Headquarters Department of the Army
PB-70-95-1

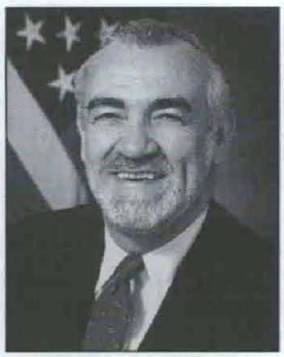
ARMY RD&A

JANUARY - FEBRUARY 1995

ARMY MATERIEL COMMAND FOCUS ON FORCE XXI

- Army Research Office
- Army Research Lab
- Federated Lab
- Acquisition Streamlining
- RD&E Center Efforts

From the Army Acquisition Executive...



I am given this space each time *Army RD&A* is published to use as a "bully pulpit" from which to speak to the acquisition community and I truly appreciate it. It allows me to highlight areas and activities that I personally believe are critical to the way we do business.

We have just started Roadshow IV. It will continue the highly successful series and will ensure that the acquisition workforce understands and applies the techniques of Acquisition Reform that have proven successful. I am personally kicking off the event at each Roadshow location and will give it my highest priority. This Roadshow covers the need for Acquisition Reform, actions by top management and the role each of us has to play. The Roadshows have been so successful that the Navy and Air Force are leveraging the idea into their own forums—and giving us credit. There are two purposes to these Roadshows and they are of equal importance. First is communications. I go to these events to share my views with you, but it is a two-way street. I expect to learn from you and incorporate what I learn into what I do as the ASA(RDA). Secondly, we are providing a training and education opportunity for our workforce. This is critical to the success of Acquisition Reform and is something we owe all of you.

Roadshow IV is emphasizing our primary role as the acquirers for the Army which will bring Force XXI to reality. This mission is especially difficult in an era with no well-defined threat. It is essential that the Army field a technologically superior force in the next century no matter what the threat may be. We will have to make this happen with fewer resources. The trends of the recent past will continue and both manpower and funds will decline. To succeed, we must cut overhead and leverage the savings into programs. To get to Force XXI we must shoot for overhead levels comparable to industry—12 to 15 percent. Therefore, we must be aggressive about Acquisition Reform. Streamlined programs will get needed equipment into the hands of soldiers sooner and at lower cost. A good example is the Precision Lightweight GPS Receiver. With seven MILSPECs, we reduced the cost 20 percent. Eliminating all MILSPECs could reduce the cost another 17 percent. This is the type of procurement that will get us Force XXI.

In Washington, a number of actions are on-going. The Federal Acquisition Streamlining Act 1994 (FASA 94) was signed into law at a White House ceremony recently. It is a good start and includes three particularly important features. First is the $100K threshold on purchases. The ability to make this level acquisition without burdensome oversight will affect over 90 percent of our contracts. These actions account for only 10 percent of our total obligation authority. Think about the effect this will have on management oversight of the big contracts. We will be able to do a much better job, where it counts the most, while attaining a much higher efficiency on the small transactions. Secondly, this Act broadens the definition of commercial products allowing us to get what we need from commercial vendors more quickly and at lower cost. I want you to all be aware that a Priority Process Action Team is codifying the requirements right now. Since DOD has been at the forefront of this effort, I expect the new rules to benefit the Acquisition Reform process. Thirdly, there are new rules that delimit truth in negotiations. I expect this action to rationalize greatly the way we do business. This act is a great start. The old way of doing business is dead in the Army.

A number of initiatives on very specific areas of streamlining are underway at DOD. The most noted one is the directive signed by Secretary Perry to eliminate military specifications and standards and mandate the use of performance-based specifications. With this bold action, the Secretary turned the present acquisition system upside down. Performance based specifications and best value contracting go hand-in-hand. Roadshow IV has great case studies in these two areas that allow the attendees to work problems and see how to implement these actions back on the job.

DOD's next major initiative is to simplify 5000.1, the management oversight process. An in-depth Process Action Team is underway to determine a new set of simplifications for doing business. There are other areas to be addressed as well.

The Acquisition Streamlining Act allows the designation of pilot programs and the Army's is the Fire Support Combined Arms Tactical Trainer (FSCATT). It will get special relief from federal rules and regulations even before implementing guidance is published. Additionally, JSTARS Ground Station Module, the Advanced Field Artillery System and the Patriot PAC-3 missile are the Army lead programs in DOD, receiving the same treatment at DOD that the federal pilot programs get at the federal level. Clearly, everyone at every level is looking to do our business better.

In case you don't get the opportunity to participate in a Roadshow, I want each of you in the acquisition business to understand that you are a critical piece of our efforts. My challenge to you is to analyze your area of work and change what you control to cut red tape and eliminate low value items. There are some simple rules to follow: Does it make good business sense? Is it legal and ethical? Are you willing to be held accountable (or take credit) for it? Is it consistent with your mission? If you can answer yes to these questions—take action. We will back you up. Mistakes made in pushing for streamlined performance will be rewarded, not punished. If you need more power to make it happen—push it up the line. Keep pushing until it gets to me. Nothing is locked in concrete; everything is achievable.

As I write this, the holidays and the New Year are approaching. There are new challenges and new opportunities on the horizon. There is a new Congress that will shape the way we do business. The FY 95 budget appears set and the future looks better now that the President has committed an additional $25 billion to the defense budget. All around us large defense firms restructure, consolidate and merge. New technologies hold out great promise but demand development. The structure of the force itself will change dramatically over the next two years. All of these things are true but what do they mean to the acquisition community? Primarily they are validation of the course we have set for Acquisition Reform. I know that you are interested, as are we all, in what the mid-term elections may mean to this direction. As far as Acquisition Reform is concerned, there will be no change! Reform has nothing to do with Democrats vs. Republicans. Reform is mandated by our stewardship of resources. We will not go back to an era of abundant resources just because the Republicans control Congress and, even if we did, we would still require Acquisition Reform to properly use any resources and to remain competitive at home and abroad. Let's step back a moment and remind ourselves of the penultimate objective of Acquisition Reform. The objective is to make it easy for the government to acquire anything it needs freely from the commercial marketplace. Only then, can we take full advantage of what is happening in the commercial market today. Acquisition Reform is the right answer and we will continue to implement it no matter who is in charge.

Gilbert F. Decker

JANUARY–FEBRUARY 1995
PB 70-95-1

To contact the Editorial Office: Call (703) 805-4215/DSN 655-4215. Articles should be submitted to: DEPARTMENT OF THE ARMY, *ARMY RDA*, 9900 BELVOIR RD SUITE 101, FT BELVOIR VA 22060-5567. Our fax number is (703) 805-4218.

Army RD&A **(ISSN 0892-8657) is published bimonthly by the Office of the Deputy Director, Acquisition Career Management. Articles reflect views of the authors and should not be interpreted as official opinion of the Department of the Army or any branch, command, or agency of the Army. The purpose is to instruct members of the RD&A community relative to RD&A processes, procedures, techniques and management philosophy and to disseminate other information pertinent to the professional development of the RD&A community. Private subscriptions and rates are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 or (202) 783-3238. Second class official postage paid at Fort Belvoir, VA and additional offices. POSTMASTER: Send address changes to DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD, SUITE 101, FT BELVOIR, VA 22060-5567. Articles may be reprinted if credit is given to Army RD&A and the author. Unless otherwise indicated, all photographs are from U.S. Army sources. Approved for public release; Distribution is unlimited.**

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07743

Research Development Acquisition ARMY RD&A

Professional Publication of the RD&A Community

FEATURES

DEPARTMENTS

COVER

Force XXI is a new U.S. Army initiative designed to make the military more efficient and effective during the next century. The Army Materiel Command's focus on Force XXI is the theme of this issue of *Army RD&A*.

SHAPING THE U.S. ARMY MATERIEL COMMAND FOR FORCE XXI

By GEN Leon E. Salomon
Commanding General
U.S. Army Materiel Command

"America's Army, trained and ready, a strategic force, serving the nation at home and abroad, capable of decisive victory into the 21st Century."

All of us recognize that these words constitute our Army's Vision. America's Army will continue to be the world's premier land force well into the 21st century. This concept of America's Army requires AMC to focus our strategic vision toward equipping and sustaining America's Army with superior technology and responsive support. But our objectives will not materialize without collective creativity, careful planning, and persistent effort.

Force XXI, the Army's reshaping concept for the force of the 21st century, is the heart of the Army's redesign effort. As a related effort, AMC is already establishing the framework and objectives for "AMC XXI." We are restructuring in order to face the challenges that lie ahead—we are changing the way we do business. Our AMC XXI strategic infrastructure is focused on three core competencies—logistics power projection, technology generation and application, and acquisition excellence.

Where we are today must necessarily provide the springboard for where we intend to be in the 21st century. However, we must be careful to balance downsizing actions and other components of change with reshaping actions within an atmosphere of continuous process improvement. It is imperative that, as we focus on the future, we keep actively aware of issues generated by national level commissions such as Base Realignment and Closure, Roles and Missions, and National Performance Review. Realistically, there are two primary elements to reshaping—the macro structure (i.e., facilities, resources, and personnel) and internal operations (i.e., divestiture, consolidations, core technologies and out sourcing).

Where we are today must necessarily provide the springboard for where we intend to be in the 21st century.

Today, AMC is well on the way to meeting our future objectives—We are doing things better, cheaper, and smarter. To illustrate:

Better: We have reduced the size of RFP/Documentation 40-60 percent.

Cheaper: AMC logistics overhead for secondary item management is the lowest in the Department of Defense.

Smarter: The ARL Federated Laboratory concept promises to combine the best of Army, industry, and academia in pursuit of technology goals for the Force XXI Army.

We are continuing to respond to future challenges with this same better, cheaper, and smarter approach. We are hard at work in response to the Office of the Secretary of Defense (OSD) guidance to reduce logistics cycle times 50 percent by the year 2000.

Here are highlights of what we are doing in our three core competencies to help shape America's Army through Force XXI.

• **Logistics Power Projection.** Advanced warfighting concepts demand that we support deployed forces while reducing in-theater burden. We are

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exploring new distribution concepts such as "velocity management"—an agile and flexible way to integrate new processes and new information technologies (computers, information processing, and telecommunications) into a unified sustainment process. For example, we need better information systems and smaller, more frequent materiel and ammunition deliveries to keep pace with Mobile Strike Forces. Velocity management and other Force XXI concepts, such as the coexistence of hierarchical and non-hierarchical command information structures, will be the driving factors in logistics management philosophy. A tool to help us explore the implications of such new sustainment concepts—the "Logistics Anchor Desk"—is taking shape in a collegial enterprise comprising AMC Headquarters, Army Research Laboratory, Advanced Research Projects Agency, U.S. Army Transportation Command, Defense Logistics Agency, and several other organizations.

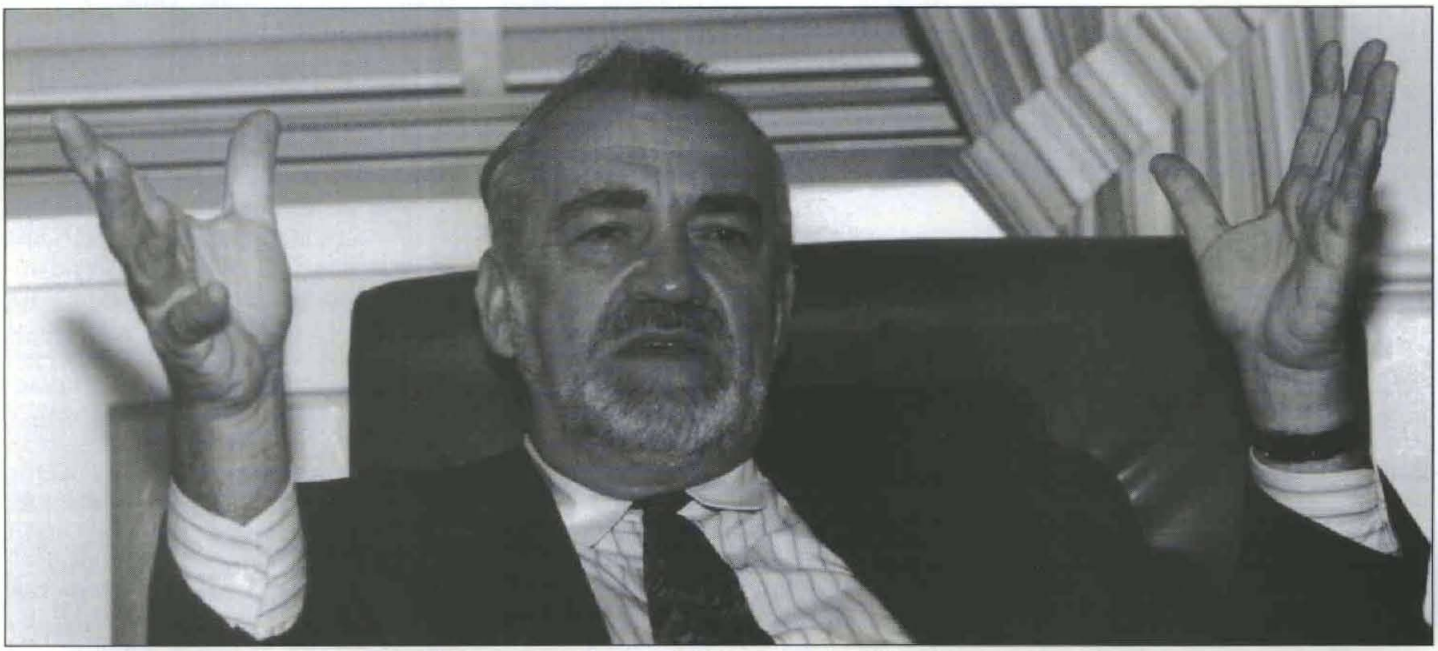
• **Technology Generation and Application.** The Army chief of staff views the Advanced Warfighting Experiments (AWE) as a primary guide along the path to new technologies, organizations, and processes for Force XXI. AMC is a full partner with the Battle Labs in achieving AWE success. Our research activities identify new technology applications and provide the engineering skills necessary for conducting scientific experiments. Our role consists of examining experimental systems and testing new materiel essential to the support of Force XXI fielding decisions. In this way, our command adds value through applications that help avoid failure and conserve time, effort, and resources during the AWE development and experimentation process. A good example is the initiative by the Army Communications-Electronics Command to create a Digitization Integration Laboratory. This laboratory provides a means to assess developmental battlefield information systems individually and interoperatively with other systems through a simulated digitized network.

Current and future operations demand that our combat systems operate in synchronization across a wide spectrum of technological sophistication. We are applying horizontal technology insertion, from experience in the Army's 2d Generation Forward Looking Infrared Radar (Sensor) Program, as a model to reduce the disparity in information technology between combat systems. But we have not limited innovation strictly to hardware—we are also creating a Soldier Systems Command to integrate system development and support for the individual soldier. These efforts are growing in importance in view of the increasingly sophisticated technology being acquired by potential opposing forces. AMC synchronizes and manages new technology insertion to best serve the Army's needs.

To achieve the best investments for dwindling research and development resources, we are establishing a Future Technologies Institute and support a Federated Laboratory System to facilitate maneuver resource leveraging among the government, academic, and industry research communities.

• **Acquisition Excellence.** AMC is committed to streamlining processes, rules, and guidelines to maximize the resources that we apply to end products for the Army and to shorten the cycle time. Our "Virtual Reality" initiatives will enhance the way we develop, acquire, and test new systems, through such concepts as virtual factories and a virtual proving ground.

Force XXI is neither a specific organization nor a particular warfighting doctrine. Rather, it is a process of experimentation and exploration of emerging technologies. Force XXI provides an opportunity for research, development, and acquisition professionals in all levels of government, industry, and academia to share in the process of creatively translating new ideas into military capability in order to overcome the combined effect that reduced budgets and new challenges create for our Army. AMC is on board as an active participant in this process and is operating at the center of this concept. There are no "cut-off dates" for good ideas—each of us can help shape and contribute to Force XXI.



INTERVIEW WITH GILBERT F. DECKER ASSISTANT SECRETARY OF THE ARMY (RESEARCH, DEVELOPMENT AND ACQUISITION)

Q. In what ways does your current management approach differ from that used while you were employed in private industry?

A. In general, my current management approach does not differ at all from that used in private industry. I learned over the years, starting with Bill Perry [Secretary of Defense]—who was my mentor and the founder of ESL Corporation which I later became president of—that you really do need team building and collaboration. You have to keep people informed relative to what the goals are, you have to solicit their support, and you have to get them to want to adopt the goals of the organization, without forcing them down their throat. I think this fundamental principle is true whether it's a large government bureaucracy or a large industrial bureaucracy. Occasionally, there will be people in the organization who, for some reason, just can't adopt the company's goals. This sometimes happens regardless of how much you try to bring them on board and show them the reasons why. It's similar to a football team where someone tries to play a solo game and just won't fit into the team. Fortunately, this only happens rarely.

Effective management requires a team building approach, the ability to communicate goals, consistent objectives, and getting people signed up. If people are unwilling to sign up, they are not good team players. I have never felt a person should abrogate their management responsibility to "be in charge." So, in terms of my management style, I really try to use a team building approach.

Q. What do you bring to this job as a result of your extensive experience in industry and what do you hope to accomplish during your tenure?

A. I wouldn't say I am unique because there are a number of incredibly successful business leaders and managers in this country. However, having served in the Defense industry for a number of years, I really do believe I have an understanding of how the government does business. From a business perspective, I have a specific knowledge of how the government buys things and knowledge about its procurement system, which is unwieldy and awkward. Before my appointed term here ends, I—like Dr. Perry—would like to make enough changes in streamlining our buying practices so that we can't return to our old system. Specifically, I want to incorporate, into as many programs as possible, new streamlined and simplified modern management methods such as product and process team approaches.

Q. Skeptics of the Vice President's National Performance Review say that this effort, like those of the past, will probably produce few results. What is your response?

A. That's a fair question. I think a key difference this time is the very fact that the Vice President—with the honest and full backing of the President—has decided that one of his main charters, in addition to his normal Constitutional duties, is to try to make government more efficient. Successful companies constantly do the same thing. The Vice President has entrusted the government's Secretaries—

The Army people who are in the acquisition business need to look at all the processes that are being reformed and get on board and carry out the resulting directives.

and particularly those in the Defense Department—to be a big part of this equation to make managerial reforms. This is the first effort I am aware of where the Vice President and the President have personally weighed in on something like this. Yes, previous Presidents and Vice Presidents have chartered other commissions and have certainly been behind them. However, this Vice President is doing some hands-on stuff. When this type of backing comes from the senior leadership, then there is a good chance of accomplishing something. I also want to emphasize the importance of having a DOD Secretary named Bill Perry who has the Vice President's full backing and is personally devoted to streamlining our acquisition process. Bill Perry has given his full support to his agents—Dr. Paul Kaminski, who is the new Under Secretary of Defense for Acquisition and Technology, to me, the Army Acquisition Executive, and to my counterparts in the Navy and Air Force. Dr. Perry has given us his full backing and the authority, without breaking the law, to tear up all the "old molds" in order to develop more efficient ways to do things. I, in turn, have told my own people not to break the law, but break everything else to get something done efficiently. All of this results in a pretty powerful chain-of-command. I don't think I have seen that before in other reform efforts. The Defense Secretary has also gone to great lengths to work with the White House to get people with my type of experience. I think all of these things will make a big difference.

Q. Among DOD's new ways of doing business is the effort to eliminate the use of military specifications and standards in the acquisition of new systems. To what extent can commercial items realistically meet military needs?

A. On the surface, that is a very straightforward question but involves several considerations. For the sake of clarity, I will respond to it in two parts. You used the term "military needs." Our military needs, which eventually turn into specific requirements, are sometimes over specified. The Army uses TRADOC as the entity to define military needs according to doctrine. We then identify specific requirements to fill a need for an item such as a new armored vehicle, a helicopter, or a new radio. During this process, the fundamental needs don't get traded off enough. So, in many cases, we tend to over specify the requirement. Once the requirement is approved, it becomes a stovepipe because we can't re-examine it. Consequently, as we get into development, we realize that in order to meet the requirement, we have to use a lot of MILSPECS and spend a lot of money. Unfortunately, we don't do well in being flexible enough to moderately relax that requirement yet still have an effective military system using a readily available item. If we could do this, we would save a lot of money. So, the problem starts with over specification of requirements. If we could get a constant interaction, up front, between the users (TRADOC and DCSOPS) and the developers and technology people, we could solve the problem. This teamwork approach would allow the users and developers to see the ongoing tradeoffs and what's happening relative to costs versus original requirements. If we could solve this problem, I believe that 80 percent of our requirements could possibly be filled by purchasing directly from the commercial marketplace. This is particularly true without using MILSPECS for such things as computers, electronics, optical systems, and many other items that are critical to the modern battlefield. This would then leave only about 20 percent of our items, such as armor and heavy artillery cannons, that would need to have MILSPECS.

Q. What other suggestions do you have for improving the Army's acquisition process?

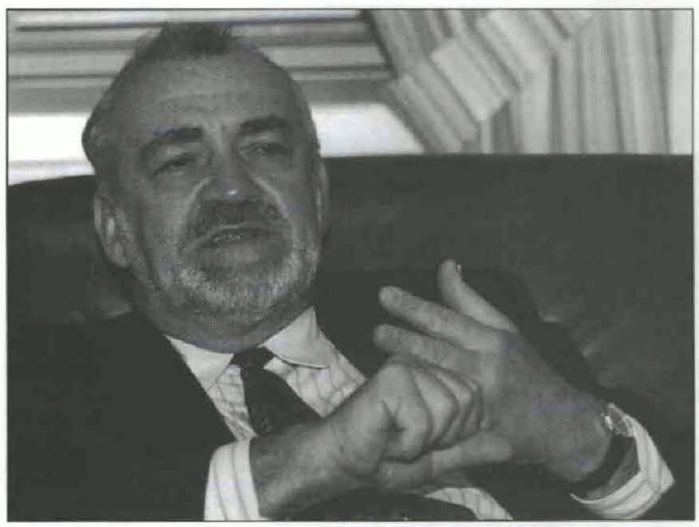
A. There are several process actions underway as we speak. These are being coordinated by Colleen Preston, the Deputy Under Secretary of Defense for Acquisition Reform. She is aggressive and is devoted to streamlining the acquisition process. She is also the individual who engineered the efforts and maintained the pressure that resulted in the new procurement reform law. We didn't get everything we thought we needed relative to legal reform, but what we did get is a major step forward. This law was recently signed by President Clinton.

Colleen Preston now has a process action team to insure that we write good regulations to implement the new acquisition reform legislation. In several areas, these regulations will simplify the process and the amount of data we have to collect. We, in turn, want the Army people—especially those involved in contracting and procurement, to adopt these standards. Another process action team, which has some very sharp Army people on it, is looking at streamlining our internal management processes. We have a lot of oppressive reviews and huge amounts of data collected that really don't contribute to decisions.

The Army people who are in the acquisition business need to look at all the processes that are being reformed and get on board and carry out the resulting directives. I should add that it's necessary to trust the people who work for you. Problems can't be solved by people who can't do the job.

All of these actions will hopefully result in a streamlined procurement process and a less oppressive review process. I am behind this one hundred percent.

Q. In view of the ongoing DOD downsizing effort, what needs to be done to maintain a strong Defense industrial base?



A. Just prior to this interview, I had a discussion with some other people regarding this same issue. I don't have a pat answer to this question, but I can look at it theoretically. If we are successful in acquisition reform, where requirements are not over specified and we can buy commercially, then we won't have an industrial base problem. The result will be a huge industrial base which is maintained by the total economy of the country. This should allow us to focus our R&D dollars on those unique technologies that only the military needs. This includes items such as armor systems, heavy caliber cannons, and smart guided missiles. Defining these unique technological capabilities is a very hard thing to do. Josh Gottbaum, the Assistant Secretary of Defense for Economic Security, and his Deputy Assistant Director for Industrial Affairs, Dr. Kenneth Flamm, are working very hard to define some of the unique technologies that don't have a commercial base.

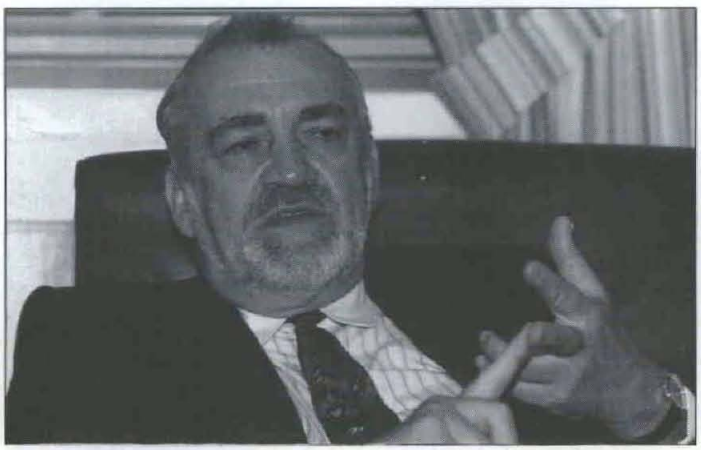
So, what we need to do is buy as much as we can from the commercial base and spend our R&D dollars on those things that have unique technological capabilities.

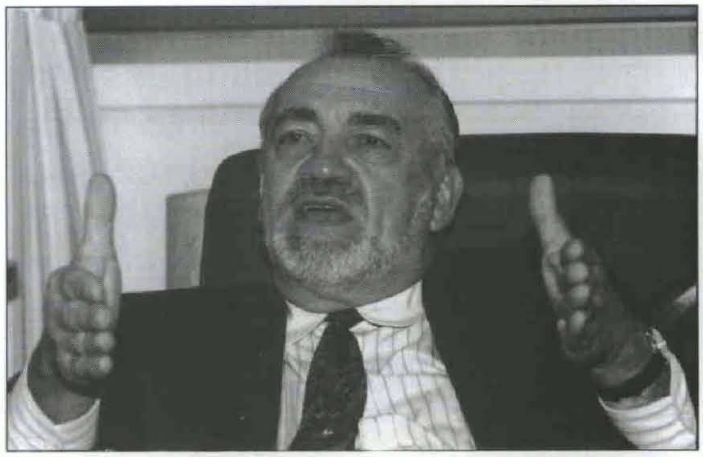
Q. Could you comment on the importance of battlefield digitization as a force multiplier?

A. There is no doubt in my mind, when we look at analyses and warfare exercises, that it is a huge combat multiplier. We hope to get more definitive proof of that in the Brigade 96 Exercise. This is where the Army will equip an entire mechanized brigade with devices that allow specific digital information to be passed around the battlefield among individual combat platforms and command and control elements. Specific information will include unit locations, how fast the unit is moving and the location of the platforms. A battalion commander will have a display in front of him and will be able to view, in almost real time, the positions and activities of a platoon leader in a tank with three other tanks or a platoon leader of a Bradley Fighting Vehicle or Apache Helicopter. Thus, the battalion commander will have what we refer to as "situational awareness." He will know, at any level of detail, where all the blue forces are. He will be able to control the fire mission and the tempo of the battle through command and control. He will also know where the enemy is. True situational awareness will allow a number of things to be accomplished. Real time changes can be made in the maneuver pattern or the fire missions before the enemy can react. This will certainly reduce fratricide, which is a big problem.

There is something to the fog of war and ground battles—there is fire artillery, it's messy, and it's smokey. Even a tank sometimes ends up shooting another friendly tank. So, we believe that situational awareness is going to be a huge combat multiplier.

Q. What individual program casualties do you foresee as a result of the DOD budget crunch?





A. The budget situation is depressing. We have properly drawn down the Defense budget since the wall came down and we have restructured our forces. The Army is coming down to an end strength of 10 divisions, less than 500,000 soldiers. Big cuts in civilian personnel strength are ongoing as we speak. So, at best, there will be further modest cuts and, at worst, some big cuts in the research, development and acquisition budget.

Bill Perry and John Deutch are absolutely devoted to making sure that our current forces are trained and ready and can be sustained, and that quality of life issues are adequate. So, to make sure these things happen and we stay ready until the budget improves, a lot of bills will have to be paid out of procurement accounts. Everyone is aware of John Deutch's letter of last August related to which large programs should be cut.

I think the Army is already down to the bare bones. We have taken our share of hits. It's not a question of fairness, but the disproportionate share of hits. Our two major development programs that are critical to the Army's needs are Comanche and the Advanced Field Artillery System (AFAS). Comanche is the only vehicle I could find that can truly do short- and long-range reconnaissance and target acquisition in day, night, all weather and close-to-the-ground environments. Nothing else can do this. We do need these capabilities in order to see deep and strike deep. Comanche and AFAS could be vulnerable to the budget knife because the money just isn't there. I am optimistic though, that these programs may be spared the knife. We will go to the mat to try to preserve them.

Q. Do you believe that adequate funding will continue to be available for the Army Acquisition Corps?

A. Yes I do. The Acquisition Corps is a body of skilled military and civilian acquisition professionals. We may see some reduction in the number of people in the Acquisition Corps. However, education and training of the current force will remain a high priority. We must maintain the high skill levels of those already in the corps.

Q. Is there anything else you would like to comment on?

A. Although I have never worked for the government before, except for my earlier service as a young military officer and in an advisory capacity as chairman of the Army Science Board, I have always had a high propensity toward maintaining our national Defense. If I didn't believe in a strong Defense, I wouldn't be in this job. I do believe the government is big, bureaucratic and inefficient—that's just the nature of the beast. We have to streamline it as per Vice President Gore's initiatives. However, having said that, I have found since my arrival that the Army has a lot of great dedicated people, both military and civilian, and I am pleased to be here.

THE SOLDIER-INFORMATION INTERFACE

By MG Wallace C. Arnold
and Dr. Thomas H. Killion

Introduction

The confluence of the information technology revolution and the changes in Defense force structure associated with the end of the Cold War have led the Army to adopt a force modernization strategy that depends heavily on advances in computers, communications, and intelligence technology. The chief of staff of the Army has established five strategic objectives to guide this modernization. Table 1 presents these objectives and some contributions of information technologies toward achieving them.

This modernization is critical to maintaining the U.S. Army's technological edge in information age warfare. In this new age, the outcome of warfare increasingly depends on the acquisition, control, and effective use of knowledge. This includes gaining knowledge about the enemy and their disposition, maintaining knowledge concerning friendly forces and their status, using this knowledge to effectively target critical enemy nodes (e.g., with precision weapons) or to mass fires on selected targets, and controlling the information that the enemy has regarding friendly forces. Such knowledge is essential to maximize the impact of massed firepower, troops, and support resources, when required.

Moving the Army into the age of information warfare presents a number of challenges. A key part of this process is the recently established initiative for digitization of the battlefield.

Table 1.
Strategic Objectives and Information Technology.

Strategic Objective	Information Technology Contributions
Win the Information War	• Collection & processing of data • Distribution of information • Analysis and assimilation to support decision making and action
Dominate Maneuver	• Synchronized maneuver and fires • Simultaneity of action throughout breadth and depth of battlefield • Command and control on the move
Execute Precision Strike	• Real-time, accurate targeting • Precision weapons guidance • Accurate battle damage assessment
Protect the Force	• Real-time threat data • Alerts and warnings • Combat status information • Shared situational awareness to minimize fratricide potential
Project & Sustain Combat Power	• Asset management/tracking • Real-time status information • Support for split-based operations

Definition of Digitization

Digitization of the battlefield involves the insertion of digital technologies across the battlefield among combat, combat support, and combat service support systems and units. The intent is to support the acquisition, exchange, and use of information to allow the creation of a common, relevant picture of the battlefield. This will allow commanders, staffs, and soldiers at various echelons to maintain a clear, accurate, and appropriate picture of the battlespace, using a common data base, and to operate with a shortened decision cycle. It will also provide warfighters and supporters with relevant, real-time information which allows them to more effectively conduct operations.

