# MAINTAINING THE GOVERNMENT'S ABILITY TO BUY SMART

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Today, the Department of Defense possesses a competent "smart buyer" (SB) capability. But unless corrective measures are soon taken, the effect of downsizing the federal government workforce may undermine future SB capability. Three measures will prevent this from happening: the Department of Defense must establish and maintain collaborative research environments; it must try to ensure that work environments encourage direct and open communications among the players; and it must maintain a talented technical staff of scientists and engineers by exploiting the full range of recruiting tools and implementing career development opportunities.

Today the Department of Defense's (DoD's) "smart buyer" (SB) capability—its in-house technical expertise to stand up to its industry counterparts when dealing with technical issues of the conceptual design, research and development (R&D), and procurement of new military systems—is sufficient. Although the DoD's SB capability involves the integrated efforts of many disciplines within each Service (including those with technological, engineering, legal, procurement, management, and funding expertise), this article focuses only on technical expertise, defined as technological, scientific, engineering, and mathematical skills. Unless otherwise noted, SB capability will be used as shorthand for only the technical element of an overall SB capability.

The technical element is provided mainly by the technical staff at each Service's R&D organizations. Their expertise helps the Services' concept and materiel developers conceive, formulate, and execute materiel programs. In the context of this article, the term "smart buyers" (SBs) refers to in-house technical personnel who, by contributing their individual specialized expertise, collectively represent a smart buyer capability.

The DoD must maintain an SB capability because technological superiority is a mainstay of this nation's overall defense

strategy. The Army's case illustrates technology's lead role in our nation's defense. The Army is relying more and more on advanced technology to modernize its force structure. For example, the Army XXI force will evolve combat through enhanced battlefield awareness via information technology. The Army After Next (AAN) force will go farther and be a revolutionary, technology-driven future force. Planning for AAN is the major driver of Army science and technology (S&T), and the Army needs knowledgeable government scientists and engineers (S&Es) who are closely attuned to state-of-the-art developments if it is to fully exploit the technology advances that AAN will require.

The government has been keenly aware of the importance of the SB function for many years. The landmark 1991 Federal Advisory Commission listed 15 principal study findings. The first and foremost of those findings states that the mission of defense laboratories is to provide the technical expertise that enables the Services to be smart buyers and users of new and improved weapon systems and support capabilities.[1] In addition, our recent survey of acquisition workers within the Army and opinions collected from industry representatives both support the position that a capable SB function is vital and must be maintained.

## Shrinking Personnel Pool Threatens SB

The SB problem that will soon face the DoD stems from a shrinking pool of civilian S&Es. Since the SB function is an inherently governmental function, its capability is dictated by the size (and quality) of the government civilian workforce.[2] Civilian S&Es who help perform the SB function make up a large portion of the DoD's civilian workforce.

Currently, there is a trend toward downsizing all government civilians, including S&Es. For example, in 1991, the total number of S&Es in the Army was 16,600. By the end of 1998, the number had decreased to 14,330.[3] The projections for the future are for even lower levels.[4] These reductions are the result of mandated personnel caps and are mirrored by similar S&E reductions in the other Services. These S&E personnel cuts run counter to maintaining an adequate SB capability: They can result in personnel turbulence, loss of technical expertise or critical mass in technology areas, poor staff morale, and fragmented work. Unfortunately, the DoD has to assume that these cuts will continue. The National Defense Authorization Act for Fiscal Year 2000 specifies further reductions for fiscal years 2000 and 2001.[5]

This article draws on current and ongoing research to identify how changes and efficiencies in the SB capability and workforce can counteract the effects of fewer personnel; it then makes some recommendations to improve the current situation.

## What Is Needed to Maintain and Strengthen SB Capability?

Before we can recommend specific corrective actions, we need to discuss what is needed to maintain and strengthen the DoD's SB capability. Our SB research over the past several years indicates that three ingredients are required to provide a good SB capability:

- a collaborative research environment;
- communication among SBs and concept and materiel developers; and
- a cadre of talented and trained technical staff.

