison.

Arroyo Center Policy Committee

- **General Peter W. Chiarelli (Co-chair)**
  Vice Chief of Staff, U.S. Army

- **Dean G. Popps (Co-chair)**
  Assistant Secretary of the Army (Acquisition, Logistics and Technology)

- **The Hon. Ronald J. James**
  Assistant Secretary of the Army (Manpower and Reserve Affairs)

- **General Charles C. Campbell**
  Commanding General, U.S. Army Forces Command

- **General Ann E. Dunwoody**
  Commanding General, U.S. Army Materiel Command

- **General William S. Wallace**
  Commanding General, U.S. Army Training and Doctrine Command

- **Lieutenant General John F. Kimmons**
  Deputy Chief of Staff, G-2, U.S. Army

- **Lieutenant General John F. Mulholland**
  Commanding General, U.S. Army Special Operations Command

- **Lieutenant General Michael D. Rochelle**
  Deputy Chief of Staff, G-1, U.S. Army

- **Lieutenant General Eric B. Schoomaker**
  Commanding General, U.S. Army Medical Command/ The Surgeon General

- **Lieutenant General Jeffrey Sorenson**
  Chief Information Officer, G-6, U.S. Army

- **Lieutenant General Stephen Speakes**
  Deputy Chief of Staff, G-8, U.S. Army

- **Lieutenant General Mitchell H. Stevenson**
  Deputy Chief of Staff, G-4, U.S. Army

- **Lieutenant General James D. Thurman**
  Deputy Chief of Staff, G-3/5/7, U.S. Army

- **Lieutenant General Robert Wilson**
  Assistant Chief for Installation Management/ Commanding General, U.S. Army Installation Management Command

Executive Agent for the Arroyo Center

- **Major General William T. Grisoli**
  Director, Program Analysis and Evaluation, Office of the Deputy Chief of Staff, G-8, U.S. Army

Membership effective December 2008.

RAND Arroyo Center Management

- **Jeff Isaacson**, Vice President and Director
- **Tim Bonds**, Deputy Director
- **Marcy Agmon**, Director of Operations
- **David Oaks**, Pentagon Liaison
- **Rick Eden**, Communications and Research Quality Assurance

Strategy, Doctrine, and Resources Program
- **Laurinda L. Zeman**, Director

Force Development and Technology Program
- **Bruce Held**, Director

Manpower and Training Program
- **Bruce Orvis**, Director

Military Logistics Program
- **Eric Peltz**, Director

SECTION 2

Fiscal Year 2008 Research Agenda

Interactive Development of the Agenda

As an FFRDC, RAND Arroyo Center operates under a renewable five-year contract that provides a core of funding to which other funds may be added for additional studies. In FY 2008 about half of the projects conducted by RAND Arroyo Center were "core" projects and the other half "add-on" projects. To help assure the usefulness and relevance of each study, the process by which it is formulated involves a high degree of interaction and coordination between the Army sponsors and the Arroyo research managers and project leaders.

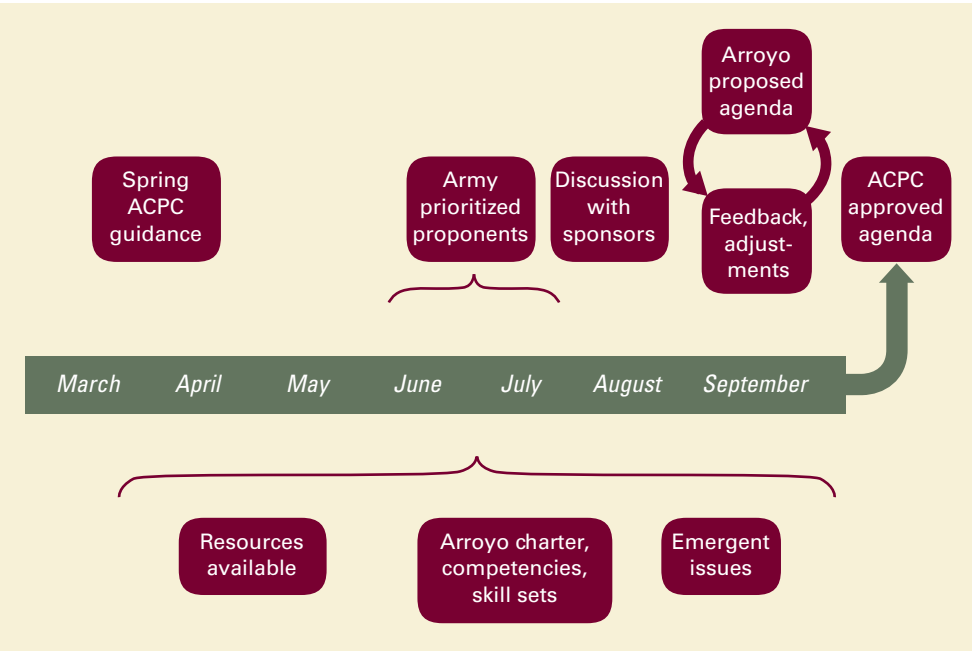
As Figure 2.1 shows, the process for developing an annual research agenda for core projects starts in late April and concludes in September before the beginning of the fiscal year in which the studies will be initiated. Arroyo's Executive Agent sends a memorandum to the ACPC members requesting research proposals. Shortly thereafter, Arroyo's director and program directors begin discussing research ideas with their respective sponsors. At the same time, prospective project leaders are discussing potential ideas with their colleagues and program directors.

The number of proposals typically greatly exceeds the number of projects for which funds are available. Individually and as a group, the proposals are evaluated within the context of criticality to the Army; available funding; and Arroyo's mission, available expertise, and comparative advantage to conduct the research. A small amount of core funding is reserved for later allocation to research undertaken to address important issues that may emerge during the fiscal year. In its fall meeting, the Arroyo Center Policy Committee approves the research agenda of core projects for the next fiscal year.

The process for an Army sponsor to add a study to the research agenda during the course of the year by using funds other than the core is also highly interactive. The Arroyo Center Executive Agent approves add-on projects. This may be done at any point during the fiscal year so long as Arroyo's total level of effort for the year does not exceed a ceiling established by the Office of the Secretary of Defense.

The remainder of this section describes the FY 2008 research projects in Arroyo's four programs as well as quick-response studies. ■

Figure 2.1
RAND Arroyo Center Works Closely with Army Leadership to Develop Core Projects



Strategy, Doctrine, and Resources Program

Mission and Research Streams

The Strategy, Doctrine, and Resources Program seeks to determine the implications of the changing security environment for the Army's future roles, structure, and doctrine. The program is directed by Dr. Laurinda Zeman; the associate directors are Mr. Thomas Szayna and Dr. Adam Grissom.

To accomplish its mission, in FY 2008 the program sustained research streams in five policy domains:

- Assessing the evolving operating environment.
- Developing capabilities to face new challenges.
- Developing partner capabilities.
- Improving resource management.
- Supporting Army wargames and analysis.

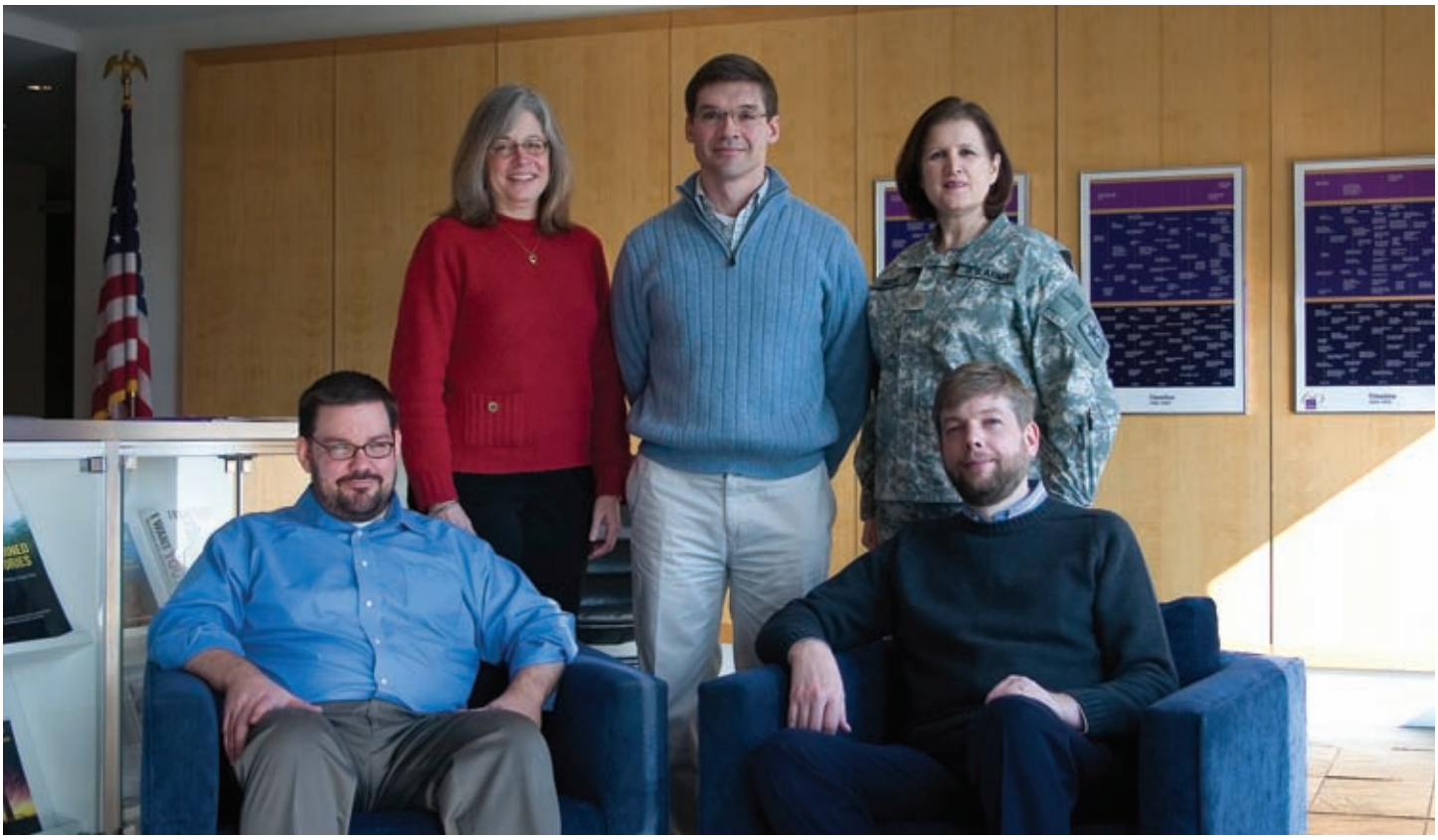
Below we describe the program's FY 2008 research agenda within each of these streams.

FY 2008 Studies Illustrating Research Streams in Strategy, Doctrine, and Resources

Assessing the Evolving Operating Environment

■ **Sizing the Army to Meet Strategic Requirements.** This continuing project is helping the Army develop models and methodologies to describe future demand for Army forces and capabilities. It is drawing analytical connections between alternative scenarios and the associated demand. Sponsored by the Deputy Chief of Staff, G-3/5/7, and the Deputy Chief of Staff, G-8.

■ **AFRICOM: Implications for the Army.** This project helped the Army support the new regional command U.S. Africa Command (AFRICOM) and shape its emerging



Strategy, Doctrine, and Resources Program researchers based in Washington include (standing, left to right) Lauri Zeman, Wade Markel, MAJ Patricia Socha, and (seated, left to right) Adam Grissom and Karl Mueller. Lauri directs the program; Adam is an associate director. MAJ Socha is participating in the Army Fellows Program (see Section 4).

Strategy, Doctrine, and Resources Program researchers based in Santa Monica include (standing, left to right) Eric Larson, LTC Eloy Cuevas, Brian Nichiporuk, and (seated, left to right) Tom Szayna, Jeff Marquis, and Derek Eaton. Tom is an associate director of the program. LTC Cuevas is participating in the Army Fellows Program (see Section 4).

strategy. Sponsored by the U.S. Army Special Operations Command and the Deputy Chief of Staff, G-3/5/7.

■ **Assessing Jihadi Strategies, Phase II.** This project assisted the Army in understanding the main trends and new developments in strategic thought related to the al-Qa'ida transnational salafi-jihadi movement—which includes al-Qa'ida Central, its branded franchisees, and its affiliated organizations—by analyzing key statements related to jihadist discourse on strategy and tracking the discourse and debates. It identified potential al-Qa'ida vulnerabilities that might be exploited and drew implications for intelligence, policy, and strategy. Sponsored by the Deputy Chief of Staff, G-2.

■ **Assessing the Possible Collapse of Strategically Important States: Implications for the Army in QDR 2009.** This project estimated the capabilities and capacity required to prevent or respond to the possible collapse of states that are strategically important to the United States, and it looked at how these requirements would affect Army plans, programs, and priorities. It suggested possible approaches for QDR 2009 to address these requirements. Sponsored by the Deputy Chief of Staff, G-8, and the Deputy Chief of Staff, G-2.

Developing Capabilities to Face New Challenges

■ **Improving Army Strategic Communications.** This project helped the Army improve its strategic communication capabilities and operationally define and cultivate a "culture of engagement." It developed a set of metrics for evaluating Army strategic communication that support the Army's Title 10 responsibilities to organize, train, and equip and provide options to Army leadership to improve strategic communication and prospects for the emergence of "a culture of engagement." Sponsored by the Office of the Chief of Public Affairs.

■ **Army Special Operations Forces Force Protection in Long-Term Unconventional Warfare.** This project analyzed Army Special Operations Forces (ARSOF) force protection requirements in long-term unconventional warfare (UW) during the conduct of a global UW campaign

in support of the Contingency Plan (CONPLAN) 7500 Series. The results suggested how Special Operations Command could focus resources and develop activities and capabilities necessary to find, fix, finish, exploit, and analyze adversaries' actions and also to prepare and develop the necessary human, physical, and environmental infrastructure to improve force survivability. Sponsored by the U.S. Army Special Operations Command.

■ **Employment of Army Capabilities for Civil Support Missions.** This project evaluated what changes might be necessary for the Army to improve its civil support planning activities and capabilities, including changes in Title 10 capabilities and constraints. Sponsored by the U.S. Army Training and Doctrine Command and U.S. Army North.

Developing Partner Capabilities

■ **Building Coalition Partner Capacity for Intelligence, Surveillance, and Reconnaissance.** This continuing project is helping the U.S. Army G-2 assess how the Army might support national and theater level U.S. government objectives to develop the ground force intelligence, surveillance, and reconnaissance (ISR) capacity of partner countries for future coalition operations. Sponsored by the Deputy Chief of Staff, G-2.