In terms of technology, digitization depends upon the effective integration of computer processing, advanced software, displays, man-machine interfaces, sensors, communications, combat identification, and position/navigation components. It will involve the movement of streams of digital data among force elements and across tactical, theater, and national grids. It will take advantage of the continuing evolution of state-of-the-art information technology to aid the Army in

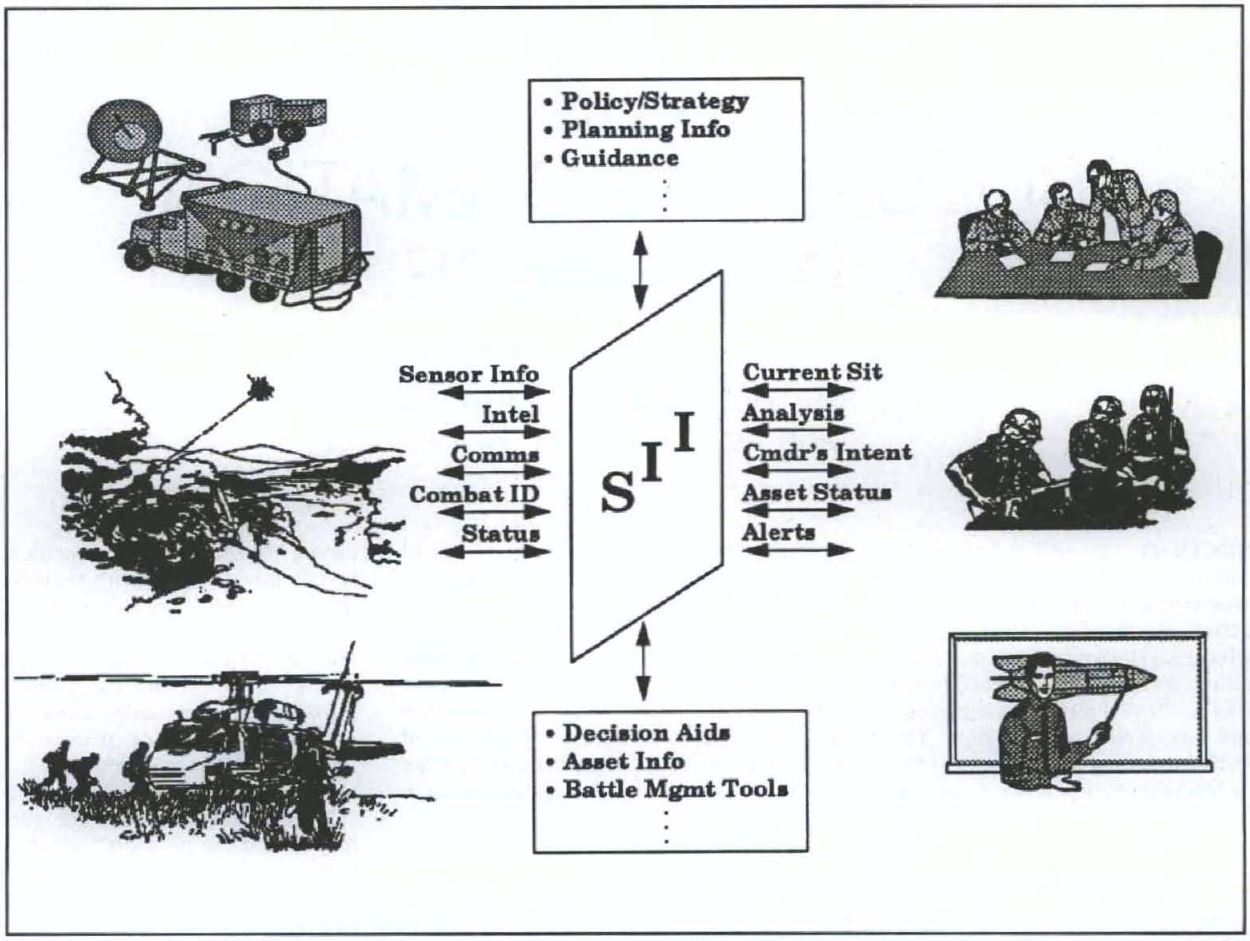


Figure 1.
The Soldier Information Interface (SII).

maintaining a strategic and tactical advantage over potential adversaries.

Much of the emphasis to date in the digitization initiative has focused on the hardware and software required to support it. However, of equal if not more importance is the effective integration of the digital subsystem(s) with the soldiers who will operate and maintain it. A key part of this integration is the design of the interface between the soldier and the information assets that digitization provides.

Soldier-Information Interface

Many terms have been adopted to refer to the interface between the human operator and a system: man-machine interface, human-system interface, human-computer interface, and user interface are some of the more common ones. In considering the issue of designing interfaces in the context of the digitization initiative, it may be fruitful to think in terms of the soldier-information interface (SII). The purpose of using this terminology is to focus attention on the cognitive aspects of the SII, as opposed to other characteristics of the interface (e.g., the physical layout of a computer workstation). Figure 1 illustrates some of the aspects of the SII.

The SII provides a "window on the battlefield" for multiple users. It can be described in terms of three general components: (1) the external interface to (other) battlefield systems; (2) the embedded processing and display capabilities, including data bases and information processing tools; and (3) the internal interface to the operator or user.

On the external interface side, digitization has the potential for providing access to a wide variety of information. Some of the types of data of interest include friendly and enemy force assets and positions, the battlefield area of operations (including terrain and environmental data), targeting data, and friendly asset status (e.g., weapons loads, maintenance status, crew status). The utility of specific information will obviously be a function of the echelon of command being considered and the function(s) being performed.

In terms of embedded processing, the SII will incorporate a variety of tools and data bases to support the generation and management of information. Examples include digital maps of the battlefield area, planning routines, tactical decision aids, communications protocols, and data base management algorithms. These tools will assist the soldier in analyzing and assimilating the battlefield situation, examining optional scenarios, and managing available assets. What is presented to the user must also consider factors such as national military strategy and policy, guidance from higher headquarters, and other elements that may influence the tactical options and decision making.

With regard to the internal interface, the SII must be adaptable to a wide variety of users. The demands that they make on the SII will depend upon the current task, the

function(s) being performed, the echelon of operations, and so on. Advances in computing, display, and audio technology enable the generation of a wide variety of visual formats or audio outputs. This has led to the increased use of graphical or pictorial interfaces that are more "natural" to the non-specialist. It is crucial that, for any given echelon, the SII must provide an appropriate representation of the battlefield, which ensures that high priority information is conveyed while minimizing extraneous or unnecessary information. There are also individual differences between individuals with regard to the format(s) they prefer. The SII must be adaptable to these individual preferences as well as to task demands.

MANPRINT Considerations

The Manpower and Personnel Integration (MANPRINT) process focuses on integrating the system with the soldier, based on analyses and trade-offs within and across seven domains. These domains are manpower, personnel, training, human engineering, system safety, health hazards, and soldier survivability. Effective design of the SII will require careful analyses across these domains to maximize benefits and minimize any negative impact on individual operators, maintainers, supporters, the fighting unit, and the force as a whole. MANPRINT provides a disciplined, systematic process whose goal is to balance trade-offs within and across the domains to achieve optimal overall system performance and effectiveness and minimize life cycle costs.

The design and implementation of the SII has implications in multiple domains. The most obvious area of concern is of human engineering. As mentioned earlier, the adoption of the term soldier-information interface was specifically designed to focus attention on the cognitive aspects of the interface. Although there is a large literature extant about human sensory, perceptual and psychomotor performance, design guidelines based on the cognitive characteristics of users are less prevalent. This includes such considerations as mental workload, the level of expertise of the user, memory limitations, the use of mental models, and decision-making strategies. The emerging field of cognitive engineering is attempting to remedy this problem through the development of principles derived from cognitive science. The goal is to guide effective designs that exploit the unique capabilities of the human information processor while compensating for known limitations.

Mental Models

A useful general approach to thinking about the SII is in terms of the "mental model(s)" of the battlefield situation that it fosters. Mental models are internalized representations of the external world, which can be used by individuals to generate and test hypotheses about alternate courses of action. Such models enable individuals to project consequences, handle novel situations, and generally incorporate causal relationships among objects in the world in their decision making. A major purpose of the SII should be to ensure that commanders and soldiers develop accurate, useful mental models of the battlespace in order to make effective decisions. This process has been referred to as battlespace visualization.

An essential element of this process is ensuring that the soldier has all of the relevant information in a usable format. The U.S. Army Research Laboratory (ARL) is currently investigating the capabilities essential for an integrated battlefield intelligence system. Five essential features have been identified, including the commander's intent, the battlefield area of operations (terrain, weather, etc.), the current situation, battle analysis tools, and mission-critical support data. ARL is using a rapid prototyping tool, called the Commander (and Staff) Visualization Research Tool (CoVRT), to investigate content and format issues to support integrated visualization of the batttlespace. ARL is also investigating the development of standard symbology to facilitate communications, reduce confusion, and ease the transition across systems.

One of the critical issues here is the amount of information that the operator must process. This affects cognitive workload as well as the speed and accuracy of response. This can be moderated to some extent by operator experience or training. It can also be manipulated by the degree to which information is preprocessed, integrated, or fused by the system as opposed to being presented in its "raw" form. To the extent that the system can perform such functions as detection, classification, targeting, communications formatting (applying appropriate protocols), and so forth, the load on the operator can be reduced. However, there are cases when the operator or commander will need or wish to have access to unfiltered data, such as for verification.

Functions Allocation

Another factor in the design of the SII will be the way that functions are allocated between the system and the soldier. The incorporation of intelligent aids or advanced data processing and management tools can reduce the workload of the operator but may increase dependence on the system. Issues such as back-up modes of operation and redundancy in the battlefield network in case key nodes are lost are relevant here.

A major purpose of the soldier-information interface should be to ensure that commanders and soldiers develop accurate, useful mental models of the battlespace in order to make effective decisions.

Beyond consideration of the individual soldier or commander, the design of the SII must also consider the distributed nature of modern warfare (decentralized staff, dispersed planning, command and control on the move, etc.). The nature of dispersed operations increases the need for a common picture of the battlefield. Research about group or team problem solving has demonstrated the criticality of shared perceptions of the situation and of mutual understanding of appropriate strategies for response. To operate effectively as a team, commanders and soldiers must have a common understanding of the battlefield situation, a clear perception of objectives, and a shared understanding of how resources can be used to achieve them. This common understanding is essential to successful decentralized planning and execution. The SII can facilitate this understanding through a common picture of the battlefield and clear indication of the commander's intent.

Training

Closely related to the issues inherent in human engineering are those related to the training domain. There are clearly trade-offs between design complexity and training requirements. The use of "natural" display formats (e.g., graphics, plain text), menu-based architectures, and other such techniques can reduce the level of sophistication required by the user. However, what is appropriate for the experienced operator may be quite different from what is useful for the novice. Knowledge that has been gleaned regarding the development and nature of expertise can aid in the design of appropriate training programs. The SII also offers the potential for enhanced training. Through the use of embedded training and use of the SII as a window into the distributed interactive simulation (DIS) environment, the SII can be an effective tool for training and maintaining critical skills. Leadership training must also evolve to incorporate the increased variety of information and battle management tools, the various formats available, and the use of the SII. The development of battlespace visualization skills will need to be emphasized. The Army Research Institue (ARI) is currently exploring innovative methods and tools for training these skills.

In addition to individual training, team training will be critical to successful use of the capabilities provided through the SII. The nature of dispersed planning and operations will require the people involved to have the necessary team skills to prepare them to contribute effectively. Experience has shown the importance of specific training for team decision-making skills. The importance of such skills will increase as the fluid nature of battlefield organizations increases (i.e., as units are "mixed and matched" to meet the greater variety of missions, individuals will be required to be better prepared to rapidly become effective players in emerging teams).

Soldier Survivability

In the soldier survivability domain, the design of the SII has several major implications. The first is the contributions that can be made to fratricide reduction through enhanced situational awareness and special alerts or warnings that may be used to signal potential incidents (e.g., targeting of friendly entities). The second relates to the issue of operator workload and fatigue. Effective design of the SII should minimize the cognitive load on the operator, reducing mental and physical fatigue and thereby enhancing overall performance. Finally, the use of effective alerts and warnings can enhance crew survivability through increased awareness of enemy sensor and targeting activities.

Finally, the design of the SII generates trade-offs in the manpower and personnel domains. The notion of the decentralized staff becomes more feasible and more likely in the digitization era. The structure and manning of that staff will obviously be directly affected by the design and capabilities of the SII. Increasing the automated analysis and assimilation capabilities of the SII may reduce manning requirements and/or the skill requirements of individual staff personnel. Any reallocation of functions may also affect the military occupational specialty (MOS) requirements for specific positions or change the training requirements for those MOSs (e.g., to include basic computer skills). In addition, the potential need for redundant capabilities across systems to adapt to the loss of key nodes has definite implications for the variey of skills that the individual operator must develop and sustain. The use of increasingly complex software tools also has implications for maintenance personnel requirements, in terms of the sophistication of software support personnel. These are the types of trade-offs that must be considered in implementing an effective SII. There are clearly force structure implications involved here in terms of the structure of MOSs and the relative demand for specific types of individuals. Operating and maintaining digital systems will demand quality personnel with the intelligence and skills to handle these advanced technologies.

Conclusions

Digitization of the battlefield offers significant promise and challenges for the soldier. A key component in the digitization process is the interface between the operator and the digitization subsystem—the soldier-information interface. In the design of the SII, the MANPRINT process is critical to ensure that the maximum benefit is achieved. Domain analyses will be required to identify and address the kinds of critical issues that were discussed previously. Research will also be required in specific areas to support recommendations for solutions to key challenges such as effective information formatting, avoidance of soldier overload, and development of effective training strategies. The optimal use of these emerging capabilities will depend upon the availability of quality soldiers who are prepared to employ these advanced technologies. The design of the SII will need to consider the force structure implications inherent in this key component of the Army's modernization strategy.

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Force XXI

AMERICA'S ARMY. . . INTO THE 21ST CENTURY

Explaining the Army Chief of Staff's Message

By Thomas G. Conway

The Vision

A significant challenge facing the U.S. Army today is ensuring that the Army story is heard and understood. The U.S. Army is doing something that no other Army has done before: While reducing its size, it is increasing its ability to fight. Total obligation authority is down, dollars are down, and the size of the Army is comparable to that of the late 1930s. Yet, missions are up significantly. Bosnia, Somalia, Rwanda, Haiti, Kuwait, and Korea are premier examples. Civil operations other than war, such as floods, hurricanes and earthquakes, have also been significant. Simultaneously, the Army is leading the way to unprecedented warfighting capabilities and readiness. Everyone, from Capitol Hill, to the taxpayer, to the soldier, and to the grade school child who is tomorrow's commander, must understand that the Army is smaller, but more powerful than any army in history, and improving. We are on the brink of implementing technologies with astounding potential. It must be made clear that our Army is on a deliberate course to bring warfare into the information age and change forever the very essence of what conducting war is.

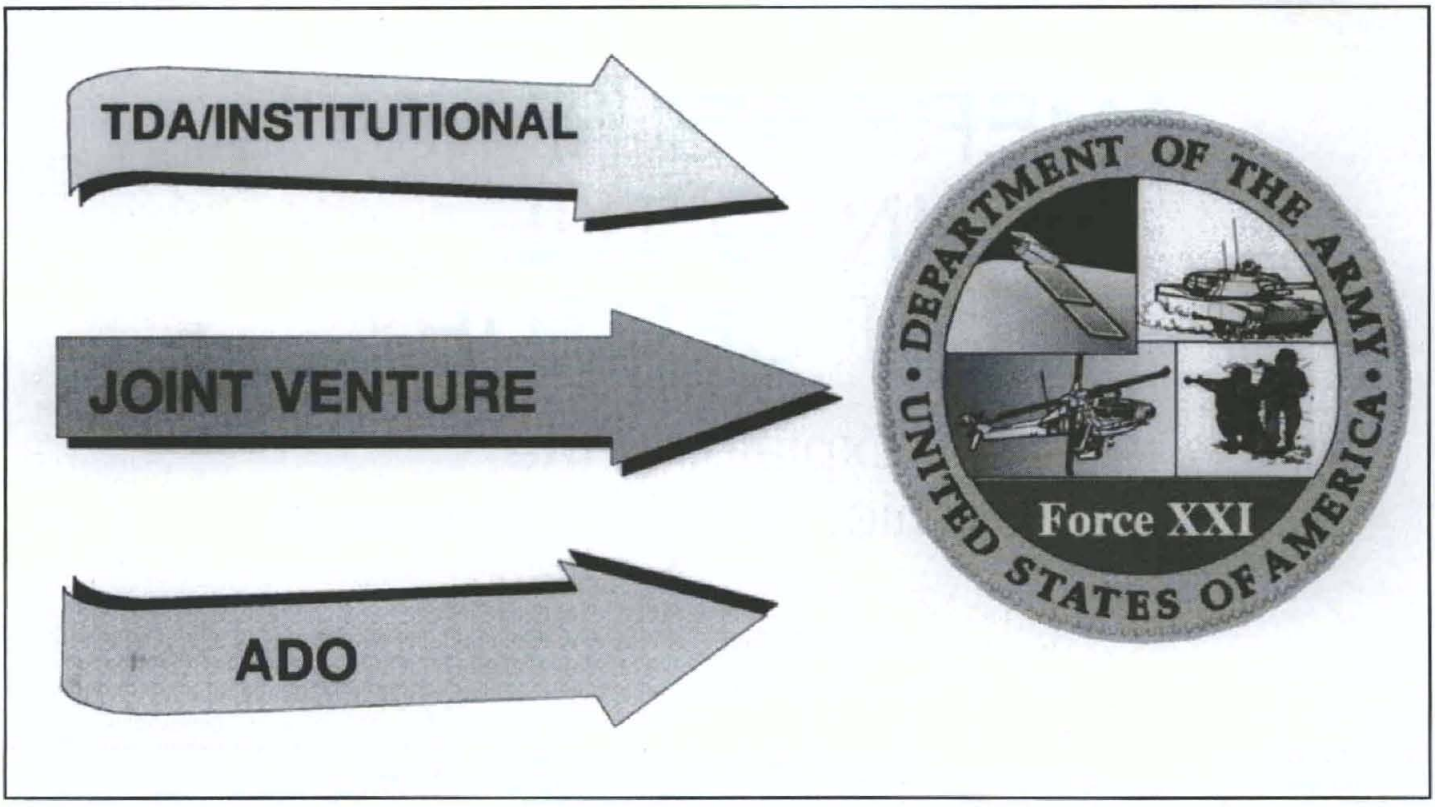
This is not "pie-in-the-sky." This is happening as you read these words. The Army is transforming itself from an industrial-age force to an information-age force. The commitment and initiatives to change from within are inspiring. The plans being made are awesome, and the vision, when fully understood, is breathtaking. The vision is Force XXI.

Unveiling the Vision

In a message to all Army commanders, dated March 8, 1994, Army Chief of Staff GEN Gordon R. Sullivan unveiled the vision and methodology for building the force for the 21st century—Force XXI. By March 1994, the Army had already invested four years in reengineering many of the major commands (MACOMs), maintained training and readiness rates, and successfully shifted the intellectual and physical posture from the Cold War to looking beyond the industrial age. What lies beyond is shaped in the March 8 message. Important aspects of Force XXI are crafted in terms of what could be and how the Army will build a bridge into the future, based upon capabilities provided by modern and emerging technology. This article explains the Army chief of staff's message, his vision, and his direction to the Army. The message makes it clear that it is time to redesign the force to better leverage the power of the people that make up the U.S. Army and to better leverage the power of technology. Redesigning the force will impact, above all, the force structure.

It must be made clear that our Army is on a deliberate course to bring warfare into the information age and change forever the very essence of what conducting war is.

Paths to Force XXI



Structure

Right now, no one knows what Force XXI will look like. However, Force XXI will be organized around the acquisition, processing and dissemination of information in order to dominate, control and win in the battle space. Units will rely on electronic connectivity, vs. geographic or physical connectivity.

Initial design of the fighting force will be centered around the division, then expanded. We must be prepared, however, for the concept of the division to be altered significantly. Force XXI requires reconceptualization and redesign of the force at all echelons including reserves, civilians and the industrial base. A holistic perspective is required in order to make real changes.

Force structure will be based upon capabilities, not specific threat scenarios. Force XXI will be flexible, allowing modularity and agility—versatility in purpose and mission with higher leader-to-led ratio. Adaptive planning and innovative force packaging from readiness pools will allow versatility and agility in mission execution. Harnessing technology for Force XXI will not only influence force structure, technology will also influence how the force will operate.

Operations

Focus is on enhanced capabilities for the force to be more lethal, more deployable and more sustainable. This is predicated upon rescoping the modernization vision to assimilate post industrial-age technology. Foremost, Force XXI will be digitized. Heavy reliance is placed on electronic connectivity in order to have a truly information-based edge. Information-based battle command is key. Responsibility will remain hierarchical and cannot be distributed. However, organizations will probably not remain hierarchical in a traditional sense. We must think about its capabilities in terms of battle command and battle space, with controlling battlefield tempo being the objective. Force XXI will be able to execute, mount and recover from operations simultaneously. Battle command and battle space are evolving concepts and, in order to fully prescribe operational doctrine, we must develop these concepts as we go. We must be prepared to adjust as necessary. Operations Other Than War will be critical, as will be the Army's ability to exploit non-lethal weapons technology.

Role of Louisiana Maneuvers (LAM)

LAM is the Army's institutionalized way of changing itself. The process is patterned after the methodology that was used to get the U.S. Army ready for World War II. In the late 1930s, the General Headquarters Exercises, dubbed "Louisiana Maneuvers," proved to be successful in applying a cogent methodology during a significant buildup in a relatively short time. Modern LAM is similar. It is a process that applies a cogent methodology during a significant drawdown in a relatively short time. LAM will synchronize three axes forming the path to Force XXI.

Path to Force XXI

"Digitization," "Joint Venture," and "Table of Distribution and Allowances (TDA)/Institutional Army" are the three axes of the path to Force XXI. Efforts along these axes will be both sequential and simultaneous.

Digitization. Creation of the Army Digitization Office by GEN Sullivan initiated the Army's concerted effort to integrate digital technology across the force incrementally: Brigade 96; Division 97; and Corps 99. With digitization, the full power of modern tech-

nology can be exploited through:

- Synchronization of direct and indirect fire to unleash unparalleled lethality;
- On-demand logistics/sustainment, contingency planning and automated reconstitution of forces;
- Greatly improved combat ID; and
- Better control of the battlefield operational tempo.

Joint Venture. Design of operating forces will be performed under the Joint Venture axis with the commanding general, U.S. Army Training and Doctrine Command (TRADOC), as lead. The U.S. Army Materiel Command, U.S. Army Forces Command, U.S. Army Intelligence and Security Command, U.S. Army Information Systems Command, U.S. Army Medical Command and the Army staff are partners under the Joint Venture axis. Other MACOMS will participate, depending upon particular issues. What will the fighting force look like in the year 2010? This is the question that Joint Venture must answer.

TDA/Institutional Army. Refocusing of the Army is placed under the lead of the Army deputy chief of staff for operations and plans. This is a total Army plan, including the civilian and reserve sectors. Force XXI structure will be predicated on experiment. Getting to Force XXI will be an iterative process of hypothesis, experiment and decision for doctrinal, materiel and organizational changes. As a means to explore concepts evolving under these axes, five Center of Gravity Advanced Warfighting Experiments are currently approved: Mobile Strike Force; Focus Dispatch; Theater Missile Defense; Joint Readiness Training Center (96-02); and Synthetic Theater of War - Europe.

Close integration of live, constructive and virtual simulations will be used to continually lead us to improved units capable of assimilating technology as the units evolve. Use will be made of information-age processes to create the information-age fighting force. Decisions will influence resourcing initiatives for the program objective memorandum. The goal is to make fielding decisions for implementation before the turn of the century.

Supporting Documents

The following documents are used to bring together the warfighter requirements and the necessary technology to achieve Force XXI.

- The TRADOC Pamphlet (P) 525-5 *FORCE XXI OPERATIONS: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century* (Aug. 1, 1994) is the cornerstone of Force XXI operations. It articulates the future capabilities and general requirements for information-based warfare. Although conceptual and a living, evolving document, TRADOC-P 525-5 puts the "mark on the wall" to initiate Force XXI development. Describing the conceptual foundations for the conduct of future operations in war and operations other than war, TRADOC-P 525-5 provides a vision of future conflict for the development of supporting concepts, programs, experiments and initiatives. Aspects of Force XXI are couched in the following terms: doctrine, training, leader development, organizations, materiel and soldiers (DTLOMS). The DTLOMS are the building blocks of Force XXI.

Close integration of live, constructive and virtual simulations will be used to continually lead us to improved units capable of assimilating technology as the units evolve.

- *Force XXI Division Organizational and Operational Concept* (Oct. 1, 1994). This organizational and operational plan is TRADOC's vision for the design of Force XXI divisions.
- *Defense Science and Technology Strategy* (Department of Defense director, Defense research and engineering, September 1994) and *STAR 21 Strategic Technologies for the Army of the Twenty-First Century* (Board of Army Science and Technology Commission on Engineering and Technical Systems National Research Council, 1992): Relevant technologies for the future are captured in these documents.
- *The Army Science and Technology Master Plan* (assistant secretary of the Army (research, development and acquisition)): Revised annually, it serves as a more near-term strategy for technology investment.

Vision Evolving

Every element in the Army chain of command is developing a vision for what Force XXI means to their command. The vision of what Force XXI means to AMC is clear. The U.S. Army Materiel Command has been reengineered around its three core competencies:

- Technology Generation and Application—Modernization is no longer characterized by weapon systems, but by capabilities afforded through inserting technologies.
- Logistics Power Projection—Power projection logistics requires a higher level of agility in planning and execution than in the past.
- Acquisition Excellence—Streamlined acquisition and assimilation of technology will allow rapid achievement of Force XXI capabilities.

An early success that brings together all three competencies is the Logistics Anchor Desk (LAD) shown at the October 1994 AUSA. State-of-the-art technology has been harnessed to provide the future logistician, at all levels of command, a common logistics picture. Total asset visibility, contingency planning and simultaneous reconstitution are three main features that LAD will provide through electronic connectivity, between and among echelons.

Turning Point and Risk

None of the changes that have occurred are by accident. A turning point has been reached and we cannot go back. The Army is not shy about reshaping the force structure to respond to the need for change. Redesigning the total force is the most critical stage. There is risk associated with reducing the size and redundancy from the Cold War bias of attrition. Risks associated with a leaner force must be understood, accommodated and managed.

Evolving toward Force XXI is about controlling our destiny—the destiny of the Army. Knowledge-based warfare is not a new concept. In his book, *Infinite in All Directions,* Freeman Dyson predicted in 1985, "As a result of the development of technology, warfare becomes more and more a battle of information rather than a battle of firepower." However, it has never been attempted at the level we are pursuing.

It is becoming a reality, and as we move forward we must be cautious. There is a risk with changing the very essence of the American Army. There is however, a greater risk in not taking the initiative—in not controlling our own destiny. GEN Sullivan made a commitment: "No more Task Force Smiths," which means that as the Army gets smaller, readiness rates will not fall. The plain truth is that soldiers die when readiness rates are low. Force XXI will ensure that as the Army reduces in size, it will, in fact, *increase* in lethality, survivability and deployability. America's Army is moving into the 21st Century...today.

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U.S. Army Research Office...

RESEARCH EFFORTS FOR FORCE XXI

By David Seitz
and Dr. Gerald Iafrate

Introduction

The Force XXI concept lays the foundation for the 21st century Army—an Army digitized and redesigned to achieve land force dominance in the information age.

The goals established for Force XXI by Army Chief of Staff GEN Gordon R. Sullivan include the creation of a digitized brigade by 1996, a digitized division by 1997, and a digitized corps by 1999. These goals will be accomplished utilizing current "off-the-shelf" technology and systems. One common rule of thumb for basic research is that it generally takes from 10 to 20 years to realize results and the first practical applications. In this sense, ARO, since the late 1970s, has been sponsoring research in support of the technologies to be vertically and horizontally integrated into the formative stages of Force XXI. The ARO has also been assigned the lead for facilitating short-range, quick-fix programs, such as the Advanced Concepts and Technology (ACT) II Program and the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program, which develop and demonstrate innovative technologies for accelerated insertion into Force XXI applications.

An excellent example of the difference that technology can make is the advent of the Global Positioning System (GPS) and its use by coalition troops in Operation Desert Storm. The simple fact of being able to locate and accurately pre-position units on the move and in real-time on the essentially featureless desert terrain gave coalition forces a tremendous advantage in concentrating forces and synchronizing attacks. Realization of Force XXI technology initiatives will result in greater advantages for Army forces in effectively resolving conflicts well into the next century. This envisions connecting all force elements: maneuver Force XXI, combat support, and combat service support forces, at or near the forward edge of the battlefield through the use of advanced computers connected in a wireless, mobile communications network. Control and synchronization will be affected through a seamless, digital, technical information architecture designed to exchange voice, text, data, graphic information and video input in near real-time environment. This network would result in shared situational awareness at all levels of command and control, while affording commanders the opportunity to conduct operations at an unprecedented and unmatchable battle tempo.

The underlying basic scientific research sponsored by ARO today will influence the course our Army pursues in the evolutionary development of Force XXI. Basic research, primarily in electronics, physics, mathematics and computer science, will result in the improved and upgraded "second generation" assets required to assure continued battlefield preeminence in the early decades of the 21st century. Table 1 is a list of research efforts currently sponsored by ARO that directly support known Force XXI goals. This article will address three areas of great importance to the future of Force XXI.

Table 1.
ARO Research Efforts In Support of Force XXI.

MATHEMATICS & COMPUTER SCIENCES	PHYSICS & ELECTRONICS
High Performance Computing	High Frequency Microelectronics
Data Compression and Fusion	Millimeter Wave Integrated Circuits
Information Fusion and Processing	Nanometer-Scale Optics and Electronics
Artificial Intelligence/Decision Aids	Nanoscale Fabrication and Defect Engineering
Distributed Data Base Management	Photonics and Opto-Electronic Imaging
Stochastic Models for Uncertainty	Phased Array and Adaptive Antennas
Algebraic & Geometric Methods for Terrain Analysis	Optical Communications
Algebraic & Geometric Methods for Information Management	Digital and Acousto-Optic Signal Processing
Automated, Low Cost, Software Production	Multi-Sensor Fusion
Non-Linear Dynamic Modeling	Automated Image Recognition and Compression
Advanced Algorithms and Graphics Technology	Lightweight, Affordable Power Sources and Displays
Virtual Reality	Millimeter Wave Imaging Technology
	Directed Energy and EMP Survivable Optics and Electronics

Communication Networks

The first of these areas, communication networks, lies at the very heart of the Force XXI requirements concept and is absolutely essential to the implementation of the digital battlefield. Research challenges include the design of network architectures and adaptive protocols with distributed control for a highly dynamic, mobile Army network providing cellular-like service in the field. Another example is network protocols which maintain message routing and transmission scheduling

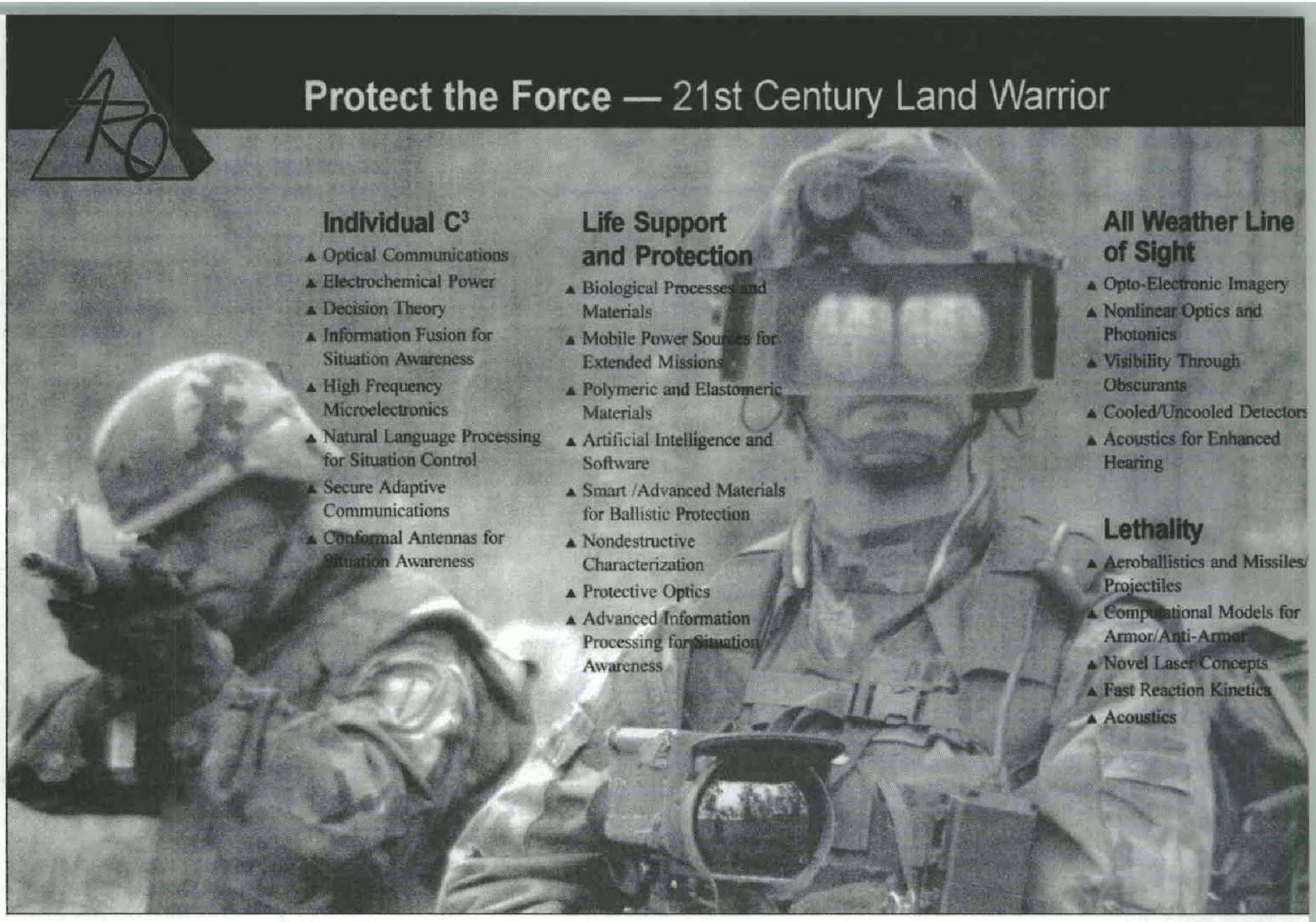

Figure 1.

when nodes are interdicted or communication links drop out. Control must be distributed, not centralized, to avoid the catastrophic network failure that would occur if the enemy could target a central control node. A final example is adaptive antenna technology which promises to provide lower probability of intercept transmissions, power conservation, wider bandwidth channels, and frequency reuse allowing increased volume and quality of data transmitted.

