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BRIEFING

Proposed Missions and Organization of the U.S. Army Research, Development and Engineering Command

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RAND ARROYO CENTER

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SUMMARY

The Army Research, Development and Engineering Command (RDECOM) was formally established in March 2004 as a component command of the U.S. Army Materiel Command (AMC).[1] It gathers under its authority the existing Army Research Laboratory (ARL), Army Materiel Systems Analysis Activity (AMSAA), a portion of the Simulation, Training and Instrumentation Command (STRICOM), and some AMC staff, as well as the Research, Development and Engineering Centers (RDECs), collectively referred to in this report as the AMC labs. These organizations comprise most of the Army's organic research and development (R&D) capability, excluding the R&D efforts of the Army medical community, those of the Corps of Engineers, the Space and Missile Defense Command, and the Army Research Institute.

Prior to the establishment of RDECOM, AMC's various laboratories and research centers belonged to a number of the AMC's major subordinate commands or were separate organizations that reported to other Army commands. AMC expects that concentrating its technology staff and organizations under one command—i.e., creating a technical and engineering "center of mass"—should make it easier to coordinate and integrate Army research, development and engineering (RD&E), which should in turn enhance innovation, flexibility, and responsiveness.

Since the Army's recent R&D reorganizing efforts began in the fall of 2002, RAND Arroyo Center has provided support, with analysis focused on the best ways to structure R&D organizations. This briefing continues that support.

The Arroyo study discussed in this report was initiated at the request of the RDECOM commander in the fall of 2003. At that time, four general officer slots were authorized for RDECOM: a major general commander and three brigadier general deputy commanding generals (DCGs). The study problem initially

[1] John C. Doesburg, Memorandum for All RDECOM Employees, Subject: Formal Establishment of the Research, Development and Engineering Command, March 1, 2004, http://www.rdecom.army.mil/letter.pdf (as of April 16, 2004). RDECOM had been operating as a provisional organization since October 9, 2003. Karen Jolley Drewen, RDECOM Magazine, "Transformation Ceremony Marks New Beginning for RDECOM," November 2003, http://www.rdecom.army.mil/rdemagazine/200311/ (as of April 16, 2003).

posed to the Arroyo team was to recommend how best to utilize the three DCGs. However, during the research, the number of DCG slots authorized for RDECOM changed from the initial three to two. The RDECOM commander later asked Arroyo to also provide recommendations for a scenario where there are only two DCGs. Thus, this report presents recommendations to accommodate both three and two DCGs.

RAND ARROYO CENTER APPROACH

Since DCGs will have management responsibilities for some parts of RDECOM, we first needed to determine how RDECOM should be organized to establish what the "parts" should be. We began by looking at the broad RDECOM mission statement and then described four "sub" or component missions that support the main mission. Next, we postulated several organizational designs that would allow RDECOM to fulfill the four component missions. We developed the most promising and identified the lower tiers of the organization.

To achieve these results, the researchers called on their combined expertise, developed from previous Arroyo studies and many years of work on R&D and organizational issues in the Army and the private sector. The team interviewed a variety of experts and staff from the Army and other organizations,[2] and brainstormed ideas internally and with Army personnel. The team also used the RAND-developed "strategy-to-tasks" framework.[3] This framework was originally designed for making resource and task planning decisions, but it was modified to make the organizational decisions required by this study. The modified framework provides a methodical way of thinking about the problem and begins at the top, in a common sense way, by asking: What is it that RDECOM should do? What is its mission? This kind of high-level strategic view is critical for determining how RDECOM should be organized and managed.

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[2] Interviews were conducted with the senior leadership of RDECOM, members of some of its component organizations, and of some of the external organizations with which RDECOM interfaces.

[3] Glenn A. Kent, *A Framework for Defense Planning*, Santa Monica, CA: RAND Corporation, R-3721-AF/OSD, 1989.

RDECOM MISSIONS

We worked with what we already knew about the Army and the goals of the new RDECOM to identify four major roles, or component missions, for RDECOM. We also considered RDECOM's stated mission: "To get the right integrated technologies into the hands of warfighters quicker." The four component missions are as follows.

1. RDECOM must provide technical support to all current Army and joint forces operations. This means helping to meet the needs of all commands that are out in the field now, whether they are training, warfighting, or peacekeeping.
2. RDECOM must provide support in the near and middle term to the Army acquisition community (the Army Program/Project/Product Managers [PMs] and others who are responsible for actually acquiring materiel) in matters of science and technology development, engineering, and systems integration. This support includes conducting leading-edge R&D work within the Army and in conjunction with contractors, and acting as consultants to make the Army "a smart buyer" as it chooses what to buy and negotiates contracts with Army suppliers and outside contractors.
3. RDECOM must be part of the process that creates the Army's vision of the future. It will work with Army military scientists and doctrine planners (in U.S. Army Training and Doctrine Command and other organizations) by providing a technical vision that both supports future warfighting requirements and creates opportunities for developing new ideas about how the United States can fight its wars.
4. RDECOM must attend to the planning, management, and oversight of all Army-funded research programs (other than those managed by the Army Corps of Engineers, the Army medical community, the Space, Missile and Defense Command, and the Army Research Institute).