■ **Refining the Security Cooperation Continuum.** This project assisted the U.S. Army G-3/5/7 in refining its security cooperation continuum, an analytical framework for measuring foreign armies' interoperability with the U.S. Army and their capability and capacity to conduct full spectrum ground force operations. Sponsored by the Deputy Chief of Staff, G-3/5/7.

Improving Resource Management

■ **Assessing Resource Implications of Changes in Strategy on the Army.** This continuing project is developing a methodology to estimate how changes in national defense strategy affect Army resources and how to mitigate the impact of a change in strategy on the main cost drivers in the Army structure. Sponsored by the U.S. Army Training and Doctrine Command.

Supporting Army Wargames and Analysis

■ **Analysis and Support for Army Future Warfare Studies and Wargames.** This project provided analyses to support FY 2008 Army studies, wargaming, and other analysis efforts including, in particular, Unified Quest 2008, with a focus on the assessment of strategic issues. Sponsored by the U.S. Army Training and Doctrine Command. ■

Force Development and Technology Program

Mission and Research Streams

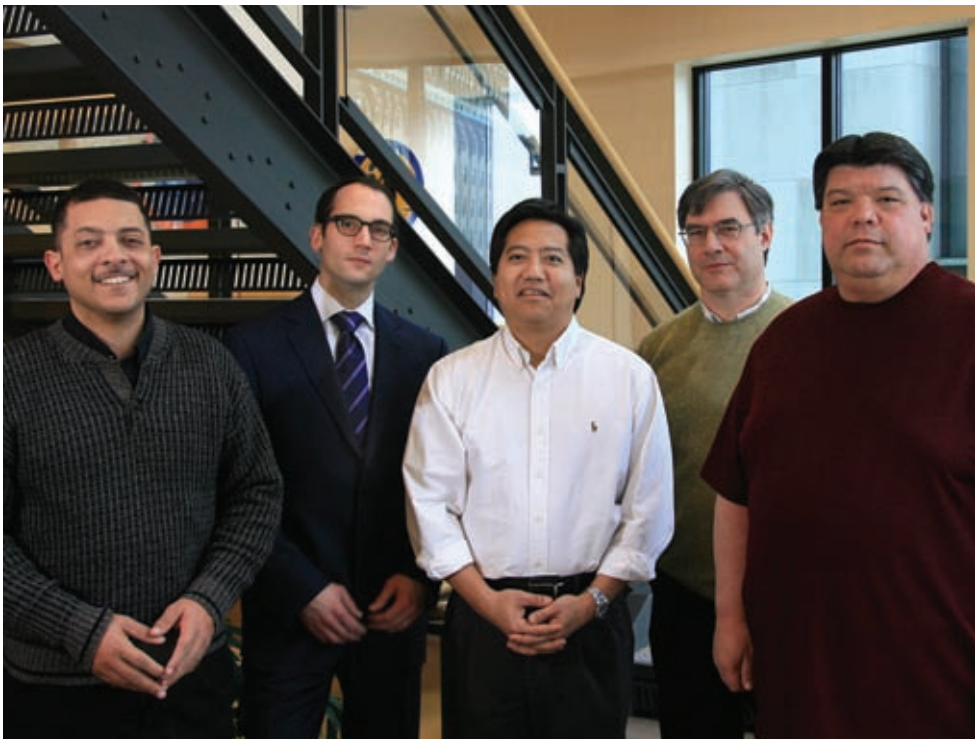
The Force Development and Technology Program assesses technological advances and new operational concepts to improve Army mission performance. It also seeks opportunities in new technologies, evaluates alternative force structures, and looks for ways to improve materiel acquisition. The program is directed by Mr. Bruce Held; the associate director is Dr. John Matsumura.

To accomplish its mission, the program sustains research streams in six policy domains:

- Systems and technology analysis.
- Networks and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR).
- Modeling and simulation.
- Force and organizational development.
- Acquisition policy.
- Assessment of tactics, techniques, and procedures.

The program's 2008 research agenda within each of these streams is summarized next.

Force Development and Technology Program researchers based in Santa Monica include (left to right) Brian Chow, LTC William Phillips, Lou Moore, Jed Peters, Ken Horn, and Bruce Held. Bruce directs the program. LTC Phillips is participating in the Army Fellows Program (see Section 4).



Force Development and Technology Program researchers based in Pittsburgh include (left to right) Isaac Porche, David Ortiz, John Matsumura, Ben Wise, and Tom Herbert. John is the program's associate director.

FY 2008 Studies Illustrating Research Streams in Force Development and Technology

Systems and Technology Analysis

■ **Advanced Technology Sensors and Data Exploitation.** This ongoing project provides analysis of sensor technology and exploits data required to advance the state of the art in leading-edge tactical sensing for the future force. To date, the technical assistance provided by this project has assessed electronic sensor technologies, evaluated competing sensor designs, improved image processing algorithms, and proposed and assessed various sensor concepts. Sponsored by the U.S. Army Night Vision and Electronic Sensors Directorate.

Networks and C4ISR

■ **Exploring the Impact of Different Command, Control, and Communications Hierarchies on Force Effectiveness.** This ongoing project assists the Army in understanding the force effectiveness tradeoffs between more traditional tactical command, control and communications (C3) networks that are more hierarchical and flatter C3 networks that are technically risky but may have advantages in generating information superiority. In addition to assessing network structures, the project is examining the impact that other new systems (e.g., new sensor technologies, unmanned ground and air vehicles, and others) have on the network and on force effectiveness. Sponsored by the Assistant Secretary of the Army (Acquisition, Logistics and Technology) and the Deputy Chief of Staff, G-3/5/7.

■ **Bandwidth Needs, Constraints, and Solutions for Future Army Forces.** This project quantified future (to 2025) Army bandwidth requirements, identified potential sources of bandwidth supply, pointed out potential bandwidth bottlenecks, and suggested a number of ways to mitigate bandwidth supply limitations. A particular area of focus was the availability of satellite communications to theaters of Army concern. The study also assessed how electromagnetic spectrum availability affects the amount of bandwidth that can be supplied by Army tactical networks. Sponsored by the Assistant Secretary of the Army (Acquisition, Logistics and Technology).

Modeling and Simulation

■ **MANA-QualNet Proof-of-Principle Study.** This project performed a proof-of-principle study to determine the utility of linking a high-resolution, agent-based force-on-force simulation—the Map Aware Nonuniform Automata (MANA)—with QualNet, a high-resolution network modeling and simulation tool. The tools were integrated so that the combat simulation in MANA fed a network simulation in QualNet, which then modeled the real-world command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities of the force. Results from the QualNet-MANA simulation reinforce the value of adequately modeling the communications network in force-on-force models. Gaining an understand-

ing of network capabilities, particularly as the networks are scaled up to brigade-sized combat forces and larger, will require advanced, high-resolution models and simulations. Sponsored by the Deputy Chief of Staff, G-8.

Force and Organizational Development

■ **Examining Options for Conducting Cyber-Operations in Support of Land Combat.** This study provided Army decisionmakers with a way to understand cyber-operations in support of land combat and in a joint context. It provided options and recommendations for improving the Army's capabilities for operations in the information environment, and the results helped to define the role of the Army in cyberspace and how it needs to operate in a joint and multi-agency environment. Sponsored by the Chief Information Officer/Deputy Chief of Staff, G-6.

■ **Joint Force Assets to Support Army Mission-Critical, Time-Sensitive Needs.** This project identified and evaluated potential changes to the organization and employment of joint and Army assets to meet the mission-critical, time-sensitive transportation needs of dispersed ground forces in a counterinsurgency environment. Sponsored by the Assistant Deputy Chief of Staff for Programs, G-8.

■ **Overhead Reconnaissance, Surveillance, and Target Acquisition (RSTA) in a Counterinsurgency Environment.** This project analyzed how the Army and other services can best provide the overhead RSTA required by dispersed ground forces in a COIN environment. The analysis addressed potential changes in doctrine (including operating procedures), organization, materiel, and training to meet the unique needs of dispersed ground forces fighting a counterinsurgency. Sponsored by the Assistant Deputy Chief of Staff for Programs, G-8.

■ **Optimizing U.S. Armed Forces Biosurveillance for Influenza and Other Strategic Health Threats.** This project described the intended and current capabilities of the current Department of Defense Serum Repository, suggested the desired characteristics of an optimal system for the use of biospecimens, identified and assessed specific opportunities for action, and offered recommendations for a health surveillance architecture to optimize the use of biospecimens to warn against influenza and other key health threats. Sponsored by the U.S. Army Medical Department Center and School.

Acquisition Policy

■ **Understanding the Army's Investment Requirements for Its Medium and Heavy Tactical Wheeled Vehicle Fleets.** This ongoing project is analyzing the condition of the Army's medium and heavy tactical wheeled vehicle (TWV) fleet. This analysis will inform the development of a holistic TWV strategy for the Army that takes into consideration the type, condition, and quantities of vehicles currently in the fleet; the extent to which future budgets may vary for recapitalizing, modernizing, developing and procuring them; and potential future uses and needs for the Army's wheeled vehicles. Sponsored by the Deputy Chief of Staff, G-8.

■ **Application of a RAND Portfolio Management (PortMan) Approach to Cost Army Capability Gaps.** This project applied RAND's PortMan methodology to estimate the life-cycle cost of particular system(s) in meeting Army capability gaps. The PortMan costing methodology can be used both to ensure that any specific capability gap can be filled at an affordable life-cycle cost and also to develop a portfolio of programs to meet all Army capability gaps at the lowest total life-cycle cost. Sponsored by the Deputy Assistant Secretary of the Army (Cost and Economic Analysis).

Assessment of Tactics, Techniques, and Procedures

■ **Airspace Management: Harmonizing Manned and Unmanned System Operations.** This project developed and examined airspace management options to facilitate the employment of manned and unmanned aircraft in support of land combat operations while maximizing flight safety and freedom of operations for all systems operating through the airspace, regardless of the operational control exercised over each. It explored the use of different control measures, techniques, and technologies to support more intensive use of the airspace by manned and unmanned systems. The study highlighted key concerns, considerations, and decisions for the Army concerning airspace management and the future employment of unmanned aerial systems. Sponsored by the Deputy Chief of Staff, G-3/5/7. ■

Manpower and Training Program

Mission and Research Streams

The Manpower and Training Program applies sophisticated economics and social science methodologies to Army personnel and training issues. It stresses quantitative analysis and testing of alternative policies and resource mixes, all oriented toward choosing appropriate strategies for manning, training, and structuring the Army for the future. The program is directed by Dr. Bruce Orvis. The associate directors are Mr. Chip Leonard and Dr. Ellen Pint.

To accomplish its mission, the program sustains research streams in eight policy domains:

- Recruiting and personnel fill requirements.
- Reserve Component readiness.
- Leader development.
- Training (major combat operations and stability operations skills).
- Distance learning, simulation training development and application, training support systems.
- Retention (Active and Reserve Components).
- Officer career fields, selection, assignment sequencing.
- Medical forces and operations and soldier support.

The program's 2008 research agenda within each of these streams is illustrated below.

FY 2008 Studies Illustrating Research Streams in Manpower and Training

Recruiting and Personnel Fill Requirements

■ **Manning the All-Volunteer Force from a Changing Youth Market.** This project undertook a comprehensive examination of how the recruiting population is likely to change through 2015 and conducted a detailed assessment of what these changes mean to the All-Volunteer Force, in general, and to how well the Army is prepared to meet its future recruiting requirements. It analyzed the effects of recent and prospective changes in Army recruiting policies, and identified possible programs and policies needed to meet future manning requirements. Sponsored by the Deputy Chief of Staff, G-1.

■ **Enhancing ROTC Production and Diversity.** This project assisted the Army in improving the production and racial/ethnic diversity of ROTC officers. It carried out a detailed quantitative assessment of recent changes in the youth population, made projections of key characteristics of eligible youth in 2015, and determined possible enhancements in matches between the locations of college student populations and ROTC detachments. In addition, the research developed planning tools for Cadet Command to use in locating high-potential schools for future expansion of ROTC programs and to evaluate the performance of existing programs. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs, and conducted for the Commanding General, U.S. Army Cadet Command.

■ **Determine Incentives That Would Influence Today's Youth to Join ROTC.** This study (1) examined the current and future college student population; (2) assessed what these results mean to the Army ROTC program in general, and to how well the current ROTC program and recruiting incentives will suit college students; and (3) identified possible changes needed to encourage current and future college students to join ROTC and to increase support for that decision among their influencers, as well as policies that will help to improve retention and optimize the future allocation of ROTC recruiting resources. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs, and conducted for the Commanding General, U.S. Army Cadet Command.

■ **Marketing S-Curve Development.** This project is identifying, analyzing, and compiling evidence about marketing channel effectiveness and using it to develop mathematical models known as S-curves. These models will allow the Army to determine the optimal investment range for specific Army national and local lead/awareness sources and the best overall allocation strategy. Sponsored by the U.S. Army Training and Doctrine Command.

■ **Implement the Recruiting RETICLE Scorecard to Support Improved Targeting of Army Marketing Investments in Recruiting Events.** This project expanded and

Manpower and Training Program researchers based in Santa Monica include (standing, left to right) Bryan Hallmark, Matthew Lewis, Tom Lippiatt, and (seated) Ellen Pint and Bruce Orvis. Bruce directs the program; Ellen is an associate director.

implemented the "proof of concept" RETICLE scorecard previously developed by RAND Arroyo Center for evaluating marketing investments to support U.S. Army recruiting. The scorecard was adapted to include the new Virtual Army Experience (VAE). It can be further expanded to include all major Army recruiting events and to collect additional, specific data on how elements of events influence the attitudes, beliefs, and intended behaviors of prospects and key influencers in the enlistment decision. The RETICLE scorecard will help the Army examine how successful different marketing efforts have been to date, and it will support decisions on future allocations of resources to maximize the return on those marketing investments. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

■ **Market Expansion Study for the U. S. Army Advantage Fund Program.** This project developed a plan for pilot testing and evaluating the results of the new Army Advantage Fund (home ownership/business fund) program in a national recruiting experiment. It is now analyzing the pilot's results with respect to whether it has increased (1) enlistments both overall and in key subgroups of the recruiting market, (2) substitution of enlistment options by enlistees into the program, (3) MOS distribution, and (4) manyears for the active component. It is also assessing the implications of the results for the level of incentives offered under the program and overall costs as well as the effects of AAF on the Army Reserve. Sponsored by the Deputy Chief of Staff, G-1.