In this section we will summarize our research findings on each of these ingredients and discuss their implications for the SB problem.

### Collaborative Research Environment

S&Es must be knowledgeable about all aspects of their rapidly changing technological fields. This means knowing what is happening in their own laboratories as well as in those of other Service and government agencies, academia, and industry. A collaborative research environment essentially forces the S&Es to be aware of what is going on outside their own organizations.

Support for this important observation is provided by studies on performing collaborative research with nontraditional military suppliers and on other forms of collaborating and partnering.[6] This point is also acknowledged in government studies of military laboratories. A good example is the National Research Council's recent assessment of the Army Research Laboratory (ARL).[7] This study notes that to perform its mission, ARL must have professional staff members aware of research outside its organization. Insularity from the outside hurts its ability to support the Army with state-of-the-art technical expertise.

All the studies are in general agreement that wide exposure to the development of technologies outside one's own organization is a key ingredient for keeping current about technological advances and honing one's SB skills. This outside exposure can be obtained by conducting collaborative efforts with other government laboratories, academic institutions, and private industry.

Although each Service is currently performing some valuable collaborative efforts with industry through cooperative research and development agreements and cooperative agreements, more opportunities exist for joint Service-government a-gency collaborations and collaborations with industry. We believe the key to forming these new collaborations lies in exploiting acquisition reform initiatives. These initiatives include establishing joint ventures with industry, using "other transaction" contractual instruments, establishing recoupment arrangements when spinoff commercial entities are formed, requiring cost-sharing with in-dustry, and exploiting revenue-generation opportunities using their infrastructure and intellectual property assets.

"Our research has shown that industry is willing to partner with the government if a collaborative atmosphere is maintained."

Our research has shown that industry is willing to partner with the government if a collaborative atmosphere is maintained. A major obstacle to collaboration with industry seems to be the Services' reluctance to embrace these new acquisition reform initiatives. To break down this resistance, cultural barriers need to be removed. Education and training must be provided to all laboratory personnel—S&Es, legal counsel, contracting, and

management. The Services must educate their work-forces about the benefits of the acquisition reform initiatives much in the way they have handled military specifications and integrated product teams (IPTs). In particular, the Services must place emphasis on the various initiatives currently available and show how they can be used to form collaborative research efforts.

"Although proximity is usually desirable, what is more important is the directness of the reporting channels."

### Communication Among Smart Buyers and Concept and Materiel Developers

Each Service's concept and materiel developers must have access to the SBs. It does not do any good for the Army, Navy, or Air Force to have the brightest and most knowledgeable SBs in the government if their talents are not used by the concept and materiel developers. To be effectively used, the SBs must be closely coupled to the Service's users with two-way communications in place.[8]

The Service laboratories need to provide the SB function to the concept developers and complement the technical expertise of the materiel developers. While generally effective, in some cases the SB communication channels pass across different command structures (e.g., going up one command ladder, across to another, and down to the SBs). In these cases, more direct communication channels are desirable. This does not necessarily imply that physical proximity is needed. Although proximity is usually desirable, what is more important is the directness of the reporting channels.

The usefulness of the SB information, however, is not determined solely by whether or not direct communications channels exist. Equally important is how effectively SBs are being used. Effectiveness is dictated by many factors, including the organizational relationships between the SBs and the users, the goals and objectives of the laboratory management, and the users' specific needs.

Our research has addressed organizational restructuring that enhances communication channels and effective information exchange. In some cases, new organizational reporting chains are needed, while in other cases, streamlined communication channels appear sufficient.

### Cadre of Talented Technical Staff

The third ingredient to providing a good SB capability involves people. Each Service must have a talented technical staff of S&Es available to maintain a competent SB capability. This means each Service needs to acquire, sustain, train, and develop technically competent S&Es and also be able to separate less productive staff. These tasks are complex and especially challenging in a period of downsizing.

Because the civilian S&E personnel issues facing the Services are multifaceted, we will first discuss some of the underlying problems and then describe the analyses we have performed to help better understand them. Our research focused on the Army, but our insights are applicable to all the Services.