21st Century Land Warrior

The second of these areas is the 21st Century Land Warrior concept. While the initial goals for implementing Force XXI will involve the netting of command and control assets with air and ground vehicles, the ultimate goals will involve the inclusion of the individual land warrior as a component of the battlefield network. The weight, size, processing power density, and electrical power requirements for the individual soldier's equipment will be more difficult to achieve than those that can be sustained on vehicles. These power sources must be lightweight, compact manportable units. Figure 1 illustrates the total impact that current ARO work is expected to have on the 21st Century Land Warrior, but no areas are more important than those aimed at integrating the individual soldier into the Force XXI concept, including advanced sensors, nanoscale, electronics, opto-electronics, advanced software, lightweight displays and mobile power sources. All these will be key factors in enhancing the individual soldier's capability and achieving unit land force dominance.

Advanced Distributed Simulation

The third area relates to Advanced Distributed Simulation (ADS). The ADS provides for simultaneously linking synthetic operational networks to maintain the warfighter and soldier "in the loop" from conceptual development through fielding. By using ADS, the Army will train exactly as it intends to fight, by bringing the Services together to train and execute joint warfighting. Such increased attention to interoperability and joint force integration over the full spectrum of warfighting will result in an increased role for simulation in terms of developing and sustaining readiness while reducing acquisition cycle time. In addition to its importance in the joint operations and training arenas, ADS will be the key technology in determining and analyzing alternatives for digitizing the battlefield. Advances in modeling and simulation techniques are needed to assess changes in doctrine and tactics and to determine the cost effectiveness of new systems for the battlefield.

Conclusion

ARO research in the areas of synthetic environments, computational modeling, virtual reality and hybrid systems will result in improved ADS systems, in which leaders and decision makers can place their trust and confidence. These issues of trust and confidence are the keystone of Force XXI—*THEY WILL CHANGE THE WAY THE ARMY CHANGES.*

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ARMY RESEARCH LABORATORY CONTRIBUTION TO FORCE XXI

By James R. Predham

The U.S. Army Research Laboratory (ARL) is "reinventing" itself as a result of changes in the external environment, and the challenges posed by the Army chief of staff's Force XXI initiative. This reorganization and restructuring will allow ARL to remain the Army Materiel Command's (AMC) preeminent research organization during this period of change and turbulence, while providing the technologies that underpin Force XXI.

Background

The post-Cold War environment is strikingly different from that of the 70s and 80s. While the Army's basic missions have not changed, the downsizing of Defense has forced a rethinking of the means to support those missions in a power projection Army. Downsizing has also led to a work overload in government, industry and university research and development organizations. This, in turn, exacerbates the competition between government (in-house) and private sector (contract) research to meet future Army needs. Finally, the explosion in information technology has provided many new opportunities for basic and applied research. It was obvious that ARL had to change to meet these challenges and opportunities, but how could we best preserve the capabilities of our talented workforce, while gaining greater access to the best of the nation's technology resources?

The Federated ARL

The federated ARL will have a unique structure. ARL will rely on industry and academia where the technological center-of-gravity and dual-use potential of the technologies give the private sector the lead. ARL will forge direct associations with these external organizations. Rather than the arms-length transactions normal in government contracting, these organizations will be partners in a "federated" ARL, in effect, branches or even full divisions of our larger organization. At the same time, ARL will maintain a strong in-house capability for construction authorized as part of the Base Realignment And Closure consolidation. The intent is to create world-class facilities that will be the cornerstone of an "open laboratory," where our federated partners can perform state-of-the-art research alongside our own employees, while other ARL researchers are working at the facilities of our industry and academic associates. Overall, this concept will expand the routes of technology transfer, both into the Army's weapon system development and from our labs to the private sector.

This concept of operation follows the recommendations of a National Research Council study sponsored by the commander of AMC. Comments on the Federated Lab proposal from Headquarters, Department of the Army, the Office of the Secretary of Defense, and members of Congress have been universally favorable.

ARL Focus

The Army chief of staff has identified the key parameters for Force XXI. These include information-based battle command, and forces that are more lethal, deployable, sustainable, versatile and effective. At ARL, we have focused our efforts on the technologies that will provide these characteristics to the Army of the 21st century. These technology areas are: digitization and communications science; armor and armaments; the soldier system; air and ground vehicle technology; and survivability and lethality analysis. In addition, ARL's new organization will include a Physical Sciences Directorate, to execute research of the basic sciences that provide a foundation for leap-ahead technologies. The following is an outline of the program ARL will pursue to allow Force XXI to be all that the chief of staff expects.

Digitization and Communications Science

This technical area supports the Army chief of staff's first objective—winning the information war. ARL will provide the fundamental science necessary to exploit the information technology explosion, close the opportunity gap that exists between military and commercial information systems, and digitize the battlefield for Force XXI. ARL will take cutting-edge private-sector technologies and apply them to the unique military environment in four areas:

Sensing. To have an automated, near-perfect view of the battlefield during the day or night and in adverse weather conditions, ARL will integrate advanced sensor concepts with new signal/data processors and communications hardware in low-cost, low-power, miniaturized packages. Technical challenges include effective automatic target recognition and real-time fusion of data from multiple sensors.

Distribution. The secure movement of information in a hostile environment requires information distribution systems to use very high bandwidth, state-of-the-art commercial products, as well as computationally intensive approaches that require less communications in exchange for access to more processing power. ARL will combine communications issues with database issues in an approach where the process of data abstraction replaces common message formats as the key factor in the integration of military application programs as used in transaction-based distribution schemes.

Analysis. To turn combat information into knowledge in real-time, ARL will investigate processes that provide reasoning at multiple levels of abstraction and which cooperatively process information from sensor through key tactical event levels to aid the tactical decision process.

Assimilation. To convert knowledge into action by providing a proper human-computer interface, ARL will measure the ability of the soldier to assimilate information in a stressful environment, and provide concepts and technologies to present and transfer battlefield knowledge to the warfighter.

Armor and Armaments

The key focus of the armor and armaments technical area is enhancement of technologies for increased lethality and survivability of Army weapons systems. Operation Desert Storm and other conflicts have demonstrated the effectiveness of the precision weapon systems and high performance armor protection currently in the Army inventory. The goal of ARL's research is to allow the Army to maintain the qualitative edge in these uniquely military technologies. Areas of emphasis include:

Computational Mechanics. This includes modeling of launch, flight and target interaction. These algorithms are designed to provide a greater fundamental understanding of projectile/target interaction phenomena. This better understanding will translate into guidance for improving the performance of future armor and anti-armor systems. In addition, it will supply critical basic information on vulnerability and lethality predictive

methodologies.

Armor Materials and Systems. The intent here is to improve the performance of ultralight, light and heavy armor. ARL is developing and evaluating new, improved and low-cost metals and ceramics, as well as composite armor materials. In addition, ARL will develop the technologies (sensors and defeat mechanisms) that provide active protection.

Soldier System

The individual soldier has always been the focus of the Army's research efforts. ARL must assure that the soldier can operate effectively on the high-tech battlefield and survive in its lethal environment while reducing equipment weight and workload. ARL efforts in this area focus on modeling and simulation of the soldier and the soldier's environment and on developing lightweight power sources for the many electronic systems that the soldier will carry. Focus areas include:

Simulation. This capability will support the individual soldier as a fighting system. The effort will include virtual reality devices, protocols and software to permit the individual soldier to interact with the electronic battlefield environment, and realistic computer-generated individual combatants with software to aggregate and disaggregate small fighting units using human figure models.

Soldier Performance. This relates to quantification of individual soldier mobility, sustainability and performance. The extent and impact of individual soldier enhancements, as related to lethality, mobility, and sustainability, elude accurate quantification. This effort will establish human factors design guidelines, measures of individual performance and measures of effectiveness.

Power Sources. The emphasis is on lightweight, portable power sources. ARL will develop primary and rechargeable battery cell technology comprising high-energy electrode materials and compatible liquid or solid electrolytes. ARL will also develop fuel cell technology using improved high-conductivity solid electrolytes and electrocatalysts that enable the use of liquid fuels.

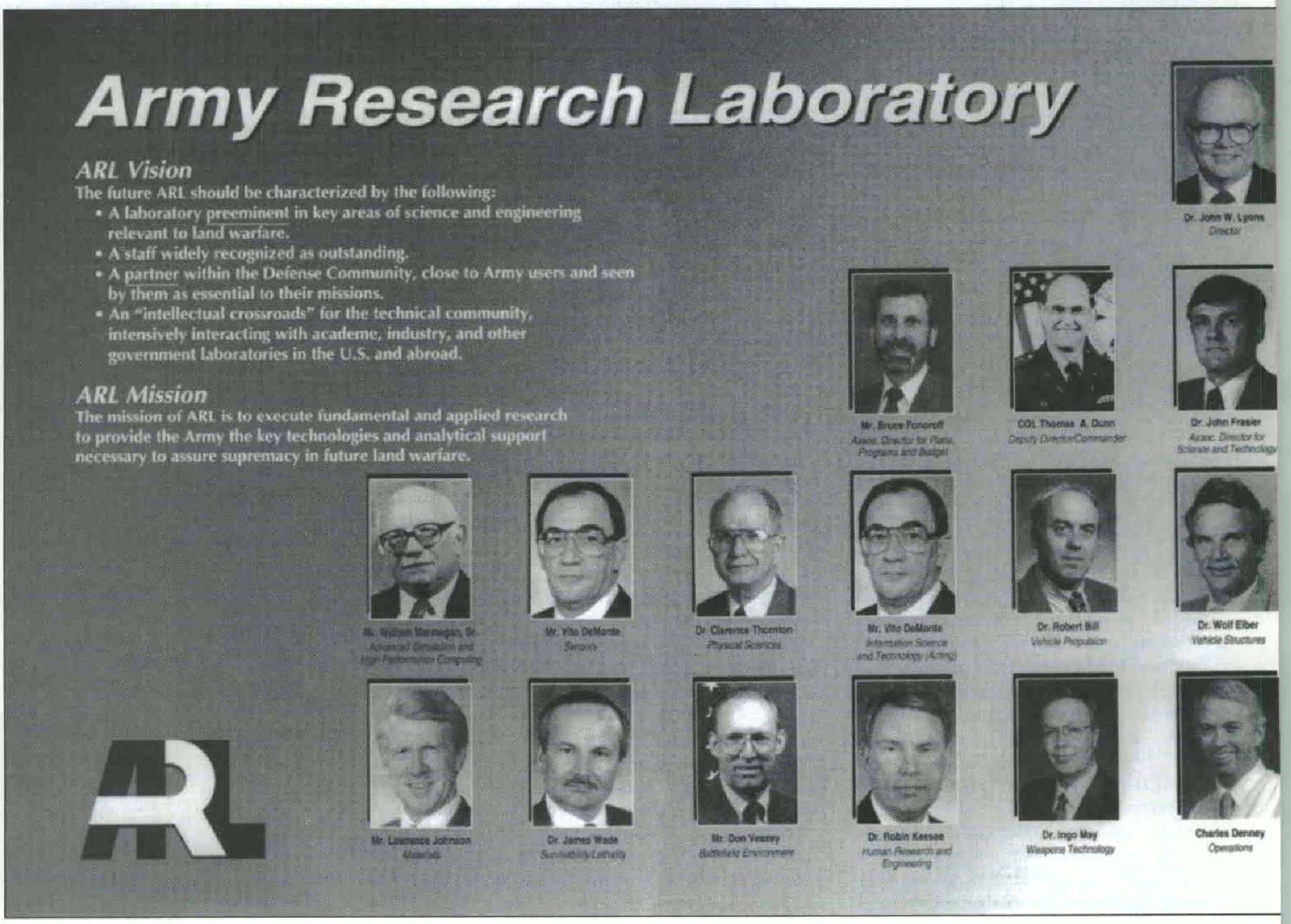
Air and Ground Vehicle Technology

ARL develops the technologies needed to extend the life of current combat vehicles, and to shorten the design and development cycle and enable flexible, affordable manufacture of the next generation of equipment. This will improve the deployability, sustainability and versatility of all Army platforms. Technologies being considered include:

Manufacturing Technology. Prototype environments for manufacturing processes are very important. ARL will use high-performance computers and distributed interactive simulation to address materiel development and acquisition issues such as flexibility of manufacture, dual-use technologies, military vs. commercial specifications, rapid prototyping and the virtual factory. Expert system and neural net technology will facilitate the economical production of high quality parts/components the first time every time.

Propulsion Technology. Emphasis is on component-level technology and validated advanced concepts. As part of a tri-Service effort, ARL will develop improved gas turbine aerodynamic components to enable doubling of propulsion capability and 40 percent reduction in fuel consumption.

Structures Technology. Efforts are geared to quantifying the trade-offs among weight, strength and cost of advanced composite structures. ARL will assess structural issues



The Federated Lab

The Army Research Laboratory (ARL) is pioneering a bold new approach in the way the Department of Defense does business, called the "Federated Laboratory" concept.

Its strategy is to focus in-house laboratory research on Army-specific business areas while exploiting and leveraging commercial information technology and expertise in digitization and communications science to meet Army technology needs through cooperative agreements.

To support this strategy, ARL issued a draft Broad Agency Announcement (BAA) in November 1994. This Federated Laboratory BAA had three primary goals. First, to provide affordable state-of-the-art digitization and communications technology that can be rapidly used to support our soldiers; second, to promote industrial/academic partnering in the five technical elements outlined in the BAA; and finally, to forge a new cooperative business relationship between the private sector and government scientists and engineers to fully exploit the joint development of emerging dual-use technologies.

To achieve these goals, ARL will establish federated extramural centers in five technical elements relevant to digitization and communications sciences. They are advanced sensors; advanced displays and interactive displays; software and intelligent systems; telecommunications/information distribution; and advanced distributed simulation. Each center must, as a minimum, consist of an industrial partner and two academic institutions. One academic institution must qualify as an Historically Black College or University or Minority Institution.

ARL will seek proposals under a single, competitive BAA which will require respondents to collaborate and form industrial/academic consortia. The consortia must describe methods for exchanging ideas and personnel with counterparts at ARL and other consortia within the Federated Laboratory. A significant outcome will be creation of a critical-mass core of private and government scientists and engineers focused on solving Army digitization challenges as well as supporting and stimulating dual-use through applications of research and technology for commercial use.

To facilitate this effort, ARL conducted two pre-solicitation conferences in November 1994, one in Newark, NJ, and the other in San Jose, CA.

The final Broad Agency Announcement was released in December. It is available on the ARL Mosiac Server and Anonymous FTP at the following addresses: By mail: Department of the Army, U.S. Army Research Laboratory, ATTN: AMSRL-OP-PR-AC (Carolyn S. Gonser), ARL-95 FedLab BAA, 2800 Powder Mill Road, Adelphi, MD 20783-1197. The ARL Mosaic Server: http://info.arl.mil:80/. The Anonymous FTP - ftp.arl.mil infile/arl/fedlab_baa.arl.

in composite structures. ARL will assess structural issues in composites manufacturing and processing, and develop formal design optimization tools for multi-disciplinary analysis for lighter, safer and more survivable structures.

Survivability and Lethality

ARL is responsible for the development of vulnerability, lethality and survivability assessments of all fielded and developmental Army weapon systems. Efforts include physical, electronic and nuclear, biological and chemical vulnerability assessments of U.S. and adversary systems, which are provided to Army decision makers to support acquisition decisions. In support of this task, ARL must develop tools that allow these assessments to be performed efficiently, and the results to be authoritative. This effort will insure the continued superiority of Army weapon systems.

Physical Sciences Directorate

Underlying all of the core technology areas are the basic sciences that provide a foundation for leap-ahead technologies. Basic research efforts are spread throughout ARL's directorates, but there was a need to focus more acutely on certain pervasive technology areas. For this reason, ARL is creating a Physical Sciences Directorate that will concentrate resources on the following key research areas:

- **Solid State Physics**—Solid state materials research for terahertz information transmission, surveillance and electronic warfare applications; Multi-wavelength lasers as sources for optical countermeasures; Non-linear optics to provide laser protection for eyes and optical sensors; and Phosphors and dielectrics for flat panel micro-displays for ground and airborne applications.
- **Nanotechnology**—Nanoscale electronics and optoelectronics for teraflop processors, steerable radiators and infrared image processing; and Discovery and exploitation of quantum phenomena and atomic level designer materials for high sensitivity, low-cost, low-power sensors.
- **Chemical Science and Technology**—Electrochemistry, polymers and electrolytes for high energy density batteries; and Fuel cells and alternative power sources for lightweight, low-cost power supplies.
- **Behavioral and Bio Sciences**—Human bionics and biomechanics to enhance individual soldier performance; Microfabrication of solid state neural and chemical toxin detectors; Neuro-receptors in molecule-sized slots in electronic chips for chem/bio detectors; and Biomimetics.
- **Manufacturing Science**—Design optimization, modeling and virtual prototyping tools for system development and upgrades; Test and verification of "best commercial practice" parts.

Conclusion

Finally, we realize that technology is useful only if the Army doctrine is ready to embrace it. In parallel with research on the technical solutions to those critical battlefield problems that have already been identified, ARL has initiated a partnership with TRADOC, the Army's combat developer, to analyze the implications of these technologies in the combat environment. We call this effort "Futures Concepting." This partnership is designed to bring physical and military scientists together to simultaneously develop future technology and doctrine in tandem. In this way, when a technology is ready for battlefield application, so is the doctrine. An initial effort will be to support the AMC/TRADOC Future Technology Conferences.

ARL's re-engineering will permit us to be an effective partner in the Joint Venture that will define Force XXI. We have positioned ARL to meet the challenges of the 90s and provide the Army with the technologies that Force XXI will require.

JAMES R. PREDHAM is a strategic planner on the staff of the director, ARL. Previous assignments have included technology planning and management positions on the DA Staff, at AMC Headquarters and the Army Laboratory Command.

RD&E CENTERS PLAY KEY ROLE IN FORCE XXI

By Janice Dickerson-Kindred

Introduction

Our current Army is evolving into a more modern, more powerful force for the 21st century. The seven U.S. Army Research, Development and Engineering Centers (RDECs) support the Army's acquisition process by ensuring that critical and leading edge technologies are developed to modernize our Army—to evolve a new force for a new century—Force XXI.

Each RDEC has a specific core competency and mission which support the overall modernization process. The RDEC missions and locations are provided in the accompanying figure.

Force XXI Planning

A major function of the RDECs, in support of Force XXI, is to generate an appropriate development strategy. Many factors shape or impact the RDEC's planning efforts. For example, reduced funding levels, technology and information proliferation, force structure or doctrine changes, and a changing international environment are all relevant concerns.

Two documents, the Army Modernization Plan (AMP) and the Army Science and Technology Master Plan (ASTMP), help guide RDEC technology development efforts. The AMP provides the Army's strategy for force modernization and sets objectives which address operational capabilities that are crucial to the Army's mission success in the 21st century. The ASTMP charts the Army's strategic plan for the S&T Program based on Army leadership's objectives, priorities, investment strategy and the vision of the future. The ASTMP also documents the planning of Advanced Technology Demonstrations (ATDs) and approved Science and Technology Objectives (STOs). ATDs address technology barriers and desired capabilities and focus on integrating technology into development programs in a timely manner. STO planning spells out a specific, measurable, major technology advancement to be achieved in a given timeframe, within budgeted fiscal guidelines. ATD and STO planning and execution are important aspects of the RDEC mission.

Together, the AMP and the ASTMP provide a foundation for the RDEC development strategy and assist in prioritizing programs, obtaining necessary resources and maintaining a strong technology base (expertise and facilities) required to transition essential technologies through development into production.

Process Management

Meeting the challenges of modernization requires more than sound planning. Fundamental process management by the RDECs is also a must. The RDECs strive for process improvements and efficiencies through effective and innovative management initiatives. These initiatives deal with such issues as best value, reduced cycle time and better product quality. The goal is to either streamline the process or optimize its outputs/products by breaking down existing stove pipe methods, out-dated paradigms and serial approaches to fielding new technology. Key Army management initiatives include:

- *Louisiana Maneuvers (LAM).* LAM is an Army chief of staff initiative (integrated organization and process components) to focus and synchronize efforts to transform today's forward-based Army into a CONUS-based, force projection Army for the 21st century. The RDECs offer new technology products (for study, demonstration, analysis, simulation, etc.) to the LAM process, in response to warfighter requirements.
- *Battle Lab Partnerships.* The RDECs team with the Battle Labs, tester and industry to explore new ideas and refine user requirements and battlefield capabilities. Each of the five Battle Labs is assigned a "lead" RDEC. The RDEC-Battle Lab partnerships help focus resources and develop smart, affordable, technology projections, thus strengthening both the requirements and the integration processes.
- *Horizontal Technology Integration (HTI).* In HTI, the RDECs attempt to identify and apply common enabling technologies across multiple systems to improve the warfighting capability, while reducing R&D cost and time and lowering unit production costs through quantity procurements.
- *Distributed Interactive Simulation (DIS).* DIS uses simulations in conjunction with real equipment and soldiers on instrumented ranges and integrates reality and simulation in war games. DIS concepts support RDEC development, testing, training and production planning. State-of-the-art simulators and simulator-enhanced testing and training help RDECs and the Battle Labs project how current ideas will work on future battlefields.
- *Integrated Decision Teams.* RDECs aggressively seek strategic alliances with the warfighter, technologists (government, industry and academia) and the producer and manufacturer. Multi-disciplinary teams are formed from functional experts to capitalize on synergism and technical expertise. These teams broaden the concurrent engineering concept by addressing integrated management of products, services and sub-processes.
- *Commercial Specifications and Standards.* The RDECs simplify contracting, reduce costs and increase competition and product availability by eliminating non-essential military specifications and standards. This initiative emphasizes the application of commercial specifications.
- *Joint and International Partnerships.* The RDECs support pooling of joint Services and multi-national projects to leverage manpower and fiscal resources. Consolidation of

ARDEC - U.S. Army Armament Research, Development and Engineering Center - Picatinny Arsenal, NJ. • Develops munitions and armaments.
AVRDEC - U.S. Army Aviation Research, Development and Engineering Center - St. Louis, MO. • Develops rotorcraft and related equipment.
CERDEC - U.S. Army Communications and Electronics Research, Development and Engineering Center - Fort Monmouth, NJ. • Develops communications and electronic equipment.
ERDEC - U.S. Army Edgewood Research, Development and Engineering Center - Aberdeen, MD. • Develops chemical and biological defense related equipment.
MRDEC - U.S. Army Missile Research, Development and Engineering Center - Huntsville, AL. • Develops systems with focus on rockets, missiles, unmanned vehicles and lasers.
NRDEC - U.S. Army Natick Research, Development and Engineering Center - Natick, MA. • Develops survivability, sustainability, individual mobility and quality of life equipment for the soldier.
TARDEC - U.S. Army Tank-Automotive Research, Development and Engineering Center - Warren, MI. • Develops combat vehicles and other military ground transportation equipment.

RDEC Missions.

programs help ensure advanced technologies will be available and compatible for joint and allied and coalition users.

Technology Development

In addition to sound planning and process management roles, the RDECs must develop weapon system technology superior to that of any potential enemy. Incorporating the latest technology into Army materiel will be a major factor in winning future military operations. Technology must leverage the power of the soldier through the use of state-of-the-art, strategically flexible and more lethal warfighting systems. It is incumbent upon the RDECs to develop and field the high payoff technologies that support these *Army Modernization Objectives:* Project and sustain the force; Protect the force; Win the information war; Conduct Precision Strikes throughout the battlefield; and Dominate the maneuver battle.

As the modernization objectives are translated into more definitive warfighting goals and capabilities the RDECs' job becomes better defined. Some examples:

• Reduce time constraints through battlefield digitization.

• Continuously and accurately update information and maintain situational awareness in four-dimensional battlespace. "Win the information war."

• Expand the battlespace to avoid close combat by outranging the enemy. Deliver high precision munitions and reduce casualties.

• See throughout the battlefield and operate under all conditions. "Own the night/environment."

• Enhance active vehicle protection and survivability. Operate in defilade and deny defilade to enemy.

• When appropriate, use non-destructive/non-lethal methods to limit collateral damage.

• Promote simulation technologies to maintain "a trained/ready" Army.

Today's "information age" dictates that a high priority be given to digitizing the battlefield and winning the information war—where more accurate and timely data becomes critical. Many of the RDEC emerging technology efforts will undoubtedly address system digitization and rapid information dissemination.

RDEC Contributions

The RDEC development efforts, based on requirements developed by U.S. Army Training and Doctrine Command (TRADOC), will ensure crucial technologies to support Force XXI. The following reflects a sampling of ongoing and projected RDEC contributions and accomplishments.

ARDEC

• Smart Mines and Intelligent Mine Fields—communicating and interfacing as an intelligent unit.

• Low Collateral Damage Munitions—incorporating light-emitting optical munitions, high power microwave projectiles, acoustic beam weapons, pulsed chemical lasers and ballistic sting nets.

• Soldier Weapons—firing compact, kinetic energy projectiles and air-bursting, fragmenting munitions.

• Smart Munitions and Identification Friend or Foe—providing advanced sensor suites and warhead integration to interrogate targets with encrypted signal.

• Advanced Warhead—incorporating lethal mechanisms to increase penetration of advanced armor.

• Electromagnetic and Electrothermal-Chemical Gun Propulsion—using electricity to fire higher performance projectiles.

AVRDEC

• Aviation Modernization Programs (RAH-66 Comanche, AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook and OH-58D Kiowa Warrior)—improving intelligence gathering, battle command, situation awareness, lethality, and survivability.

• Combined digital flight control data system with fuel and fire control systems—increasing accuracy and extending night operations.

• AH-64D Longbow Apache—with its adverse weather target acquisition capability, fire-and-forget missile, rapid target servicing, and improved cockpit; insuring attack helicopter superiority.

• Integrated high-performance turbine engine technology—extending air vehicle range.

• Airborne (manned and unmanned) vehicles—working as a system and providing improved reconnaissance.

CERDEC

• Survivable Adaptive System ATD—using multimedia network, fiber distributed data interface and wireless network technologies; affording increased throughput, continuous access, increased survivability and seamless communications.

• Combined Arms Command and Control ATD—providing real time force synchronization, automated target handover, shared situation awareness, and automatic self/friendly position to reduce fratricide.

• In addition to the above ATDs, three others (managed or executed by CERDEC) are considered critical to the success of Force XXI. They are: Digital battlefield communications, Common Ground Station and

Battlefield Combat ID.

• Special Project Office for Battlefield Digitization—established to manage and execute CECOM's digitization efforts for Brigade '96, Division '97, and Force XXI.

• CECOM Integrated Lab/Test Bed—providing a dynamic, first class integrated facility linked to several key RDEC lab facilities, selected industry, government and battle labs. The facility can be rapidly reconfigured to replicate diverse, existing and evolving tactical capabilities in communications, command and control, electronics and night vision sensors.

ERDEC

• Advanced Systems/Equipment—providing advanced detection, protection, decontamination and smoke/target defeat:

—Biological warfare agent point and standoff detectors.

—Lightweight chemical sensors for ground or unmanned aerial vehicles.

—Sensor interfaces to digital communication network.

—Lightweight gas mask.

—Air purification systems for vehicles, vans and shelters.

—Smoke/obscurants for vehicles and warfighters.

• Joint Directors of Laboratories (JDL) Technology Panel for Chemical Biological (CB) Defense—assuring all CB technology base efforts are coordinated among the services.

• Joint Service Consortium (ERDEC lead)—developing accurate, realistic chemical, biological and smoke battlefield environments using DIS, where soldiers train in simulated environments without actual hazards, allowing evaluation of tactics, doctrine and equipment.

MRDEC

• The Army's Combined Arms Weapon System (TACAWS)—affording air-to-air, air-to-ground, ground-to-air and ground-to-ground attack of multiple targets and ensuring compatibility with the tube-launched, optically-tracked, wire-guided (TOW) missile and Hellfire launcher.

• Adaptive Missile—providing multi-payload capability and containerized for launch from the M270 vehicle. Missile body of composite structures, reducing radar cross-section signature and the ability to adapt, in flight, to changing battle conditions.

• Multi-Platform Launcher-Low-Cost Guidance for Artillery Rockets (MPL-LCGAR)—providing advanced performance, enhanced/low cost guidance, improved accuracy, and increased lethality.

• Product Improvements—increasing performance/effectiveness, linking fire control and condition status into the digitized battlefield for more effective use of valuable missile assets.

• Expanding the Battlespace—providing extended range, reliable communication of missile status to fire control and command and control networks, use of in-flight missile sensor data for surveillance and increased accuracy and lethality.

NRDEC

• Enhanced Land Warrior (ELW) Program—umbrella program encompassing: Land Warrior for dismounted soldiers (available technology), Air Warrior for aviation community, Mounted Warrior for tracked community and 21st Century Land Warrior (next generaion technology). Five basic ELW subsystems include; Integrated Headgear, Individual Soldier Computer/Radio, Weapon Interface, Protective, and Microclimate Cooling.

• Technology Advancements—providing microelectronics and signal processing, improved and lightweight sensors, advanced materials, individual power sources, high resolution flat panel display and modeling and simulation.

• Capability Enhancements—providing situation awareness, target hand-off, real-time intelligence, digital maps/overlay, secure voice/data radio, personnel status monitoring, mine avoidance, body armor, signature suppression/control and mission planning.

TARDEC

• Advanced Vehicle Technologies (AVT) Top Level Demonstration—integrates a series of intra-vehicle digitization ATDs through a new Army Standard Commercially-based Combat Vehicle Open Architecture. ATDs include:

—Hit Avoidance—providing battlefield reconfigurable architecture, capable of tailoring to counter/protect against specific anticipated treats.

—Crewman's Associate—providing advanced crew station controls and displays for simplified operations.

—Combined Arms Command and Control—fulfilling inter-vehicular digitization needs of the maneuver force by maximizing the use of on-vehicle digitization streams.

• Helicopter-HMMWV—integrates a central tire inflation system, active suspension system and hybrid electric drive and decreases width by six inches, permitting easy roll-on-off and transport in the CH-47.

• Electric cannon-vehicle—(advancements by ARDEC/TARDEC), enabling plans for an all-electric tank by 2015.

• National Automotive Center—facilitating automotive technology transfer between DOD and the transportation community.

Summary

Force XXI is the focus of the Army's modernization vision. As we have seen, the RDECs play a key role in achieving this vision. Force XXI systems will project Army power deeper and provide better survivability, improved accuracy and increased effectiveness. Tomorrow's soldier will go into battle with the most sophisticated tools and weapons the world has ever known. In the current sociopolitical environment, the RDECs face the challenge of fewer resources, a smaller force and world-wide technology proliferation. Only those new systems with significantly increased capability and value-added upgrades can be pursued. Innovative approaches by the RDECs (in planning, process management and technology development) will be the key to success. The accelerating pace of technological change will continue to offer significant challenges and opportunities to enhance operational capabilities. The RDECs stand in the forefront to meet these challenges. The warfighting implements for the 21st century are being researched and developed by today's forward looking scientists and engineers at the U.S. Army Research, Development and Engineering Centers.