■ **Assessment of ARMS Effects on Increasing Accessions and Reducing Attrition.** This project is analyzing recruit qualification and screening information following the expansion of the Assessment of Recruit Motivation and Strength (ARMS) program beyond the six initial, experimental sites. In conjunction with earlier results from the Army's ARMS study at these six sites, the information is being used to assess accession and attrition rates for recruits who pass existing enlistment screeners versus the ARMS as well as the reasons for attrition. The results will inform decisions concerning potential longer-term increases in accessions through expanding the ARMS administration and setting ARMS scores sufficient for accession of recruits screened out by other criteria. The evaluation complements assessments by the Army, informing the Army and OSD which recruits are most likely to succeed and, if attrition becomes a problem or other adverse effects are experienced, how far standards can be changed before such outcomes are encountered. The research also estimates and compares overall flows and costs with and without the ARMS intervention, including recruiting-, training-, attrition-, and ARMS-related costs, as well as how those costs compare with those of other options for expanding the recruiting market. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

■ **Analytical Support to Planning for the Restructuring and Move of the U.S. Army Human Resources Command.** This project began with support for a wargame testing

options for realignment of the Army's Human Resources Command (HRC) and an analysis of the game's results and implications. The project continued by focusing on competency requirements for the current and future HRC, and produced competency models and a framework for assessing personnel training requirements to support HRC's future delivery of personnel services and actions. The analyses took into account the context of possible changes in HRC's organization, its move to Fort Knox, characteristics of the labor market in the Fort Knox area, emerging human capital management strategic approaches, and automated systems with which HRC personnel interact now and in the future. Sponsored by the U.S. Army Human Resources Command.

Reserve Component Readiness

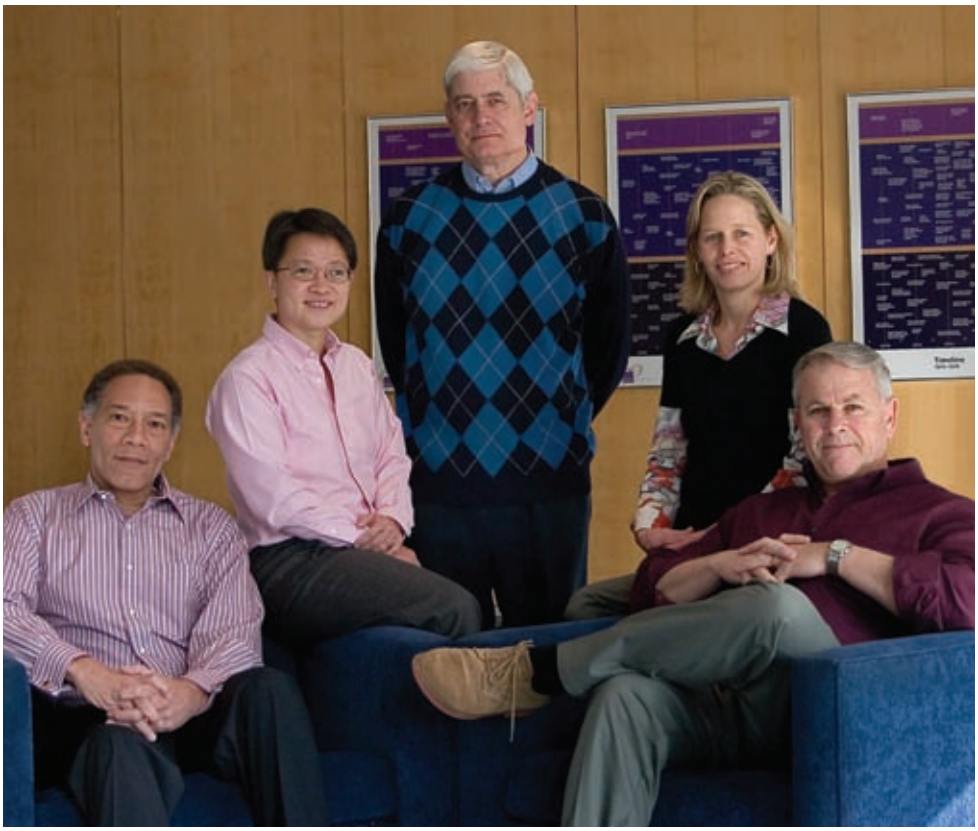
- **Enhancing Reserve Experience Levels Through Continuum of Service Initiatives.** This project explored continuum of service approaches that would increase the level of active duty experience in the U.S. Army Reserve Components (USAR and ARNG) and help sustain an "operational reserve." It evaluated alternative mechanisms for increasing the prior active service content of the Reserve Components based on their potential impacts on personnel supply and demand, unit manning and readiness outcomes, and resource requirements. Sponsored by the Deputy Chief of Staff, G-1.
- **Break Point: A Study of the Effects of Operationalizing the Army Reserve on the Army Reserve TPU (Troop Program Unit) Soldier.** This study is helping the Army Reserve sustain a campaign-capable expeditionary Army by examining how changes in training and mobilization policies affect soldiers, family members, and employers. In January 2007, the Secretary of Defense issued guidance that reserve component soldiers can be required to mobilize for no more than one year within a six-year period. To reduce the time needed for post-mobilization training, the ARFORGEN model increases active duty training requirements for reserve component soldiers in the years leading up to the mobilization year. This study held focus groups with soldiers, conducted telephone interviews with family program coordinators, and solicited comments from members of Employer Support of the Guard and Reserve. It also examined recent data on personnel turnover in reserve units and its implications for the timing of pre-mobilization training. Sponsored by the U.S. Army Reserve.

Leader Development

- **Colonel Competencies and Critical Experiences.** This project helped the Army's Senior Leader Development Office develop tools and approaches for managing the development and utilization of critical competencies and experiences of Army senior leaders, concentrating on the population of colonels and promotable lieutenant colonels. The project determined critical competency and experience requirements; searched for identified competency and experience deficiencies within this leadership pool; and developed an analysis capability to assist in forming policies and strategies for the development and utilization of senior leaders. Sponsored by the Office of the Chief of Staff, Army.
- **Evolution of Noncommissioned Officer Corps Professional Development.** This project examined how the roles, responsibilities, duties, and authorities of noncommissioned officers (NCOs) are changing as a consequence of changes in the contemporary operating environment, warfighting doctrine, and policy. It identified opportunities to improve NCO professional growth and contributions to unit-level operations and staff functions. Sponsored by the Deputy Chief of Staff, G-3/5/7, and the Office of the Sergeant Major of the Army.

Training (Major Combat Operations and Stability Operations Skills)

- **Battle Command Decision Processes.** This project is developing an analytical means for examining key elements of decision and decision-support processes in operational Army units from platoon through brigade combat team, concentrating in particular on information requirements and transfer processes at the platoon and company levels. It is examining the connection between such factors as type of information, timing, relevance to a particular tactical event, type of task being supported, source and mode of transmission and assessment, and impact on tactical outcomes. Sponsored by the U.S. Army Training and Doctrine Command.
- **Assessment of the Stryker Brigade Combat Team Warfighting Forum Prototype Training Program.** This project is assessing the impacts the U.S. Army Stryker Brigade Combat Team Warfighting Forum (SWfF) can have on leader and unit tactical proficiency. Specifically, the study is examining how the SWfF staff directly and indirectly supports units during reset/training, how SWfF



Manpower and Training Program researchers based in Washington include (left to right) Lynn Scott, Anny Wong, Chip Leonard, Amy Richardson, and Ralph Masi. Chip is an associate director of the program.

network tools can better support leader development, and the best methods for gathering tactical lessons from units returning from deployments and disseminating those lessons to units preparing for a deployment. Sponsored by Commanding General, I Corps and Fort Lewis.

Distance Learning, Simulation Training Development and Application, Training Support Systems

■ **Making Improvements to the Army Distributed Learning Program.** This project supported the Army's continuing efforts to implement an effective Distributed Learning (DL) program. With a view toward increasing DL's benefits and impacts, the research recommended improvements to TRADOC's current interactive multimedia instruction (IMI) program that could support an expanded vision of DL. The research also focused on strategic improvements that could enable the Army to leverage DL more effectively in the future. Recommendations include pursuing an expanded range of options for providing more exportable training and establishing a systematic evaluation process to gauge DL effectiveness. Sponsored by the U.S. Army Training and Doctrine Command.

Retention (Active and Reserve Components)

■ **Evaluation of Alternative Policies to Improve Retention.** This project examined future challenges to desired retention levels, including changes in civilian employment opportunities, evaluated evidence from recent data on retention programs, and designed alternative policies to meet manpower requirements, including retention bonus levels and the effects of alternative conditions for extension and reenlistment. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

■ **Effects of GI Bill Benefit Transferability to Dependents.** To help retain the talented and experienced soldiers it needs to be successful, the Army initiated a program to allow eligible soldiers who reenlist for critical occupational specialties to transfer up to 18 months of unused Montgomery GI Bill and Army College Fund benefits to dependents, in exchange for giving up a portion of their reenlistment bonus. This project examined the number of soldiers who elected the transferability incentive, the demographic and service characteristics associated with those who chose the incentive, the impact of the incentive on reenlistments, the number and dollar value of educational benefit claims by dependents relative to actuarial projections, and the magnitude of potential effects on enlistments by soldiers' dependents who might have joined the Army to receive educational benefits for themselves. The study also conducted focus groups with soldiers that explored how soldiers value education benefits for themselves and their families, their reactions to the transferability incentive, and its potential effects on retention. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

Officer Career Fields, Selection, Assignment Sequencing

■ **Joint, Interagency, Intergovernmental, and Multinational (JIIM) Opportunities and Knowledge, Skills, and Abilities (KSA) Tracking.** This project is describing the KSAs in JIIM domains at successive stages in officer careers, and developing a framework that will help the Army to better track and manage these skills in the officer inventory. Sponsored by the Officer Personnel Management System Task Force in the Army's Human Resources Command.

Medical Forces and Operations and Soldier Support

■ **Determination of Most Effective Incentives for Army Medical Department (AMEDD) Clinicians.** This project identified options to improve the retention and, secondarily, recruitment of Active Component and U.S. Army Reserve clinicians, including both financial and nonfinancial incentives. The researchers reviewed existing data and literature on clinician retention and recruitment, conducted interviews and focus groups with AC and USAR clinicians, helped the Army Research Institute design surveys for AC and USAR clinicians, jointly analyzed the information collected, and recommended options to improve the retention and recruitment of clinicians. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

■ **Determination of the Most Effective Methods for Accessing AMEDD Clinicians in the Future.** The Army is facing reduced success in recruiting some types of clinicians. Increasing operational demands and the possibility of deployment are deterring some clinicians from joining the Army, and clinician recruitment is being further challenged by high demand in the private sector and the changing demographics of students pursuing clinical careers. This project examined the current and future recruiting environment for AMEDD clinicians, identified areas likely to require increased recruiting attention, characterized current and anticipated barriers to recruiting high-demand clinicians, and provided recommendations on incentives and other actions that the Army might consider to increase success in recruiting active-duty clinicians. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs.

■ **Effects of Multiple Deployments on Children's School Performance and Behavior.** This project examined the effects of soldiers' frequent and extended deployments on their school-age children's academic performance and behavior in the school setting. It recommended changes to Army and school support programs to ensure that they are meeting the emotional and academic needs of these children. Sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs. ■

Military Logistics Program

Mission and Research Streams

The Military Logistics Program conducts high-quality, objective analyses to help the Army improve support to operational forces, enhance the effectiveness of its business processes, and optimize the industrial base and support infrastructure. The program is directed by Mr. Eric Peltz; Dr. Rick Eden serves as the associate director.

To accomplish its mission, the program sustains research streams in four policy domains:

- Supply chain management.
- Fleet management and modernization.
- Logistics force development.
- Infrastructure management.

The program's FY 2008 research agenda within each of these streams is illustrated below.

FY 2008 Studies Illustrating Research Streams in Military Logistics

Supply Chain Management

■ **Assessing Joint Options for Prepositioned Sustainment Stocks.** This project assessed options for forward positioning of war reserve secondary items. Options include land-based general support supply support activities (SSAs), Defense Logistics Agency (DLA) forward distri-

Military Logistics Program researchers based in Santa Monica include (standing, left to right) Mary Chenoweth, Matthew Lewis, Ken Girardini, Mark Wang, Carol Fan, Rick Eden, Marc Robbins, Keenan Yoho, MAJ Ron Harper, and (seated, left to right) Nancy Moore, Lisa Colabella, Eric Peltz, and Lou Miller. Eric directs the program; Rick is the associate director. MAJ Harper is participating in the Army Fellows Program (see Section 4).

bution depots, and afloat stocks intended to seed general support SSAs on land. Options were evaluated based upon their comparative advantages. Sponsored by the Deputy Chief of Staff, G-4, and the Army Materiel Command.

- **ASL Inventory Expert Team Support.** This project provided quarterly updates to authorized stockage lists (ASLs) for supply support activities SSAs in Southwest Asia as part of the Army Materiel Command (AMC) central ASL expert team in accordance with the current G-4, Department of the Army ASL policy for Southwest Asia. The project also developed ASLs for SSAs in Europe and Korea. The project conducted theater inventory reviews for AMC in accordance with Arroyo-developed business rules for theater inventory in Kuwait. Sponsored by the Deputy Chief of Staff, G-4, and the Army Materiel Command.
- **Analytical Support to Distribution Improvement Efforts.** This project conducted analyses to assist with distribution process and policy improvement efforts. It also evaluated the effects of tire privatization. Sponsored by the Deputy Chief of Staff, G-4, and Army Materiel Command.
- **Improving Army and DLA Integration at the Theater Level.** This project analyzed the theater support structure in Southwest Asia to evaluate how the Army can most effectively utilize DLA forward distribution depots in order to reduce costs and improve support performance on a global basis. The project identified what changes the Army should propose to DLA, associated needed changes in financial policies, and advised on whether the Army should rationalize some of its theater-level capabilities with DLA's. Sponsored by the Deputy Chief of Staff, G-4, and Army Materiel Command.
- **Analysis of a Commercial Off the Shelf (COTS) Readiness Based Sparing (RBS) Algorithm.** This project evaluated a COTS RBS algorithm to determine whether it is suited for solving Army multi-indenture, multi-echelon inventory problems and analyze its effectiveness using actual Army data. The evaluation assessed the ability of the COTS RBS algorithm to address the requirements of inventories held in the tactical ASL as well as the ability to obtain the data from Army information systems needed for the COTS RBS algorithm. Sponsored by the Army Materiel Command.
- **Strategic Supplier Relationship Management (SRM).** This project identified best practices in supplier management and development that have been shown to continuously reduce costs and improve performance (e.g., quality, delivery schedules, flexibility, technical competence, etc.); highlighted impediments to applying these best practices within the Army; and recommended ways to successfully adapt them to the Army context as part of the development of an Army strategic SRM plan. Sponsored by the Army Materiel Command.
- **Direct Vendor Delivery Performance Assessment and Improvement.** This continuing project is assessing aggregate DLA direct vendor delivery (DVD) performance for supply classes II, IIIP, IV, and IX with respect to Army customer expectations, determining the root causes of shortfalls, developing recommendations to address these causes and correct shortfalls, and identifying whether there are categories of items for which DVD contracts should be expanded or reduced. Sponsored by the Deputy Chief of Staff, G-4, and the Defense Logistics Agency.
- **Assessment of CENTCOM Medical Distribution Structure.** This continuing project is evaluating whether changes in the U.S. Central Command (CENTCOM) medical supply distribution structure would lead to decreased costs and/or improved performance of the theater health service support system. Sponsored by the Office of the Surgeon General/U.S. Army Medical Command.