**Some Army personnel issues.** The civilian personnel issues facing the Army

are numerous, as illustrated by the staffing statistics of S&Es at two Army laboratories. Figure 1 shows that at ARL, the population of S&Es is bimodal in age distribution. The first peak occurs around age 36, with very few staff members under 30. This suggests that few new S&Es are being hired after college graduation, which means there is a small "feeder group." Also, as the figure indicates, the distribution of grade levels at ARL has bunched at General Schedule (GS) grade 13. Finally, as shown in the bottom of the figure, approximately 65 percent of the ARL separations in the period fiscal year 1993 to fiscal year 1997 were voluntary (including retirements), while only 8 percent were involuntary (the result of individual removals or reductions-in-force). This suggests that many of ARL's voluntary departures may have included highly qualified and talented S&Es.

The Army Research, Development, and Engineering Centers (RDECs) are facing their own personnel problems. Data for the Tank-Automotive RDEC (TARDEC) are shown in Figure 2.

While the S&Es at the TARDEC and ARL have different age distributions, both laboratories are experiencing a bunching of GS grade levels, and most separations are voluntary. The age distribution of S&Es at the TARDEC shows a similar bimodal shape, although the distribution is not as pronounced as ARL's. In addition, unlike at ARL, at TARDEC many of the S&Es are young enough that a reasonably-sized feeder group (S&Es from 21–34 years of age) exists. This is partly because of TARDEC's successful cooperative program