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ACQUISITION STREAMLINING IN SUPPORT OF FORCE XXI

By Lawrence C. Williams

Introduction

The Army of the 21st century is being shaped today. Tactics, doctrine, materiel capabilities, manpower strengths, and support requirements are all being closely examined to ensure that our forces can respond effectively to any situation demanded by a changing, volatile world. A key element in this shaping of Force XXI is the need to streamline the Army's acquisition process. Shortened acquisition cycle times are required to maximize the effectiveness of reduced resources and to take full advantage of rapid technological advances occurring in commercial markets.

Fortunately, the environment has never been better for changing the acquisition process. One of President Clinton's first actions was to establish the Office of the Deputy Under Secretary of Defense for Acquisition Reform, with the sole purpose of increasing the efficiency of the DOD acquisition process.

Vice President Gore's "Reinventing Government" review provided an opportunity to examine and change the way government does business at all levels and across all activities. Congress also has acknowledged the need for change and demonstrated a willingness to act by recently passing the Federal Acquisition Streamlining Act of 1994 which legislates sweeping changes to the government procurement process.

OSD has implemented the recommendations of two process action teams (PATs), one on the use of military specifications and standards, and the other on the use of electronic data interchange (EDI), and has established four additional PATs to further streamline and enhance the efficiency of the acquisition process. These PATs are examining the Defense Acquisition Board (DAB) process, the contract administration services (CAS) process, the procurement process and the requirements process.

Clearly, management at all levels is receptive to change. Within this fertile environment, considerable streamlining of the acquisition process has already occurred and more changes are being developed. This article attempts to describe the major components of the Army's acquisition streamlining program and shows what streamlining options/tools are available to the program manager during the various phases of the acquisition cycle.

Two-Axis Approach

The Army leadership has endorsed a two-axis approach towards shortening the acquisition cycle through the use of streamlining and re-engineering initiatives. Streamlining initiatives are process improvements that allow us to move through the acquisition "gates" faster, while re-engineering initiatives are process changes that allow us to combine or eliminate some of the gates. The goal is to establish a process that has the agility to accommodate the requirements and timelines of any acquisition need. Examples of process improvements include use of commercial items and practices, electronic commerce, and cooperative research and development agreements (CRDAs). Examples of process changes include combat and performance modeling, virtual prototyping, virtual manufacturing, and virtual testing.

Clearly, significant benefits can be realized by improving the way technology finds its way into weapon systems or battlefield support applications. The Army Battle Labs were created to monitor and experiment with existing and emerging technologies in order to continually assess warfighting enhancement potential through the application of these technologies. The Advance Concept and Technology II (ACT II) Program provides one such mechanism for the Battle Labs to identify mature technologies or industry developed prototypes that could potentially increase our warfighting capability. Once identified, Advanced Warfighting Experiments (AWEs) are performed by the Battle Lab to demonstrate the battlefield effectiveness of these technologies, and, if successful, the technology and materiel is transitioned to a program manager or materiel developer for acquisition and fielding.

Cooperative Efforts

Another tool that hastens the application of technology to battlefield systems is the use of CRDAs. CRDAs are cooperative efforts between two or more parties who agree to share personnel, facilities and equipment in the development of a particular technology, process or materiel. CRDAs can be an important tool for reducing cycle time by accelerating the maturity of a technology, thereby speeding both commercial and military applications. Industry familiarization with the technology allows the development of economical production methods and widens the scope of applications that may ultimately be exploited for military use. The Army is making significant use of CRDAs across the full range of emerging technologies. Currently, there are over 400 active CRDAs with industry and academia, examining such items as pultruded composite tubing, high density capacitators, oxynitride glass fibers and fortified confectionery products.

Non-Developmental Items

Once a mission need statement (MNS) is generated and phase 0, concept exploration and definition, is entered, several important streamlining tools are available. Probably the single, most effective factor in decreasing acquisition time is the ability to satisfy the user requirement with a non-developmental item (NDI). This is not a "luck of the draw" event, but can be significantly influenced by the conduct of a thorough market investigation and an aggressive requirements trade-off analysis.

A pure NDI, where the item can be used "as is" with no required modifications, permits a combined milestone I and III which effectively enters the program into production at the time of operational requirement document (ORD) approval. Phases I and II (concept exploration and definition phase, and demonstration and validation phase), and milestone II are eliminated. An NDI item that requires some limited research and development effort to ruggedize or to add some Army-unique capability permits a combined milestone I and II, an abbreviated phase II, and elimination of phase I.

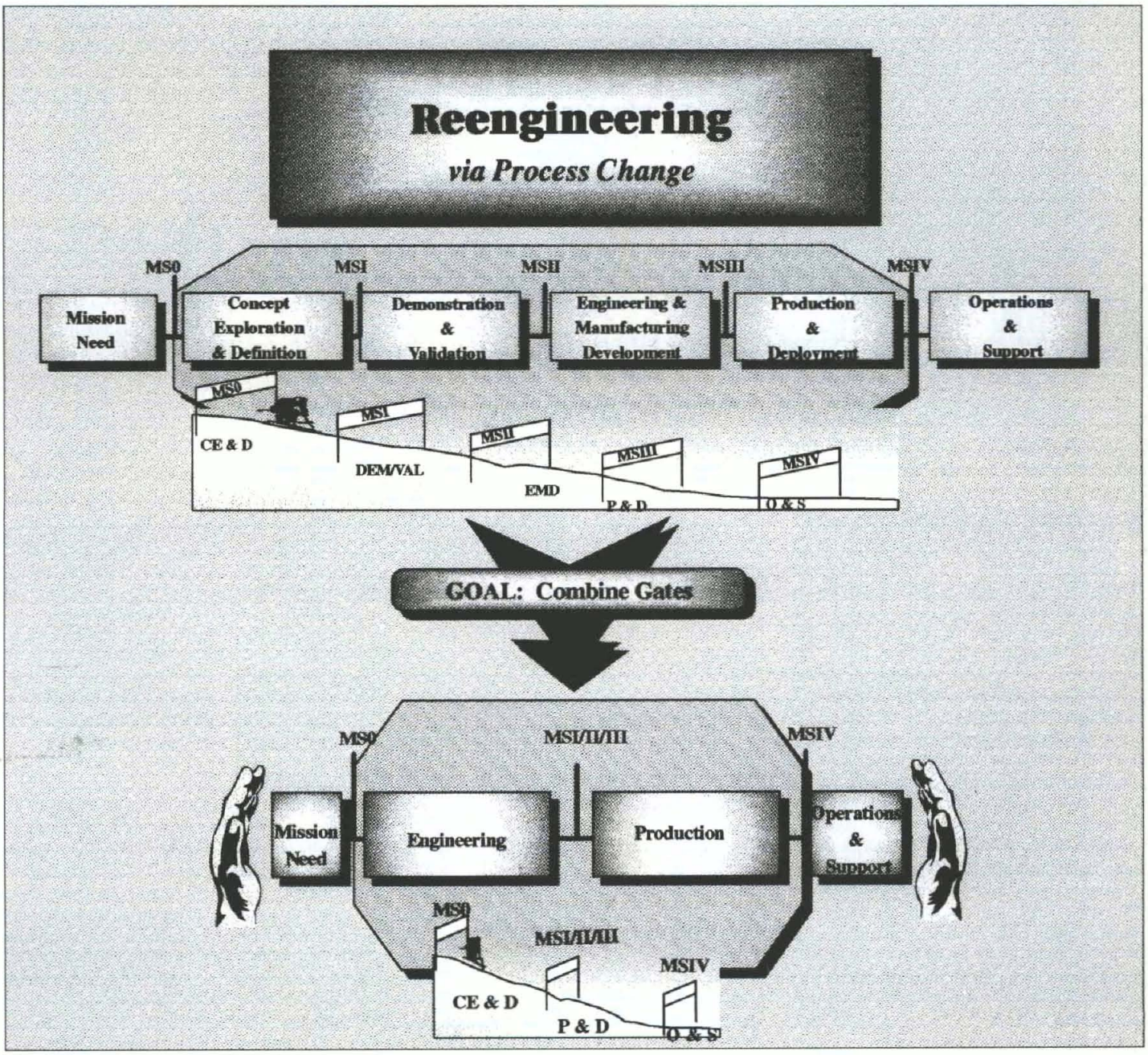
The Army has an aggressive program designed to increase the reliance on NDI and

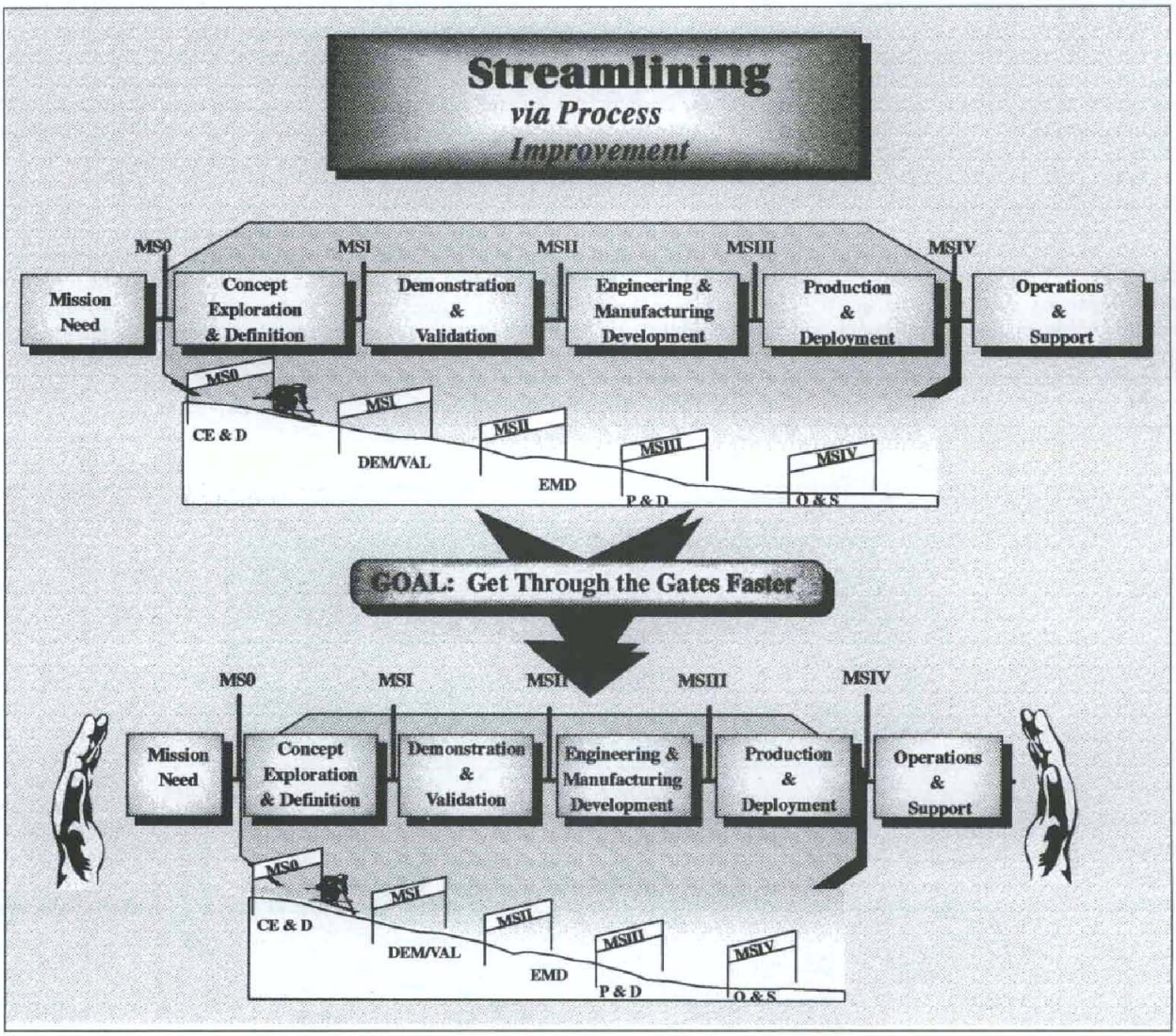
commercial items through the establishment of a Service NDI advocate and local, site-specific, associate advocates. These advocates are responsible for challenging barriers to the use of NDI and commercial items and ensuring that all NDI and commercial options are identified and fully considered in program acquisition strategy deliberations. There are currently 11 Army NDI associate advocates located at each acquisition site within the Army.

Modeling

Combat performance modeling and simulation and virtual prototyping techniques can also be applied during Phase 0 of the acquisition process to refine the requirements and examine potential solutions. These modeling techniques provide the capability to experiment with different design concepts using performance simulations prior to any physical fabrication. Various concept alternatives can be examined quickly and inexpensively, thereby reducing technical risk by eliminating poor or inadequate solutions. Trade-off analysis can also be conducted to ensure that only essential requirements are included in the ORD; thereby, increasing the likelihood of an NDI and commercial solution.

If an NDI acquisition strategy is not feasible and a Phase I is required, virtual prototyping can again be used to further define the critical design characteristics and system capabilities. During this phase, a solicitation will need to be prepared for award and execution in phase II, system engineering and manufacturing development. Through the application of "functional support templates," significant reductions in contractor requirements and the attendant matrix support effort can be realized. These "templates" were developed to provide program managers with a disciplined approach to determining the minimum essential functional requirements necessary for conduct of a development or production effort commensurate with a prudent level of risk. They essentially provide a structured framework for performing cost and benefit analysis of requirements that are placed in solicitations. The template concept was described and demonstrated to all program executive officers (PEOs) and AMC major subordinate commands (MSCs) during the Roadshow III series of the Acquisition Improvement Seminars.





Non-Government Standards

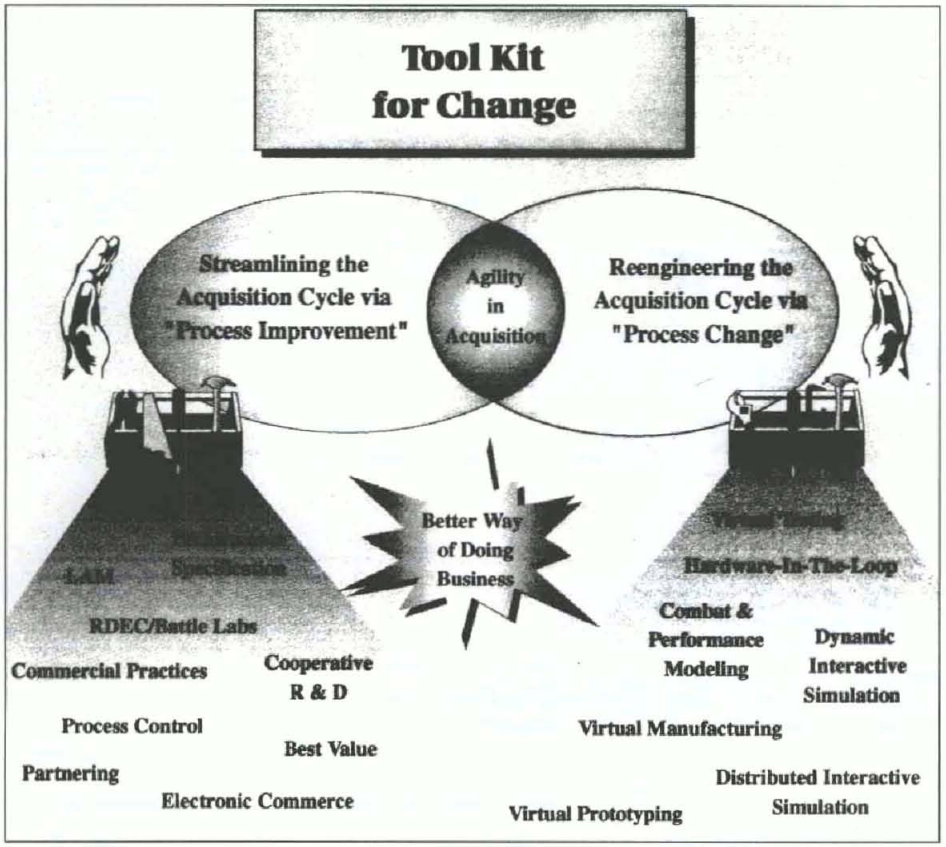
Another key element in structuring the solicitation to minimize cost and shorten the design and manufacturing timelines is the use of non-government standards (NGS). By enabling contractors to use commercially accepted components and processes, the development of unique parts and the establishment of separate production lines can be eliminated. Capabilities lost as Defense firms are downsized, converted, or eliminated can be replaced by tapping the commercial manufacturing base, allowing commercial firms to apply their expertise and capabilities to Defense needs. Additionally, use of NGS encourages Defense contractors to adopt prevalent manufacturing techniques that reduce costs or enhance their commercial capability. The result is decreased development and production times, reduced costs, and higher quality products. These benefits have long been recognized; however, it is just recently that serious action has been taken to maximize use of NGS.

The Army plan to implement the secretary of Defense-endorsed recommendations of the DOD process action team on military specifications and standards requires a waiver from the Army acquisition executive (AAE) or the milestone decision authority (MDA) for each use of a military-unique specification or standard. The intent is to provide a powerful disincentive for specifying a military specification or standard except in cases where no alternative exists.

Electronic data interchange (EDI), or the broader electronic commerce, can contribute significantly to shorter acquisition times in phase I by accelerating the flow of information. EDI is the computer-to-computer exchange of routine business data in a standard format, and includes electronic bulletin board systems and other client and server architecture systems. Near real-time exchange of acquisition-related documents between the Army and industry can dramatically reduce document preparation time and result in a higher quality product. Draft specifications, statements of work, and requests for proposals (RFPs) can be relayed to industry for comment and updated rapidly. Finalized RFPs and solicitations can be generated, transmitted and returned electonically, virtually eliminating paper copies and delivery inefficiencies, thereby greatly reducing cycle time. Fully implemented, this process ensures early industry involvement, quick and effective two-way communication, and a sense of partnership between government and industry engendered through full participation of all parties in each step of the process.

Phase II

In phase II—engineering and manufacturing development—several acquisition steamlining options are available. Virtual prototyping can again be used, this time to pass engineering level information and data among the various offices that evaluate and refine the system development. This improves the probability that the design is "right" the first time the system is built in hardware; thus, avoiding the time-consuming and costly "build-test-build" loops that historically occur in new systems. Three-dimensional



solid models can be generated to allow assessment of operational performance, maintainability issues, producibility, human engineering concerns, component placement, and system integration compatibility. Significant reductions in both time and cost are possible using this powerful design tool.

Closely aligned with virtual prototyping, virtual testing supports the design effort in phase II through assessment of system or component performance in a synthetic environment prior to an actual prototype or production model being built. Terrain scenarios, environmental factors, and real-world obstacles can be simulated and their effect on the subject system can be evaluated. Design changes can be made based on these test results and the system retested. Testing can be conducted without endangering personnel, test equipment or the system under test, thereby eliminating the need for safety planning and testing methodology precautions that diminish test realism. Once testing models have been validated and confidence established that the data represents actual results, real-world testing can be significantly reduced. The result is less time spent in test or retest, more performance data available earlier in the process, and significantly reduced testing costs.

Virtual Manufacturing

Completing the trio of modeling and simulation tools available in phase II of the acquisition cycle is the concept of virtual manufacturing. By accurately modeling existing or planned production facilities or operations in the virutal world, producibility and manufacturing issues can be rapidly and accurately examined at relatively low costs. The impact of design solutions on production time, manufacturing costs, production efficiency, and product quality can be assessed prior to tooling and initial hardware manufacture. Based on virtual manufacturing trials, accurate, efficient production can occur beginning with the first unit.

Once milestone III is passed and production begins, the virtual manufacturing effort begins to pay dividends through manufacturing process stability and efficient production. Reduced requirements made possible by careful application of the templates decrease the production effort. Use of NGS allows contractors to employ the same, familiar processes used for commercial customers, and virtual prototyping has optimized the design to economically meet user requirements. Virtual testing has quickly, inexpensively, and accuratley identified and eliminated design flaws to ensure performance objectives are met, and the production contract has benefited from the efficient two-way communication allowed by EDI. All of this adds up to reduced production time, further streamlining an acquisition process that has already been significantly shortened.

It is acknowledged that many of the streamlining tools described here are not currently available for widespread use. Virtual prototyping, virtual testing, virtual manufacturing, and EDI all require additional development before they become firmly established in the acquisition process. But significant progress is being made on these important technologies.

The U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC) has demonstrated dramatic accomplishments in the area of virtual prototyping, and has modeled the 30,000-square-foot TARDEC production facility for virtual manufacturing application. The U.S. Army Communications-Electronics Command (CECOM) has established an electronic bulletin board that allows Army and industry to exchange information quickly, and the U.S. Army Test and Evaluation Command (TECOM) has developed testing models that generate data acceptable to program managers, contractors, and independent evaluators.

Conclusion

As a final note, a DA-chaired Tiger Team has identified four acquisition programs to serve as pilots for a Battle Lab Rapid Acquisition Process. Each of these programs have accelerated acquisition schedules based on innovative use of the existing process and a willingness to accept and manage a higher degree of program risk. Although it is too early to report success, results look promising.

There is no silver bullet. Although some of the initiatives discussed here have the potential to significanly reduce fielding time and costs, more often than not a combined approach will be necessary. It is not enough to look through the laundry list of acquisition streamlining initiatives and select one for use in your program. A concerted effort must be made to use all appropriate tools, discarding only those that are impractical due to real world constraints. With continued development and uncompromising application of these tools, we will be able to meet the acquisition needs of the next century and ensure that the soldiers of Force XXI continue to be the best-equipped in the world.

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THE ACQUISITION INTERN AND MENTOR PROGRAMS

By Dr. Bennie H. Pinckley
and James M. Welsh

Acquisition educational programs such as mandatory training, tuition assistance, long-term training, executive seminars and developmental assignments have all become a reality as the AAC plans for the future by investing heavily in its most important asset, the existing acquisition workforce.

Introduction

One of the most prominent provisions of the Defense Acquisition Workforce Improvement Act (DAWIA) is its strong focus on education and training. The Army Acquisition Corps (AAC) leadership responded to this challenge by establishing the Acquisition, Education and Training Office, under the director for acquisition career management (DACM), Office of the Assistant Secretary of the Army (RDA).

Acquisition educational programs such as mandatory training, tuition assistance, long-term training, executive seminars and developmental assignments have all become a reality as the AAC plans for the future by investing heavily in its most important asset, the existing acquisition workforce. The Army's latest addition to training and career development is the Acquisition Program Management Intern and Mentor Programs.

AAC Intern Program

With roots embedded in the DOD Acquisition Scholarship Program, the intern program takes master's-level graduating scholars into the next step of learning—an internship in the acquisition community. Following successful completion of the three-year intern program, the interns will embark on their first competitive assignment and set their goals on future membership in the Army Acquisition Corps.

In 1992, the DOD announced its first competition for the Defense Acquisition Scholarship Program (DASP). Sanctioned by Section 1744, Title 10, United States Code, the scholarship program was established to qualify personnel for civilian acquisition positions in DOD. Individuals must meet the following criteria to be eligible to participate:

- Be accepted for admission, or currently enrolled as a full-time student at an accredited educational institution authorized to grant the master's degree;
- Be pursuing or have completed an undergraduate or graduate degree in one of the acquisition career fields and have received a baccalaureate degree with a cumulative grade point average of at least 3.0 out of 4.0;
- Sign an agreement to serve as a full-time civilian employee in a DOD acquisition position for one calendar year for each school year, or part of a school year, for which the student received scholarship support; and
- Be a U.S. citizen.

Through the Defense Acquisition University, the DASP pays a stipend of $15,000 for a full-year (12-month) period of study and $13,000 for a full academic year of study. Additional terms of the agreement are specified in the scholarship program brochure, which is published each winter, and is available through the school academic placement office.

The average DASP schedule is for two consecutive years. Second-year awards are dependent upon the availability of funds; successful completion of the first year course of study, as evidenced by acceptable academic progress and good standing within the institution; and the likelihood of receiving the master's degree at the conclusion of the second year of study.

Acquisition career fields include: program management, communication/computer systems; contracting and purchasing; industrial property management; systems planning, research development and engineering; test and evaluation engineering; manufacturing and production; quality assurance; acquisition logistics; business, cost estimating, and financial management; and auditing.

The intern program begins as the DASP scholars complete graduate school. Upon receiving a master's degree, scholars are brought into the Army acquisition workforce at grade GS-09 in the Program Management Career Field, series 301. At this juncture, they are officially designated as program management interns. During the subsequent three-year period of training, based on performance evaluations and mentor recommendations, interns are considered for noncompetitive promotion through grade GS-12.

Three Army participants graduated from the DAS Program in mid-1994 and are currently serving internships at separate Army facilities. The AAC has six additional DOD scholarship students who are in varying stages of completion. One graduated in December 1994 and within 30 days of graduation, was assigned and placed as a program management intern within the acquisition community. Two more students are scheduled to graduate in the spring of 1995. The three remaining students are expected to complete their studies in the spring of 1996. It is anticipated that each year, the Department of the Army will receive three or four scholarship students under the DASP.

According to the senior acquisition leadership, the initial three years of internship is critically important to the Army. The success of the intern program depends to a great extent on how well the AAC provides challenging and responsible training to meet the personal and professional career needs of these interns. In the long term, these interns should eventually be found at numerous locations occupying senior leadership positions throughout the AAC.

The Acquisition Program Management Intern Program complies with Section 1742 of the DAWIA, which requires each DOD acquisition component to implement an acquisition intern program to provide exceptionally qualified individuals an opportunity for accelerated promotions, career broadening assignments, and specified training, to prepare them for entry into the AAC. Although interns are presently brought into the acquisition workforce following successful completion of the DASP, the AAC will expand the intern program to include exceptionally qualified employees who are already in the workforce and who have been nominated for the program by a supervisor or mentor.

With roots embedded in the DOD Acquisition Scholarship Program, the intern program takes master's-level graduating scholars into the next step of learning—an internship in the acquisition community.

AAC Mentor Program

The key to the success of the intern program depends largely on the mentor program. Mentoring is not new to the Army. Most organizations have their own mentoring programs as do many functional area career fields. Acquisition mentors are volunteer senior Acquisition Corps leaders who were selected by the deputy director for acquisition career management (DDACM). They were selected based upon background, training, career success, and a genuine desire to help others.

A major benefit of the mentor program is that the outstanding interns can learn from the wealth of education and experience of successful mentors who are currently top contenders for advancement to various senior acquisition leadership posistions. An important role for the acquisition mentors is to draw upon their knowledge and experiences in designing an educational and career development road map by which interns can plan and set their goals toward a successful career in the AAC.

The mentor/mentee (intern) association begins shortly after applicants win their candidacy to the DOD Acquisition Scholarship Program. The relationship between mentor and mentee (intern) will be particularly close and active during the first several years of the program. In some cases, this relationship may likely become a career-long association.

During FY 95, an announcement should be published by the DDACM Office outlining the criteria for selecting volunteer mentors, together with procedures for nomination. Like the intern program discussed earlier in this article, the mentor program will be greatly expanded.

Conclusion

Although it is too early to evaluate these programs for potential impact on the AAC, the high rate of applications received thus far suggests that it is achieving what it is designed for. In addition, senior acquisition leaders, while serving in their mentor role, have a tremendous opportunity to become directly involved in the overall intern training program. This involvement, in addition to its positive impact on intern careers, will do much in assisting AAC managers at all levels, in developing near- and long-term strategies for both training and organizational goals and will improve the mentors significantly.

Readers who have comments or questions regarding this article are encouraged to contact James Welsh, (703)805-4161, DSN 655-4161, or Fax (703)805-4163. Those wishing to know more about the Acquisition Program Management Intern Program should contact Dale Fradley at the Army Acquisition Executive Support Agency, (703)805-4205, or DSN 655-4205.

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Hitting the Road. . .

ACQUISITION INTERNS, MENTORS VISIT SELECT ARMY FACILITIES

By Debbie Fischer
Staff Writer

Late last year, four Department of the Army acquisition interns and their mentors participated in a five-day series of briefings, demonstrations and tours at several Army facilities. The purpose was to introduce the new Acquisition Program Management Intern and Mentor programs, and to provide an orientation for the participants. Accompanied by Dr. Bennie H. Pinckley, deputy director for acquisition career management, Office of the Assistant Secretary of the Army for Research, Development and Acquisition (OASARDA) and Dale Fradley, chief of program management, Army Acquisition Executive Support Agency, the interns and mentors visited the U.S. Army Simulation, Training and Instrumentation Command (STRICOM) in Orlando, FL; the U.S. Army Missile Command (MICOM) at Redstone Arsenal, AL; and Picatinny Arsenal in Dover, NJ. The visits culminated in a meeting at the Pentagon with Assistant Secretary of the Army (Research, Development and Acquisition) Gilbert F. Decker.

The interns and their mentors are, respectively, Charlotte C. Cates and Linda M. Gentle, Multiple Launch Rocket System Project Office, Program Executive Office (PEO), Tactical Missiles, Redstone Arsenal, AL; Monique Anneker and Marlene D. Seaton, STRICOM (a major subordinate command of the Army Materiel Command); Doreen DeBenedictis (who at the time was completing her master's studies) and Spencer Hudson of the PEO, Standard Army Management Information Systems (STAMIS) Fort Belvoir, VA; and Ross Rosengren and Charlie Mattingly, Office, Project Manager (PM) for Advanced Field Artillery System, Picatinny Arsenal, NJ.

STRICOM

The orientations began at STRICOM, with the mentors and interns participating in a workshop presented by Dr. John A. Daly, a professor in the College of Communication and Business at the University of Texas. Daly

Ross Rosengren and Linda Gentle participate in a demonstration of GUARDFIST I.

The trip concluded at the Pentagon with a brief visit with ASA(RDA) Gilbert F. Decker. Front row, left to right, are Marlene D. Seaton, Monique Anneker, Doreen DeBenedictis, Charlotte Cates, and Linda M. Gentle. Back row, left to right, are Dale Fradley, Spencer Hudson, Ross Rosengren, Charlie Mattingly, Dr. Bennie H. Pinckley, and Gilbert F. Decker.

said that organizational support is key to a successful mentorship program. He also emphasized the importance of teamwork between the mentor and the intern's boss when the mentor is someone other than the intern's boss. He recommended that mentors set achievable goals on a daily basis and that interns be direct and up-front with their concerns.

The following day, BG John Michitsch, commander, STRICOM, welcomed the group and provided an overview of the command.

The mentors and interns visited the Institute for Simulation and Training (IST) at the University of Central Florida, where Ronald W. Tarr, PM for the institute, presented a briefing and video on the IST as well as a tour of its labs.

MAJ Ted Koufas, project director, Guard Unit Armory Device Full Crew Interactive Simulation Trainer (Guardfist I), Orlando, and Don Chase, project director for Industrial Data Link, Guardfist I's prime contractor, described the trainer. They then gave a demonstration, with hands-on participation by Linda Gentle and Ross Rosengren.

At Loral Federal Systems Company, Orlando, COL James E. Shiflett, PM, combined arms tactical trainer (CATT), spoke on the CATT project. This project uses synthetic environments—electronic representations of the real world.

John A. Sorokowsky, program manager, close combat tactical trainer (CCTT), Loral Federal Systems, Manassas, VA, briefly discussed the CCTT, which is a part of the CATT.

MICOM

The group then travelled to MICOM, where Judy York, chief of Branch B, Force Development Division, Resource Management Directorate, presented a command overview. A major subordinate command of the Army Materiel Command, MICOM develops superior missile capabilities and other technological advances. Another key mission of MICOM is to support PMs in the PEO structure.

A welcoming speech from Earnest A. Young, deputy to the commanding general, MICOM, followed York's presentation. He noted that MICOM, like the rest of the Army, is affected by downsizing, but he believes that reductions can be addressed mostly through voluntary means. Young also noted that as restructuring occurs, new thought processes on how to do business are necessary. Teaming approaches are one example, where groups of personnel with different functional interests work together in support of the project manager. Young recommends that individuals entering the acquisition field become generalists, broadly trained early in their careers.

COL Roy Millar, deputy PEO, tactical missiles, emphasized to the interns and mentors the importance of diversification in selecting career assignments in order to gain a broad background. He cited the experience of George Williams, PEO-tactical missiles, one of the first civilian PEOs, whose background includes engineering, program management, testing and logistics.

Dr. Bennie H. Pinckley also spoke at MICOM, with a briefing on the Army Acquisition Corps (AAC). He stressed that education and training are the keys to success and advancement in the AAC. Pinckley believes that civilians need independent individual development plans similar to military IDPs which say, "here's my career field, here's where I want to go, and here is a reasonable path to get there ... It is a career-enhancing move."