Fleet Management and Modernization

- **ARFORGEN Equipping Strategies.** This project conducted analyses to inform ARFORGEN implementation plans and equipment procurement decisions, showing the impacts of different training strategies and readiness goals, changes in reset process capabilities, and long-term rotational force requirements on the total amount of equipment needed. Sponsored by the Army Materiel Command and the Deputy Chief of Staff, G-8.
- **Long-Term Depot-Level Maintenance Capability Needs and Options.** This continuing project is assessing the range of depot-level capabilities the Army is likely to need in the long run and characterizing the Army's options for meeting its needs in terms of flexibility, cost, and risk.
- **Effects of Theater Provided Equipment.** This continuing project is helping the Army determine the Theater Provided Equipment (TPE) policy—levels, types, and management practices—that is most likely to maximize the operational readiness benefits and minimize the costs (monetary and/or nonmonetary) associated with TPE. Sponsored by the Deputy Chief of Staff, G4, and the Deputy Chief of Staff, G-8.

■ **AMEDD'S Equipping and Maintenance Solution to ARFORGEN.** This continuing project is developing and evaluating options, to include current plans, for the AMEDD ARFORGEN equipping strategy. Sponsored by the Office of the Surgeon General/U.S. Army Medical Command.

Logistics Force Development

■ **The Implications of Performance-Based Logistics for AMC.** This project assessed how performance-based logistics (PBL) contracts change the functions performed by people and the relationships between suppliers and AMC in order to determine whether the increasing adoption of PBL should be accompanied by changes in personnel mix and career development patterns, organizational structures, financial policies, and supplier management policies. Sponsored by the Army Materiel Command.

Infrastructure Management

■ **Strategic Management of Army Energy Usage: Collaboration with Utilities to Reduce Energy Usage.** This continuing project is developing recommendations for improving Army installation collaboration with utilities to reduce traditional energy usage. Sponsored by the Assistant Chief of Staff for Installation Management and the Installation Management Command. ■

Quick Response Studies

RAND Arroyo Center reserved a portion of its research agenda for small, quick studies on important issues that emerge during the course of the fiscal year. In FY 2008, Arroyo performed five quick response studies for the Army.

- **Development of a Guidebook for Economic Stabilization Efforts in Stability Operations.** This quick response study prepared the *Guidebook for Supporting Economic Development in Stability Operations* for Army tactical- and operational-level teams engaged in stability operations missions. Sponsored by the Deputy Chief of Staff, G-3/5/7.
- **Assessment of JIEDDO Initiatives FY09 Transfer to the Army.** This quick response study helped the Army understand Joint IED Defeat Office (JIEDDO) functions and initiatives and determine which were candidates for transfer to the Army, retention within JIEDDO, or elimination. Sponsored by the Deputy Chief of Staff, G-3/5/7.
- **Improving Strategic Communications to Enhance the Army's Equipping Process.** This quick response study provided the Army with recommendations for better articulating the Army modernization strategy to decision-makers and resourcers. Sponsored by the Deputy Assistant Secretary of the Army for Strategic Communication and Business Transformation.
- **Creating Security Cooperation Organizations.** This quick response study designed an approach to providing U.S. security cooperation and assistance that assumes the creation of a Security Cooperation Organization (SCO) reporting to the Chief of Mission. The SCO and proposed approach would synchronize U.S. security cooperation and assistance and conduct all activities (Title 10 and 22) in support of U.S. policy for a specified country. Sponsored by the Deputy Chief of Staff, G-3/5/7.
- **Application of U.S. Army Veterinarian Assets in Stability Support Operations and Economic Development.** This quick response study assessed U.S. Army veterinary assets, capabilities, and programs that may be applied during Army operations in fragile and failing states. It provided an assessment of U.S. Army veterinary programs as an element of "soft power" and included insights into the application of U.S. Army veterinary capabilities in a comprehensive interagency approach to both stability support operations and longer-term economic development. Sponsored by the Deputy Chief of Staff, G-3/5/7. ■

SECTION 3

Summaries of Selected FY 2008 Studies

This section of the Annual Report provides summaries of six studies completed in FY 2008:

- **Economic Assistance During Stability and Support Operations**
- **Capabilities That Medium-Armored Forces Bring to the Fight**
- **Targeted Use of Theater Inventory to Effectively Sustain Overseas Forces While Minimizing Supply Chain Costs**
- **Are Today's Forces Maintaining Proficiency in the Skills Needed for Major Combat Operations?**
- **Environmental Considerations in Combat and Stability Operations**

Economic Assistance During Stability and Support Operations

Key Findings

The *Guidebook for Supporting Economic Development in Stability Operations* is:

- **Designed to help U.S. Army personnel more effectively use economic assistance to support economic and infrastructure development.**
- **Designed to apply to current and future conflict settings.**
- **Focused on tactical unit commanders.**
- **Buttressed by actual unit experiences in contingency operations.**

As part of stability operations, U.S. Army personnel have become increasingly involved in providing assistance to support economic and infrastructure development. Officers in Afghanistan and Iraq have had to select and implement assistance programs in their areas of operation. In many instances, they have neither the background nor the training to make informed decisions about which programs to support and how to go about implementing them. They therefore need better guidance on how to make such decisions, as well as a better understanding of the economic context of their efforts. While the U.S. government has produced such guidance for use at the national level, that work lacks sufficient detail on tasks appropriate for military forces. The Army asked RAND Arroyo Center to produce a guidebook for unit commanders that could be used by units deploying to Iraq and Afghanistan to help Army personnel more effectively use economic assistance to support economic and infrastructure development. The result of the Army's request was an Arroyo publication, *Guidebook for Supporting Economic Development in Stability Operations*, designed for unit commanders at the brigade level and below.

To produce the guidebook, Arroyo researchers interviewed commanders in Afghanistan and conducted interviews with U.S. military officers who have served in that theater, Iraq, Bosnia, Kosovo, and Haiti. They drew on their own work and that of others in previous RAND research and support efforts in Iraq, Afghanistan, Liberia, and the Balkans. The authors also tapped the substantial literature about effective economic assistance.

Economic Issues in Pre-deployment Preparation

The guidebook first discusses the economic issues that should be considered as part of pre-deployment preparation, and it includes a structured process to gather information on how local people in the area of deployment make a living and survive, how the economy can recover, and how the Army can tell whether its efforts are working by measuring outcomes, not inputs or outputs. It describes indicators of a more stable and secure environment and of improvements in the local economy that should be visible to ground forces. Additionally, it discusses the actors engaged in economic and infrastructure development that U.S. military personnel may encounter or with whom they may work, including the host nation government, U.S. civilian agencies, the United Nations, international financial institutions, bilateral agencies, nongovernmental organizations (NGOs), and the local society. It also lays out the resources that may be available to both U.S. military and other assistance providers to carry out projects and tasks.

This part of the guidebook also lays out how economies recover. This discussion is especially relevant because U.S. forces tend to rotate in and out of the area of operations.

The research described here is published in Keith Crane, Olga Oliker et al., *Guidebook for Supporting Economic Development in Stability Operations*, Santa Monica, CA: RAND Corporation, TR-633-A, 2009. http://www.rand.org/pubs/technical_reports/TR633/

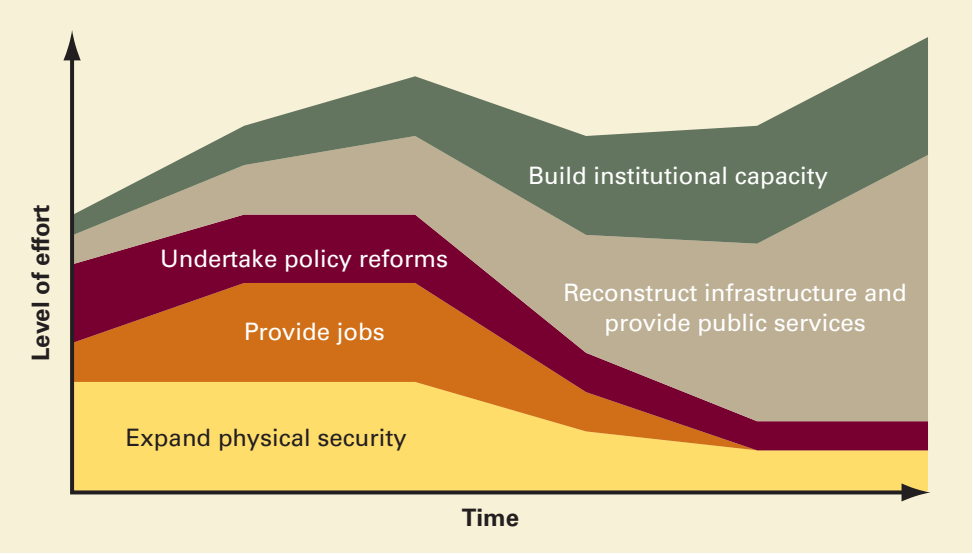
The focus of economic recovery will vary depending on the recovery stage of the economy. Figure 3.1 presents a stylized diagram of how economies typically progress.

As the diagram shows, physical security initially constitutes the top priority because without a secure and stable environment, economic development will not occur. Security remains a constant task, although the emphasis given to it can decline as conditions improve.

The first stage of recovery sees rapid growth. Since World War II, every country in which the United States has conducted stability operations experienced an initial period of rapid economic growth once violence declined. During this period, trade expands and refugees return as security improves. Units will notice a huge increase in imports of consumer goods trucked in from abroad. In the early stages, short-term job-creation projects are most effective. They put money in people's pockets, which then gets funneled back into the economy as they buy goods and services. So in the early stages of an operation, U.S. Army units may support short-term public works projects like road repair, clearing irrigation systems, and restarting electricity supply.

Later in the recovery, attention should shift to larger scale infrastructure after supply chains have been re-established and local and national governments are in better shape to plan, contract, and manage major projects. Units need to bear in mind that the activities of the local inhabitants, not foreign donors, are the key drivers of growth.

Figure 3.1
As an Economy Recovers After a Conflict, the Relative Importance of Each Recovery Objective Changes over Time



SOURCE: *Guide to Economic Growth in Post-Conflict Countries*, USAID.

Military Contributions to Economic Recovery

The second part of the guidebook discusses seven topic areas: humanitarian assistance; infrastructure; agriculture; currencies, budgets, banking and finance, and foreign trade; private sector development and employment generation; natural resource management; and the effect of the U.S. military on local economies. The guidebook also includes an appendix on how to conduct a bidders conference.

For each topic area, the chapter details the types of problems typically posed, what the host government and other agencies should deal with, and what tasks may potentially be carried out by U.S. military units. Each chapter ends with a checklist focused on a U.S. military tactical unit.

Each chapter also includes vignettes that illustrate with actual events the types of incidents that occur in each topic area. For example, the chapter on humanitarian assistance illustrates the importance of securing infrastructure by detailing the methodical looting that went on in Iraq, which seriously impeded assistance operations because government offices had been stripped of everything that could be carried off, including plumbing fixtures and electrical outlets.

The chapters also offer examples of things that went wrong. In some cases, well-intentioned efforts have effects diametrically opposed from what was meant to happen. A case in point was the effort to deal with trash in Baghdad, which had become an enduring problem. In an attempt to deal with the trash, military units hired local contractors to build large, four-sided trash storage bins, operating under the theory that the trash could be put in them until collected rather than just being dumped on the street. Almost immediately after the containers were built, they were occupied as dwellings, in one case housing a family of 35 adults and children. The error resulted from focusing on outputs (trash containers built) rather than outcomes (trash collected). A subsequent effort that placed metal trash containers that were easier to lift and maneuver proved to be a much better solution. ■

Capabilities That Medium-Armored Forces Bring to the Fight

Key Findings

- **Medium-armored forces can make critical contributions, especially when augmenting light forces or when effective rapid response is needed.**
- **While medium armor enjoys clear advantages over heavy armor in many situations, adversaries operating in complex terrain with heavy armor and highly lethal weaponry can be expected to negate these advantages.**
- **Future Army forces need to maintain an appropriate mix of heavy, medium-armored, and light forces tailored to the battlefield conditions that best match their attributes.**

Medium-armored forces are central to the U.S. Army's vision of the future force, expected to combine the agility of light infantry with the greater lethality and survivability of heavy units through the technologies that will be encompassed by the Future Combat Systems (FCS).[4] While the U.S. Army develops FCS, it is fielding Stryker brigade combat teams, medium-armored forces that give the current force increased capability.

Medium-armored units have been employed extensively in the 20th century, but today the U.S. Army has little resident experience with them across the full range of military operations. To provide additional insight and to help inform decisions about the future force, researchers at RAND Arroyo Center conducted a qualitative assessment of the performance of medium-armored forces, both U.S. and foreign, in 13 past conflicts that span the range of military operations (see Table 3.1). The results clarify the unique capabilities that medium-armored forces have brought to past conflicts along the range of operations, how they have performed in complex terrain, and what advantages the rapid-deployment capability of medium-armored forces has provided to operational commanders in the past.

Medium-Armored Forces Can Be Disadvantaged Against Heavy Forces

At the higher end of the range of operations, the performance of medium-armored forces has been mixed. In World War II, U.S. tanks and tank destroyers operated with an enormous lethality and survivability disadvantage against competent German forces equipped with tanks and anti-tank weapons. This was a circumstance that U.S. Army doctrine assumed would not be necessary, and which it mitigated by overwhelming the Germans with sheer numbers and very effective artillery and air support. Absent a threat of tank-on-tank combat, medium armor was more effective in many situations than heavy armor would have been. For example, medium-armored vehicles generally were able to move more rapidly over the operational area and usually required less logistical support than heavy armor.