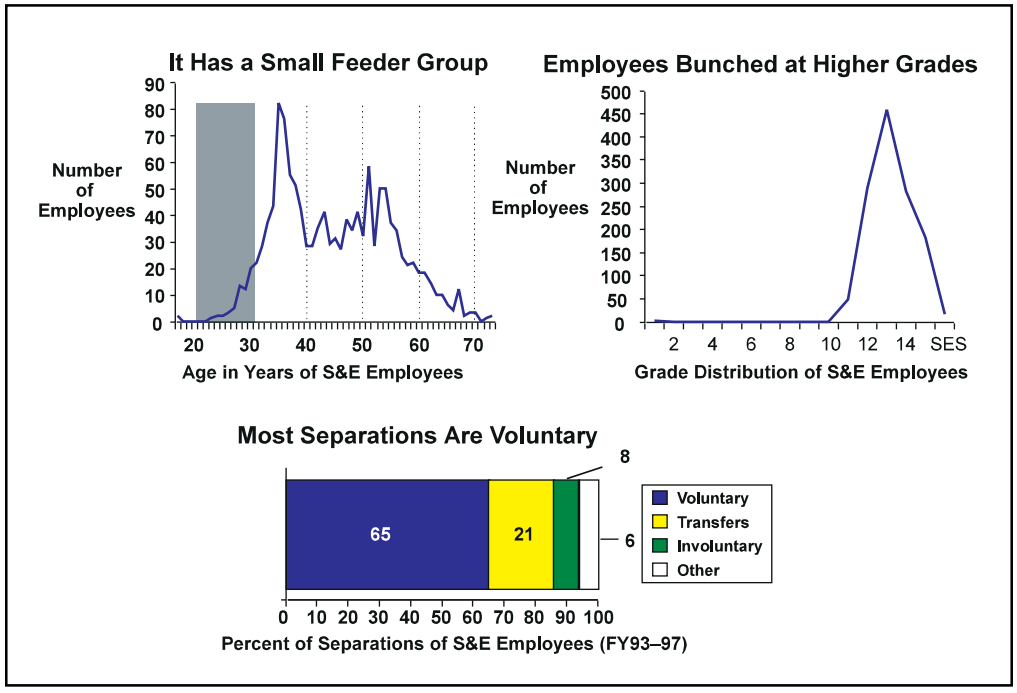


Figure 1. ARL Is Facing Serious Personnel Problems

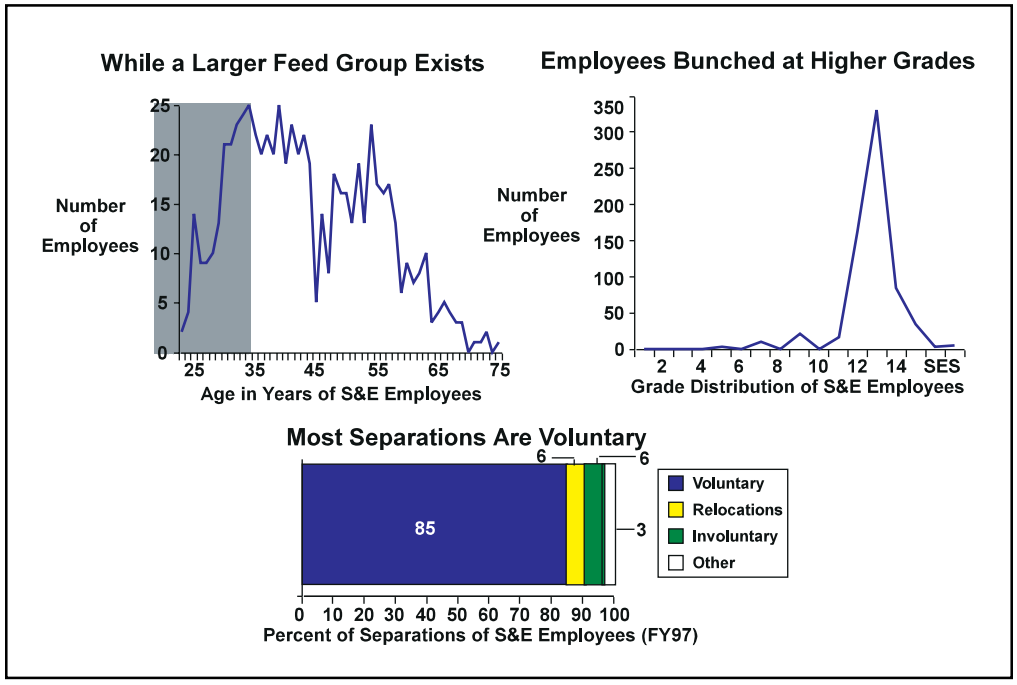


Figure 2. RDECs Face Related Problems

and the TARDEC University. Like ARL, however, there is a bunching at the GS–13 level, and the number of voluntary separations is very large. Personnel out-briefs at the TARDEC suggest that many S&Es are leaving because positions with greater responsibility and higher salaries are currently available in industry.

**Analysis of personnel reform initiatives.** To gain a better understanding of the Army's S&E personnel situation, we performed two types of analyses. First, we assessed the potential of the various personnel reform initiatives currently being tested within the government that are designed to help alleviate some of these civilian personnel problems. Some of these initiatives are part of the new personnel demonstrations authorized under the National Defense Authorization Act. Others are techniques and instruments that have already been approved but are infrequently used by laboratory managers (e.g., recruitment or relocation bonuses).

New initiatives are also being examined as part of the DoD Acquisition Workforce Personnel Demonstration Project and the Army S&T Reinvention Laboratories demonstrations. In addition to these congressionally authorized demonstrations, other personnel programs have recently been approved. All in all, there are about 50 personnel reform initiatives in the hopper.

We assessed the effectiveness of these initiatives, grouping them into four generic force-shaping areas: acquire, sustain, train and develop, and separate. We then evaluated each initiative by assessing how well it addressed specific concerns. For

example, in the sustain area, we considered whether the various initiatives would:

- stop voluntary departures of experienced personnel;
- reduce the industry pay gap;
- stop GS grade-level bunching;
- increase morale; and
- improve flexibility and prioritization in work assignments.

Based on our analysis, we have found effective personnel reform initiatives in all four force-shaping areas. Some of the more important initiatives in each area relevant to civilian S&Es are shown in Table 1.