Before departing Alabama, the group visited the U.S. Space and Rocket Center in Huntsville.

Picatinny Arsenal

The mentors and interns were welcomed to Picatinny Arsenal by Patrick A. Serao, acting deputy PEO, field artillery systems (FAS), who discussed materiel acquisition management. He said that the PM shop is "parochial," that is, PMs focus primarily on their own systems, while the PEO must focus on how the systems in their domain fit into the Army as a whole. Serao also described many of the systems within PEO-FAS.

Renata Price, associate technical director for systems, concepts and technology, U.S. Army Research, Development and Engineering Center (ARDEC), Picatinny, provided an overview of ARDEC.

The travelers then viewed numerous displays on subjects such as precision munitions, warhead technology, the ammunition surveillance information system, packaging, and environmental technology.

The Picatinny Arsenal visit also included a series of tours to several facilities, with demonstrations and displays on battle labs, decision aids, robotics, Paladin, enhanced mortar fire control, rapid fire force projection, the lightweight howitzer, the electromagnetic gun, stereolithography (rapid prototyping), and explosively formed penetrators.

Pentagon

The trip concluded at the Pentagon, with a brief visit with Assistant Secretary of the Army (RDA) Gilbert F. Decker, who is also the Army Acquisition Executive. Decker listened intently to some very positive feedback on the program from the interns, as well as from the mentors. Decker emphasized the importance of training and education so that individuals aren't put into positions that are over their heads. Said he: "Everyone needs training and experience ladders, and I believe these programs are a great start." Decker conveyed his thanks to the mentors for their outstanding contributions to the program, adding that "mentoring is unquestionably the best way to broaden people's perspectives while enhancing their professional development."

Editorial Note: Some very candid comments from the acquisition mentor and intern program participants appear on pages 30-33 of this issue of Army RD&A.

WHAT MENTORS SAY ABOUT MENTORING. . .

Editorial Note: The following comments from four Department of the Army mentors regarding their participation in the mentoring program were gathered late last year during a series of visits with them at various Army facilities. An article on those visits appears on pages 28-29 of this issue.

Linda M. Gentle
Chief, Program Management Division
Multiple Launch Rocket System (MLRS) Project Office

Successful people do not reach top positions in an organization alone. How do high achievers acquire the positions they desire? First, they know where they want to be in five, 10, and 20 years. Goals vary among individuals—some have no aspirations to reach the top, but are dedicated, loyal, outstanding employees, happy where they are. I have several in my organization and treasure their dependablilty, loyalty, and expertise. These I refer to as the "satisfied."

Others aspire to be at the top, but don't extend the necessary effort. Their attitude is, "I deserve the position(s) because I've been here for a long time." They fail to understand qualities they lack. Some accept a wake-up call and improve attendance, work ethics, etc., and accept guidance and encouragement to apply effort in pursuing goals. They become "eagles." Others do not. They are the "deservers."

The high achievers I call eagles. They combine intelligence with positive work ethics and realistic goals. They are honest, hard-working employees who give 110 percent every day. Eagles reach out for new tasks, assignments and opportunities. They grow by excelling in their field; they learn by stretching their wings.

A manager must objectively evaluate employees to determine which category each fits into, or may grow into—satisfied, deserver or eagle. A manager should guide the career growth of all employees. However, the largest payoff probably comes in mentoring eagles.

The mentor-mentee relationship requires open, two-way communication. Mentees must feel free to seek out mentors. The relationship also requires honesty—mentees must share their real goals, and mentors should not push them to stretch more than is comfortable.

Although mentoring is time-consuming, mentors can serve more than one mentee simultaneously. A mentor may have several mentees in various stages of growth, each requiring time and attention. The mentees may or may not be competing in the same career field.

My responsibility to the AAC workforce is to grow future leaders; to instill and promote good work ethics, honesty, and loyalty.

Just as everyone is not an eagle, everyone cannot be a successful mentor. All eagles won't be mentors; however all mentors should be eagles. Mentors should remain apprised of eagles' activities, provide suggestions, encouragement for training opportunities, such as shadow assignments, on-the-job training in other areas, and educational requirements and opportunities. Mentees should value the mentor's opinion and seek their advice.

Professional, career mentoring is an area of growth available and under-used by women. There haven't been many women mentors because there haven't been many women in leadership managerial positions. Today the number is growing. Women have powerful, rewarding opportunities. They can help eagles grow, mature and fly to the top of the ladder of success. If each mentor could grow just one eagle, the rewards would be sufficient.

Spencer Hudson
Director, Resource Management
Program Executive Office
Standard Army Management Information Systems

Mentoring has taken on a new look under the creative program established by Dr. Pinckley. In the past, most of us who have advanced in our government jobs have been informally mentored by several individuals at different times in our careers. This assistance has been offered to help at a specific time in our development without consideration for long term goals or the future needs of the Army. Even though there are some shortcomings, informal mentors play a significant part in civilian advancement in government service.

As discussed by Dr. Pinckley, the active Army has successfully utilized a formal mentoring system for many years. Under his new program for civilian mentoring, he applies many of the lessons learned from the mentoring system used by the active Army. Great care has been taken to select young individuals who are well-educated and have high potential as future leaders in the government. Care was also taken in deciding who should mentor each of these individuals, taking into consideration their needs and desires. Because of the amount of effort and planning put into this program, I have a high degree of confidence in its success.

The first phase is more defined than the follow-on. Initially, we must provide each individual a strong background in program management while assuring exposure to several of the other disciplines in the Acquisition Corps. This will be accomplished through on-the-job training outside their home office, some classroom training, and a core job. Hopefully, the interns will achieve the grade of GS-12 at the end of their tour.

Following the internship, the mentor's job will change but the need to assist and advise will still be part of their responsibility. As the intern progresses toward their chosen field, there will be many areas where a mentor will be able to help by providing knowledge gained from experience and an understanding of the total organization. This information should

save valuable time in the intern's progression and aid them in working toward achieving their goals while providing the Army with the best informed and best trained individual. If all I perceive in this program materializes, I will have been part of a win/win/win program where a promising young person has been helped, where the Army has the services of a very intelligent and highly trained individual, and where I, as the mentor, will have received great self satisfaction. This program has all the ingredients to be one of the most successful programs of its kind and one that will give much back to the Army and all involved.

Charles Mattingly
Chief, Business Management Division
Project Management Office
Advanced Field Artillery System/ Future Armored Resupply Vehicle

I view the Army Acquisition Program Management Internship Program as a unique opportunity for both the interns and mentors selected for this program. The interns will have the opportunity to participate in, and help shape, the first program for civilians which is focused on developing managers, not just professional specialists. For the mentors, this program offers them the opportunity to develop and refine their coaching and teaching skills, and to give something back to the Army.

I began my career as an intern in the comptroller career field. Throughout my early career, I was fortunate to work for a supervisor and a comptroller who believed very strongly in bringing young talent into the profession and developing their skills in comptrollership. Although the Comptroller Intern Program did not include mentoring in the formal program, the people I worked for in my early career became my mentors. We never discussed our relationship in those terms, but through their interest in the intern program and our eventual friendship, they provided invaluable guidance and advice and a positive role model for me. I think many successful managers in government and industry have benefited from similar experiences, even though the relationships were also probably informal and unstructured.

These informal mentoring relationships have often worked well, but because they are random they are often hit-or-miss. Also, many interns are not fortunate enough to work for a supervisor with an interest in developing young talent, or the ability to teach or coach well. The formal mentoring program established in the Army Acquisition Program Management Internship Program should ensure a positive, reliable mentoring relationship for each intern. Selection of mentors through a formal evaluation process will help ensure that the mentors are eager and capable of providing the guidance and encouragement an intern needs. The investment that the Army will make in training and developing these interns is significant and the selection of mentors should not be left to chance.

A formal mentoring program also adds discipline to the intern/mentor relationship by requiring a formal individual development plan. It helps ensure that training opportunities and developmental assignments are planned and scheduled so that the intern is taught all the necessary lessons envisioned for the program. If properly done, it also focuses attention on results, the lessons to be learned, not just putting in time.

I'm excited about the opportunity to mentor a young intern. The success I've achieved in my career has been due in large part to the guidance I've received from supervisors and others who took an interest in my future early in my career. This mentoring program gives me the chance to return the favor and help guide an eager young professional through the hard lessons all of us have faced some time in our careers. I also expect to learn much about myself as my relationship develops with my intern. We've been together only a short time, but mentoring has already caused me to take a fresh look at many things I have taken for granted for a long time. Being a mentor is a challenging responsibility, but I believe it will also be rewarding and fun for both of us.

Marlene Seaton
Program Analyst
PM-Instrumentation, Targets and Threat Simulators

Mentor is a character in Homer's *The Odyssey*. It was the name of a loyal advisor of Odysseus entrusted with the care and education of his son, Telemachus. The current dictionary defines mentor as a wise and trusted counselor. Mentors are just one part of the mentoring relationships that we form all our lives. In the early years we are on the receiving end of this relationship, but in our later years, we become the mentors ourselves. In our early years, this wise counsel is usually provided by our parents, but as we mature our relationships are formed outside of our families, in school and later in our work organizations.

A mentoring relationship in the federal government is the same as any other organization. Some people refer to this relationship as networking. Usually, for an individual this relationship has two focuses: mentoring at the journeyman level, and mentoring at the executive level.

At the journeyman levels, the focus for the individual is one of finding mentors. You can attract the notice of people in the executive ranks by: completing assignments on time and in an exceptional manner, volunteering for difficult tasks or tasks that will expand your experience level, and being dependable. In addition, at the journeyman level the focus for the individual is also on developing relationships with your peers. These relationships could be the source of future mentorships, and also provide the journeyman with insight into the value of team work and human relationships. It teaches you how to motivate people, and focuses them to work *with* you and later *for* you as a unit. These relationships also provide the source for individuals who you can mentor to in the future, as you rise in the organization or other organizations.

Mentoring at the executive levels, although still focusing on the same areas as journeyman, adds the focus of mentoring to people who work below you. With each promotion, you should begin examining your relationships to begin this counsel for the people who work for you in the organization, or anywhere within the organization, where they have noticed personnel who are worthy of advancement. Women, due to their relatively new emergence in the executive ranks, are forging new ground in mentoring other women, and men, as they advance through the executive ranks. As a woman myself, after my initial promotion to the executive level, I quickly realized that my responsibilities in this area had greatly increased. First, I had become a role model, and someone to look up to. Then, although I had given career advice in the past, I was now looked upon as someone with the power to provide opportunities.

I have noticed that people who make it to the executive levels, in addition to showing drive and hard work, have the following shared characteristics: they dress professionally, are mobile, keep their educational development current, always have their resumes up to date and are registered in all career data banks (i.e. ACCESS, Acquisition Corps). It is easy to decide to mentor individuals who are interested in new opportunities, and who are ready for new challenges.

The important thing to remember about the mentoring process, regardless of what phase you are in, is that it is usually a voluntary relationship. If nurtured, it can result in career-long advancement.

WHAT INTERNS SAY ABOUT INTERNING. . .

Editorial Note: The following comments from four Department of the Army interns regarding their participation in the intern program were gathered late last year during a series of visits with them at various Army facilities. An article on those visits appears on pages 28-29 of this issue of Army RD&A.

Monique Anneker

Two years ago Deputy Secretary of Defense Donald J. Atwood administered the oath of office to me, introducing me to the world of Army acquisition. The process to receive one of the first 10 Defense Acquisition Scholarships—which enabled me to pursue an M.B.A. from Crummer Graduate School of Business at Rollins College in Winter Park, FL—was competitive and required geographic and functional mobility in exchange for educational and experience opportunities.

The objective of the M.B.A. program at Crummer is to develop well-rounded professionals with competence in key functional areas of business, interpersonal and group relationship skills, and an understanding of the economic, social and political responsibilities of management.

Especially interesting was my course work related to public policy and specifically the budgeting process; as the defense budget is drastically reduced, each dollar becomes relatively more important to readiness. One highlight of the program was the way students could apply what they learned in class by working on group projects, often involving local business. The program required extensive use of computer applications; tuition included a laptop computer, which forced each student to become familiar with standard computer applications.

Also beneficial was interaction with fellow students who worked in the local area, including several with Defense contractors. Through this interaction, I learned that the corporate world is faced with many of the same issues confronting the Army, such as downsizing, TQM, technology management, and a rapidly changing environment. During these two M.B.A. years, my horizon broadened significantly, and it became clear that a commitment to excellence and continuous self-improvement is pertinent.

On completing my M.B.A. I was assigned to STRICOM, but before I started there, I took the eight-week Materiel Acquisition Management (MAM) Course at the U.S. Army Logistics Management College. The course provided an overview of DOD system acquisition life cycle management and technical and business processes. It prepared me well for life as an acquisition intern.

My training period is supervised by my mentor, Marlene Seaton. Being an intern is an excellent way to get an overview of the command and of different acquisition career paths, while being guided to accept more challenges and to display competence, ethics, judgment, teamwork and leadership.

At STRICOM I will learn about program management and systems acquisition. My knowledge of the contractual and fund management processes will also increase. Rotating within the different areas of STRICOM will improve my ability to plan, organize, direct and control work using multiple disciplines, while meeting the academic requirements of DAWIA.

Educational opportunities and challenging assignments make Army acquisition a very attractive career field. The possibilities for job satisfaction are endless and I look forward to taking every possible opportunity to be part of a professional career field and broaden my perspective through training and education.

Charlotte Cates

In 1992, when I was selected by the Army for the DOD Acquisition Scholarship Program, I entered the M.B.A. program at the University of Texas at Austin. I completed my M.B.A., with a concentration in management information systems, in May 1994.

In June 1994, I began the Materiel Acquisition Management Course at the U.S. Army Logistics Management College, Fort Lee, VA. There I received an overview of Army materiel acquisition with specific instruction in the activities required during each phase of the process.

On completing the MAM Course in August 1994, I came on board at MICOM, to begin an internship under Linda M. Gentle. I was assigned to the MLRS Improved Launcher Mechanical System (ILMS) Tiger Team. This cross-functional team was formed to develop a program to link fieldings of the MLRS Improved Fire Control System (IFCS) and the ILMS.

To meet the requirement for concurrent ILMS/IFCS fielding, we must carefully manage the ILMS schedule. So, we have prepared a network indicating milestone decision and acquisition activities, with early start and finish dates and action officers for each. To maintain our network, I work closely with action officers to understand their activities' requirements and the interdependencies between activities. In doing so, I gain a better understanding of how these activities support the acquisition process.

Already, I have had experience with many of the things I was exposed to during the MAM Course. For instance, our team recently finished preparing an acquisition strategy and acquisition plan. As we prepared these documents, I gained a better understanding of their content and purpose. In addition, as we routed them for review and approval, I learned more about the relationships between the parties involved.

We have also completed the preparation of a zero-based performance specification. OSD guidance did not allow the use of military specifications or standards. We worked closely with PEO, Tactical Missiles, and other MICOM project offices which had prepared contract packages under similar guidance. With input from them, division chiefs and other experts within the MLRS Project Office, we have created a document we feel is in full compliance with the latest streamlining initiative guidance.

When the Tiger Team submits the ILMS contract requirements package to the Procurement Activity, I will accompany it. I will work with the contracting officer to learn about preparing the request for proposal. When it is released, I will rejoin the Tiger Team as we prepare for proposal evaluation. During down-time with the team, I will float through the Cost, Budget/Review and Analysis, and Acquisition Management Branches of the Program Management Division of the MLRS Project Office. I will attend several formal training courses, including "Evaluating Contractor Proposals." Through these assignments and courses, I will gain extensive acquisition experience. I am fortunate to have this opportunity. I look forward to the year ahead and to learning more about Army acquisition!

Doreen DeBenedictis

As an undergraduate, I attended Villanova University, Villanova, PA, as a Presidential Scholarship recipient. In 1990, I graduated magna cum laude, receiving a bachelor of science in business administration, with a concentration in marketing, and a bachelor of arts in English.

In 1991, hired under the Outstanding Scholar Authority, I began working for the Department of Navy at the Aviation Supply Office (ASO), Philadelphia, PA. As an inventory management specialist at ASO, I provided logistical support for the AV-8B, or Harrier, marine aircraft. During this same period, I returned to college to pursue a graduate education, enrolling in the M.B.A. program at La Salle University, also in Philadelphia.

In 1994 I applied and competed for a Defense Acquisition Scholarship. That summer the Department of the Army selected me as an acquisition intern. As a result, I was able to attend graduate school full-time during the fall semester and received an M.B.A. degree with a management information system specialization in December.

The scholarship program affords a worthwhile opportunity, combining an education with a DOD career. In addition to identifying career paths in the acquisition field, the Army has also provided its interns with another valuable service by pairing each individual with a mentor. I feel fortunate to be involved in the mentor/intern program.

My first assignment is with the Program Executive Office, Standard Army Management Information Systems (STAMIS), at Fort Belvoir, VA. I look forward to the challenge ahead and to becoming a productive member of the PEO-STAMIS team.

Ross Rosengren

My experience with the Department of Defense Scholarship Program overall has been positive. I originally applied for the scholarship to be able to finance my final year of graduate school. This turned out to be just what I needed because funding problems at Washington State University after my first year of course work resulted in my teaching assistantship being cut. The living stipend allowed me to fully devote myself to my studies without having to worry about finding a new job to support myself and my family.

In meeting and working with the people who administer the scholarship program, my only complaint is that we didn't have enough contact. It would have been nice to have more information about what the government actually expected of us and what they had planned for us. The idea was that we would generally be left alone while we were in school so that we could concentrate on our studies. In a number of M.B.A. programs, including mine, students have some control over the electives they take. It would have been nice to have some input about what classes would have been most beneficial to ourselves and the government as we moved into our future careers.

Beyond the lack of information, this program has been wonderful. It has been exciting to enter the world of government work. I have begun learning the language of government-ese with all of its acronyms and abbreviations. I have enjoyed the chance to sit in on staff meetings with the PEO and PMs and see how they manage their programs. I have learned that money comes in different colors, and only lives for one year, and can be taken away if it is not obligated and dispersed in a timely manner. I have had a chance to see the process that division chiefs and team leaders go through when they sit down and decide how to allocate a multimillion dollar budget. I have also had the opportunity to see how a large bureaucracy works and that a good strong leader can keep things running smoothly, while a poor leader will either intentionally or inadvertently let problems creep into the system.

I am looking forward to using the skills and abilities I have acquired to make a real contribution to the acquisition process. I am grateful for the chance to be learning and I look forward to the opportunity to be responsibile for some projects and to improve my leadership skills.

The DOD Scholarship Program has put my fellow scholars and me in a position to quickly move into leadership positions in the Acquisition Corps and make a positive impact on the way the DOD acquires new systems. I look forward to this opportunity with enthusiasm and excitement.

ARMY NAMES R&D ACHIEVEMENT AWARD WINNERS

Forty-nine Army scientists and engineers have been selected to receive Department of the Army R&D Achievement Awards for 1994. This award is given in recognition of outstanding achievements or leadership in research and development that have resulted in improved U.S. Army capabilities and contributed to the nation's welfare during calendar year 1994. The winners and their achievements, listed by major command, are as follows:

U.S. ARMY MATERIEL COMMAND

U.S. Army Armament Research, Development and Engineering Center

Dr. Paul Cote and *Dr. Lawrence Meisel,* both physicists, will be cited for their development of new magnetic methods used for the characterization and analysis of material transformation behavior. These techniques have been applied to determine the thermal histories of steel components and the suitability of material heat treatments in the understanding and prevention of heat fatigue failures of U.S. Army equipment.

Dr. Eugene Church, a research physicist, will be recognized for his research in the field of signal processing and optical design that has led to the development of the Long Trace Profiler, a surface measuring device of unprecedented accuracy. The Long Trace Profiler and the associated analysis techniques provided the quantitative basis for the development of a new class of optical imaging systems using X-ray radiation.

U.S. Army Research Laboratory

Dr. Fred Grace, a research physicist, and *Nevin Rupert,* a mechanical engineer, will be cited for the development of analytical and experimental approaches resulting in a new understanding of penetration mechanisms. This research has resulted in penetration descriptions that are far more accurate than existing approaches and has for the first time enabled efficient modeling of the complexities acting in armor arrays. Their work has significantly impacted U.S. Army advanced gun-fired penetrator design efforts and vehicle armor systems.

Lorna Harrison and *William Lawler,* electrical engineers, and *Dr. John Pellegrino,* a physicist, will be cited for improving the performance of one- and two-dimensional photodetector arrays. Light handling capability of linear detector arrays was increased by almost four orders of magnitude and the two-dimensional imager work resulted in a performance improvement of two orders of magnitude. This technology will enable high speed X-ray and photographic imaging for both the military and civilian sectors.

Dr. Lawrence Kingsley, Dr. Terence Burke, and *Hardev Singh,* all electronics engineers, will be honored for the development of a new class of optically triggered power semiconductor switches made from silicon carbide. The new devices promise to far surpass the performance of silicon devices in terms of efficiency, power handling capability, speed, and operating temperature. This will result in mobile Army battlefield systems which are lighter, more compact and rugged.

Dr. Mitra Dutta, Dr. Hongen Shen, and *Dr. Michael Wraback,* all research physicists, will be recognized for the invention of a normal-incidence optical modulator with exceedingly high contrast, an order of magnitude better than current state-of-the-art. Optically modulated processors will provide unprecedented terahertz computing rates for battlefield communications and data integration. This device promises a significant increase in computing capabilities on the battlefield through massively parallel processing techniques.

U.S. Army Research Office

Dr. James Mink, a senior research scientist, and *Dr. Felix Schwering,* a senior research scientist at the Communications-Electronics Command, will be honored for the development of quasi-optical technology for the millimeter wave and sub-millimeter wave regions. Their hybrid waveguide offers a solution to the difficult challenge of providing a well-designed, low-cost transmission medium for planar integrated circuits and components for the sub-millimeter wave region. Their pioneering research has stimulated subsequent high-level work in this area in academia and industry.

U.S. Army Aviation and Troop Command

Keith Stein and *Richard Benney,* both aerospace engineers, will be cited for analyzing and predicting the opening behavior of parachutes. They produced a motion and pressure distribution describing the air surrounding an opening parachute and a description of the motion and stresses of the parachute fabric. This achievement provides a cost-effective method of parachute design.

Phillip Gibson, a materials research engineer, will be recognized for research on the interaction of air shock waves with soldiers' body armor. His research has defined important material properties and design features which can reduce air blast injuries to the chest-lung system. This will increase combat effectiveness by reducing the vulnerability of soldiers to air blast injuries without compromising ballistic protection.

Dr. Irwin Taub, a senior research scientist, and *John Halliday* and *Dr. Young-Kyung Kim,* both research chemists, will be cited for determining the organizations of bread components and elucidating the influences of bread composition on the textural properties and physiochemical stability of bread. Their research provides a fundamental basis for developing bread products with superior texture and extended stablility for both military and civilian use.

U.S. Army Aviation Research, Development and Engineering Center

William Bousman, an aerospace engineer, will be honored for leadership and research in the analysis and experimental investigations of rotor airloads. He has shown exemplary management and leadership during the creation of a comprehensive airload and acoustical database by inspiring and guiding his team members. The database serves as a landmark set of data for use in rotorcraft design, analysis, and systems improvements.

Dr. Robert Ormiston, Dr. Michael Ruthowski, and *Dr. Gene Ruzicka,* all aerospace engineers, will be cited for the design, development and testing of the Second Generation Comprehensive Helicopter Analysis System. This interdisciplinary rotorcraft

aeromechanics prediction code will enable improved design and development of future Army and civil rotorcraft with significantly reduced development time, cost and risk.

U.S. Army Chemical and Biological Defense Command

Bruce Jezek and *Patrick Berry,* both technical managers, will be honored for the advancement and deployment of biological agent detection technology. Their work resulted in the design, fabrication, and testing of a biological integration and detection system prototype that, for the first time, provides the Army with the ability to detect biological attacks. This project has been accepted for further development and deployment.

U.S. Army Communications - Electronics Command

James Dillon, a supervisory general engineer, and *Gilbert Buhrmann Jr.,* a supervisory physical scientist, will be recognized for the development of mine blast and ballistic protection kits for five-ton cargo trucks and the high mobility multi-wheeled vehicles. This innovation increases the survivability of soldiers performing peacekeeping missions.

Russell Langan, an electronics engineer, will be cited for the development of an ultra-high frequency voice and data communications link between a stationary facility and a moving vehicle. This work will insure that military forces do not outrun their communications and that forces can seamlessly access needed information.

Richard Anthony, a computer scientist, will be honored for the development of a unified data fusion automation theory and the design of a next-generation database system that supports a wide range of data fusion applications. His work will provide an improved command awareness of battlefield situations.

U.S. Army Edgewood Research, Development and Engineering Center

Arthur Carrieri, a research physicist, will be cited for the development of new methodologies in detection of contaminants on surfaces. Chemical and biological warfare agent simulants are detected using laser or microwave simulation techniques that produce infrared thermoluminescence. Remote thermoluminescence flux detectors will give soldiers advance warning of biological or chemical attack.

U.S. Army Missile Command

Dr. Mark Bloemer, a research physicist, will be recognized for the development of a fabrication process for photonic integrated circuits. By combining the unique properties of semiconductor quantum wells and light emitting diodes, the number of fabrication processes used to develop compact fiber optic gyroscopes have been reduced fourfold.

Shawn Pethel, a physicist, will be recognized for research in neural network theory and application resulting in a learning algorithm which is faster and more accurate than conventional approaches. This algorithm represents a breakthrough in making neural networks practical solutions to challenging problems such as target recognition and adaptive signal control.

Dr. Paul Ruffin, a research physicist, and *Cassie Lofts* and *Janet Sawyer,* both electronics engineers, will be cited for the development of ultra-miniature fiber optic group technologies used to design, develop and demonstrate advanced fiber and integrated optic components. These components contribute to reliable and low cost inertial systems for weapons systems, aviation and communications.

U.S. ARMY CORPS OF ENGINEERS

U.S. Army Construction Engineering Research Laboratories

Dr. Ashok Kumar, a supervisory metallurgist, will be honored for inventing a process to vitrify lead-based paint by using molten alkali silicate glass. This technology results in the prevention of lead release from slag waste, thereby reducing the costs associated with lead-based paint abatement.

U.S. Army Cold Regions Research and Engineering Laboratory

Dr. Thomas Jenkins, a research chemist, and *Marianne Walsh,* a chemical engineer, will be recognized for their development of rapid field screening methods to detect TNT, DNT and RDX explosive compounds in soil. This technology greatly enhances the Army's capability and efficiency in cleaning up soils contaminated with residues of explosives and propellents at sites where these were manufactured, stored or disposed.

U.S. Army Topographic Engineering Center

Charles Carleton, an electrical engineer, will be cited for the creation of a software tool kit that has improved Army terrain visualization capabilities. This tool kit has enabled terrain visualization techniques portraying complex battlefield information. Army operations, including Operations Provide Promise and U.S. Army corps-level exercises, have been supported by this software.

U.S. Army Corps of Engineers Waterways Experiment Station

Dr. James Brannon, a research chemist, and *Tommy Myers,* an environmental engineer, will be recognized for the development and application of a leachate protocol for sediments and soils. Applications of the leachate protocol will insure that confined disposal facilities and treatment processes are optimized to provide adequate protection of groundwater and surface water. This protocol is used in the design of confinement and treatment facilities by engineering and regulatory communities throughout the United States.

Steven Ragan, a supervisory civil engineer, will be cited for the development of roller-compacted concrete using commercially available air-entraining admixtures. Air-entrained roller-compacted concrete is resistant to deterioration caused by weather cycling and will be used to construct cost-effective, durable structures and pavements.

W. Jeff Lillycrop, a research hydraulic engineer, and *Larry Parson,* a research physical scientist, will be honored for their work in the development and field testing of the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) system. This helicopter-mounted system enables high-speed, accurate measurements of water depth. The SHOALS system is a product of a cooperative effort with the Canadian government and will be used to provide improved cost-effective hydrographic surveys.

U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

U.S. Army Armed Forces Research Institute of Medical Sciences

MAJ Dennis Kyle, a parasitologist, will be honored for his efforts to combat malaria. He developed new assays to improve antimalarial drug treatment, determined the extent of drug resistant malaria in Southeast Asia, and initiated a large field trial of a new malaria vaccine. His efforts will further malaria treatment techniques and provide increased protection for civilians and the U.S. Army in Asia.

U.S. Army Armed Medical Research Unit—Europe

MAJ Mark Vaitkus, a research psychologist, will be cited for research resulting in an Army regulation on family support in Europe. He conducted a series of investigations following the Gulf War on the social and organizational aspects of Army family health and adaption to war-related stressors. His research provides a number of cost-effective solutions for enhanced family support to increase soldier psychological health and readiness.

TACTICAL ENDURANCE SYNTHETIC APERTURE RADAR

An Example of Acquisition Streamlining Through Team Work

By LTC Stephen C. Horner, Arnold A. Rappaport, and Kenneth J. Entwistle

Background

The urgency and high visibility of the Congressionally mandated Medium Altitude Endurance (MAE) Unmanned Aerial Vehicle (UAV) Program mandated a paradigm shift in the Army's approach to the acquisition of the high resolution imaging radar payload. The institutional ways of doing business were not adequate to meet the required time lines especially in light of the technology involved and the need to leverage into the industrial base.

Recent cultural and policy changes that promote best business practices presented an opportunity for the product manager (PM) to take the lead in building an integrated product team (IPT) inclusive of all necessary functional disciplines. At Fort Monmouth, a total team concept approach was implemented that is seamless and totally focused on timeliness and best value contracting.

The IPT eliminated organizational boundaries in aggressively implementing a streamlined acquisition schedule necessary to attain the Army's program objectives. The Acquisition Center at Fort Monmouth processed this acquisition as one of their PACER actions which places it on a fast track for award within 100 days. During fiscal year 1994, the Tactical Endurance Synthetic Aperture Radar (TESAR) team successfully demonstrated that this IPT approach could result in the award of a sophisticated technical procurement in the streamlined time of 96 days from synopsis to contract award.

In 1993, the under secretary of Defense for acquisition (USD(A)) established a senior-level joint steering committee to review requirements for immediate, near-term and long-term endurance unmanned aerial vehicles (UAV). Acting upon the recommendations of the steering committee, the USD(A) issued a letter specifying the urgent need for an MAE UAV Advanced Concept Technology Demonstration (ACTD) that would provide intelligence gathering assets capable of collecting high quality fine resolution images, in all weather conditions, from altitudes of 25,000 feet for a continuous period of 24 hours or more. By the use of a satellite data link, this system will provide near real-time imagery from electro-optic/infrared (EO/IR) and synthetic aperture radar (SAR) sensors, at extended ranges, without the potential for loss of air crews over hostile territory.

Program Responsibility

The Navy program executive office for cruise missiles and UAVs (PEO-CU) was assigned overall program responsibility with the

UAV joint project office (UAV JPO) responsible for program execution. The Army Acquisition Executive (AAE), chartered the PM TESAR (located at Fort Monmouth, NJ) under the project manager for night vision/reconnaissance surveillance and target acquisition (PM NV/RSTA). A formal agreement between the program executive office for intelligence and electronic warfare (PEO-IEW) and PEO-CU assigned responsibility for the MAE UAV SAR sensor payload development to the Army.

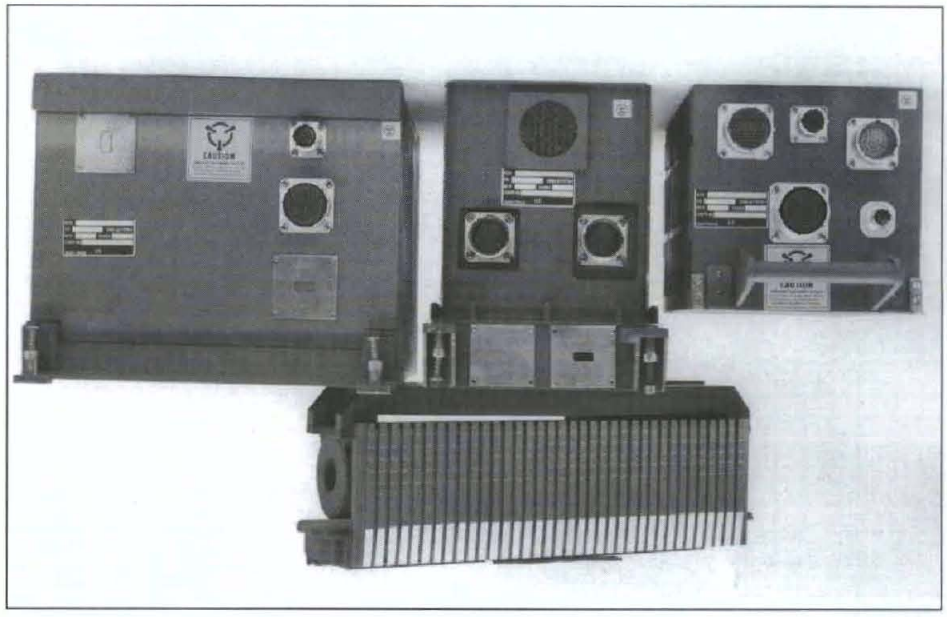
The PM TESAR is responsible for the design, development, fabrication and integration of ten Synthetic Aperture Radar (SAR) payloads onto MAE UAV platforms and three sets of SAR UAV ground control station elements. The first SAR payload will be integrated onto an MAE UAV platform and ready for flight tests in the third quarter of fiscal year 1995.