Medium-armored forces have been particularly valuable at the lower end of military operations (crisis response and limited contingency operations). Even small numbers of medium-armored forces can make a critical difference, particularly in augmenting light forces or when operating independently in raids or strikes. In Somalia (1993), Malaysian and Pakistani armor provided the protected mobility and firepower required to extricate soldiers trapped in Mogadishu during a raid to capture a clan warlord. In Iraq (2003–2005), Stryker brigade combat teams were able to provide rapid response across a large operational area, providing greater survivability than light forces. In each case,

The research described in this summary is published in David E. Johnson et al., *In the Middle of the Fight: An Assessment of Medium-Armored Forces in Past Military Operations*, Santa Monica, CA: RAND Corporation, MG-709-A, 2008. http://www.rand.org/pubs/monographs/MG709/

[4] This study defined a medium-armored force in terms of platforms (e.g., tanks and other armored vehicles) and in the context of (1) a nation's overall force and (2) the opponent's armored vehicles.

medium-armored vehicles allowed forces to perform better than light forces alone by providing protected mobility, mobile firepower, and a rapid reaction capability that foot soldiers or truck-borne infantry do not possess.

Medium-Armored Forces Have Performed Well over Complex Terrain

In almost every case examined (see Table 3.1), medium-armored forces had to operate in some form of complex terrain (i.e., urban, jungle, or mountainous, or some combination thereof). Furthermore, most of the operations were affected by the underdeveloped infrastructure that characterized the operational environments.

Medium-armored vehicles were better than heavy tanks at operating with mobility in complex terrain, and the weapons on medium-armored vehicles were more readily adaptable to combat in mountains (Afghanistan, Chechnya) and urban areas (Chechnya) than those of heavy-armored units. Medium-armored platforms also provided greater survivability to infantry than light vehicles did. Finally, medium-armored forces were more able to operate in areas with less-developed infrastructure.

Table 3.1
Arroyo Assessed the Performance of Medium-Armored Forces over Complex Terrain in 13 Conflicts

- Armored warfare in the Spanish Civil War (1936–1939)
- U.S. armored divisions in France and Germany during World War II (1944–1945)
- Armored cavalry and mechanized infantry in Vietnam (1965–1972)
- Soviet airborne operations in Prague, Czechoslovakia (1968)
- South Africa in Angola (1975–1988)
- Soviet Union in Afghanistan (1979–1989)
- Operation Just Cause, Panama (1989)
- 1st Marine Division light armored infantry in Operation Desert Shield and Operation Desert Storm, Southwest Asia (1990–1991)
- Russia in Chechnya I (1994–1996)
- Russia in Chechnya II (1999–2001)
- Stryker Brigade Combat Teams in Operation Iraqi Freedom (2003–2005)
- Task Force Ranger in Mogadishu, Somalia (1993)
- Australia and New Zealand in East Timor (1999–2000)

Nevertheless, complex terrain created survivability problems. For example, until very recently, armor has been thickest on the front end of most armored vehicles, in expectation of head-to-head, direct-fire engagements. In complex terrain, however, direct-fire attacks frequently occur at close range and are aimed at the more vulnerable sides, rear, or tops of vehicles. Additionally, the belly of most armored vehicles is thin and thus vulnerable to mines and improvised explosive devices (IEDs), weapons that are easier to conceal in complex terrain.

Rapid-Deployment Capability of Medium-Armored Forces Has Been a Key Asset

The capacity to rapidly deploy medium-armored forces may be an important national capability. In the strike and counterinsurgency operations conducted by the Soviet Union in Czechoslovakia and Afghanistan (1968 and 1979–1988, respectively), the Soviets chose medium-armored forces, preferring their greater deployability compared to heavy forces and their greater mobility and firepower compared to light forces.

Key Insights and Recommendations

First, medium-armored forces fare poorly against competent, heavily armored opponents. This finding will be an important consideration if plans to enhance the survivability and lethality of medium-armored forces do not live up to expectations or cannot be fully realized in battlefield conditions.

Second, doctrinal and organizational steps can, in certain circumstances, mitigate medium armor's liabilities. These steps include the implementation of high-quality combined-arms tactics down to the lowest echelons, the effective application of supporting firepower, and training for crews and junior leaders.

Finally, the U.S. Army has lacked a forced-entry armor capability since the retirement of the M551 Sheridan. Neither the Stryker vehicle nor the Future Combat Systems (as currently envisioned) can fill that critical void. The authors conclude that it would be prudent for the U.S. Army to maintain a mix of heavy, medium-armored, and light forces that can be task organized and employed in conditions that best match their attributes. Medium-armored forces have much to offer in such a mix. ■

Targeted Use of Theater Inventory to Effectively Sustain Overseas Forces While Minimizing Total Distribution Costs

Key Findings

- **To provide effective overseas support at minimal total cost, the distribution network must integrate theater inventory, airlift, and sealift planning.**
- **Theater inventory should include items with high recurring demand and low price-to-weight ratios (e.g., track, cans of oil, and construction materiel).**
- **Optimal implementation of theater inventory would save over $200 million per year, with about three-quarters of a billion in savings already achieved since 2004 through improvements in theater inventory.**

During Operation Iraqi Freedom (OIF), the high costs of air shipments have garnered attention. There have been calls to send fewer items by airlift and instead to transport the items to units by low-cost but slow sealift. In some cases, these calls have led to such a shift, resulting in lower cost but worse support, as expected. However, this choice between cost and performance need not be made.

With an effective overall distribution network design that is continually monitored and updated, rapid response can be delivered at low total cost, with different items shipped via the ideal mode for each type of item, i.e., the method that meets customer response needs at the lowest total distribution cost possible. A key component of an effective distribution network to support overseas units is the targeted use of centralized theater inventory—for example in Kuwait to support units in U.S. Central Command (CENTCOM)—with replenishment of stocks via sealift. Selected use of theater inventory in conjunction with a targeted mix of airlift and sealift enables optimal support.

RAND Arroyo Center, in conjunction with the RAND National Defense Research Institute, has laid out a construct and developed a detailed methodology for designing a distribution network that minimizes total costs while ensuring effective distribution support through integration of transportation planning and theater inventory planning. Implementation of this construct has reduced costs and improved support of operations in CENTCOM.

The Key Is to Focus on Reducing Total Distribution System Costs

There are three costs to trade off—transportation, inventory, and materiel handling—in distribution network design. By considering all three costs, the ideal distribution network design option can be determined for each item. The ideal option varies among items, because the relative value of the three costs varies based upon item physical characteristics, demand profiles, and cost:

- For a small, expensive item, inventory cost dominates, so the best option would be stockage in the continental United States (CONUS) with strategic airlift upon demand.
- For a heavy, inexpensive, high-demand item, transportation cost dominates, so the best option is theater inventory with surface replenishment and delivery upon demand by intratheater airlift or truck.
- If slower delivery is acceptable, sealift direct to units from CONUS can be the best option.

The research summarized here is published in Eric Peltz et al., *Effectively Sustaining Forces Overseas While Minimizing Supply Chain Costs: Targeted Theater Inventory*, Santa Monica, CA: RAND Corporation, DB-524-A/DLA, 2008. http://www.rand.org/pubs/documented_briefings/DB524/

[5] This research built on a previous study: Eric Peltz and Marc L. Robbins, *Leveraging Complementary Distribution Channels for an Effective, Efficient Global Supply Chain*, Santa Monica, CA: RAND Corporation, DB-515-A, 2007. http://www.rand.org/pubs/documented_briefings/DB515/

The Theater Inventory Value Proposition

The choice between CONUS stockage with strategic airlift and theater inventory can be illustrated with examples of shipments for CENTCOM, as shown in Tables 3.2 and 3.3.

A common vehicle battery weighs 89 pounds and has a price of $113. From January 2006 to January 2007, the cost to fly the battery via military-managed strategic air averaged $328. Every time a battery was flown, almost three more could have been purchased instead for the amount of the airlift bill. Additionally, because inventory turns over, each battery purchased for theater inventory enables multiple airlift bills to be avoided. However, while the battery is relatively inexpensive to buy compared to its transportation costs, the engine costs $962 per pound to buy compared to about $5 per pound to ship by air.

Table 3.3 shows a comparison of total theater inventory costs for the battery and engine, with the key costs shaded. For the battery, the optimal investment in theater inventory saves $9.6 million per year. For this type of item, a cost-minimizing inventory level can be determined. In contrast, if most engines were delivered from theater inventory, net costs would increase by about $10.1 million annually, due to increased inventory-holding costs of about $10.7 million annually that overwhelm the potential airlift savings.

Researchers computed these tradeoffs for all items shipped to determine which should be in theater inventory and at what inventory level. Reviewing the results produces logical "classes" for theater inventory:

- Greatest return on investment from theater inventory: items with high recurring demand and low price-to-weight ratios (e.g., track, cans of oil, and construction materiel).
- Also appropriate for theater inventory, but with a lower return on investment: high-volume, moderately priced, and heavy items (e.g., engineered automotive parts).
- Not appropriate for theater inventory: low-volume or expensive items (e.g., aircraft engine, electronics).

Reducing Costs and Improving Distribution Performance in OIF

Arroyo has been working with Department of Defense supply chain organizations to apply this methodology in CENTCOM in stages since early 2004, with about three-quarters of a billion dollars in savings to date. Additional potential for improvement remains. In many cases, inventory levels have not been set high enough or maintained at needed levels—either for theater inventory or for U.S.-based stocks, which are used to replenish theater inventory.

Table 3.2
Comparison of Item Characteristics: Vehicle Battery and Apache/Black Hawk Engine, January 2006 to January 2007

	Vehicle Battery	Apache and Black Hawk Engine
Number shipped/yr.	60,309	314
Weight (each/total)	89 lb. each/2,700 tons	722 lb. each/113 tons
Unit price	$113	$694,615
Unit price/lb.	$1.27/lb.	$962/lb.
Airlift cost	$328	$3,550
Airlift cost/lb.	$3.68/lb.	$4.92/lb.

Table 3.3
Comparison of Theater Inventory Costs: Vehicle Battery and Apache/Black Hawk Engine, January 2006 to January 2007

	Vehicle Battery	Apache and Black Hawk Engine
Transportation savings/cost	– $10.1M	– $0.6M
Inventory savings/cost	+ $0.3M	+ $10.7M
Materiel handling	+ $0.2M	+ $5K
Total annual savings/cost from theater inventory cost	– $9.6M savings	+ $10.1M increase

Recommendations

Arroyo researchers also made the following recommendations:

- Establish a standard process for determining theater inventory and run it periodically.
- Establish a joint theater inventory policy that is aligned with theater inventory benefits and apply it to all theaters of operation.
- Establish metrics and goals oriented to total distribution costs.
- Transportation costs should be borne by suppliers so they will position stocks to minimize the use of strategic airlift. ■

Are Today's Forces Maintaining Proficiency in the Skills Needed for Major Combat Operations?

Key Findings

- **Some atrophy is occurring in skills associated with major combat operations.**
- **Battle staff skills may be the greatest area of concern, given their historical high risk.**
- **Atrophy is also evident in both maneuver companies and Paladin firing batteries.**
- **Research provides limited support for the notion that some skills can transfer across operation types.**

Army and other national defense officials have been concerned that the current focus of Army forces on preparing for and conducting stability and counterinsurgency (COIN) operations may be causing some atrophy in the skills associated with modern "conventional" major combat operations (MCO), the large-scale operations at the mid- to high-intensity end of the operational spectrum. Today's operations and training resources are focused on stability operations and COIN, so the Army's forces are getting little to no direct experience or training in the conduct of conventional warfare in MCO.

Recent RAND Arroyo Center research has examined trends in task and skill proficiency. The key question is whether or not there exists any decay in tactical skills, and if so, which skills are decayed. A related question is whether or not it is possible that using these skills in one operational type (e.g., stability or COIN operations) helps improve or maintain proficiency on those or similar skills in another kind of operation, such as MCO.

Based on unpublished research led by Bryan Hallmark and Henry A. Leonard.

Study Compared Historical Proficiency to Recent Trends

Battle staff skills have historically been among the most challenging skills to train. To understand current battle staff proficiency trends, Arroyo researchers surveyed mid-grade Army leaders, both officers and NCOs, regarding these skills and their confidence in their ability to perform them. The research included insights drawn from surveys of observer-trainers (OTs) from the Army's Battle Command Training Program (BCTP) at Fort Leavenworth concerning the frequency of training on these skills and the degree of similarity in executing them in COIN compared to MCO contexts. The research also gathered data on more branch-specific tactical skills from junior officers and mid-grade NCOs in the infantry, armor, field artillery, and engineer branches. To compare historical performance with more recent performance on company- and platoon-level tasks and skills, researchers also used training proficiency data from two of the Army's Combat Training Centers (CTCs): the National Training Center and the Joint Readiness Training Center.

Some Signs of Skill Atrophy Are Occurring, With Battle Staff Skills the Greatest Area of Concern

Results indicate that some skill atrophy is occurring. Although most respondents on the battle staff skill surveys were confident in their ability to execute tasks and skills in both a COIN and an MCO context, the more junior respondents, who typically had less experience in the era when the focus was on MCO, were less confident regarding MCO.

A comparison of these downward trends with findings from the BCTP OT surveys suggests that the ability

to execute some battle staff skills appears likely to have declined, particularly for those skills for which MCO execution is either different, more difficult, or both. These skills include the abilities to

- maneuver to achieve favorable force ratios at decisive points;
- develop, execute, and monitor movement and mobility/countermobility plans;
- employ heavy ground maneuver capabilities;
- employ field artillery; and
- employ electronic warfare.

These five skills were also seen by BCTP OTs as tasks having lower similarity (and thus less transferability) to stability operations or COIN, greater MCO difficulty, and less frequent practice, and they were also rated lower by future battle staff officers.

Some Skills Declining at Company Level and Below

Survey and CTC training proficiency data indicate that a few skills were also trending downward among junior captains and mid-grade NCOs across branches. While infantry and armor NCOs and junior officers indicated they felt equally prepared to execute many relevant tasks and skills in both MCO and COIN, the armor leaders indicated less confidence than did their infantry counterparts on several tasks and skills connected with MCO. These include situational awareness, reacting to obstacles, and tactical movement. Additionally, performance of heavy company teams was statistically lower on one of four tasks observed as compared to their historical counterparts, or "baseline units."

Although surveyed field artillery personnel considered themselves equally prepared for either MCO or COIN, they were considerably more likely than their counterparts in other branches to rate themselves as "unprepared." Among the tasks on which a significant number of artillery respondents rated themselves as unprepared for MCO, six are staff skills, which would affect their performance as members of a combined arms battle staff.

Artillery unit performance has also declined. Traditionally, Paladin artillery batteries have had few skills in the "most at risk" category. Recently, however, they have declined on over 80 percent of the tasks measured. Many of the declining skills in artillery batteries closely relate to battle staff skills, and so are important parts of the development of future leaders.