## Analysis of SB Development and Training

The second analysis we performed specifically addressed the training of SBs: In particular, we sought to find out what S&Es must do to become good SBs. We performed this analysis by surveying Army acquisition staff members who either performed the SB function or used the SB products. Fifty-five staff members were surveyed from a half-dozen Army R&D organizations; they included program managers, ARL S&Es, and RDECs S&Es. Management selected these personnel as being either examples of good SBs or knowledgeable about what it takes to be a good one. The survey findings were supplemented with reviews of past studies, telephone interviews of selected staff from ARL and some RDECs, and transcripts

Table 1. Important Personnel Reform Initiatives

| Force Shaping Area | Initiative |
|---|---|
| Acquire | Special pay scale<br>Recruitment bonus<br>Relocation bonus<br>Co-op/intern programs |
| Sustain | Retention allowance<br>Pay broadbanding[a] |
| Train and Develop | Fellowship programs<br>Postdoctoral studies |
| Separate | Voluntary separation incentives<br>Voluntary early retirement<br>Voluntary emeritus program |

[a] Broadbanding refers to a situation where several GS grades are combined into a band with no steps, meaning that movement through a band is tied to performance, not just seniority.

from recent Army Materiel Command (AMC)-conducted interviews of selected acquisition personnel in the Army, the Office of the Secretary of the Defense, and industry.[9]

Respondents were asked, for example, to "Please rank the factors contributing to the quality in your smart-buyer personnel: (education, recent experience as a performer of research, general engineering experience, and industrial experience." Respondents were asked to list other factors; none did. Thus we conclude that all the important factors were considered in the survey.

Figure 3 is a summary of the responses to this question. Surprisingly, no one factor clearly stood out as being the most important to maintaining one's SB capability. A general engineering experience is the most important of the four factors, while industrial experience is the least important. Recent hands-on research and education fall somewhere in between.

These results suggest that to train civilian S&Es to be good SBs, the Service laboratories must provide opportunities for staff members to engage in each activity. In some cases, changes in the way research is performed at a laboratory will help satisfy the SB training needs. For example, by performing more collaborative research (as discussed above), S&Es will be able to gain industrial experience through assignments with industrial teams. Off-site exchange programs with industry and exposure to industrial operations and research practices can also provide valuable industrial experience.

S&Es must also be given opportunities to perform hands-on research. While there is increased pressure today to outsource more and more government activities,