USING A MATRIX ORGANIZATION TO ACHIEVE RDECOM'S MISSIONS

RAND Arroyo Center proposes a matrix organizational structure for RDECOM as the archetype that will best enable it to accomplish its mission. A matrix is one type of structure for arranging teams or groups of people representing various functions of a company or other organization. In a matrix organization,

divisional groups are made up of multi-disciplinary teams and task forces integrated from across many functional groups. Task force and project managers span the boundaries across departments and operate as integrators; they understand the problems of various groups and foster solutions that are mutually acceptable.

The matrix structure was first developed in the aerospace industry. It has been successfully employed in many industries and by many companies, including Pittsburgh Steel, IBM, Unilever, and Ford. Each of these organizations fine-tuned the matrix to suit its particular goals and cultures, as we have done in adapting the generic matrix concept to the missions of RDECOM.

The alternatives to a matrix structure include the traditional functional and divisional organization structures. In the functional organizational structure, departments are created around specific functions, such as marketing, sales, R&D, engineering, and manufacturing. In the divisional organizational structure, departments are created around the organization's intended outcomes, such as products, services, or programs.[4] High internal efficiency and technical quality are characteristic functional strengths, whereas flexibility, speedy decisionmaking, and high adaptability to environmental changes are qualities of a divisional organization.

A matrix organization that harnesses the advantages of the functional and divisional organization structures can address complex technical issues (via matrix support groups) at the same time that it focuses on the unique requirements of its customers (via mission- or project-dedicated groups). Furthermore, a matrix is an excellent example of an organization with a strong component of lateral decisionmaking and "top-down/bottom-up" information flow (where communication flows from management down through the ranks and from lower-level staff up to management). Such structures enable an organization to become adaptable to continuous changes in its environment.[5] A matrix organization also:

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[4] Richard Daft, *Organization Theory and Design*, 7th edition, Cincinnati, OH: South-Western College Publishing, 2001, pp. 214–220.

[5] Jay R. Galbraith, *Designing Organizations: An Executive Briefing on Strategy, Structure and Process*, San Francisco, CA: Jossey-Bass Publishers, 1995, pp. 41–47.

- Leads to a more balanced top-down/bottom-up R&D planning and budgeting process and, as a result, a more strategic view of research, development and engineering (RD&E) for the current and future Army.
- Allows better leveraging and more efficient use of RDECOM resources, such as flexibility of staff deployment in accordance with current needs.
- Allows adaptability and coordination when nonroutine technologies have to be mastered both within and across functions to respond to rapidly changing Army needs, Department of Defense (DoD) policies, and technology trends.
- Promotes the exchange of ideas and networking across RDECOM.
- Breaks up stovepipes—i.e., groups that are organized around narrow, highly specialized functions—and fosters collaboration among diverse functional groups to encourage network-centric and system of systems expertise and approaches.

A matrix organization has a few disadvantages as well. They include potential employee confusion in working for several "bosses" (because they report to one or more project managers *and* the manager of their functional group). Also there is some expense to train the workforce—in particular middle management—in teamwork techniques.[6] However, we strongly believe that the advantages largely outweigh the disadvantages.

Four Possible Matrix Organizations

We propose four alternative matrix organizational structures: two with three DCGs and two with two DCGs.

Model 1

The first proposed matrix organization has three DCGs.

DCG Operations manages the Army's technical requirements for current operations and fielded materials, i.e., component mission 1. Under the DCG Operations are the:

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[6] Daft, pp. 228–229, and Stanley M. Davis and Paul R. Lawrence, *Matrix*, Reading, MA: Addison-Wesley Publishing Company, 1977, chapter 6.

- Agile Development Center (ADC). ADC will bear primary responsibility for managing quick-response projects to address immediate warfighter needs.
- Office for Field Assistance in Science and Technology (FAST). The FAST will provide technical personnel to work with Army and joint commands to provide the commanders of those units with technical advice and a gateway to the Army's science and technology (S&T) community.

DCG System of Systems primarily manages RDECOM's mission of supporting materiel acquisition programs that will impact the Army in the near to middle term, i.e., component mission 2. Under the DCG System of Systems are the:

- System and System of Systems Process Institute, which is the Army's repository of best practices and tools for training and certifying systems and system of systems professionals.
- Joint Technology Integration Office.
- Modeling and Simulation and Software Office.

DCG Army of the Future focuses on those mission areas that deal with longer-term materiel and system goals, i.e., component missions 3 and 4. This DCG will be responsible for the:

- Technology Mining Center (TMC).
- Science and Technology Planning, Budgeting, and Oversight (S&T PBO).

Matrix support organizations, namely, the Army Materiel Systems Analysis Activity (AMSAA), the Small Business Innovation Research (SBIR) office, the Army Research Laboratory (ARL), the Army Research Office (ARO), and the six new Research, Development and Engineering Centers (RDECs), will be directly overseen by the commanding general.