Some Amount of Skill Transfer Is Likely Taking Place

The study provided encouraging results on skill transferability. On many skills, officers and NCOs generally rate themselves as confident for either type of operation. This suggests that some amount of skill transfer is taking place.

Moreover, analysis of CTC results showed that many tasks and skills, particularly at the company and platoon echelons, are being done at least as well today as previously. Units that had recently returned from the first round of deployments to Operation Iraqi Freedom, where they executed MCO-related tasks and skills, compared well with baseline units. Tank and mechanized infantry platoons did as well as or better than baseline units, while company teams did as well as comparison groups.

In addition, a comparison of CTC data regarding company-level units in recent COIN scenarios and similar units in MCO in the baseline period indicated that COIN units did as well as or better than the baseline units on similar tasks. These findings indicate that current operations may help preserve (or improve) some skill competencies that can carry over into future MCO settings.

Recommendations

The study provides evidence of decline in some key MCO skills. It also suggests that while transferability is possible across scenarios for some tasks and skills, it is not guaranteed. Based on these findings, the researchers made three recommendations:

First, given evidence of skill atrophy today in key MCO skills, some efforts are needed today to prevent long-term atrophy; deferring these efforts raises the risks.

Second, the Army's Training and Doctrine Command needs to have the primary role in maintaining MCO competencies for future leaders and soldiers and needs to be reinforced in this role. Future leaders should have some level of MCO competency, and operational units cannot be expected to achieve full proficiency for MCO when faced with the immediate need to prepare for COIN and stability operations.

Third, the Army should continually monitor specific skills that are either critical for future MCO missions or are not being actively used today. By using methods similar to those in this study, the Army can identify specific downward trends more accurately and effectively, and before too much atrophy occurs. ■

Environmental Considerations in Combat and Stability Operations

Key Findings

- **Environmental effects in military operations can harm soldiers, damage relations with the host nation and local populace, and create liabilities.**
- **By effectively managing environmental issues during deployments, Army units and commanders can reap tactical and strategic rewards that can extend from combat into the post-conflict phase of operations.**
- **The Army needs a comprehensive environmental approach that includes a strong environmental ethic emphasizing sustainability, increased investment, and improved policy, guidance, planning, and training.**

Because environmental problems pose risks to the health and safety of troops, they can influence combat operations. But the effect of environmental issues goes well beyond that. In most contingencies over the past two decades, U.S. forces have stayed in the theater much longer than anticipated, becoming deeply involved in such activities as stabilization, reconstruction, and nation building. Environmental issues become even more important during such protracted engagements, not only because of their effect on day-to-day operations in base camps, but also because of the significant role they can play in achieving U.S. national objectives.

However, competing with warfighting concerns for attention, environmental considerations rarely receive high priority in contingency operations. Arroyo analysts looked at the many ways that issues related to the environment can affect combat and post-conflict operations. They identified areas for improvement and developed a comprehensive and systematic approach the Army could take to manage the environment effectively during contingencies.

Environmental Effects in Military Operations

Environmental effects occur in all types of military operations, as shown in Table 3.4. Of most immediate concern to commanders is the potential effect the environment can have on soldiers. Endemic diseases can severely undermine the health of troops. Unclean water, polluted air, and poor sanitation can cause debilitating shorter-term illness and sometimes cause longer-term health problems. Toxic substances also pose a threat.

But, as the table indicates, effects can occur elsewhere as well. Environmental practices can harm or help relations with the local populace, which are particularly important in stability and reconstruction operations, and they can affect relations between nations. They can also leave the United States liable for financial damages and cleanup expenses.

The Army's Current Approach to the Environment During Contingencies

Army units, commanders, and planners tend to assign relatively low priority to environmental considerations during contingencies. This tendency stems from three factors.

First, in the United States, environmental conditions and infrastructures are excellent, and the Army's environmental activities focus on complying with and even going beyond U.S. environmental laws and regulations. An installation staff manages most day-to-day environmental issues. In contingencies, the situation differs significantly. Often there are few, if any, environmental laws or regulations, and the local environment can be severely degraded. In this

This summary is derived from David Mosher et al., *Green Warriors: Environmental Considerations in Army Contingency Operations from Planning Through Post-Conflict*, Santa Monica, CA: RAND Corporation, MG-632-A, 2008. http://www.rand.org/pubs/monographs/MG632/

Table 3.4
Environmental Effects in Military Operations

Effect	Combat Operations	Stability Operations, Reconstruction, and Nation Building
Soldier health and safety	X	X
Logistics	X	X
Military mission	X	X
Relations with local population	X	X
Diplomatic relations		X
Liability (financial and legal)		X

context, soldiers and commanders may view environmental issues as irrelevant—or may not even recognize them.

Second, until recently, the military has devoted less attention to stability operations and reconstruction than to combat operations. Consequently, commanders and planners have assumed either that U.S. participation in the operation will end quickly after the combat phase or that other U.S. and international organizations will take responsibility for reconstruction.

Third, planners and commanders tend to take an ad hoc, short-term approach to environmental issues during contingency operations. Operation plans contain limited information about environmental concerns and do not cover use of the environment to achieve desired environmental outcomes or strategic objectives. Almost no high-level guidance covers the environment in contingency operations. For example, base camps present numerous environmental challenges, yet the Army has no standard policies for their design, construction, or operation.

A Comprehensive Approach to the Environment Will Boost Mission Success, Especially in the Post-Conflict Phase

The Army needs a coherent, comprehensive approach to address environmental issues in contingency operations. Developing such an approach will require six activities:

Improve policy and guidance. A standard DoD-wide policy will clarify the need for cooperation in addressing environmental issues. The Army can then tailor its doctrine to implement these departmental directives. Policies should establish standard operating procedures, responsibilities for commanders, and clear expectations that can set training standards. The Army Strategy for the Environment could provide an excellent starting point for improving Army policy.

Promote an environmental ethic that extends to contingency operations. The environmentally responsible behavior demonstrated at permanent installations must carry over to contingency operations. Commanders and soldiers alike must take part in a cultural change that recognizes the tactical and strategic benefits of good environmental stewardship. A broader definition of environmental issues and recognition of their importance for locals are key.

Better incorporate environmental considerations into planning. Current environment-related planning must expand to include strategic aspects of the environment and specific regional issues. Army doctrine and planning procedures should ensure that commanders receive high-quality information and analysis so that they can make informed decisions, including how to achieve desired end states.

Improve training and awareness. Commanders, soldiers, and noncombatant personnel should receive environmental training before deployment and in the field. Topics should include the short- and long-term importance of environmental considerations, regional environmental conditions, prominent local concerns, and on-the-ground environmental procedures.

Increase investment. Funds are needed to (a) secure personnel with the right skills to oversee and follow through with environmental issues and (b) support R&D to create innovative technologies that can reduce and manage the environmental effects of Army operations and reduce logistics requirements and costs.

Emphasize sustainability. Sustainability should be the Army's model for managing environmental considerations in contingency operations, particularly during the post-conflict phase. Sound environmental practices can help sustain troops, make base camps safer, ensure good relations with the local populace, improve basing rights in host countries, and, perhaps most important, provide a sustainable country after U.S. forces leave. ■

SECTION 4

Training and Education of Army Officers

Among the research products and services that RAND Arroyo Center provides to the Army are the training and education of Army officers as analysts. This educational function reflects RAND's goal, stated in its 1948 Articles of Incorporation, "To further and promote scientific, educational, and charitable purposes, all for the public welfare and security of the United States of America." Because of RAND's institutional commitment to education and training, Army officers at RAND have the opportunity not only to work side-by-side with RAND analysts but also to engage with officers from sister services who are also at RAND participating in visiting analyst programs.

Army officers at RAND are typically enrolled either in the Army Fellows Program, a one-year tour in RAND Arroyo Center, or in the Pardee RAND Graduate School, a three-year tour culminating in a doctoral degree in policy analysis.

Army Fellows Program

Each year the Army selects a number of Army majors and lieutenant colonels to work at Arroyo as visiting analysts in the Army Fellows Program.[7] Based typically in RAND's Santa Monica or Washington office, Army fellows work with researchers on critical Army policy issues. To date, 153 officers have participated in the program. The one-year fellowship is followed by a utilization tour on a senior-level Army or Joint staff.

Six officers participated in the program in the 2008/09 cohort.

2008/09 Army Fellows

LTC Patrick Grady most recently served as chief financial officer at Carl R. Darnall Army Medical Center, Fort Hood, Texas, a 101-bed hospital supporting more than 97,000 enrolled TRICARE beneficiaries. Previously, he served as budget chief at Walter Reed Army Medical Center, Washington, D.C.; medical trainer at the National Training Center, Fort Irwin, California; and on the command and primary staff of the 1st Armored Division in Germany and Bosnia. LTC Grady holds a BS and an MBA from the University of Illinois, Urbana-Champaign. At RAND, projects worked on by LTC Grady included one characterizing and assessing the medical readiness of the reserve components, another assessing the effect of parental deployment on children, and another on improving the Army's property accountability process.

LTC William Phillips most recently served as a senior strategist/analyst on the Army Staff in the Pentagon. He has held a variety of command and staff positions at the tactical, operational, and strategic levels in the Infantry and Engineer branches. He is a graduate of the Army and Navy Command and Staff, Red Team Leader, and Defense Strategy courses; the School of Advanced Military Studies, Fort Leavenworth, Kansas; and the Canadian Forces College, Toronto, Ontario. He has master of military arts and science degrees in strategy and theater operations and master's degrees in information systems and public administration. At RAND, LTC Phillips participated in several research projects encompassing the possible collapse of strategically important states; logistics roles in unmanned aircraft systems; and joint force assets to support Army mission-critical, time-sensitive needs. He also participated in a RAND National Defense Research Institute project that involved developing alternatives for the drawdown of forces from Iraq.

LTC Eloy Cuevas most recently served as a strategic intelligence officer with Joint Task Force–North at Fort Bliss, Texas. He has held a variety of command and intelligence staff positions at the tactical, operational, strategic, and interagency levels. LTC Cuevas has a BA in history and political science from Texas A&M University, Kingsville, an MA in human resource development from Webster University in St. Louis, and an MS in strategic intelligence from the National Defense Intelligence College in Washington, D.C. At RAND, he participated in

[7] For more information, including eligibility requirements and application instructions, consult http://www.rand.org/ard/fellows/.

research projects assessing Jihadist strategies; mapping extremist narrative; assessing the possible collapse of strategically important states; examining and providing border security recommendations on the utilization of Department of Homeland Security resources along the U.S.-Mexico border; and analyzing Army support to civil support.

MAJ Patricia Socha was most recently a quartermaster systems integrator at the U.S. Army Reserve Command. She recently completed the Defense Strategy Course and has a BS in health and physical education from Arkansas Tech University and an MSM in management from Southern Nazarene University in Oklahoma. At RAND, MAJ Socha participated in two research projects focused on providing full-time support to units throughout the ARFORGEN readiness cycle.

MAJ Ronald Harper was most recently assigned to the I Corps Surgeon's Office as the Corps health service materiel officer. His prior assignments include supply officer (S4) at the 47th Combat Support Hospital (CSH) at Fort Lewis, Washington, and executive officer at the 47th CSH in Tikrit during Operation Iraqi Freedom (in May 2008); chief of logistics for the Wurzburg Army Medical Activity, Germany; and health service materiel officer for the 1st Infantry Division Medical Operations Center, Kitzingen, Germany. He has a BS from the University of Oregon and an MS in logistics management from the Florida Institute of Technology. At RAND, MAJ Harper participated in research projects developing new equipping and maintenance strategies for Combat Support Hospitals and improving the medical distribution supply chain for U.S. Central Command.

MAJ Steven Cram was most recently the database manager for PROBE Database, Office of the Deputy Chief of Staff for Programs (G-8), Program Analysis and Evalu-

2008/09 Army Fellows based in Santa Monica are (left to right) LTC Patrick Grady, MAJ Steven Cram, LTC Eloy Cuevas, MAJ Ronald Harper, and LTC William Phillips. A sixth fellow, MAJ Patricia Socha, is based in Washington, D.C. (photo on page 12).

ation. His prior assignments include program analyst in G-8, Force Development Resources; assistant operations officer for U.S. Forces, Korea/Eighth U.S. Army, Air Defense Artillery Liaison Office; and combat operations analyst at the Army Training and Doctrine Command Analysis Center. He has a BS from the U.S. Military Academy at West Point and an MS in operations research from Kansas State University. At RAND, MAJ Cram participated in studies on improving strategic communications in the Army acquisition process; improving OCIE (Organizational Clothing and Individual Equipment) inventory; analyzing joint force assets to support Army mission-critical, time-sensitive needs; and improving airspace management to harmonize manned and unmanned system operations.

Pardee RAND Graduate School

The Pardee RAND Graduate School was founded in 1970 as one of America's original eight graduate programs in public policy. It remains the only one based at a nonuniversity research institution. The interdisciplinary doctorate in policy analysis offered by the school is designed to train creative thinkers to play important roles in solving major problems facing the world. Students work alongside RAND researchers on a broad range of projects as part of their on-the-job training. Graduates have moved on to leading positions in government, academia, and the private sector. (For more information about PRGS, see http://www.prgs.edu/).

In the 2008/09 school year, the student body of PRGS included two Army officers:

COL S. Jamie Gayton graduated from the U.S. Military Academy at West Point as an Army Corps of Engineers officer. He also earned an MBA from the Sloan School of Management at the Massachusetts Institute of Technology. His combat and deployment experience includes service during Operation Desert Shield/Storm in 1990–1991 and Operation Iraqi Freedom in 2005–2006. At RAND, he participated in many research projects and co-authored several research publications, including *Guidebook for Supporting Economic Development in Stability Operations* (see the first summary in Section 3 of this Annual Report). COL Gayton is completing his doctoral thesis assessing the role of the Stryker Warfighting Forum in preparing soldiers to conduct counterinsurgency operations. He will return to West Point as a professor of economics in July 2009.

MAJ Misha Cuyler is an officer in the U.S. Army Medical Service Corps. He served in a variety of command and leadership positions, including the Chief of Program Analysis and Evaluation for the Army Surgeon General's $498 million medical construction program. He graduated from Tuskegee University with a BS in mechanical engineering and also holds a master's degree in healthcare administration from Baylor University. MAJ Cuyler's research activities at RAND have included contributions to a study to develop equipping and maintenance strategies for Combat Support Hospitals. ■

On September 2, 2008, Pardee RAND Graduate School fellow LTC S. Jamie Gayton was promoted to the rank of colonel. MG William H. McCoy, Jr., commanding general, Maneuver Support Center, Fort Leonard Wood, Missouri, and a former RAND Arroyo Center Army fellow from the cohort of 1991/92, presided over the ceremony.