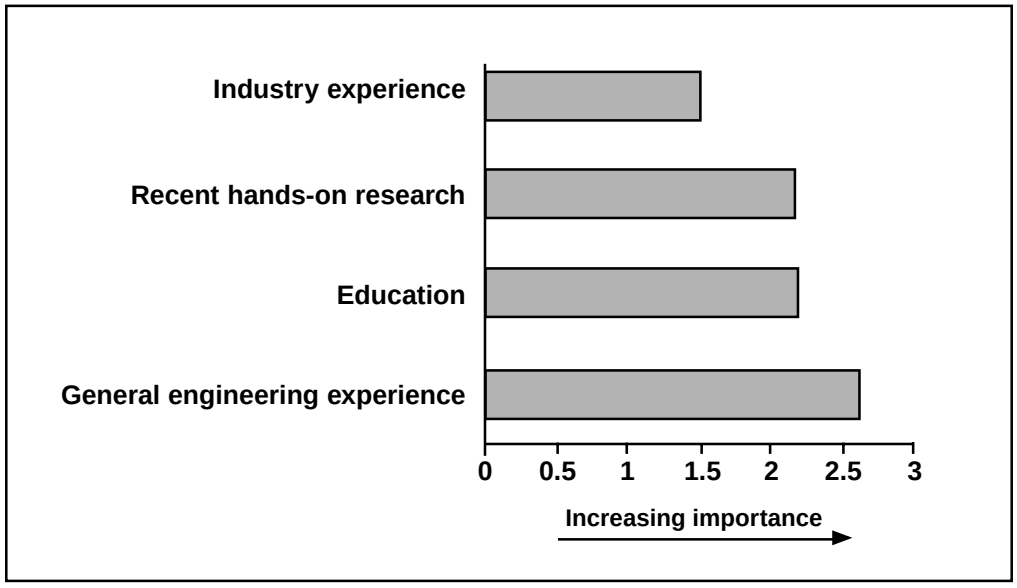


Figure 3.
Relative Importance of Key Factors in Maintaining SB Capability

including more of the Service's science and technology, if carried too far this practice could hurt SB capability by reducing opportunities for S&Es to gain hands-on research experience. For example, the AMC already outsources about two-thirds of its science and technology budget. If outsourcing of science and technology continues and is overdone or done unwisely, SB capability will likely degrade. Instead of keeping up with state-of-the-art technology developments through performing hands-on research, the government S&Es will be relegated to the role of monitoring the contractor's work (and steadily losing the technical capability to perform the work) and performing other nonresearch-related administrative and oversight functions.

The importance of education means that efforts are needed to seek top-notch technical talent from ranking colleges and universities using all the available recruiting tools. Intern and co-op programs (as shown in Table 1) also provide a mechanism for obtaining qualified recruits from local or regional colleges. S&Es should also be given the opportunity and the encouragement to obtain advanced degrees and take sabbaticals with other Service and government agency laboratories, universities, and industry.

With regard to general engineering experience, S&Es should be given career-enhancing work assignments to expand their engineering experiences. Such assignments can be a part of each S&E's career plan.

Another issue addressed in our survey was the recognition of outstanding SB performance. Based on the survey results, we believe the Army laboratories may inadvertently be sending conflicting messages about how they value SBs. While smart buyer activities are recognized as important because they promote good relations with the customers and keep the laboratory recognized as relevant, it is not apparent that the SB efforts of the Army's S&Es are always adequately acknowledged.

A cursory examination of achievement award programs suggests that awards are given for performing publishable experimental and theoretical research. For example, of the 27 Army R&D Achievement Awards for 1996, none were given for performing an outstanding job as an SB. Similarly, an assessment of the Communications-Electronics Command (CECOM) awards for the same year showed that none of the 13 awards was given for exceptional SB performance.

"The importance of education means that efforts are needed to seek top-notch technical talent from ranking colleges and universities using all the available recruiting tools."

## What Can Be Done to Improve the Situation?

Our discussion shows that a work environment that includes collaborative efforts with all segments of the government and industry fosters the awareness and exposure to technological advancements that S&Es need to maintain and develop their smart-buying skills. In addition, a working atmosphere that encourages open and direct communications among the concept and materiel developers allows both SBs and developers to hone

their skills and effectively use each other's talents to benefit the nation's defense. While a collaborative work environment that encourages direct communications would be desirable under any circumstances, its existence is essential when personnel ceilings, recruiting difficulties, and fierce competition for S&Es from the private sector threaten to degrade the DoD's SB capability.

The DoD must establish a strategic approach to help mitigate the effects on its SB capability of government downsizing, recruiting impediments, and rivalry for S&Es. Based on our analysis and ongoing research in this area, we recommend that the DoD's approach include the following elements.

"Work environments must ensure that SBs, concept developers, and materiel developers can easily communicate with one another."

**Establish work environments that contain substantial amounts of collaborative efforts.** R&D organizations should be encouraged to perform more collaborative research with other Services, government agencies, and private industry. This will entail implementing new ways of doing business using acquisition reform initiatives that permit leveraging the other Services and government agencies and partnering with industry. Collaborations will help guarantee that the technical staffs involved in the smart-buying process are aware of what is going on elsewhere in their technical fields. Such a collaborative atmosphere, along with techniques such as the use of postdoctoral scholars and Intergovernmental Personnel Act (IPA) employees, will allow SBs to increase their technical competence and currency.

Each Service must take several steps to effectively expand its collaborative research efforts with industry.[10] First, each Service must identify technology areas where collaborative efforts overlap with industry (e.g., align Army technological objectives with the company's strategic goals). Next, the Services must proactively seek industrial partners through aggressive "marketing" techniques that include understanding the company's market niche and strategic goals. Finally, the Services must be willing to be flexible in negotiating with candidate industrial partners (e.g., minimizing burdensome oversight and regulations).