The Program

This program is an approved OSD ACTD. The basic intent of the ACTD initiative is to provide the warfighter in the field with a system for operation and evaluation in significantly less time than the conventional fielding process would permit. The objective of this ACTD is to quickly satisfy an existing military need by providing a deployment capability within 30 months. In addition, this ACTD will develop concepts of operation for endurance UAVs in general.

As early as August 1993, PM TESAR proceeded to form a highly qualified, dedicated team to formulate the acquisition strategy and solicitation package. Senior technical personnel, who were experienced in source selection process and radar technology, were brought on to the team. A dedicated contracting officer and legal advisor were selected to advise the team in all relevant procurement and legal matters. In-depth meetings with the UAV JPO, Army and other support personnel were immediately initiated to form a consolidated approach. The early team involvement in requirements formulation was critical to the success of this program. Close coordination between the user and material developer was invaluable.

Several meetings were conducted between the user representatives, the UAV JPO, PM TESAR and other Army technical personnel to review the requirements documentation. Page by page reviews of the statement of work and specifications were performed to ensure that the minimum requirements of the user were met. Performance specifications were used in lieu of military specifications in order to allow industry the opportunity to propose the most direct approach to solving the technical and schedule challenges of this program. In other words, contractors were informed of what we needed the system to do and not how to design or build it.



The Medium Altitude Endurance Unmanned Aerial Vehicle synthetic aperture radar payload consists of a receiver/transmitter, a mechanical and electronic scanning antenna, and a signal/image formation processor.

Requirements

Ongoing Army technology base programs within the Army Research Laboratory and at Sandia National Laboratory were critical in formulating the requirements for this ACTD program. The use of commercial-off-the-shelf, non-developmental items and maturing technologies were encouraged to the maximum extent practicable to minimize risk and compress the acquisition cycle time. Repeated rewrites and discussions finally resulted in a technical requirement that placed few constraints on industry.

Classifying this program as an urgent ACTD reduced the documentation. Neither an operational requirements document nor a mission need statement were required. The purpose of these documents was essentially satisfied by the letter provided by the USD(A). Also, a blanket delegation of authority to waive non-statutory acquisition policy and procedures was granted to PM TESAR by the Army acquisition executive. A formal specification and data review board, test and evaluation master plan, a senior board of solicitation review and a business clearance review were all waived.

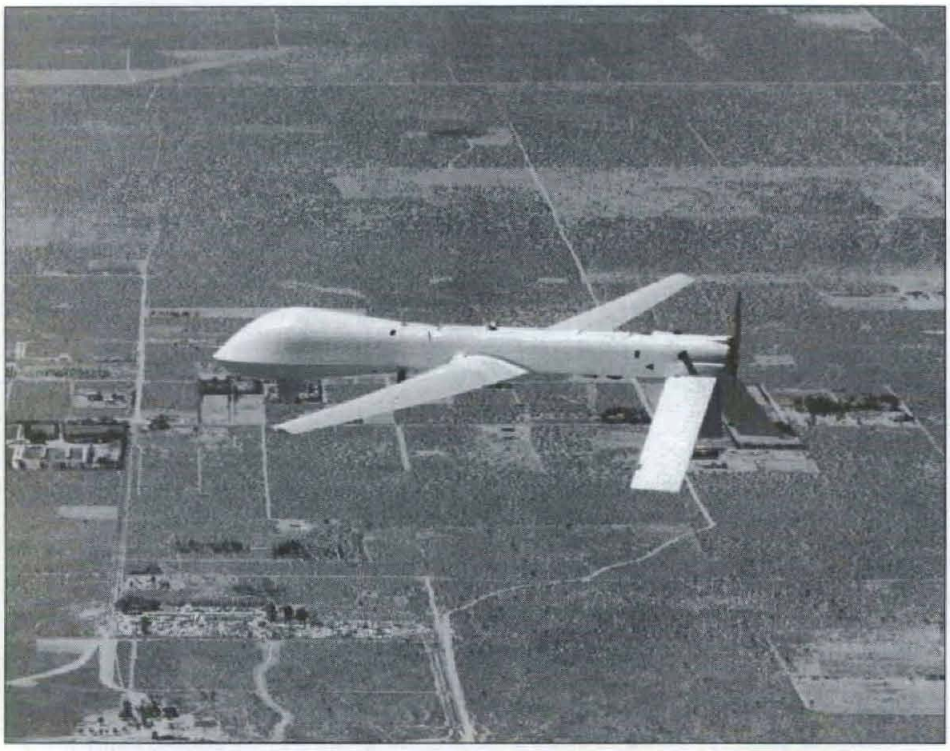
The Schedule

To ensure the OSD mandated schedule would be met, the exchange of essential design information between the SAR, UAV and data link programs had to be synchronized. For this reason, a contract award on or before March 9, 1994, was critical. Once program authorization was provided on Dec. 3, 1993, an announcement was released immediately to the *Commerce Business Daily*, a draft solicitation was issued on Dec. 10, and the formal solicitation was issued on Dec. 17. In lieu of the more time-consuming presolicitation conference, a pre-proposal conference was held on Dec. 22. Some 50 industry representatives attended this meeting on short notice and were briefed on the technical and contractual objectives of the program. Industry questions at the meeting were answered the next day via the electronic bulletin board (EBB).

The EBB was used throughout the process for the draft solicitation, formal solicitation, clarifications, solicitation amendments, items for negotiations and contract award documentation. Cost data was provided in a standard spreadsheet format for easy analysis on a desk top computer. Nearly all documentation and communication between the Army and contractors was done electronically over the EBB. There were no face-to-face negotiations, however, more than 300 questions were sent to the offerors during the source selection.

Source Selection Board

The Source Selection Evaluation Board (SSEB) was comprised of representatives from the Army, Navy, Air Force and federally



Medium Altitude Endurance "Predator" Unmanned Aerial Vehicle.

funded research and development centers (FFRDC). The SSEB recognized and addressed the need for day-to-day involvement from all contributing functional areas. All members of the SSEB, which included engineers, contracting officer, contract specialist, attorney advisor, and pricing personnel, were located at the proposal evaluation site. The SSEB and factor chairmen were experienced in their roles. The key players were involved with the writing of the source selection plan and provided detailed training to all of the SSEB members in their respective areas prior to the receipt of proposals. Extensive automation was utilized at the evaluation site to expedite and standardize the evaluation process.

The evaluation process was not bogged down with the consideration of detailed proposal information that was not critical to the identification and selection of the best overall proposal. The proposal preparation instructions and evaluation criteria focused on critical discriminating areas of interest. The process of identifying the discriminators required considerable effort on the part of the senior members of the team and they worked through several versions of the plan to arrive at the critical discriminators. Proposal preparation instructions requested specific information consistent with the evaluation criteria. The up-front effort in writing the plan saved considerable time during the evaluation process. Also part of the proposal instructions was a well-defined limitation on the number of pages permitted in the technical proposal. As a result of the elimination of non-critical proposal information and a compressed proposal preparation period, both proposal preparation and evaluation costs were minimized.

Formal Meetings

Formal meetings with the Source Selection Advisory Council (SSAC) and Source Selection Authority (SSA) were kept to a minimum. Updates of the source selection progress and issues were provided in real time. Only one formal meeting with the SSAC and SSA was necessary. All evaluation questions were resolved prior to best and final offers and items for negotiations were kept to essential matters.

Contract Award

In coordination with the UAV development/deployment schedule, the contract award was signed as scheduled on Mar. 9, 1994, within 96 days from OSD authorization. The total team concept approach caused members to challenge not only the procurement system but also themselves to perform better, faster and more efficiently.

Conclusion

The TESAR procurement demonstrates that the system can be redesigned by participants to meet the needs of the Army and DOD in general. Industry understands and appreciates the need for a streamlined procurement system. For the TESAR acquisition, company representatives stated that the quick evaluation cycle made it possible for them to save valuable proposal dollars and reallocate proposal personnel sooner than a conventional source selection. The conventional acquisition approach would have been significantly more expensive for the government and would have delayed us from meeting schedule requirements. The bottom line shows that both the government and industry benefit greatly from the efficiencies of a streamlined acquisition.

LTC STEPHEN C. HORNER is the Army product manager for the TESAR Program. He is a 1976 graduate of the U.S. Military Academy and holds a B.S. degree with emphasis in engineering and an M.S. degree in systems technology from the Naval Post Graduate School 1987.

ARNOLD A. RAPPAPORT is a contracting officer at the C3I Acquisition Center at Fort Monmouth. He holds a B.A. degree in political science and an M.B.A. from Fairleigh Dickinson University.

KENNETH J. ENTWISTLE is a procurement analyst for PM NV/RSTA. He holds a B.A. degree from Saint Louis University.

RETURNS ON INVESTMENT IN AMC-FAST

By Richard E. Franseen

Introduction

The Army Materiel Command (AMC) annually invests about $6,000,000 in the AMC-Field Assistance in Science and Technology (FAST) Activity. AMC's returns on this investment come from five distinct sources.

- Direct dollar savings resulting from insertion of new technology and equipment;
- Training of AMC scientists and engineers;
- Providing a ready and mutual access between AMC and field operational units;
- Increased AMC knowledge of field needs and operational environments; and
- Provision of a visible reminder to field units that AMC is always ready to provide support.

Investment

The estimated annual investment of $6,000,000 pays for the operations of the FAST Headquarters (including funding of selected projects); the payment of science advisers' salaries and expenses, FAST junior salaries and expenses while working on FAST projects, and the FAST portion of the salaries of quick reaction coordinators. The word "estimated" is used advisedly and conservatively. The line item allocation for FAST varies annually and has changed within a given fiscal year. The salaries and expenses of all FAST personnel, other than headquarters personnel, are paid by AMC major subordinate commands. These costs vary with station, travel, grade, and percentage of time devoted to FAST. For all of these reasons $6,000,000 is an estimate, however, it is an estimate based on the higher end of costs; it is a conservative estimate.

FAST Returns on Projects

FAST has conducted over 500 projects and is currently working on over 100. These projects provide benefits in quantifiable cost savings, improved or new operational capabilities, increased safety and improved training. The following examples have been chosen to illustrate projects which have provided the quantifiable as well as non-quantifiable benefits.

FAST has conducted over 500 projects, trained over 50 science advisers, provided field experience for over 100 junior scientists and engineers, and provides a unique network between the field and the R&D community.

AMC-FAST ANNUAL COSTS*

Line Item in Budget	$ 3,000,000**
Science Adviser Salaries, Travel, Expenses	$ 2,090,000
Quick Reaction Coordinators	$ 135,000
TOTAL	$ 5,625,000

* These costs represent estimates on best data available
** This figure has varied on a yearly basis depending on changes in budget

RETURNS ON INVESTMENT

- Projects
  - Save Dollars
  - Improve Operational Capabilities
  - Improve Training
- Professional Development
- Communications
- Knowledge
- Good Will

Figure 1.
The Auxiliary Power Unit for the Abrams Tank.

Cost Savings: Estimates of financial benefits have only been determined for a few of the over 500 FAST projects. Estimates for the following six projects were provided by the Department of Army, Cost and Economic Analysis Center; III U.S. Army Corps; 7th Army Training Center; Communications and Electronics Command; and U.S. Army Europe.

• **The Auxiliary Power Unit** for the Abrams tank (initially developed by the Army Research Laboratory, then transferred to TACOM and PM Abrams) permits stand-by operations to be conducted for long periods of time without using the main tank engine. In addition to providing great operational benefits, the power unit permits savings in fuel and engine wear. The Cost and Economic Analysis Center estimated a savings of $30,000 per year per tank. The Army is equipping 1,500 tanks with the unit which provides an *annual savings* of *$45,000,000.*

• **The Recycled Anti-Freeze** project of the III Corps science adviser addresses the high cost of anti-freeze and the environmental problem of disposing of used anti-freeze and the accompanying costs. This system has potential use throughout the Army, other Services, the National Guard and Reserves. Based on data collected at Fort Hood, the estimated *annual savings* can easily be *$5,000,000.*

• **The Gun Tube Exerciser** is an example of a project which brought together several AMC organizations (Benet Laboratories and ARL's Human Research Engineering Directorate and Weapon Technology Directorate) to produce a product which is now standard within the Army. The gun tube exerciser reduces by a factor of 20 the labor required to mechanically exercise the recoil mechanisms of tank guns. Based on a requirement for 2,000 operations per year and the labor involved, a conservative estimate of *annual savings* is *$420,000.* In addition, the gun tube exerciser eliminated some procedures which had on occasion caused damage to the gun and its recoil mechanism.

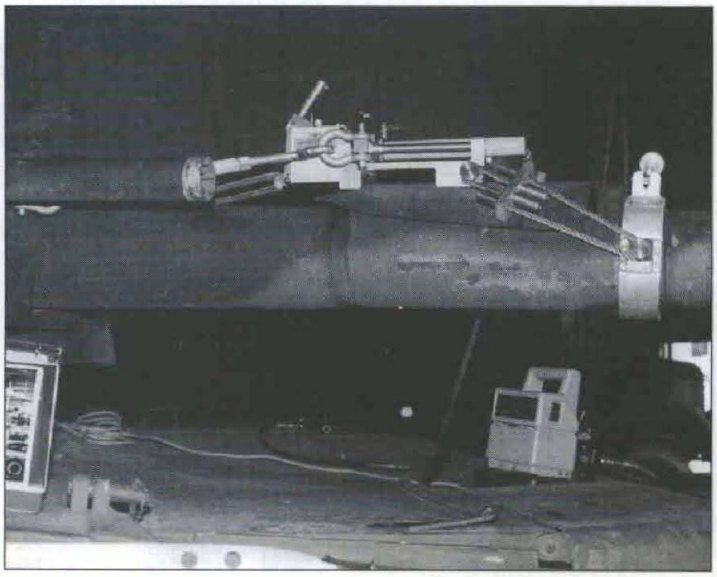


Figure 2.
The Gun Tube Exerciser.

• Lithium batteries are expensive; their state of charge cannot be accurately estimated; and their disposal creates a hazardous waste problem. In addressing these problems, Dr. Don Snider, former FORSCOM science adviser—now ARL, proposed the **Lithium Battery Tester.** The tester has decreased premature disposal of batteries thereby saving initial cost of batteries and subsequent disposal costs. In taking over the lithium battery project, CECOM estimated an *annual savings* of *$45,000,000.*

• **The Solargizer** is a device which extends the life of automotive batteries. This is accomplished using electric pulses to break the sulfate plating which builds up in batteries. R.J. Holly, III Corps science adviser, proposed the device as a solution to some of the battery problems at Fort Hood. The Solargizer is now being evaluated by III Corps units. The Air Force, Marine Corps, National Guard and Reserves are all interested in its use. Based on data collected up to this time, Fort Hood estimates an *annual savings* of *$30,000,000.*

• **No Power Thermal Target Material Paper (NPTTM)** will be used at 7th Army Training Command (7ATC) to produce targets that realistically portray the thermal image of a variety of threat vehicles. This project evolved through the cooperative work of two Seventh Army Training Command science advisers, Robert Watts and James Lim (both of TACOM) and the support of Dr. Austin Yingst of CECOM's Night Vision and Electronics Sensors Directorate. NPTTM will eliminate the need to use electrically heated targets. An *annual* electrical *savings* of *$438,000* is estimated by 7ATC.

The estimated annual cost savings from only the six projects listed above is $125,858,000.

Increased Operational Capability. Many FAST projects have resulted in equipment which has operational capabilities. Three examples are the Foxhole Digger, Large Scale Graphics Transmission System and a collection of efforts designated "Combatting the Cold."

• As of today, the standard entrenching tool is the major piece of equipment which the soldier has to prepare a two-man fighting position. Under the direction of FAST, a **Foxhole Digger** system was developed and demonstrated. It is now a Soldier Enhancement Project and fielding is expected in 1997. This will provide the soldier better protection faster and with less work. The Foxhole Digger will increase the soldier's chances of survival.

• Prior to the **Large Scale Graphics Transmission** project, field commands were restricted to the manual preparation of

operational overlays using techniques which had not changed since the introduction of acetate and grease pencils. Once the overlays had been prepared, their distribution depended on the availability of messengers who would hand carry these overlays to their respective subordinate and adjacent commands. This FAST-sponsored CECOM system permits the production and electronic transmission of 36-inch by 72-inch overlays. Time saved, reduced labor, and increased accuracy provided by this system represent a major advance in the operational capability of field commands.

• **Combatting the Cold** is a term used to describe a collection of projects designed to increase operational capabilities in cold climates. The FAST science adviser in Alaska, Milad Mekari, now at TACOM, identified a number of problems which fell into three categories: keeping the soldier warm (individually and in his work place); warming equipment so that it will operate; and overcoming obstacles to transportation. Figure 3 is a list of FAST projects to improve cold weather fighting capabilities.

Improved Safety. Two outstanding FAST projects dealing directly with safety follow:

• Within less than six months from his discovery of a safety problem with the Jettison Stores Switch on the AH-64 helicopter, Dr. Pat Easton, the FAST science adviser at Fort Hood—now at TECOM, had designed a **Jettison Stores Switch Cover**, supervised prototype development, gained support for its fielding and monitored the fielding. This device virtually eliminated the accidental jettisoning of AH-64 loads.

• FAST contributed to the efforts of the PM Combat ID through the development of a **Thermal Combat Marking System.** The system was evaluated and data provided to the PM.

Improved Training. FAST has supported the Army's training mission with projects which helped monitor unit training and equipment effectiveness and the development of new training devices.

• The FAST project which has had the most far-reaching effect on training has been the **Miles Training Devices.** The commander of the National Training Center requested his FAST adviser, Don Gross, now with CBDCOM, to investigate the possibility of having a device which would simulate hand grenades within the Miles System. A prototype was developed by Dr. Carl Campagnuolo, ARL's Sensors, Signatures, Signal and Information Directorate who is now the FAST USARPAC science adviser. Extended to include claymore mines and other devices, the project was taken over by STRICOM who is now overseeing production and fielding of the devices.

Fast Returns on Training

The FAST science adviser is assigned to the field command for a period of two years. Some have been extended and, in a few cases, due to changes in organizational structure and requirements, the tours have been less. The tour as a science adviser provides daily, first-hand experience of how the field army operates, its operational environment and the needs of the field. Without exception, our science advisers have expressed how valuable this experience has been to them. On completion of their tours, they take their field experience back to their home organizations. These organizations then know more about what the field needs and how to work with the field organizations.

- HMMWV Vehicle with Coolant Heater
- M939A2 5-Ton Truck Coolant Heater
- M939A2 5-Ton Truck Thermoelectric Generator Heater
- SUSV Coolant Heater
- SUSV Trailer Skis
- New Concept SUSV tracks
- 60,000 BTU Dantherm Heater (small tent heating)
- 150,000 BTU Heater (Tactical Operations Center and aircraft starting)
- Anti-Wheel Lock and Anti-Wheel Spin Braking and Traction System
- Shelter with Boot to fit SUSV
- Vehicle Exhaust Brake Retarder
- Arctic Troop Cover and Heater for Tactical Wheeled Vehicles
- Vehicle Air Starter

Figure 3.
FAST projects to improve cold weather fighting capabilities.

In addition to the science advisers, FAST provides junior AMC scientists and engineers an opportunity to work in the field. Science advisers request assistance on specific projects and FAST juniors are assigned for short periods of time to work under the supervision of an adviser. The FAST junior program has brought excellent results not only in training, but in providing answers to problems. ARL's Weapons Technology Directorate conducts an excellent FAST junior training course to prepare ARL personnel for duty as FAST juniors.

Communications Network

FAST currently has 20 science advisers located at all major U.S. Army commands throughout the world, the European Command and the U.S. Transportation Command. There are 26 FAST quick reaction coordinators located at AMC centers, ARL directorates, TRADOC and the Corps of Engineers. In addition, FAST and its Air Force and Navy counterparts established TriNet which links all Services together. This net is new, but has already proven to be effective in transferring technology from one Service to another.

The FAST Activity permits the entire Army in the field to have access to the Research, Development and Technological organizations of the Army Materiel Command, the Navy and the Air Force. Using FAST, the R&D community can have access to elements within the community and to units in the field. This network has seen a remarkable growth in obtaining information, arranging for evaluations and demonstrations and identification of requirements.

Goodwill

In the evaluation of the net worth of a business enterprise, "goodwill" can be a major factor. This is true with FAST. The commanders in the field have accepted our science advisers as members of their staffs. They depend on our science advisers for advice, solutions to their materiel problems, and access to AMC. In many cases, commanders have designated science advisers as their representatives at important meetings. Almost all of the extensions of the assignment of science advisers have been instigated by their commanders.

The Bottom Line

FAST has conducted over 500 projects, trained over 50 science advisers, provided field experience for over 100 junior scientists and engineers, and provides a unique network between the field and the R&D community. On only six projects, the annual savings is realistically estimated to be $125,858,000. Conservatively, AMC invests $6,000,000 annually in FAST. If AMC-FAST were on the New York Stock Exchange, it would be a hot investment.

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SOFTWARE SPECIFICATIONS AND STANDARDS

The Increasing Role of Performance Specifications

By Dr. John P. Solomond

Introduction

The acquisition process has endeavored to acquire the latest technology in the Defense inventory, while at the same time, has tried to ensure the currency of some 31,000 unique military specifications and standards. This has been a difficult task. This situation could be relieved by the increased use of performance specifications which describe what is to be acquired with much less emphasis on the detailed description of "how to." This article deals largely with software related issues and how software development, particularly for weapon systems, would be impacted with an increased emphasis on performance related specifications and their relationship to software development methodology.

In his article in the July-August 1994 issue of *Army RD&A Bulletin*, Darold Griffin, former principal deputy for acquisition at the U.S. Army Materiel Command, wrote, "The fundamental problem is not that the Department of Defense specifies its needs, but rather that standardization documents are written and applied inappropriately and are improperly tailored."

This shortcoming was addressed in an Aug. 15, 1994, memorandum by Gilbert F. Decker, the Army Acquisition Executive, in which he required that the Army Acquisition Officials "...must immediately begin using performance specifications and avoid using military specifications and standards.."

The overall goal of this article is to determine just how the recent emphasis on performance specifications and, to a certain extent, commercial standards, will impact the technology of software development.

In order to understand the acquisition reform taking place, one must understand that the goal of the new acquisition process is to enhance and unify the commercial and Defense industrial base by applying the most modern industrial products, processes and practices to our acquisitions. This will also include the most modern methods and principles of software engineering.

DOD will limit its responsibility for the maintenance of its large set of military specifications and standards. The DOD is unable to maintain its large inventory of some 31,000 military specifications and standards. The costs of maintaining military specifications and standards become prohibitive when one considers the rate at which technology changes, particularly in high technology disciplines, such as software engineering.

The initially perceived way out of this dilemma is to either convert military specifications and standards to commercial standards or eliminate them outright. Converting them to commercial standards would require that an industry sponsor assume responsibility for keeping the standards current, while outright elimination might leave a void in the engineering discipline covered by the military specification or standard.

Reform: An Example of the Implications

As an example of the conversion to industry standards, the Joint Logistics Commanders' (JLC) Joint Policy Coordinating Group for Computer Resources Management (JPCG-CRM) undertook the development of the draft standard MIL-STD-498, "Software Design and Documentation." MIL-STD-498 was undertaken in order to consolidate the software life cycle processes for weapon systems and information processing systems. While the harmonization process was underway, the National Security Agency Product Standards Group determined that MIL-STD-498 was a suitable document that could eliminate their unique standard (DOD-STD-1703: "Software Product Standards") as well. Thus, MIL-STD-498 would have replaced DOD-2167A, DOD-7935A ("DoD Automated Information Systems Documentation Standards"), and DOD-STD 1703. For each of these standards, revisions were long overdue. While MIL-STD-498 was never formally approved, the process of consolidation was useful for understanding the ultimate transition to industry standards.

This consolidation was done in order to accomplish long over due revisions in each standard, as well as be ready for the transition to industry standards. As a result of this consolidation, chain references to other standards were eliminated; process related activities are no longer based on documentation; and metrics indicators would be included in the consolidated standard, which previously was not the case.

Besides consolidating three standards, MIL-STD-498 was targeted as a potential implementation of a future national or international standard. During the development interval for MIL-STD-498, another international standard for software was being developed concurrently, ISO/IEC Draft International Standard (DIS) 12207, "Software Life Cycle Processes." DIS 12207 covers more than just software development, it also covers such things as acquisition, supply, operation, maintenance, and quality assurance, among others.

Carrying this one step further, the Institute

of Electrical and Electronic Engineers (IEEE) has commissioned a joint effort with the American National Standards Institute (ANSI) and the Electronic Industries Association (EIA). The joint effort, IEEE/ANSI/EIA 1498, would be a national implementation of 12207 and be tentatively titled "Acquirer-Supplier Agreement Software Standard for Software"; this implementation is due out in approximately 18 months.

The following chart summarizes the both MIL-STD-498 and ISO/IEC 12207 from a top level perspective.

CRITERION	MIL-STD-498 (Draft)	ISO/IEC 12207
LEVEL	TOP LEVEL,	TOP LEVEL,
AUDIENCE	ACQUISITION AGENCY	ALL PARTIES
PROCESS	DEVELOPMENT	ALL PROCESSES
CLAUSES	WHAT's REQUIRED (No "How To's")	WHAT's REQUIRED (No "How To's")
DOCUMENTATION	COMPLETE	NONE YET

The primary contribution of ISO/IEC 12207 will be to contain the fundamental portions of the standard together with the ancillary areas such as resource utilization, metrics and indicators, specialty standards, etc.

Software Product Specifications

For software, the general definition of a specification is a description of an entity stating its essential properties. Since a formal specification may only be demonstrated by logical proof, not by testing, formal software specifications must be verified via formal proofs in order to achieve any credible result. This concept is summarized in Lehman *et al*, in their 1983 report, "Another Look at the Software Development Methodology", Imperial College, U.K., as follows:

> "...straight forward programming techniques and improved quality of programs are both irrevocably related to the recognition that program correctness must not be viewed as a empirical but as a calculable notion..."

Software Development Philosophy

Harlan Mills, in his 1976 article "Software Development" which was published in the *IEEE Transactions on Software Engineering*, describes software development as an incremental process, with continuous user involvement. He also advocates successive "design-to-cost" programming within each stage. He reminds the development community that the great advances in hardware development since 1950 helped to challenge the software development community, largely involved in data processing activities, to reach higher levels of productivity and reliability. Their operations were largely ad hoc, relying little on formal standardized approaches to software development. However, the data processing activities were slow to move to more formal methods of operations.

Mills also stipulates that the basis for software reliability is design, not testing. It is well known that for both hardware and software, one can not test reliability into a product; it must be properly designed for reliability. Effective design, using a suitable standard, promotes reliable software. Besides making embedded errors much easier to detect, an effective design can reduce the size of a system, reduce the number of interconnections and, most importantly, reduce the complexity of its program specifications. Extensive testing, while important to assure that the software has met a minimum threshold of reliability, does nothing to enhance a software program's reliability. One can test for the "presence" of errors, not the "absence" of errors. This concept is promulgated by the use of "performance" specifications, which do not dictate the specific actions required to develop a particular software design, but only specify the end objectives of the programmed software. These principles form the basis for the current state of practice in software engineering.

Current Developmental Practices

There are a number of methodologies available both for DOD and civilian software development. A few are described below:

- *Waterfall Methodology.* The "waterfall" approach is probably the most traditional and has been in use for the longest period of time, and is schematically described in Figure 1. This approach is very dependent upon the complete specification of both software and system requirements at the beginning of the software development process. The major drawback is that any deficiencies in the original requirements definition will result in changes later on in the software coding and testing process.

Furthermore, this methodology is NOT suitable for development efforts where the requirements can not be defined at the beginning of the project. The advantage of this methodology is that one can predict reasonably accurate cost and resource estimates at the beginning of the project.

- *Evolutionary Software Development Methodology.* This methodology, based on a successive number of software versions or "builds" is used when one does not have a strong understanding of the system and software requirements at the beginning of the development process. This methodology usually begins with a general specification of system and/or software objectives. These objectives may include performance objectives. After the user's experience with the first "build" is evaluated, then the information from this is used to define in detail the requirements for the next "build." This process is repeated for each successive software "build".

- *Prototyping Methodology.* In this methodology, the critical software elements are defined only to the extent that current knowledge and experience permits. The prototype is used to obtain information about the total requirements and confidence in the correctness for the design approach. It is also used to obtain characteristics needed in the final software product such as efficiency, maintainability and ease of use. At that point the prototype may be evaluated in order to refine the initial requirements and the basic design.

With prototyping, one may normally bypass normal software development documentation, since the prototype is normally replaced after the basic concept is verified. If the software is not discarded, one remains with a package of undocumented and unmaintainable software. The software replacing the prototyped software will usually have been developed using the necessary steps and documentation. The prototyped software is usually not delivered to the customer, but rather discarded or kept by the developer.

- *Spiral Development Process.* This methodology is due to Barry Boehm's work,

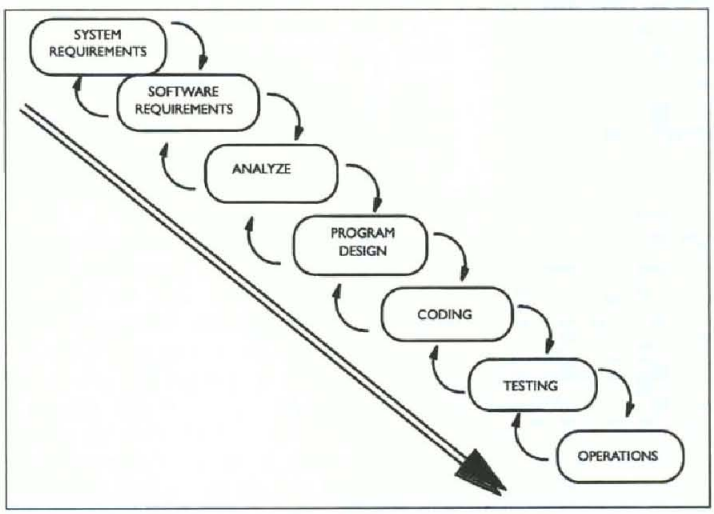

Figure 1. Schematic description of waterfall methodology.

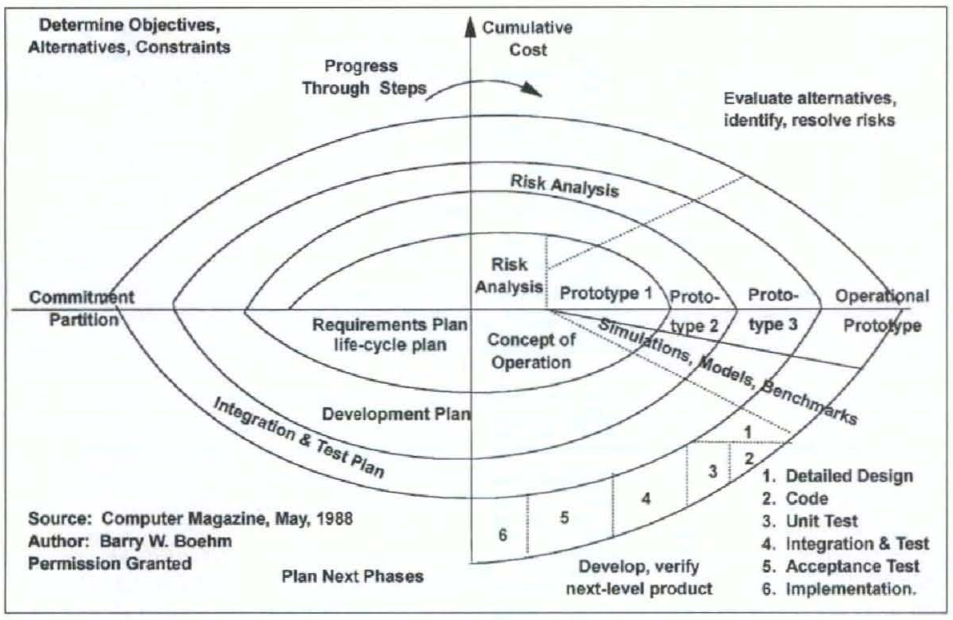

Figure 2.
Spiral methodology.

published in *Computer Magazine*, May 1988 as "a spiral model of software development and enhancement." The spiral development process contains a group of successive steps which precede the basic waterfall objectives with a group of activities which basically define the risks, and identify system software constraints. Based on this, the prototype is evaluated and the next iteration cycle is planned. After this process of refinement continues, final coding and test of the final product resumes. Figure 2 contains a schematic description of this model.