SECTION 5

Honors and Awards

In FY 2008, several RAND Arroyo Center analysts were recognized for exceptional performance by the U.S. Army and the Office of the Secretary of Defense.

LTC Kimberly Colloton and MAJ John Coombs presented an inscribed saber to Jeff Isaacson as a departing gift to RAND Arroyo Center from the Army Fellows cohort of 2007/08. Other members of the cohort were LTC Peter Colón and LTC Thomas Bartow.

U.S. Army Order of Saint Martin

In September 2008, Eric Peltz, director of RAND Arroyo Center's Military Logistics Program, was honored by the U.S. Army for his long-term contributions to improving the Army's capabilities in inventory management and supply chain management. Mr. Peltz was inducted into the Order of Saint Martin, an honor bestowed by the Quartermaster Branch of the Army. The honor was presented by LTG Mitchell H. Stevenson, an Army logistics officer who has sponsored many RAND projects and who currently serves as the Army's Deputy Chief of Staff, G-4 (Logistics). RAND staff member Ken Girardini was inducted into the order in 2003.

U.S. Army Ancient Order of Saint Christopher

In April 2008, Marc Robbins, a senior analyst in RAND Arroyo Center's Military Logistics Program, was inducted into the Ancient Order of Saint Christopher for his many important contributions to improving the military's global distribution capabilities. Then-MG(P) Mitchell H. Stevenson, serving as commanding general of the U.S. Army's Combined Arms Support Command, presented Dr. Robbins with the honor on behalf of MG Jim Chambers, the U.S. Army's Chief of Transportation. General Stevenson stated that Robbins has helped to dramatically improve the responsiveness of support to soldiers worldwide through his velocity management research for the Army, strategic distribution research for the Defense Logistics Agency and the U.S. Transportation Command, and direct support of distribution management process improvement during Operation Iraqi Freedom.

U.S. Army Order of Samuel Sharp

In October 2007, Ken Girardini was honored by the U.S. Army for his many years of research on improving the Army's tactical inventories of repair parts, which are critical to enabling maintainers to keep equipment ready for use. Dr.

Girardini was inducted into the Order of Samuel Sharp, an honor bestowed by the ordnance branch of the combat service support branch of the Army, which is responsible for the maintenance of equipment. The honor was presented by then-MG Mitchell H. Stevenson. Other RAND staff who have received the Samuel Sharp honor include John Dumond and Eric Peltz. In 2003, Girardini was inducted into the Army quartermaster branch's Order of Saint Martin.

Secretary of Defense Medal for Exceptional Service

Ellen Pint, an Associate Director of RAND Arroyo Center's Manpower and Training Program, was awarded the Office of the Secretary of Defense Medal for Exceptional Public Service; Dr. Pint shared the award with Laura Baldwin, another senior RAND researcher and research manager. David S. C. Chu, then–Under Secretary of Defense for Personnel and Readiness, presented the award during the 83rd annual Western Economic Association International conference, held June 29–July 3 in Hawaii. Dr. Chu had served as the director of RAND Arroyo Center from 1998 to 2001.

The presentation also included a citation, which stated that Pint and Baldwin "are distinguished by exceptional public service by organizing, promoting and participating in the Defense Economics panels at the annual meetings of the Western Economic Association International, from June 1995 to August 2008. [They] fostered the growth of the Defense Economic panels from an initial handful of participants to 16 panels of nearly 80 leading scholars and researchers. This interchange promoted a better understanding of a wide variety of issues including recruiting, retention, compensation, and human resources productivity, as well as procurement and costs of weapon systems." In recent years, panels have featured participation by several Army organizations in addition to RAND Arroyo Center, including West Point, the Office of Economic and Manpower Analysis, the Office of the Deputy Under Secretary of the Army for Business Transformation, and the Office of the Director for Programming, Analysis, and Evaluation. ■

Ellen Pint (left) and Laura Baldwin (center) were awarded the Office of the Secretary of Defense Medal for Exceptional Public Service, presented by David Chu, then Under Secretary of Defense for Personnel and Readiness. Ellen is an associate director of the Manpower and Training Program. David Chu directed RAND Arroyo Center from 1998 to 2001.

SECTION 6

Selected 2008 Publications

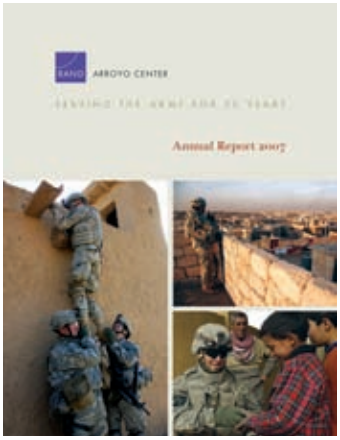
To fulfill its mission, RAND Arroyo Center places the results of its research in the public domain whenever such publication is consistent with classification and distribution restrictions. Army Regulation 5-21 enumerates three reasons for this open publication policy: "The Army encourages broad distribution of Arroyo Center results to achieve maximum benefit, to permit widespread peer review, and to increase awareness of issues identified by the Army leadership as important."

Arroyo publishes only research that has been peer reviewed to assure that it meets RAND's standards for high-quality, objective research (http://www.rand.org/standards/). Arroyo uses the same model of peer review that is standard for scientific journals, requiring each research document to be reviewed by at least two experts and revised in response to their recommendations before publication. Additionally, Arroyo research documents are approved for publication by the sponsoring Army office and cleared for public release by the Army Office of Public Affairs.

In addition to its Annual Report, RAND Arroyo Center produces research publications in five RAND series:

- **Monographs**, publications that include both research findings and policy recommendations for senior Army leadership.
- **Technical Reports**, research publications targeted at analysts and other readers with strong technical expertise.
- **Documented Briefings**, publications that document briefings presented widely to the senior Army leadership.
- **Occasional Papers**, publications that present an informed perspective on policy issues important to the Army.
- **Conference Proceedings,** publications that document Arroyo-hosted conferences.

RAND Arroyo Center research publications are available for free downloading at http://www.rand.org/ard/. A selection of Arroyo's publications in 2008 follows.



Annual Report

RAND Arroyo Center Annual Report 2007: Serving the Army for 25 Years

AR-7125-A

RAND Arroyo Center's annual report describes the skills and abilities that have been carefully developed over its history, with an eye on large, complex institutional problems that the Army is likely to face. While particular research streams have evolved over time, generic areas of substantive focus have remained largely intact and are reflected in Arroyo's four programs of research: Strategy, Doctrine, and Resources; Force Development and Technology; Military Logistics; and Manpower and Training. These programs, along with the specific research streams they maintain, support the four "imperatives" essential to restoring the Army's balance: sustain the Army's soldiers, families and civilians; prepare forces to succeed in the current conflict; reset units and rebuild readiness; and transform the Army to meet the demands of the 21st century.

http://www.rand.org/pubs/annual_reports/AR7125/

Documented Briefings

Effectively Sustaining Forces Overseas While Minimizing Supply Chain Costs: Targeted Theater Inventory

Eric Peltz, Kenneth J. Girardini, Marc L. Robbins, and Patricia Boren

DB-524-A/DLA

For shipping supplies to sustain troops overseas, airlift or sealift can be used with differential speed and cost. This documented briefing lays out a construct for designing a distribution network that takes advantage of the two

transportation modes' respective strengths to meet combatant command needs while minimizing total supply chain costs. In doing so, it provides recommendations for when and how the two modes should be employed in conjunction with their integration with inventory management and positioning and operational planning.
http://www.rand.org/pubs/documented_briefings/DB524/

Ensuring That Army Infrastructure Meets Strategic Needs

Ellen M. Pint, Beth E. Lachman, Justin L. Adams, and William M. Hix
DB-547-A

U.S. national security strategy has changed since the terrorist attacks of September 11, 2001; the Army must adapt to these changes to meet current and future strategic requirements. This documented briefing describes the results of a study that examined U.S. national-level strategic documents and Department of Defense and Army strategic plans and initiatives to identify issues affecting the Army's infrastructure needs. The authors then reviewed DoD and Army installation plans to determine how well these strategic issues are currently being addressed. Where gaps exist, Pint et al. identify areas that should be included in strategic planning activities. These areas include deployment infrastructure; training capacity needed to support restationing, joint training, and the introduction of new technology; hedging against long-term risk and uncertainty; using public/private and Army/community partnerships to increase investment in family and community services; the sustainability of land use; and innovative approaches to relieve environmental pressures on Army installations. Finally, the authors discuss the types of data that would be needed for more in-depth infrastructure analysis, whether these data are currently available, and how they might be collected.
http://www.rand.org/pubs/documented_briefings/DB547/

Toward the Effective Use of Military Veterinarians in Stability Operations

Melinda Moore and Gail Fisher
DB-560-A

Stability operations, a new core mission of the U.S. Army, serve immediate military needs, but these activities can also overlap with the missions of civilian agencies such as the U.S. Agency for International Development. Among the medical civil-military missions figuring prominently in current operations in the Middle East are requests for technical support from Army veterinarians, DoD's source of expertise for food safety and the prevention and control of animal diseases. This short quick-response study was undertaken to provide guidance for the Army's deliberative planning for the use of such specialists in stability operations. The researchers found that military veterinarians are contributing to economic development in Iraq and Afghanistan and will likely be important to future stability operations elsewhere. Their short-term activities can contribute to larger U.S. and host nation strategic goals, especially if well coordinated with relevant civilian agencies. However, current operations suggest challenges and opportunities to assure that military veterinarians are used appropriately and efficiently and that their activities can meet both immediate military goals and can be sustained within a longer-term development context. This documented briefing should be of particular interest to Army and DoD audiences concerned with stability and reconstruction operations, and particularly to the medical communities among those audiences.
http://www.rand.org/pubs/documented_briefings/DB560/

Monographs

Performance Evaluation and Army Recruiting

James N. Dertouzos and Steven Garber
MG-562-A

Designing and implementing performance metrics that support Army goals requires analysis of how different metrics would affect recruiter behavior and, in turn, recruiters' contributions toward achieving the Army's goals. The authors evaluate traditional performance metrics, such as the number of contracts signed per month per recruiter, and find that they do not adequately measure recruiter effort, skill, and productivity. They then develop a "preferred

performance metric" that takes into account the difficulty of recruiting different types of youth in various markets. Using a performance metric that better reflects Army values and more accurately assesses recruiter effort and skill would have significant benefits. However, because the recruiter reward system is deeply engrained, the authors propose modest, gradual changes to the system—for example, improving mission allocation algorithms to reflect variations in market quality and differences in market segments and lengthening the performance evaluation window to at least six months to reduce emphasis on monthly station-level mission accomplishment.

http://www.rand.org/pubs/monographs/MG562/

Stabilization and Reconstruction Staffing: Developing U.S. Civilian Personnel Capabilities

Terrence K. Kelly, Ellen E. Tunstall, Thomas S. Szayna, and Deanna Weber Prine

MG-580-RC

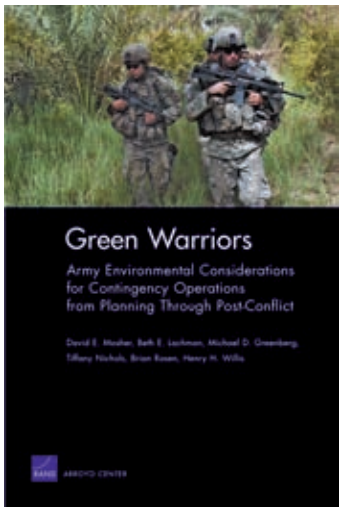
The United States participated in several interventions and state-building efforts during the 1990s, and the rationale for U.S. engagement in such efforts received a new urgency after the 9/11 attacks. However, recent U.S. experiences in Afghanistan and especially in Iraq have shown that engaging in stability and reconstruction operations is a difficult and lengthy process that requires appropriate resources. Most of all, to have a chance of succeeding, such operations require a realistic understanding of the capabilities needed for them. The authors present the results of research on the U.S. civilian personnel and staffing programs for stability and reconstruction operations undertaken in other countries under U.S. leadership or with the participation of the United States. The study uses the Office of Personnel Management's Human Capital Assessment and Accountability Framework to assess the personnel requirements for such operations. The framework advocates strategic alignment, workforce planning and development, leadership and knowledge management, results-oriented performance culture, talent management, and accountability. The authors also present recommendations that the U.S. government should consider undertaking to deal with the types of problems that the United States has encountered in post-2003 Iraq. The research draws on the rapidly growing body of literature dealing with reconstruction and stability missions, interviews with U.S. and British civilian personnel deployed to Iraq, and the authors' own experiences in Iraq as U.S. civilians involved with the Coalition Provisional Authority (CPA). The study should be of interest to policymakers dealing with stability and reconstruction operations.

http://www.rand.org/pubs/monographs/MG580/

Green Warriors: Army Environmental Considerations for Contingency Operations from Planning Through Post-Conflict

David E. Mosher, Beth E. Lachman, Michael D. Greenberg, Tiffany Nichols, Brian Rosen, and Henry H. Willis

MG-632-A



Recent experiences in Iraq, Afghanistan, and the Balkans have highlighted the importance of environmental considerations. These range from protecting soldier health and disposing of hazardous waste to building water supply systems and other activities that help achieve national goals in the post-conflict phase of contingency operations. The Army has become increasingly involved with environmental issues in every contingency operation and must be better prepared to deal with them. This study assesses whether existing policy, doctrine, and guidance adequately address environmental activities in post-conflict military operations and reconstruction. Findings are based on reviews of top-level policy and doctrine, analysis of operational experience,

extensive interviews with diverse Army personnel, and a review of operational documentation and literature. From these sources, a database of 111 case studies was created. The research showed that environmental concerns can have far-reaching and significant impacts on the Army, both direct and indirect, especially in terms of cost, current operations, soldier health, diplomatic relations, reconstruction activities, and the ultimate success of the operation or the broader mission. Some evidence suggests that environmental problems may have even contributed to insurgency in Iraq. Recommendations include updating current policy and doctrine to fully address environmental considerations in contingency operations; ensuring that contractors are carefully selected and managed; and transmitting proactive field environmental practices and lessons throughout the Army.

http://www.rand.org/pubs/monographs/MG632/

MG-632-A is also summarized in

The Army's Green Warriors: Environmental Considerations in Contingency Operations

David E. Mosher, Beth E. Lachman, Michael D. Greenberg, Tiffany Nichols, Brian Rosen, and Henry H. Willis

RB-9335-A

This research brief describes the growing importance of environmental considerations for the Army in contingency operations and suggests ways to better address environmental issues in Army planning, training, policy, guidance, and operations.