**Ensure that work environments encourage direct and open communications among SBs, concept developers, and materiel developers.** Military strategists and program managers or program executive officers (PEOs), along with the military R&D organizations, should work together to ensure open and direct communications channels. Work environments must ensure that SBs, concept developers, and materiel developers can easily communicate with one another. Such efforts might entail developing organizational realignments that provide close two-way SB communications. Emphasis should be placed on eliminating complicated mazes of reporting structures that hamper access.

**Maintain a cadre of talented technical staff.** The Services must successfully accomplish three tasks to maintain a cadre of talented technical staff. First, the Services should exploit the full range of recruiting tools to attract the most promising candidates. Personnel reform initiatives

include a number of tools available for attracting these individuals. Intern programs—such as the Career Related Experience Science and Technology (CREST) program, which provides summer and part-time employment to undergraduate and graduate students, the Student Temporary Employment Program (STEP), and the Student Career Experience Program (SCEP)—appear to be successful and should be continued. Other tools, such as recruitment bonuses, have rarely been tried, and some pilot trials with these tools will help establish their role in successful recruiting practices.

Second, the Services should implement career development opportunities to ensure that employees have all the skills to perform the SB function. This means providing all S&Es with opportunities to acquire the four proficiencies necessary to becoming a good SB. In particular, the Services must provide opportunities for S&Es to acquire industry experience, perhaps through industry exchange programs and well-designed collaborative projects.

S&Es must also be able to devote a portion of their time to performing hands-on research. To ensure ample opportunities to gain this experience, the Services must devise criteria for determining what and how much R&D should be kept in-house and what can be outsourced. S&Es must be able to acquire the required level of education in their fields. The Services and their workers will mutually benefit if the Services encourage and support education at the nation's top universities. Finally, S&Es need general engineering experience. The Services can ensure this requirement is met through a well-planned series of work assignments.

Third, the Services must create influences that will encourage talented and promising SBs to stay. The Services must ensure that career advancement opportunities are available to its S&Es. Reform initiatives such as pay broadbanding will help, but more innovations may be needed. In addition, the Services must ensure that tangible recognition of good smart buying adequately reflects the importance of this capability. For example, criteria for salary increases, promotions, and awards may have to be defined, established, or revised to better tie outstanding performance of smart buying to these rewards.

If these actions are implemented, then the DoD's SB capability will not only be maintained, it will be strengthened, and the nation will benefit.

**AUTHORS' NOTE**

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## ENDNOTES

1. Federal Advisory Commission on Consolidation and Conversion of Defense Research and Development Laboratories. (1991, September). *Report to the Secretary of Defense*. Washington, DC: Author.

2. For a variety of reasons, the SB function should not be outsourced. For example, it would create conflicts of interest, result in a loss of user understanding or institutional memory, result in torn loyalties between satisfying a contractor's financial goals and the government's materiel needs, or lead to proprietary concerns by other contractors.

3. Career Program 16 (engineers and scientists in nonconstruction), data provided by Office of the Deputy Assistant Secretary of the Army (Civilian Personnel Policy).

4. For example, the S&Es at Army Materiel Command (AMC) are likely candidates for future cuts. The AMC response to the Defense Reform Initiative Directive No. 20 (DRID No. 20) has indicated that 73 percent of the S&Es at AMC are listed as "subject to review," meaning that their jobs could be replaced with contracted workers. For consistency across major commands, the AMC position was changed by the Department of the Army to 15 percent; however, the Office of the Secretary of Defense may change this percentage again to achieve leveling across the Services.

5. Section 922, "Defense Acquisition Workforce Reductions," of the National Defense Authorization Act for Fiscal Year 2000 specifies reductions in the Department of Defense acquisition workforce. SBs, and S&Es in particular, are part of that workforce. Although the law does not specify the exact number of S&E positions to be eliminated, it is reasonable to assume that some of the reductions will be S&Es. Similar indications of S&E reductions reside in AMC's plans to eliminate 10,000 civilian jobs in the next several years.