These alternatives to the waterfall model are not without their shortcomings, however. First of all, they can increase the risk of violating cost and schedule constraints. Further, they tend to ignore the importance of documentation and configuration management. Finally, there may be certain incompatibilities with the review and audit process.

Capability Maturity Model

The Capability Maturity Model is an example of the government supporting an effort which has resulted in improved commercial and defense practices for software development. The Capability Maturity Model was developed by the Software Engineering Institute at Carnegie Mellon University, and allows an organization to assess its own software performance based on certain fundamental criteria. These criteria are basic maturity characteristics which seem to be correlated to the organization's ability to develop code. These data are largely anecdotal, so the level of scientific proof is limited at this time. These criteria are not to be confused with formal software development standards, but are guidelines for self assessment. Anecdotal evidence seems to indicate that higher levels indicate more maturity and improved capability for software development.

The five distinct levels of the capability maturity model are based on a methodology from quality management. The five levels of process maturity are defined as follows for software:

- *Level 1*—The software process allows only very limited visibility into the project's processes. Software requirements flow into the process in an uncontrolled manner; notwithstanding these detriments, a software product usually does result. Because of these phenomena, the process of software development is often viewed as chaotic, requiring something akin to black magic in order to understand.
- *Level 2*—There is more control over customer requirements and work products. Fundamental project management practices are in place. With these basic management controls in place, a considerable amount of increased visibility into the project can occur.
- *Level 3*—The process becomes "defined"; the software process for both management and engineering activities is documented, standardized, and integrated into an organization-wide software process. All projects use a documented and approved version of the organization's process for developing and maintaining software.
- *Level 4*—the defined software processes are instrumented and controlled quantitatively. Managers are able to measure progress because they have an objective and quantitative basis for making decisions.
- *Level 5*—New and improved ways of building software are continually tried in a controlled fashion to optimize both quality and productivity. Defect prevention data are documented and tracked across teams coordinating defect prevention activities.

In summary, this approach does not define the standards that a company has implemented, but only the degree to which they adhere to a repeatable process for software development. Keep in mind that the underlying assumption that this methodology is suitable for software development and may not be, and in fact, probably is not, applicable for hardware development efforts.

Conclusions

In order to move in the direction of performance specifications in software engineering, the focus must be directed more to process oriented specifications relying on performance objectives. Furthermore, this would also define a shift in trend from defining a set of tasks to defining the measurable attributes of a process. Finally, there will be an objective set of methods by which specified quality attributes can be built into a product at a defined cost. Performance specifications for software development will allow one to verify achievement by using objectively prescribed methods. This methodology should serve to reduce unnecessary oversight and enhance the process of acquisition streamlining.

Acknowledgement

The author wishes to express his thanks to Christopher Neubert for his assistance in discussing current activities of the joint logistics commanders in the area of software standards.

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INDIVIDUAL MOBILIZATION AUGMENTEES

The Force Multipliers In RD&A

By Robert L. Menist

Introduction

Individual Mobilization Augmentees (IMAs) assigned to the Office of the Assistant Secretary of the Army (OASA) for Research, Development and Acquisition (RDA) provide an added dimension and expanded perspective to the RD&A community. In 1992, 72 U.S. Army Reserve officers held IMA positions in OASA(RDA). Subsequent force reductions in personnel claimed eight IMA billets in 1992 and later reduction actions set the IMA force at its current level of 52.

As with other IMA programs throughout the Army, IMA personnel assigned to OASA(RDA) provide the active components with reservists who are trained in peacetime to perform specific wartime functions. IMA personnel are unique in that their peacetime training relies heavily on, and takes advantage of their considerable civilian training in addition to their military training.

Many officers, currently assigned to the RD&A community within HQDA, possess extensive technical, scientific and procurement expertise that was developed as a result of their civilian work experience. This in-depth experience and background renders them a significant addition to the OASA(RDA) staff.

More than 90 percent of the OASA(RDA) IMA officers have advanced degrees in science, engineering or business. Our IMA force boasts 11 Ph.D., 13 M.B.A., 13 M.S./M.A./M.E. degrees and two officers with law degrees. Moreover, these officers are employed by such "high-tech" firms as General Electric, Northrop Grumman, Fairchild Space and Defense, McDonnell Douglas, Hughes, Allied Signal, Boeing, Bell Atlantic Communications and Johnson & Johnson.

Force Multipliers

OASA(RDA) IMA officers fulfill their roles as "force multipliers" by applying their individual expertise to support a myriad of Army RD&A activities and programs. They have repeatedly proven their worth to the Army and the national Defense by performing a variety of functions. A multiplicity of success stories clearly show that IMAs have:

- Designed unique assessment models for evaluating the utility of major weapon systems, including mission effectiveness, cost and political factors;
- Served as experts on missile guidance systems and developed a model to analyze missile effectiveness against obscured targets;

Individual Mobilization Augmentee personnel are unique in that their peacetime training relies heavily on, and takes advantage of their considerable civilian training in addition to their military training.

In addition to holding down full-time positions in the civilian sector, Individual Mobilization Augmentees are required to meet the same standards as their active Army counterparts by completing all professional development education requirements mandated by their organizational assignments.

- Developed appropriation reports for research, development, test and evaluation obligations;
- Provided automation security assessments on computer "viruses" and their impact on U.S. government operations;
- Prepared and coordinated the Army's response to draft reports by the General Accounting Office; and
- Developed budget controls for an Army abbreviated budget review.

A specific example of the experience of our IMAs is LTC Austin Bay, currently assigned to Systems Integration, who, in civilian life, is a journalist and published author specializing in wargaming and simulation. He served as an evaluator for the Army chief of staff's Louisiana Maneuvers Task Force—Exercise Prairie Warrior 94 where he applied his civilian wargaming and simulation expertise. Using insight gained during his tour of duty, LTC Bay is writing an article for *Army Magazine* on the impact of battlefield digitization.

IMA personnel assigned to OASA(RDA) possess the innate capacity to rapidly expand the peacetime capabilities of the full-time RD&A staff. Upon mobilization, 200K Presidential Call-up, or other national emergency, these IMAs significantly augment the regular staff's ability to transition to a "round-the-clock" operation. As a direct result of their military and civilian training and experience, they have literally become "force multipliers."

Although, most IMA personnel only receive pay for their annual training (AT) period (approximately 12 days), many perform technical and administrative duties for the agency on their own time. Such tasks as project research, information papers, staff studies and formal input to the Army's senior leadership and the Congress are well within their capabilities.

In addition to holding down full-time positions in the civilian sector, IMAs are required to meet the same standards as their active Army counterparts by completing all professional development education (PDE) requirements mandated by their organizational assignments. Consequently, U.S. Army Reservists must attain success on three fronts, i.e., military assignments, professional development education, and civilian employment pursuits.

IMA personnel are a "special breed" who must learn to effectively manage three distinct career endeavors simultaneously.

Force Reductions

Consistent with the active component force reductions, Army Reserve and Army National Guard forces are being downsized and some restructured. Army National Guard units will focus on wartime combat and peacetime domestic emergency missions, while Army Reserve units will support wartime combat forces. Some combat missions currently assigned to the Army Reserve will be transferred to the Guard, and some support functions in the Guard will be transferred to the Reserve. As a result of these changes, Army Reserve and Army National Guard elements will decline from 670,000 personnel in 1994 to 575,000 in 1999. These forces comprise the bulwark of the Selected Reserve or more commonly referred to as priority reserve forces.

The IMA program is part of the Selected Reserve, and may be exposed to some of these force reductions. As the entire Department of Defense force structure downsizes, there is a danger that some IMA positions could be at risk. Personnel are becoming increasingly more important to each of the Services—the Army is no exception. Obviously, the IMA program offers a cost-effective alternative to the Army because it provides critical or key personnel assets in times of national emergency. The Army Reserve's elite IMA program provides the "personnel surge" needed during a national crisis. IMAs were called up during Operations Just Cause, Desert Shield and Provide Comfort, and they were utilized with great success.

Conclusion

As the Army faces future force reductions, the respective roles of U.S. Army Reserve IMAs will become increasingly more important to the active force. They constitute the vanguard of the Army's "pre-trained" manpower pool. They are prepared and ready to serve the nation in any emergency—foreign or domestic. They are truly one of the Army's most important "force multipliers."

MG ROBERT L. MENIST is the assistant military deputy to the assistant secretary of the Army for research, development and acquisition. He holds a master's degree in business administration and a doctorate in business management from the University of California's School of Business Administration at Berkeley.

USER EXPERIENCE: DOES IT REALLY MATTER?

By CPT Damon T. Walsh,
CPT Kelly Campbell
and Dr. David Lamm

We are now witnessing the death of management. By management, I mean the peculiarly American idea (still taught at many business schools) that a "good manager" should be able to manage any enterprise, anywhere, any time. Through incisive analysis and decisive action, our supermanagers supposedly could make any company productive and profitable.

With hindsight, we can see the absurdity. We don't imagine a winning football coach switching to basketball, nor a concert pianist becoming a symphony violinist. We don't think an orthopedic surgeon would automatically make a good psychiatrist. We recognize that differences in talent, temperament, knowledge and experience make some people good at some things and not at others.

—NEWSWEEK, May 10, 1993

Introduction

The preceding quote was taken from an article by Robert J. Samuelson in which he takes a critical view of the commonly held belief that managers can manage without possessing in-depth knowledge of, or prior experience with, the business they are charged with managing. The quote readily summarizes the critical issue of this article; Are U.S. Army contracting officers the "supermanagers" to which Samuelson refers, or should their previous operational experience play a role in the billets to which these officers are assigned?

In an attempt to answer this question, a thesis was recently completed at the Naval Postgraduate School in Monterey, CA. The specific objective of the thesis was to examine the rationale behind the current organization of uniformed contracting officers in an attempt to determine whether there should be more Functional Area (FA) 97 positions coded to require branch, or branch-type, specific officers, as well as to identify where the billets should be. For the purposes of the research, user experience was defined as the specific knowledge, skill, or judgment gained through the practice or conduct of military operations. Some of the findings of the research effort are presented here.

Background

The military portion of the Army Acquisition Corps is composed of 2,500 officers in the grade of captain through colonel serving in one of three functional areas: FA 51-Research, Development and Acquisition; FA 53-Systems Automation; and FA 97-Contracting and Industrial Management. These officers are assigned to billets as identified on a Military Acquisition Position List (MAPL), which shows 2,236 billets in a variety of Army, Joint, and DOD acquisition organizations. Each billet is coded in one of three ways. The code will indicate either: the basic branch from which the officer should come (e.g., Infantry, Signal Corps, Ordnance, etc.); it will indicate a branch type (e.g., Combat Arms immaterial, or Logistics immaterial), or it will be coded as a "branch immaterial" position meaning an officer from any

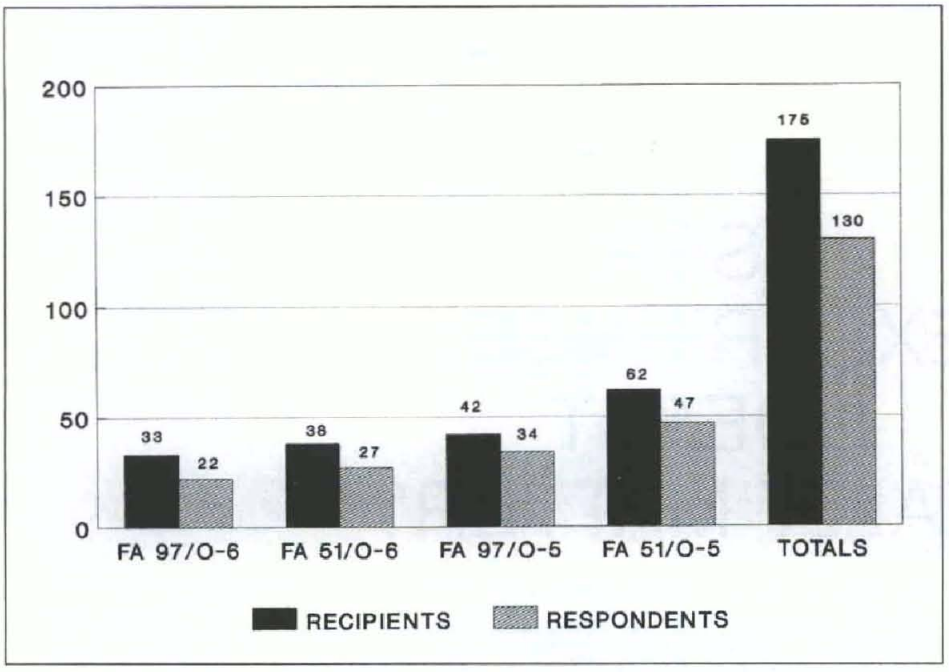

Figure 1.
Recipients vs. respondents by functional area and rank.

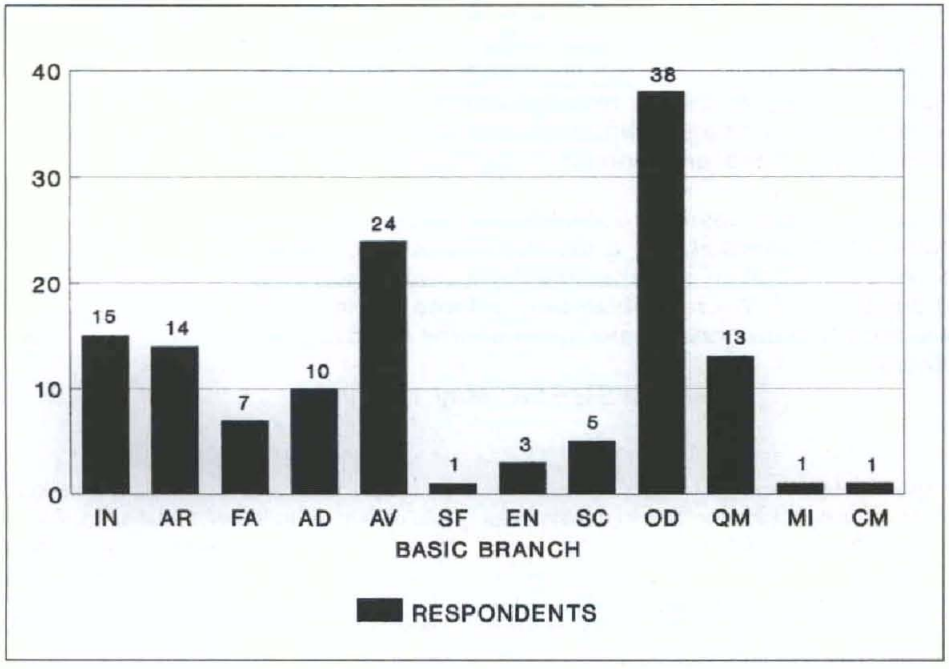

Figure 2.
Survey respondents by basic branch.

branch can be assigned to fill the position.

According to a 1992 PERSCOM information paper on the Acquisition Corps, the corps was built to "...reflect the composition of the Army..." in terms of basic branches, and that one of the primary purposes for including a uniformed presence in the AAC at all (as opposed to a completely civilian corps), was "...to capitalize on the operational experience of the military officers...." Additionally, DA Pamphlet 600-3 states that an officer's operational experience is gained during assignments in his/her basic branch. If the Acquisition Corps is built to reflect the branch composition of the Army, the purpose of having officers is to capitalize on their operational experience, and the operational experience of officers is developed through service in their basic branch, it would seem to make intuitive sense that the MAPL should be built to mirror the branch composition of the corps. It appears that it does not.

The Acquisition Corps population vs. billets. For illustrative and analytical purposes, the Acquisition Corps' officers were categorized as either combat arms or non-combat arms. A review of the Acquisition Corps population of 2,500 officers shows that 44 percent are combat arms officers and 56 percent are non-combat arms officers. The same review of the MAPL indicates that of the 2,236 billets, 24 percent are coded for combat arms, 21 percent are coded for non-combat arms, and 55 percent are coded as branch immaterial.

The FA 97 population vs. FA 97 billets. The FA 97 population constitutes 23.4 percent, or 585, of the total AAC inventory of 2,500 officers with 49 percent of these officers being combat arms and 51 percent being non-combat arms. There are 534 slots on the MAPL designated for FA 97 officers. A review of just the FA 97 slots on the MAPL reveals that 84 percent are coded as branch immaterial, 7 percent are coded for combat arms officers, and 9 percent are coded for non-combat arms. Adhering to the philosophy that a picture is worth a thousand words, the graphic comparison of the FA 97 population with the FA 97 billets by branch type reveals what appears to be a significant disparity between building the FA 97 population (i.e. the way officers are brought in to the AAC), and employing that population within the AAC.

The impression one comes away with is that an FA 97 officer's previous user, or operational experience, which is developed through initial assignments in a basic branch, played a relatively insignificant role in determining what sort of billets the officer could be assigned to in the acquisition community. The question that then posed itself was: "So What??" Does it matter whether or not Functional Area 97 officer assignments are made using previous operational experience as a factor? Should there be an increase in the amount of emphasis placed on user experience when it comes to assigning FA 97 officers?

As part of the attempt to address these issues, a survey of 175 senior officers in the Army Acquisition Corps was conducted in order to gauge the level of command preference for contracting officer user experience.

Survey

Survey audience. The target audience for the survey consisted of colonels or lieutenant colonels serving as either FA 51s in program offices/program executive officer (PEO) billets, or FA 97s serving in any billet. Of the 175 surveys mailed out, 75 were sent to FA 97s and 100 were sent to FA 51s. Roughly 75 percent of recipients responded with 130 completed survey questionnaires being returned to the author. A total of 56 FA 97s and 74 FA 51s responded. A profile of the survey recipients and respondents is illustrated in Figures 1 and 2.

Survey design. The survey consisted of nine statements to which respondents were asked to provide their level of agreement or disagreement on a bar scale ranging from 1 (strongly disagree) to 5 (strongly agree). The nine statements along with the bar scale as they appeared on the survey are shown in Figure 3.

In addition to the scaled response statements, respondents were encouraged to provide free-form written comments as to whether or not there should be a heavier reliance on branch coding for FA 97 billets.

Survey results. The survey results were tallied and then analyzed using a classical statistical approach. There were two primary scores obtained on each of the statements: a mean score, and a score within the 95 percent confidence interval range. The confidence interval range is based on the sample size, the standard deviation, and an allowance for a 5 percent possibility of error and can be interpreted as the range of scores within which we can be 95 percent confident that the true mean for the whole population falls. In other words, if every single colonel and lieutenant colonel in the Acquisition Corps had been surveyed, there would be 95 chances in 100 that there response scores would have fallen somewhere within the range reported here. The mean scores and confidence interval ranges for each statement on the survey are depicted graphically in Figure 4.

Conclusions

In addition to the survey, interviews were conducted with representatives from: the Military Acquisition Management Branch at PERSCOM; the Director of Acquisition Career Management's Office; the Functional Area 97 Proponency Office of the Army Contracting Support Agency; and the Personnel Office at Headquarters, Army Materiel Command. Based on their comments, the statistical analysis of the scaled responses, as well as an analysis of the free-form comments provided by respondents, the following four key conclusions were made.

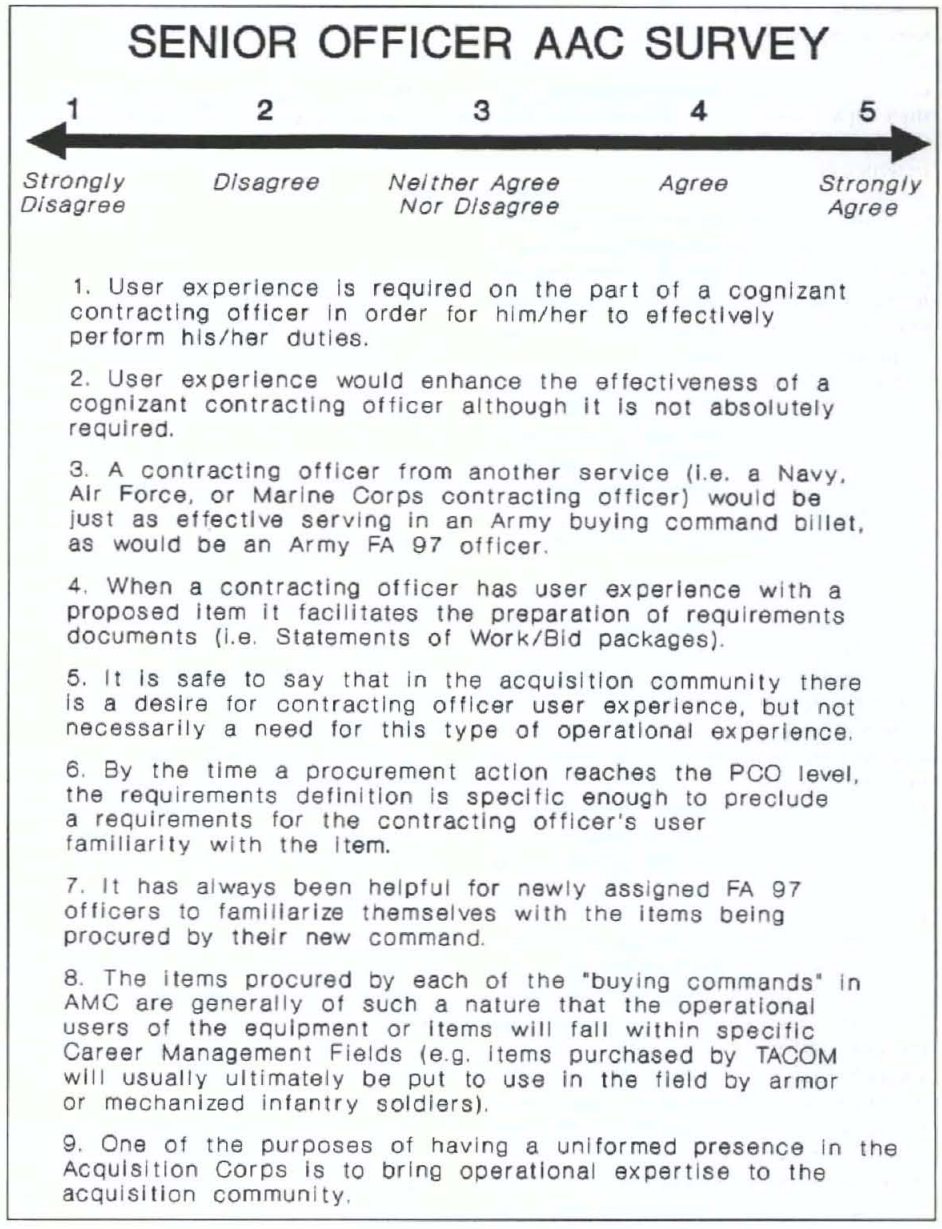

Figure 3.

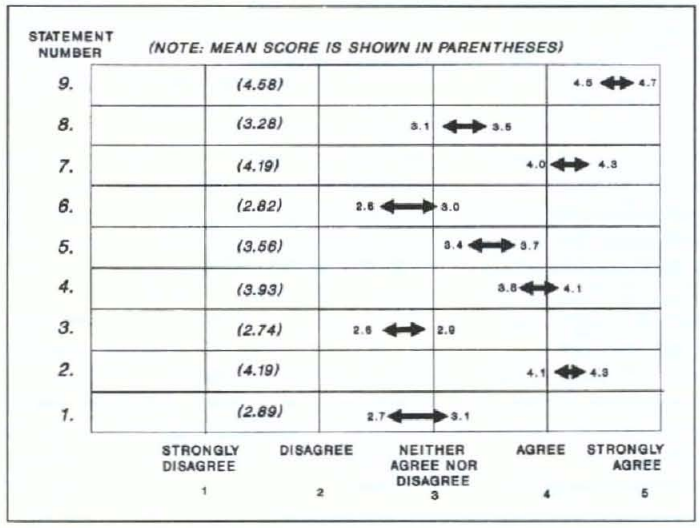

Figure 4. Survey response mean scores/confidence ranges.

• *Increased reliance on branch coding.* Survey respondents believed that an increase in the amount of emphasis placed on branch coding FA 97 billets should be beneficial to the Corps. This conclusion was derived from the specific findings that showed: user experience enhances the effectiveness of a cognizant contracting officer; there is a desire for contracting officer user experience within the Acquisition Corps community; and the presence of branch-specific contracting officers allows for the introduction of both general and specific military experience into the acquisition community.

• *Branch-coding decisions.* Respondents felt that the best place to make branch-coding decisions, in terms of both the specific branch as well as which billets to code or not to code, is at the organizational level, e.g., MACOM or buying command level, as opposed to the Headquarters, Department of the Army level.

• *CMF-AMC major subordinate command relationship.* The research showed that a relationship does exist between the commodity groups around which the Army Materiel Command's major subordinate commands are organized, and the Career Management Fields (CMFs) of the soldiers that ultimately put the equipment to operational use. This conclusion was caveated with the notion of "primacy of knowledge." In other words, in terms of identifying where CMF-commodity relationships do, or do not, exist, the fundamental question that must be asked is: Who, and where, are the "subject matter experts" on the equipment?

• *Branch specific assignments prohibitions.* The research showed that, although currently there is a relative lack of emphasis on branch coding FA 97 billets, there is nothing in terms of either philosophy or policy that prevents the assignment of an FA 97 officer with user experience to a billet. In many cases, in fact, PERSCOM makes FA 97 assignments where the assigned officer has specific operational experience with the commodity type of the command to which he/she was assigned.

Recommendations

There were three major recommendations provided in the thesis.

• *User experience policy letter.* The FA 97 Proponency Office should initiate a study to identify and compare/contrast the potential costs and benefits associated with an increased reliance on branch coding. This study should involve a MACOM-by-MACOM review of all FA 97 contracting officer positions so as to identify the specific functional duties performed by each. A decision should then be made with regards to the usefulness of coding each billet by branch, or branch type. This process must focus on whether or not a branch specific officer would be the most effective in filling the position.

The end result of this study (or studies as the case may be), should be the preparation and publication of an FA 97 "user experience" policy that identifies considerations to be applied in deciding whether billets should, or should not, be branch coded. These considerations might include items such as: the amount of interface an FA 97 has with user (e.g., PM) organizations; the availability of branch-specific officers in the Acquisition Corps population that can be used to fill branch coded billets; or the use of "branch types" (e.g., combat arms immaterial, or logistics immaterial) in coding billets.

• *PERSCOM assignment policy change.* The interviews indicated that the current PERSCOM-wide assignment policy is one whereby officers are assigned to billets based solely on the Functional Area requirement. The FA 97 personnel managers should develop an assignment policy wherein the first priority is given to an officer that simultaneously fulfills the requirement of both the Functional Area and the branch. This is, admittedly, a subtle change but a necessary one all the same. The acquisition community is one area of the Army where uniformed officers will rely on integrating their previous experience into the performance of their acquisition peculiar tasks.

While the assignments officers currently state that they do attempt to keep branch specificity in mind when making assignments, this is subject to variation based on the personal judgment of whoever the particular assignments officer happens to be at the time an assignment is made. In other words, as soon as the assignments officer changes—the relative emphasis placed on branch specificity could change. The policy should be "codified" to the maximum extent possible in a written policy so as to reduce the impact of variation due to personnel turnover in the FA 97 Assignments Office.

• *FA 97 billet review.* Personnel managers at the Army Materiel Command should initiate a detailed review of each FA 97 contracting officer position within AMC (either unilaterally, or in conjunction with an FA 97 proponency office study), so as to identify the specific functional duties performed by each and then render a decision with regards to the usefulness of branch specificity. This process, however, must stress that the focus should be on whether a branch specific officer would be more effective than a non-branch specific officer in performing the job. Consideration should be given to the relationship between the manner in which AMC major subordinate commands are organized along specific commodity lines, and the CMFs of the soldiers that ultimately put the commodity items to use in the field.

The bottom line in the thesis was that the research clearly showed that an increased reliance on branch coding Functional Area 97 contracting officer billets should be beneficial to the Acquisition Corps, but that the topic requires additional research before any changes to the current system should be made. The thesis showed, however, that the fundamental question that must be asked in addressing the how (to increase the level of user experience), is not one of "Could a non-branch specific officer do the job?" Rather it should be one of "Would a branch specific officer do the job better?"

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CPT KELLY CAMPBELL is a 1984 graduate of the U.S. Military Academy at West Point. Campbell is a field artillery officer who entered the Acquisition Corps as an FA 97 in 1992. He completed the acquisition and contract management curriculum and received a master of science in management at the Naval Postgraduate School in 1993. He is currently serving as a contracting officer at the Red River Army Depot in Texarkana, TX.

DR. DAVID LAMM is an associate professor of acquisition and contract management at the Naval Postgraduate School in Monterey, CA. He is the academic associate for the acquisition and contract management curriculum and instructs military officers and civilians in the fields of acquisition, contracting, program management and logistics.

EMBEDDED DIAGNOSTICS TECHNOLOGY FOR REDUCED LOGISTICS AND MAINTENANCE COSTS

By Charles D. Bosco
and Dr. Li Pi Su

Introduction

Modern weapon systems continue to become more and more complex as new technological advances occur. This necessitates continuous and costly training of Army maintainers. The diagnostics process is time-consuming, thus delaying a system's reentry into service. The diagnostics process also has various levels. The system operator determines that the system is not working properly by routine testing. The maintainer isolates the faulty part and either repairs or replaces it. The shop isolates the problem down to the lowest throw-away part. The maintainer must not only have a thorough knowledge of the system but must know how to use complex test equipment to diagnose the problem and isolate the fault. Test program sets developed for use with the test equipment aid the maintainer, but these test program sets are very expensive to develop and maintain. The Army currently has many millions of dollars invested in test program sets.

Moreover, modern complicated and complex weapon systems also necessitate the incorporation of built-in-test (BIT) and built-in test equipment (BITE) to help maintenance personnel correctly isolate faults to the lowest level and, hence, reduce the weapon system downtime. However, the required BIT and BITE are very costly, especially since the newer line replaceable units (LRU) are more densely packed with integrated circuits, chips, and micro-processors. In addition, BIT and BITE are often not adequate and it is difficult to verify fault detection coverage.

Army's Vision—Embedded Diagnostics

Much of the cost and time of diagnosing a system's problem could be avoided if the system were able to diagnose itself. If the system could automatically tell the maintainer what is wrong and where the fault is, the maintainer would then only have to repair or replace the part. This would be true whether the bad part is a shop replaceable unit, LRU, or a small component. The savings in soldier training and test programs development would be substantial.

This same concept could be applied to software functional diagnostics, thereby allowing for complete embedded diagnostics. Because the diagnostic analysis would be automatic and self-contained, different trouble reports would be generated. The weapon system operator would receive a "battle impact" report that would describe the degraded operation. At the same time, a diagnostics report could be automatically sent to a rear maintenance area where the needed parts could be made ready for replacement. Under this scenario, the weapon system would be out of service only as long as it took to replace the defective part.

While the technology to create the above scenario has not yet been developed, present technological advances indicate that it is feasible.

What is required to implement embedded diagnostics is BIT that reports periodically, or on command, to an embedded diagnostics reasoning capability. The embedded diagnostics can reside either on the system's computer or can be integrated as strategically placed built-in diagnostics chips. The embedded diagnostics can be interrogated by means of a standard personal computer (PC) or be part of the operator's display.

An Army Tool to Achieve the Vision

To achieve total embedded diagnostics of a system, diagnostics must be part of the system design. This is very difficult since most designers are not trained to design for diagnoseability. It is difficult enough to design for

testability. It is even more difficult to design testability for maintenance purposes.

To address this problem, the U.S. Army Test, Measurement, and Diagnostic Equipment Activity has just completed development of an Army-owned software tool, the Diagnostic Analysis and Repair Tool Set (DARTS). This is a concurrent engineering tool that allows for diagnoseability during design. DARTS allows the designer to assume the traditional role of the test engineer early in the system design phase. It does this by advising the designer of the fault coverage and capability to isolate faults in real time during the design process. The designer can also use DARTS to determine placement of optimum test points to isolate faults at the lowest level. It also recommends where additional tests are required to reduce ambiguity groups.