http://www.rand.org/pubs/research_briefs/RB9335/

After Saddam: Prewar Planning and the Occupation of Iraq

Nora Bensahel, Olga Oliker, Keith Crane, Richard R. Brennan, Jr., Heather S. Gregg, Thomas J. Sullivan, and Andrew Rathmell

MG-642-A

This monograph begins by examining prewar planning efforts for postwar Iraq, in order to establish what U.S. policymakers expected the postwar situation to look like and what their plans were for reconstruction. The monograph then examines the role of U.S. military forces after major combat officially ended on May 1, 2003; the analysis covers this period through the end of June 2004. Finally, the monograph examines civilian efforts at reconstruction after major combat ended, focusing on the activities of the Coalition Provisional Authority (CPA) and its efforts to rebuild structures of governance, security forces, economic policy, and essential services prior to June 28, 2004, the day that the CPA dissolved and transferred authority to the Interim Iraqi Government. The authors conclude that the U.S. government was unprepared for the challenges of postwar Iraq for three reasons: a failure to challenge fundamental assumptions about postwar Iraq; ineffective interagency coordination; and the failure to assign responsibility and resources for providing security in the immediate aftermath of major combat operations.

http://www.rand.org/pubs/monographs/MG642/

Leader Development in Army Units: Views from the Field

Peter Schirmer, James C. Crowley, Nancy Blacker, Richard R. Brennan, Jr., Henry A. Leonard, J. Michael Polich, Jerry M. Sollinger, and Danielle M. Varda

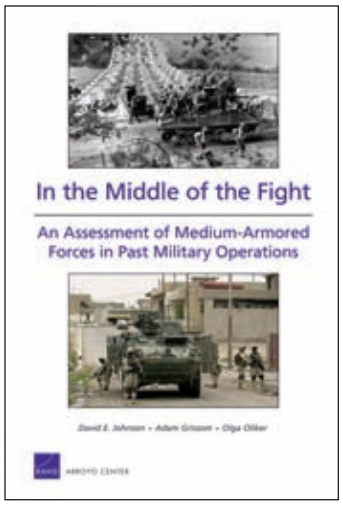
MG-648-A

Developing leaders is critical for the Army; given the amount of time officers spend in units, that experience should be important to their development. Yet few studies indicate whether Army units even have leader development programs, and, if they do, what the programs consist of and how well they are executed. To gain insight into these issues, RAND Arroyo Center researchers met with over 450 officers (lieutenants through colonels) to discuss leader development within Army units. The discussions revealed that no set of activities exists that could be characterized as a standard unit-level leader development program. Instead, leader development tends to be informal, personality-driven, and dependent on the abilities, experience, and inclinations of the unit commander. The researchers do not recommend that the Army impose more formal programs or requirements on commanders, but instead that the Army's school system demonstrate the proper way to do counseling; introduce Army leaders to an array of leader development tools that could be adapted to a unit's needs in different situations; and, most importantly, foster the expectation that leader development will take place, according to Army standards, in operational units. The authors note that the Center for Army Leadership

can support these efforts by fostering the sharing of leader development tools and ideas, possibly online, and exercising continuing quality control over the ideas being shared, based at least in part on user feedback.
http://www.rand.org/pubs/monographs/MG648/

In the Middle of the Fight: An Assessment of Medium-Armored Forces in Past Military Operations

David E. Johnson, Adam Grissom, and Olga Oliker
MG-709-A



This monograph presents a qualitative assessment of the performance of medium-armored forces in 13 past conflicts that span the range of military operations. The accompanying analysis is designed to help inform U.S. Army decisions about fielding medium-armored forces in the future. The case histories yielded three major insights. First, medium-armored forces fare poorly against competent, heavily armored opponents. This finding will prove relevant to the U.S. Army's medium-armored forces if their survivability and lethality do not live up to expectations or cannot be fully realized in battlefield conditions. Second, doctrinal and organizational steps can, in certain circumstances, mitigate medium armor's liabilities. These steps include the implementation of high-quality combined-arms tactics down to the lowest echelons, the effective application of supporting firepower, and training for crews and junior leaders. Finally, the U.S. Army has lacked a forced-entry armor capability since the retirement of the M551 Sheridan. Neither the Stryker vehicle nor the Future Combat Systems (as currently envisioned) can fill that critical void. The authors conclude that it would be prudent for the U.S. Army to maintain a mix of heavy, medium-armored, and light forces that can be task organized and employed in conditions that best match their attributes. Medium-armored forces have much to offer in such a mix.
http://www.rand.org/pubs/monographs/MG709/

Commonality in Military Equipment: A Framework to Improve Acquisition Decisions

Thomas Held, Bruce Newsome, and Matthew W. Lewis
MG-719-A

Increasingly, the U.S. Army and the Department of Defense as a whole are developing families of systems built around common components. To inform the Army's decisionmaking process surrounding commonality, RAND Arroyo Center was asked to assess the advantages and disadvantages of commonality and how to best manage their tradeoffs. To do so, this report uses historical review, literature analysis, and case studies of commercial and military efforts to exploit commonality. It examines the effects of commonality on costs, capabilities, and training and offers a decisionmaking aid that designers, developers, and procurers, in particular, could use to inform their decisions about commonality. It concludes with recommendations for the Army.
http://www.rand.org/pubs/monographs/MG719/

Unfolding the Future of the Long War: Motivations, Prospects, and Implications for the U.S. Army

Christopher G. Pernin, Brian Nichiporuk, Dale Stahl, Justin Beck, and Ricky Radaelli-Sanchez
MG-738-A

The United States is currently engaged in a military effort that has been characterized as the "long war." The long war has been described by some as an epic struggle against adversaries bent on forming a unified Islamic world to supplant Western dominance, while others describe it more narrowly as an extension of the war on terror. But while policymakers, military leaders, and scholars have offered numerous definitions of the long war, no consensus has been reached about this term or its implications for the United States. To understand the impacts that this long war will have on the U.S. Army and on U.S. forces in general, it is necessary to understand more precisely what the long war is and how it might unfold over the coming years. To address this need, this study explores the concept of the long war and identifies potential ways in which it might unfold as well as the implications for the Army and the U.S. military more generally.

This monograph uses the generation of either "trajectories" or alternative paths in which the long war might

unfold to explore the implications for the U.S. military. The discussion focuses on the potential threats the U.S. faces in each trajectory and considers the confluence of three major problems raised by the war: those related to the ideologies espoused by key adversaries in the conflict, those related to the use of terrorism, and those related to governance (i.e., its absence or presence, its quality, and the predisposition of specific governing bodies to the United States and its interests). The goal of this monograph is not to determine which of these areas is the key problem. Instead, the authors take the stance that in order to ensure that this long war follows a favorable course, the United States will need to make a concerted effort across all three domains. Numerous broad conclusions and recommendations are given for addressing issues surrounding the long war.
http://www.rand.org/pubs/monographs/MG738/

Technical Reports

Allocation of Forces, Fires, and Effects Using Genetic Algorithms

Christopher G. Pernin, Katherine Comanor, Lance Menthe, Louis R. Moore, and Tim Andersen
TR-423-A

Decisionmaking within the Future Battle Command structure will demand an increasing ability to comprehend and structure information on the battlefield. As the military evolves into a networked force, headquarters and others must collect and utilize information from across the battlefield in a timely and efficient manner. Decision aids and solution methodologies in constructive simulations must be modified to better show how this information affects decisions. Using information about friendly and enemy forces and the terrain, a RAND-developed model that incorporates a genetic algorithm (1) determines preferred Blue routes around Red forces and (2) allocates forces to these routes. This model is unique in its incorporation of many higher-level intelligence products—including intelligence about Red's location, activity, intent, military capability, intelligence capability, and adaptability—into the planning algorithm. The integration of these products allows the model to produce sophisticated look-ahead representations of enemy forces that are superior to the static representations typically used in planning sessions. The model also features terrain representations that measure impassibility, inhospitableness, and shadowing, allowing planners to transcend scenarios that assume a lack of interesting terrain.
http://www.rand.org/pubs/technical_reports/TR423/

Improving Recapitalization Planning: Toward a Fleet Management Model for the High-Mobility Multipurpose Wheeled Vehicle

Ellen M. Pint, Lisa Pelled Colabella, Justin L. Adams, and Sally Sleeper
TR-464-A

The U.S. Army is undergoing a major transformation to ensure that its future capabilities meet the needs of the nation. One element of its transformation strategy is the recapitalization (RECAP) program, which entails rebuilding and selectively upgrading 17 systems. The program has continuously evolved, with ongoing decisionmaking about what types of system modifications will occur and the scale of programs. Greater insight into aging effects can facilitate such decisions. This report describes regression analyses carried out to assess how vehicle age relates to annual repair costs and availability (or, conversely, downtime) for High-Mobility Multipurpose Wheeled Vehicles (HMMWVs). The study found that estimated repair costs and downtime increase with vehicle age, with the strength of both effects tapering off slightly for older vehicles. The study also found that vehicle usage, location, and variant type have significant effects. These estimated cost-versus-age and downtime-versus-age relationships were embedded in a vehicle replacement model that, given assumptions about the cost and effectiveness of RECAP, can be used to estimate the timing recommended for RECAP and replacement of HMMWVs. The model results indicate that the Army might be able to achieve modest life-cycle cost savings by replacing some HMMWV variants at an age lower than the current average fleet age, but the savings from RECAP will depend on the program's costs and its effectiveness in reducing future vehicle maintenance costs and downtime.
http://www.rand.org/pubs/technical_reports/TR464/

Journal Articles and Web-Only Publications

Logistics: Supply Based or Distribution Based?

Eric Peltz

RP-1271

Originally published in *Army Logistician*, PB 700-07-02, Vol. 39, No. 2, March/April 2008

Attempts to characterize logistics systems as either supply-based or distribution-based logistics are misguided. Every logistics system must integrate supply and distribution to meet customer requirements, including risk considerations, while minimizing total supply-chain cost. The ideal logistics system for a given situation depends on process capabilities, resource costs, and item, demand, and customer profiles. What is ideal is subject to change. As processes improve, the system design should evolve; as process improvements breach thresholds and as new capabilities are developed, the logistics system should change in a more revolutionary manner. The continual need for a nuanced and dynamic balancing of distribution and supply in logistics system design has implications for the training and career development of Army logisticians. A logistician's ability to make the right integrated decisions depends on his having broad system knowledge—on being a logistics expert rather than a supply or transportation specialist.

http://www.rand.org/pubs/reprints/RP1271/

Stockage Determination Made Easy

Kenneth J. Girardini, Arthur W. Lackey, and Eric Peltz

RP-1272

Originally published in *Army Logistician*, PB-700-07-04, Vol. 39, No. 4, July/August 2008

The Army has been able to achieve historically high levels of performance in its tactical inventories of repair parts by applying a series of RAND-developed process and algorithm improvements. The Army's tactical inventories are stored in mobile mini-distribution centers called Supply Support Activities (SSAs) that are part of each brigade-sized unit. Each SSA stocks repair parts and other supplies according to an Authorized Stockage List (ASL) tailored to the maintenance needs of the equipment specific to the unit, within storage constraints. In the late 1990s, the Army was dissatisfied with the performance of its tactical inventories and sponsored research to develop an improved algorithm for use in developing ASLs. In 1998, RAND Arroyo Center developed Dollar Cost Banding (DCB), an algorithm that added consideration of the relative costs of repair parts. DCB tied the decisions of what and how much to stock not only to the benefits produced but also to the resources required. Also, DCB adopted a new method for inventory quantity determination designed to deal better with the highly variable demand for most parts, and it automated criteria for excluding some items from the ASL. After several successful pilots, the Army incorporated DCB into its policies and information systems for inventory management, making it possible for all Army units to use it to create their ASLs. The next step in improving tactical inventories was to incorporate detailed information about which repair parts were most critical to bringing broken equipment back to a ready condition. RAND developed the Equipment Downtime Analyzer (EDA) to archive daily equipment maintenance reports and developed an improved and highly focused list of critical parts. The EDA data was combined with the DCB algorithm to create an approach called Enhanced Dollar Cost Banding (EDCB), which was piloted in 2002 and then applied in Southwest Asia starting in 2004. Using feedback from implementation efforts, it was continuously improved. Then, to address process issues and fully leverage EDCB's potential, the Army instituted a pilot policy in Southwest Asia in 2006 that shifted from SSA personnel determining their own stockage to having a centralized expert team do so, with most recommendations implemented automatically, without review by unit personnel. This has sped the ASL review process, reduced workload in the units, and improved performance consistency across SSAs. RAND continued research on the tactical inventory and developed a new model for computing ASL recommendations called the Inventory Readiness Optimizer with Constraints (IROC), which optimizes ASL effectiveness subject to any number of constraints through mixed integer programming. Thus, in developing an optimal ASL, IROC, which has been piloted for one brigade, is able to take into account still more valuable information, such as the number and volume of storage locations in a specific SSA and the workload associated with changing to a new ASL. Currently, the expert ASL team uses IROC to fine tune the EDCB algorithm. As a result of these cumulative improvements, the performance of Army tactical inventories has risen to an all-time high.

http://www.rand.org/pubs/reprints/RP1272/

Lean Thinking Comes to the Battlefield

Eric Peltz and Rick Eden
***Forbes.com*, June 5, 2008**

In the buildup to its liberation of Kuwait in 1991, the United States moved mountains of supplies to Saudi Arabia. After the war, the U.S. military would begin the shift to a new support paradigm, adapting the lean, best practices of contemporary business. In the mid-1990s the Army and its partner, the Defense Logistics Agency (DLA), embarked on an effort to apply lean thinking to logistics. Focusing first on distributing supplies in the United States, they mapped processes, adopted improved metrics, and formed process-improvement teams supported by analysts and championed by top leaders. Lean combined with systems thinking produced dramatic change. By the end of the 1990s, as the process improvement spirit took hold, metrics drove competition, new initiatives proliferated, and delivery times came down by almost two-thirds. At the same time, the operations side of the Army began to develop a vision: one of agile forces deploying quickly, striking over long distances, and maneuvering flexibly around the battlefield. The strides made in logistics meant Army logisticians involved in Operation Iraqi Freedom planning could start acting on this vision. In fact, they launched the attack into Iraq toward Baghdad with just a few days of supplies on hand in Kuwait.

While there were issues to work through, the new logistics concepts have proved their adaptability to wartime. How far can this lean approach go? The business of war requires extraordinarily careful management of risk. When military supplies run out, the result is not lost sales, but potentially lost lives. Determining the acceptable risk has become a crucial part of military logistics. The difference is that today's inventory buffers are not mountains built to a "just-in-case" standard, but carefully calculated as part of a distribution network able to respond to real-time conditions on the battlefield.

http://www.forbes.com/technology/2008/06/05/military-supplies-business-tech-cx_pe_re_logistics08_0605reinvent.html ■

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