Model 2

The second option with three DCGs is identical to the first except for the addition of a Deputy for Engineering and Technology to oversee the functional organizations that are directly under the commanding general in model 1. This will relieve the RDECOM commander of the day-to-day management responsibilities of these functional organizations to better focus on strategic concerns.

Models 3 and 4

The third and fourth options assume the presence of only two DCG positions. We take the view that while having three DCGs would be best, RDECOM could function effectively with only two DCGs. We would merge Operations and System of Systems and assign oversight of both areas and the organizations under each to one DCG, "DCG Systems and Operations." This arrangement creates an area with substantial responsibility, but the advantage is that it collects those missions that require support and collaboration with program, project, or product managers under one DCG. Funding management is also less complicated because most activities under Systems and Operations are customer funded,[7] while the Army of the Future's funding comes primarily from the RDECOM core budget.

What distinguishes between models 3 and 4 is the presence of a Deputy for Engineering and Technology in one but not the other. Just as in model 2, the Deputy for Engineering and Technology will be responsible for the day-to-day management of the matrix support organizations within RDECOM, namely, AMSAA, SBIR, ARL, ARO, and the RDECs, to provide some relief to the RDECOM commanding general.

DCGs Would Promote RDECOM Component Missions

In each of the four proposed matrix organizations, we outline what role each DCG would play in fulfilling the four component RDECOM missions. This outline ensures the most effective use of DCGs, highlights where overlaps occur, and clarifies the relationships among DCGs when overlaps occur; i.e., it specifies who has lead authority and who assumes support responsibilities. For example, for the first two proposed matrix organizations involving three DCGs (models 1 and 2), we allocated missions as indicated in Table 1.

[7] Customers are typically Army acquisition program managers, though other customers, such as other, non-Army service laboratories and program managers, often request and pay for RDECOM support.

Table 1

Mission Allocation

RDECOM Missions	DCG Operations	DCG System of Systems	DCG Army of the Future
1. Provide technical support to current operations	Primary responsibility	Secondary responsibility	Tertiary responsibility
2. Provide technical support to Army acquisition programs	Primary responsibility (Post-FUE)* Tertiary responsibility (Pre-FUE)	Primary responsibility (Pre-FUE) Tertiary responsibility (Post-FUE)	Secondary responsibility
3. Provide technical vision for the future	Tertiary responsibility	Secondary responsibility	Primary responsibility
4. Attend to the planning and management of future Army research	Tertiary responsibility	Secondary responsibility	Primary responsibility

* After newly developed systems achieve First Unit Equipped (FUE) status, i.e., they have been fielded for the first time with at least one unit.

Impacts of a Matrix-Type Organization

Building a matrix organization for RDECOM will have many important consequences, including the following.

- A top-level consolidation of planning, budgeting, and oversight under the DCGs.
- Improved support for Army acquisition programs by having clear lead authorities assigned to work with program/project/product managers.
- Distribution of the current system of systems integration staff among the DCGs.
- An integrated system and system of systems focus for all program phases.
- Releasing the commanding general from the day-to-day management of the matrix support organizations within RDECOM (in models 2 and 4).

- Focused reporting structure with each DCG responsible for a specific subset of RDECOM missions.
- Adding staff for the DCGs. These personnel would primarily come from RDECOM's laboratories and centers. Adding the DCGs to RDECOM and making them responsible to the RDECOM commander for managing and coordinating the organization's primary missions means that much of this load is removed from the laboratories and centers. As a result, many of the personnel who currently work for the laboratories and centers as marketing specialists, planners, and coordinators should be available to the DCGs.

RECOMMENDATIONS

RDECOM must add value to the Army's R&D efforts for it to succeed. It will do so if it strengthens the Army R&D community's system of systems orientation and the Army's ability to adapt quickly to changes in technology and to warfighting and soldier requirements. We believe that the matrix-type structure we propose would enable RDECOM to provide the research, development and engineering integration, flexibility, and responsiveness critical to our engaged and transforming Army.

A number of strategies should be effective not only for implementation of the matrix model, but to give it every chance to succeed in the long term. In general, these strategies fall into four broad categories: communication; rewarding desired behaviors; establishing metrics to measure success; and allocating adequate resources. Specifically, the Army should consider the following.

- Actively interface with the Army, DoD, other federal agencies, academic and industry organizations, and individuals to influence R&D policy, highlight RDECOM capabilities and successes, and identify and contribute innovative ideas for using technology to address Army needs, among others.
- Make RDECOM an adaptive organization that can stay relevant in a rapidly changing technical world by nurturing the matrix organizational model, providing opportunities for staff to challenge conventional thinking, and creating an institutional culture that rewards improvement and innovation.
- Search for and implement measures to monitor and promote improvement.
- Recruit and maintain a dynamic and highly qualified workforce.

- Plan and invest in Army RD&E infrastructure, and workforce education and training.