6. Horn, K. et al. (1997). *Performing collaborative research with nontraditional military suppliers* (Report MR-830-A). Santa Monica, CA: RAND; Wong, C. (1998). *An analysis of collaborative research opportunities for the Army* (Report MR-675-A). Santa Monica, CA: RAND; Chang, I. et al. (1999). *Use of public-private partnerships to meet future Army needs* (Report MR-997-A). Santa Monica, CA: RAND.

7. Army Research Laboratory Technical Assessment Board, Commission on Physical Sciences, Mathematics and Applications, National Research Council. (1998). *1997 Assessment of the Army Research Laboratory*. Washington, DC: National Academy Press. (Also summarized in *Defense Week*, 1998[February 23], 15.)

8. This finding is a fundamental tenet of communications theory (see, e.g., Burke, K. [1969]. *A rhetoric of motives.* University of California Press, p. 39.) We have addressed some of the associated issues in Chang, I. et al. (1999). *Use of public-private partnerships to meet future Army needs* (Report MR-997-A). Santa Monica, CA: RAND.

9. *Assuring adequate Army capability in science and technology.* (1998, July). Army Materiel Command (video format).

10. As a result of interviews with leading-edge information technology (IT) companies, we have gained insight into what is required to attract nontraditional military suppliers, such as IT companies, to work for the government. (See K. Horn, et al. [1997]. *Performing collaborative research with nontraditional military suppliers* (Report MR-830-A). Santa Monica, CA: RAND.

## BIBLIOGRAPHY

Army Research Laboratory Technical Assessment Board, Commission on Physical Sciences, Mathematics and Applications, National Research Council. (1998). *1997 Assessment of the Army Research Laboratory.* Washington, DC: National Academy Press.

Brown, A. (1998, August). *Reinventing government research and development: A status report on management initiatives and reinvention efforts at the Army Research Laboratory* (ARL-SR-57). Adelphi, MD: Army Research Laboratory.

Chang, I., et al. (1999). *Use of public-private partnerships to meet future Army needs* (Report MR-997-A). Santa Monica, CA: RAND.

Committee on Alternative Futures for the Army Research Laboratory Board on Army Science and Technology Commission on Engineering and Technical Systems. (1994). *The Army Research Laboratory alternative organizational and management options.* Washington, DC: National Research Council.

Crawford, M. (1998, February 23). NRC identifies weaknesses in Army Research Laboratory. *Defense Week,* 15.

*Defense acquisition organizations: Status of workforce reductions* (GAO/NSIAD-98-161). (1998, June). Washington, DC: U.S. Government Accounting Office.

Federal Advisory Commission on Consolidation and Conversion of Defense Research and Development Laboratories. (1991, September). *Report to the Secretary of Defense.* Washington, DC: Author.

Horn, K., et al. (1997, November-December). Conducting collaborative research with nontraditional suppliers. *Army RD&A,* pp. 39–41.

Horn, K., et al. (1997). *Performing collaborative research with nontraditional military suppliers* (Report MR-830-A). Santa Monica, CA: RAND.

Horn, K., et al. (1999). *Maintaining the Army's "smart buyer" capability in a period of downsizing* (White Paper WP-120). Santa Monica, CA: RAND.

National Defense Authorization Act for Fiscal Year 2000. Pub. L. No. 106-65.

Office of the Under Secretary of Defense for Acquisition and Technology. (1998, June). *Report of the Defense Science Board (DSB) Task Force on the defense science and technology base for the 21st century.* Washington, DC: Author.

Secretary of Defense. (1998, April). *Report to Congress: Actions to accelerate the movement to the new workforce vision.* Washington, DC: Author.

Wong, C. (1998). *An analysis of collaborative research opportunities for the Army* (Report MR-675-A). Santa Monica, CA: RAND.

Wong, C., et al. (1998, Fall). An approach for efficiently managing DoD R&D portfolios. *Acquisition Review Quarterly, 5*(4), 339–356.