Designing With DARTS

To effectively embed diagnostics, the designer must be able to systematically meet the diagnostics requirements while not being distracted from the performance requirements. DARTS makes no demands on the designer unless the designer chooses to accept recommendations, as where to put test points, BITs, or BITE. That is, the designer can use DARTS to perform trade-off analysis (in terms of units' volume, size, or weight, etc.) during the design phase to minimize test points, BITs, or BITEs while achieving the maximum system diagnoseability.

For existing weapon systems or systems consisting of non-development items, DARTS can be used to develop and embed a "diagnostic subsystem." The diagnostic subsystem can perform run-time diagnostics analysis for a system in various environments: with test programs, BIT/BITE, or portable maintenance aid programs using the integrated family of test equipment platforms.

Embedded Diagnostics Technologies

BIT and BITE are designed into a system to reduce external testing and test equipment while performing diagnostics for a system. However, this approach is costly and not always very effective. The advent of several new technologies makes it possible to effectively implement embedded diagnostics at a reasonable cost. Embedded diagnostics require less testing. Also, traditional test program sets are eliminated. The new technologies—embedded systems technology, real time data acquisition and processing, and automated fault diagnostics using DARTS—are available to perform embedded diagnostics, either as a system or embedded on a chip (diagnostics on chip (DOC)).

- *Embedded Systems Technology* - Because DARTS diagnostics analysis is derived from the design data, it is "pure" diagnostics and independent of the manner of testing or test equipment. Therefore, it does not matter how a test is made or whether the testing is done as BIT/BITE or externally. It is this important attribute of DARTS that makes embedded diagnostics possible.

The availability of very powerful microprocessors with large on-board memory, now makes it possible to embed the DARTS diagnostics analysis on a chip for real-time evaluation of the system. By constantly or periodically non-intrusively monitoring system performance, the DOC will detect faults and send out a signal that identifies and/or isolates the fault.

- *Data Acquisition and Processing* - The DOC will monitor analog and digital signals coming from strategic locations in a system. This can be done in real time or during test conditions. If these signals are interfaced with a data acquisition system which processes, packages, and analyzes them, system performance can be closely monitored and evaluated. This is critical to embedded health maintenance systems since the failure information may be needed immediately in a combat situation.

- *Automated Fault Diagnostics using DARTS* - Embedded diagnostics will consist of a DOC microprocessor which not only has the capability to diagnose but has knowledge of the system to be analyzed. If necessary, the knowledge of the system can be hosted on an additional memory chip. The DOC will continuously or periodically examine test data from the system's built-in test. This is best done by means of a bus. Since the tests and analysis are determined during the design of the system, there is no dependence on test program sets or external test equipment. Moreover, the maintainer need not be fully versed in the operation of the system being analyzed.

When the analyzed system fails, the DOC immediately sends out an alarm. If the system is interrogated using simple software on a PC, the DOC will isolate the fault to design specifications and the output will be displayed on the PC.

Diagnostics on Chip

Development of DOC technology was completed in September 1994. The DOC is a generic diagnostics chip which can be directly embedded into a unit or a system to achieve real time fault detection and isolation without the need for costly and time consuming external test equipment. DOC can be implemented at each level of the system hierarchy. This allows the diagnostics to be performed automatically to a much greater depth of resolution and eliminate much of the costly intermediate level maintenance currently required to support fielded weapon systems. The NAVSTAR ITS-B design is presently undergoing a diagnostics analysis and the system will be used to demonstrate the insertion of embedded diagnostics.

Conclusion

Embedded diagnostics technologies are available and mature enough to be inserted into weapon systems, equipment, or any industrial systems. The DOC can be applied to a system to increase the operational performance and readiness while reducing the operational support and maintenance costs.

CHARLES D. BOSCO is an electronic engineer at the U.S. Army Test, Measurement, and Diagnostic Equipment Activity. He has a B.S. degree in engineering physics from the City University of New York, and an M.S. degree in physics from Monmouth College, NJ. He has managed the Army's diagnostics and prognostics technical base for the past three years.

LI PI SU is an electronic engineer at the U.S. Army Test, Measurement, and Diagnostic Equipment Activity. She has a B.S. degree in mathematics from the National Taiwan Normal University, a B.S. degree in electrical engineering from The University of Oklahoma, and a Ph.D. degree in mathematics (The University of British Columbia). She has researched diagnostics and prognostics technologies for the past two years and has managed the DARTS and Embedded Diagnostics Programs.

TARDEC EYES ACTIVE SUSPENSION FOR MILITARY VEHICLES

By George Taylor
and Bill Mackie

The U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), in Warren, MI, is evaluating a hydraulically-operated, fully active suspension system. This system will react to and nullify the effects of rough terrain conditions, thereby improving off-road mobility by providing a more stable ride.

Developed by British-based Lotus Engineering, the system reacts to the vertical forces and velocities of the individual wheels that are encountered while traveling over rough surfaces, to reduce the pitch and roll motions that normally occur.

The system is well-suited for incorporation into wheeled vehicles with fully independent suspensions, such as the Army's HMMWV (High-Mobility Multipurpose Wheeled Vehicle), which uses an independent double A-arm suspension.

The system consists of a network of transducers that supply input to a central control computer. This input includes wheel hub accelerations, forces and displacements, chassis lateral and longitudinal accelerations, vehicle yaw rate, engine speed, steering angle, and numerous calculated parameters.

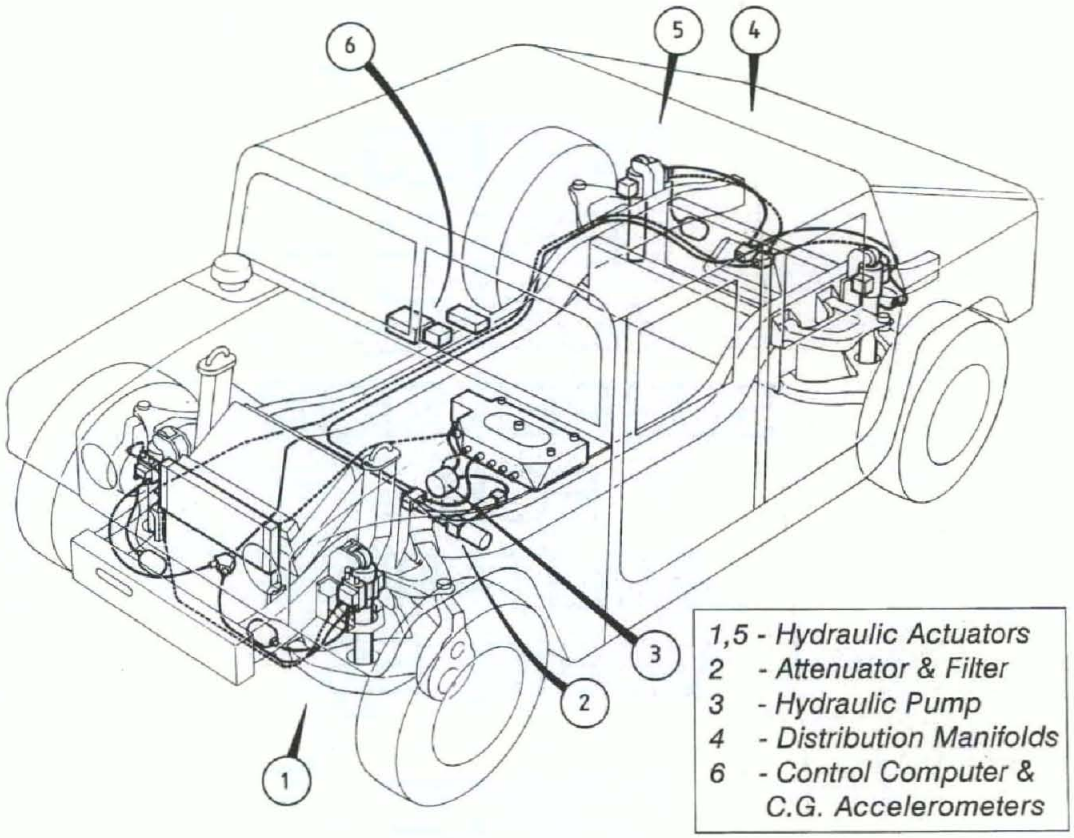
The computer analyzes these parameters using an established control algorithm (or road map), which, in turn, determines the optimum wheel forces, velocities, accelerations and direction of travel. Electric servo valves at individual hydraulic actuators located at each wheel station are then positioned appropriately to control the hydraulic condition of the actuators to offset the road inputs for maximized chassis stability and attitude. These internal calculations and control commands are updated numerous times per second.

The system substantially reduces pitch and roll compared to the standard HMMWV, but it doesn't result in a perfectly smooth ride. The reason for this is that it is a reactive type system that relies strictly on input forces and accelerations to initiate any control sequence. In the future, however, we hope to investigate the use of forward-seeking sensors that will enable the system to determine upcoming terrain conditions and simultaneously adapt the suspension to these conditions in real time.

TARDEC recently began testing a HMMWV outfitted with the modified suspension following training and familiarization with the system to ensure safety and to protect the prototype. Initial testing consisted of obstacle runs at TARDEC that were run side by side with a standard HMMWV and provided both quantitative and subjective test results. More extensive formal mobility testing was recently conducted at the Waterways Experiment Station in Vicksburg, MS.

Besides investigating the merits of the active suspension, TARDEC has a primary objective of evaluating alternative off-road algorithms that govern the control

Lotus' HMMWV Active Suspension System



RD&A Contributing Author Retires

George Taylor III, a regular contributor of technical articles to *Army RD&A*, retired from federal service on Jan. 3, thus ending a writing career that spanned nearly three decades.

Taylor had been a technical publications writer and editor at what is now called the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, since March 1966. He attended Michigan State University, where he received a B.A. degree in journalism in 1964 and an M.A. degree in communications in 1966, graduating both times with "high honors." While in college, Taylor was elected to Phi Kappa Phi Honor Society and Kappa Tau Alpha Journalism Honor Society.

While employed at TARDEC, Taylor had written numerous technical articles dealing with combat and tactical vehicles and related equipment. His articles appeared in a wide variety of government military and commercial media.

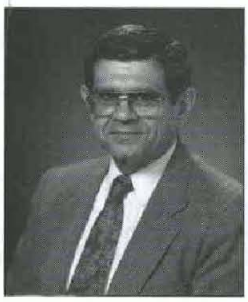
Taylor's achievements brought him numerous accolades. In 1978, he was named U.S. Army Tank-Automotive Command Handicapped Employee of the Year. (He has no vision.) Taylor also received four outstanding performance awards, as well as letters of commendation from past TACOM commanding generals.

computer in addition to the algorithm presently in use.

It is hoped that the active suspension will provide substantial cross-country enhancement by improving stability and ride quality. If this turns out to be the case, it could be used to improve the stability of weapons and electronics platforms, as well as ambulances.

The preceding article was written by George Taylor and Bill Mackie. Taylor is a technical writer in the Marketing Office of the U.S. Army Tank-Automotive Research, Development and Engineering Center, Warren, MI. Mackie, also a TARDEC employee, is the engineer in charge of the active suspension effort.

What Professional Development Opportunities Are Available Under Your Career Program?

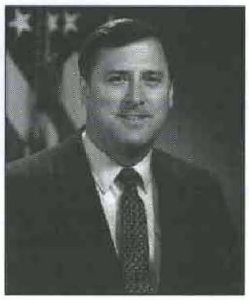


Neil Ginetti
Functional Chief Representative
Comptroller Career Program
The Pentagon

In the Comptroller Civilian Career Program, we are pursuing several career-enhancing programs believed to be the first of their kind anywhere in the Army and possibly throughout the Department of Defense.

- Our Comptroller Career Program's long-term training programs, featured in the annual PERSCOM civilian training catalog, are open to candidates for self-built university graduate and undergraduate programs. We fund 12 employees per year in these programs. The Army Comptrollership Program at Syracuse University, offering an M.B.A. degree to about 10 competitively-selected, centrally-funded civilians per year, is our best-known and most highly-sought opportunity. A similar program we sponsor, of particular interest to the acquisition workforce, is the Air Force Institute of Technology 16-month Graduate Cost Analysis Program at Wright-Patterson AFB, OH. In both of these programs, we centrally fund all costs and place the students in new jobs ("operational assignments") in which they will work following graduation.
- The Resource Management Mentorship Program incorporates and builds on three distinct but related mentoring approaches that help train, develop, manage and retain our workforce, supervisory/managerial mentoring, informal mentoring and formal mentoring. Last September, 455 military (CPT-COL) and civilian (GS-11-SES) personnel finished our one-year Army-wide prototype formal mentoring program. Their end-of-program evaluations have convinced us to remain dedicated to mentoring, at roughly 40 percent of the prototype level.
- The Comptroller Developmental "Job Swap" Pilot Program is a formal developmental position exchange mechanism to give careerists a way of broadening experience during this "downsizing." The program includes temporary and permanent same-grade placement. We were able to arrange matches for about 90 percent of the 150 who applied last October. Most of the swaps have begun and are now underway.
- The Comptroller Student Intern Program at FORSCOM headquarters includes work and study in the resource management field. It draws its recruits from Atlanta Cluster high schools and is teamed with ex-President Jimmy Carter's Atlanta Project. In June 1993, the first five students were competitively selected on the basis of scholastic achievement, community and school activities, and education and career goals. The program gives participants Army resource management work experience during college vacations and breaks, annual tuition expense up to $10,000 each, and Army Comptroller Career Intern status upon college graduation.

These are just some of our programs that may interest acquisition workforce readers. They are in addition to other professional development programs we participate in, such as tuition assistance, Army Management Staff College, and Senior Service College competitions.



J. Bruce King
Functional Chief Representative
Civilian Contracting and Acquisition Career Program
Falls Church, VA

In accordance with the Defense Acquisition Workforce Improvement Act, we offer the contracting workforce a comprehensive program of training, experience and educational opportunities.

Training is primarily focused on the mandatory contracting curriculum offered by the Defense Acquisition University. It is broken out as Level I (grades 5-8), Level II (grades 9-12), and Level III (grades 13-SES). Funding and course quotas are adequate to meet mandatory training needs; however, individuals who are flexible enough for the standby program (to attend courses on short notice when unforeseen emergencies cause scheduled students to cancel), and activities who are willing to host on-site courses, can increase their training levels more quickly. Many of the mandatory courses are also available through other delivery modes, such as correspondence, equivalent university courses, and credit via equivalency exams.

Experience opportunities include developmental assignments that are funded under the Army Civilian Training, Education and Development System (ACTEDS) Program. These currently include a one-year assignment on my staff, a developmental assignment requested by one of the Principal Assistants Responsible for Contracting (PARC), or other tailored developmental assignment which an individual arranges, proposes, and has approved by my office. In addition, PARCs are encouraged to arrange rotational developmental assignments for their own personnel. CP-14 careerists are also eligible for other developmental assignments announced separately by the deputy director for acquisition career management.

Educational opportunities encourage careerists to obtain, at a minimum, 24 accredited semester hours of business-related study. Again, the ACTEDS Program is an avenue for employees in grades 11 and above to obtain up to one year of undergraduate or graduate tuition assistance on either a full-time or part-time basis. The Army Tuition Assistance Program provides college undergraduate course funding, with particular emphasis on obtaining the 24 accredited business-related semester hours. The Army Acquisition Corps offers other graduate school and tuition assistance programs. However, none of the programs fund doctoral degrees at this time.

I am placing particular emphasis on leadership development and long-term training opportunities at such institutions as the Army Management Staff College, Industrial College of the Armed Forces, Army War College, Naval Post-Graduate School, and Harvard Senior Executive

Fellows Program. I am pleased to note a recent increase in the number of successful CP-14 selectees, particularly in view of the highly competitive nature of these opportunities.

In conclusion, I would like to remind careerists that they determine how far and how fast they progress in their career field. I try to ensure that the contracting workforce is made aware of the opportunities and funding available for these programs. However, it is up to the individual to be their own career manager by taking the initiative to pursue these opportunities and investing their time and effort to enhance the skills that will enable them to be all they can be.

Miriam F. Browning
Functional Chief Representative for Communications-Computer Systems Career Field
Office of the DISC4

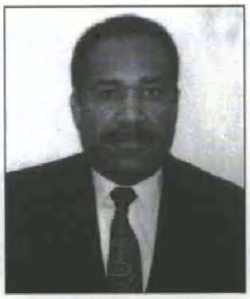
Communications-Computer Systems Career Field personnel are an integral part of the overall acquisition workforce. They provide direct support in the acquisition of major automated information systems (AIS) and related components. Individuals in a variety of job positions, including computer specialists, communications specialists, computer scientists, electronics engineers, and others, comprise the workforce.

Civilian education is the cornerstone for career development in the Communications-Computer Systems Career Field. All grades in the acquisition workforce may competitively apply for tuition assistance. Tuition assistance is readily available for those individuals who elect to earn a degree part-time while continuing to work in their jobs. Entry-level communications-computer systems workforce members should focus on Acquisition Corps qualifications as the primary goal. Those individuals without a degree should pursue a major in information systems, communications, or a related field. The exact orientation of the degree depends upon individual interests and aspirations. A master's degree is recommended in either the communications or computer disciplines or in business management.

The Information Resources Management College offers the Communications-Computer Systems Career Field mandatory courses: AIS Procurement Strategies and AIS Advanced Management Program. During FY 95, three new courses will be developed to replace these courses. Also in FY 95, workforce members may attend software acquisition management courses on an as-needed basis. Attendance at the mandatory courses of other career fields, such as program management, and systems planning, research, development, and engineering, is encouraged for cross-training and enrichment.

Army Acquisition Corps members may competitively apply for full-time long-term degree programs and short-term seminars. In addition to civilian institutions, graduate programs at the Air Force Institute of Technology and the Naval Postgraduate School are alternatives. Professional seminars at institutions such as Harvard, Massachusetts Institute of Technology, Carnegie Mellon, and others are viable options for staying abreast in the field.

Those Corps members at the top of their field may apply to attend the 10-month Senior Acquisition Education Program at the Industrial College of the Armed Forces (ICAF). This program presents a unique blend of resource management and acquisition education to prepare military and civilian personnel for senior leadership positions.



James H. Redmon
Functional Chief Representative
Quality and Reliability Assurance
Redstone Arsenal, AL

As the functional chief representative for the Quality and Reliability Assurance (Q&RA) Career Program, I would be remiss if I did not provide the reader with a short description of the Q&RA Career Program. The primary purpose of the Q&RA function is to support the accomplishment of the Department of Defense worldwide acquisition, logistics and maintenance mission by assuring high quality and reliable materiel, facilities, and services are provided to the armed services.

Professional development opportunities in the career program take on many forms. A person may enter the career program as an intern/trainee. There are four entry points into intern and trainee positions: formal Army civilian training, Education and Development System intern positions which are centrally-funded; Army Mobility Opportunity and Development (AMOD) personnel; functional trainees recruited internally through local upward mobility programs; and functional trainees recruited externally as new hires.

The Q&RA career ladder consists of five progression levels GS-05 through GS/GM-15. It should be noted that although the typical progression pattern is vertical within a specific Q&RA function, lateral movement and progression opportunities are feasible among all Q&RA functions. Progression from the intern/trainee level to the specialists/journeyman level is usually direct.

Other professional development opportunities include the Logistics and Acquisition Management Program (LOGAMP). The LOGAMP is a two-track system that provides broad-based experiential development for career employees who aspire to placement in multifunctional positions. The career program offers employees opportunities to compete for full-time academic training (colleges and universities), Army Management Staff College, Long-Term Training, Organizational Leadership for Executives, Personnel Management for Executives, Women's Executive Potential, and developmental assignments.

Development opportunities in the Army acquisition process have increased due to recent changes. Members of the Army Acquisition Workforce and Corps have many new academic opportunities.

The professional development opportunities for the Q&RA Career Program are many. The career program ensures continued systematic technical, managerial, and professional training and development for all its careerists.

From The AAC Career Manager...

AAC General Officer Promotions

Congratulations to the following Army Acquisition Corps (AAC) officers selected for promotion to general officers in FY 94.

Name	Promotion To	Promotion Date
GUENTHER, Otto J.	LTG	Dec 2, 1994
HITE, Ronald V.	LTG	No Date Announced
LONGHOUSER, John E.	MG	Oct 25, 1994
VAN PROOYAN, Jan A.	MG	No Date Announced
BLACK, Richard A.	BG	Jul 1, 1994
CALDWELL, John S.	BG	No Date Announced
SNIDER, James R.	BG	Oct 12, 1994

MAJ Diego-Allard Joins AAC Proponent Office

We are pleased to announce the arrival of MAJ Vicki Diego-Allard to the Army Acquisition Corps Proponent Office. She will serve as the proponent officer for the contracting and industrial management community (FA 97s) and as the Training With Industry (TWI) program manager for the AAC. MAJ Diego-Allard is a recent graduate of the Command and General Staff College, and has served as the chief and assistant chief for contracts management at the Defense Contract Management Area Office (DCMAO) Twin Cities, MN. MAJ Diego-Allard also served at Honeywell (Alliant TechSystems) during her tenure as a TWI participant. She holds a B.A. degree in economics from Boston University, a J.D. in contract law from Hamline University, and is a graduate of the Materiel Acquisition Management Course. MAJ Diego-Allard is a welcome addition to the AAC Proponent Office.

Senior Service College Selectees

Congratulations to the following Army Acquisition Corps members selected to attend Senior Service College:

Name	Grade	Functional Area
ANDREWS, Aaron R.	LTC	53
BURKE, Donald S.	LTC	51
COMO, John A.	LTC	51
DOBECK, Kenneth R.	LTC	51
ELLIS, Bernard E.	LTC	51
FAST, William R.	LTC	51
FLOM, Ronald C.	LTC	97
GUNNING, Robert T.	LTC	51
HARRISON, Thomas M.	LTC	97
HORTON, Walter S.	LTC	51
INSKEEP, James H. W.	LTC	53
IZZO, Paul S.	LTC	51
LANCE, Darell G.	LTC	51
LANGBEIN, George L.	LTC	53
LANGHORST, Richard	LTC	51
LOVE, Anthony N.	LTC	97
MAUSER, George E.	LTC	51
MONKS, Stephen A.	LTC	51
MOORE, Stephen C.	LTC	51
MORRIS, Richard D.	LTC	51
MOYER, Anita L.	LTC	97
MURRAY, Joseph P.	LTC	51
NADEAU, Roger A.	LTC	51
RAIFORD, Robert C.	LTC	51
ROGERS, Michael W.	LTC	51
ROMANCIK, David J.	LTC	97
SCHWOEBEL, Charles	LTC	53
SWANSON, Gregory H.	LTC	53
TONER, Sheila C.	LTC	97
URIAS, John M.	LTC	51
VASQUEZ, Adolfo E.	LTC	97
YATES, Donald R.	LTC	97

On the Horizon

• **AAC Proponency Office—New Location:** The ASA(RDA) Army Acquisition Corps Proponency Office is now collocated with the U.S. Army Acquisition Executive Support Agency at Fort Belvoir, VA. The e-mail addresses are:

FA 51: JONESM@BELVOIR-ARMY.ARMY.MIL
FA 53: RASMUSSE@BELVOIR-AIM.ARMY.MIL
FA 97: DIEGOALV@BELVOIR-AIM1.ARMY.MIL

The phone numbers are: DSN 655-4509 or Commercial (703)805-4509 or FAX DSN 655-4163 or Commercial (703)805-4163. Contact us with your address and we'll put your organization on distribution for up-to-date information on certification, Military Acquisition Position List (MAPL), Training with Industry, and other related topics.

• **Software Acquisition Management Training:** The deputy under secretary of Defense for acquisition reform recently approved implementing several reforms identified in a March 7, 1994, report titled, "Report of the Software Acquisition Management Education Review Team." The team was comprised of subject matter experts from the Army, Navy, Air Force and industry. One near-term result is the Defense Systems Management College's development of assignment-specific courses for software acquisition management personnel. Assignment specific courses are by definition not "mandatory" for any one career field, but defined by DOD 5000.52-M as "a course that must be completed successfully in order for an employee to...perform a *specific* assignment." The software assignment-specific courses oriented on addressing the minimum software competencies for the PM, communication and computers; contracting; quality assurance; acquisition logistics; systems planning, research, development, and engineering; and test and evaluation career fields will be piloted in late FY 95.

• **DOD 5000.52-M and ADS-93-01-GD:** These documents have been revised and as of their effective date, implement new requirements for certification and fulfillment of mandatory courses. Organizations should ensure that acquisition personnel understand the revised requirements as they directly affect mandatory courses, experience, and education requirements for certification in every career field. ADS-93-01-GD addresses how to obtain credit for mandatory courses required for certification through the fulfillment program.

Questions about these subjects should be directed via e-mail to the appropriate proponency officer at the above e-mail addresses.

From the Military Acquisition Management Branch (MAMB)...

Communicating with Military Acquisition Management Branch (MAMB)

All mail for MAMB must be sent to this address:
U.S. Total Army PERSCOM
ATTN: TAPC-OPB-E
(Assignment officer's rank and name)
200 Stovall Street
Alexandria, VA 22332-0411

It is extremely important that you use complete nine-digit zip code and office symbol. Send e-mail to: userid@hoffman-emh1.army.mil

Desk	Incumbent	E-Mail User ID	Telephone Number*
Branch Chief	LTC Richard O. Bailer	BAILERR	221-3131
FA51 LTC Assignments	MAJ Chuck Gault	GAULTC	221-3129
FA51 MAJ Assignments	MAJ Ed Dowling	DOWLINGE	221-3128
FA51 CPT Assignments	CPT Bill Rhodes	RHODESW	221-2800
FA53 LTC/MAJ Assignments	LTC Rob Reyenga	REYENGAR	221-3114
FA53 CPT Assignments	MAJ Jeff Lipscomb	LIPSCOJ0	221-2759
FA97 LTC/MAJ Assignments	MAJ Jesse Stone		221-3124
FA97 CPT Assignments	MAJ John Womack	WOMAKJ	221-2801
ACS Officer	CPT(P) Regina Hamilton	HAMILTOR	221-2760
AAC Future Readiness	CPT Dan Munoz	MUNOZD	221-3130
MAM Manager	Richard Yager	YAGERR	221-3127
Military Personnel Tech	Tom Tabor	TABORT	221-2758
Military Personnel Tech	Latesha Smith	LYNCHL	221-2757
Fax			221-8111
Promotion Line (List Release and Sequence Number Information)			221-9340

**All Phone Numbers listed are DSN.*
To Call Commercial, Dial (703)325-XXXX.

Voice Mail

Voice mail was implemented in the Officer Personnel Management Division to enhance our ability to respond to our customers. It is a force multiplier that allows every caller to get through instead of hearing a busy signal or constant ring. Now, if you do not get through to a person, you can leave a message and we will call you back. While this increases the number of "lines" into the branch, the number of assignment officers and technicians has decreased.

Assignment officers are returning an average of 30 to 60 calls a day in addition to the ones that get through directly. It is our intent to respond within 48 hours of your leaving a message. If we get busy signals or no answer when we return the call, it may take longer for us to hook up with you. You can also communicate with us via e-mail or fax. E-mail is the preferred method (instead of phone).

AAC Selectees for Promotion to Major

Congratulations to the following Army Acquisition Corps (AAC) officers, who were recently selected for promotion to major:

Name	BABR	CRFLD2
ALVAREZ, Joseph H.	AR	97
AMOS, Vincent A.	SC	51
ARTERBURN, David R.	AV	51
ASHWORTH, James S.	FA	53
BAILEY, Christopher A.	AD	51
BARR, Matthew J.	OD	51
BATEMAN, Dennis L.	SC	51
BELLIZAN, John L.	TC	97
BELVA, David G.	EN	53
BLECKLEY, Dennis R.	AV	51
BOLICK, Steve C.	EN	97
BURKE, Kyle T.	TC	51
CAMPBELL, Jon W.	IN	97
CAMPBELL, Kelly N.	FA	97
CAMPBELL, Larry W.	SC	53
CAMPS, David C.	IN	53
CANTRELL, Roy R.	FA	53
CARPENTER, Robert C.	IN	51
CARSON, Craig H.	AR	51
CARTER, Donald K.	AD	97
CHASE, Vance A.	FA	51
CHUBB, Deborah M.	OD	51
COLLINS, Ethan	TC	51
CONCEPCION, Jorge R.	AR	53
CONEY, Jacklyn	SC	53
CROUCH, Thomas W.	AV	51
DAMPIER, David A.	OD	53
DEJONG, Ronald J.	FA	53
DICKENS, Chailendreia M.	SC	97
DIETZ, James E.	CM	51
DINGLE, Gwendolyn O.	CM	51
DOLGOFF, Scott J.	SC	53
EARL, Arthur J.	MI	51
EDWARDS, Keith R.	AV	97
ELLIS, Carl M.	QM	97
ERNYEI, Mark A.	SC	51
FIELDS, Gregory M.	EN	51
FINLEY, Alfonso J.	IN	53
FLEISCHER, John A.	MI	51
FLORESCA, Michael B.	AD	51
FORTIER, Norbert H.	AV	51
GAGER, Calvin D.	SC	51
GALLOP, David L.	AR	51
GIUNTA, Joseph A.	AR	97
HAASE, Thomas K.	AD	51
HAFFEY, Paul J.	OD	53
HAIGHT, Timothy A.	SC	53
HALL, Randy R.	AD	51
HAMILTON, Regina J.	QM	97
HARDEN, Monroe B. Jr.	AR	51
HARRINGTON, Jeffrey J.	SC	97
HAY, Ralph G.	OD	51
HESS, John P.	QM	97
HILLIARD, Jay	FA	51
HINKSON, Mary E.	MI	51
HODGE, Tony F.	IN	51
HOYT, Edward E.	FA	53
HUTCHISON, Steve A.	SC	51
IDDINS, Jeffrey B.	AR	51
IKIRT, Steven C.	SC	97
JACKSON, Karen J.	SC	51
JENNINGS, Kevin N.	AD	51
JIMENEZ, Anthony R.	MP	97
JOHNSON, Diane E.	SC	53
JOHNSON, Gregory M.	SC	53
JUPITER, Joseph H.	AR	97

Name	BABR	CRFLD2
KIHARA, Steven W.	AV	51
KING, Dion J.	IN	51
KLUMPP, Joseph J.	AV	51
KREIPE, Stephen G.	AV	51
KRZISNIK, Gary M.	EN	97
LANE, Broderick B.	SC	53
LEGRANDE, John P.	EN	97
LEWIS, Stanley M.	QM	51
LINDLEY, James M.	SC	51
MALATESTA, Mark L.	CM	51
MANNING, Barry G.	AD	97
MARSHALL, Edward F. III	CM	97
MASON, Danny T.	AD	53
MASTERSON, John H.	FA	51
MATTHEWS, Keith E.	MI	51
MATTHIAS, Gregory J.	AG	53
MAY, Marshall K.	QM	97
MCCORMICK, Daniel J.	FA	51
MCCRACKEN, Richard R. Jr.	OD	51
MCDONALD, Bradley N.	AR	51
MCGINNESS, Dennis L.	AG	53
MCRAE, Lawrence W. Jr.	AD	51
MCVEIGH, Bryan J.	AR	51
MEAD, Timothy G.	OD	97
MERCER, Thomas E.	FA	97
MEUSCHKE, Karl R.	EN	51
MILLER, Donald H.	IN	51
MINEAR, Steven J.	EN	97
MOORE, David M.	IN	51
MORIN, Roger J.	EN	51
MUNN, Randy W.	FA	97
NAGEL, James R.	IN	51
NICHOLS, Richard E. Jr.	FA	51
NICOLELLA, Anthony J.	AR	97
NIEVES, Robert R.	AR	51
NOTHSTEIN, Thomas A. Jr.	FA	51
OCONNELL, Judith L.	QM	97
ODAY, Sean P.	OD	97
OELBERG, Gregory P.	AV	51
ORDONIO, Robert R.	AG	53
OXFORD, John R.	AD	51
PELCZYNSKI, Anthony S.	AV	51
PELLICCI, Jack A.	QM	97
PITTS, Billy E.	MI	51
PRESGRAVES, Donald C.	AV	51
RICE, David J.	FA	51
ROBERTS, Richard A.	SC	53
ROBINSON, Keith W.	AV	51
ROITZ, Frederick P.	AD	97
SACKS, John R.	AR	97
SAFFORD, Michael R.	OD	97
SAMEK, Rocky G.	FA	51
SCHALLER, Michael E.	FA	97
SHALOSKY, Christopher A.	IN	51
SHIFRIN, Scott E.	AD	51
SIZEMORE, David R.	MI	51
SMITH, Bobby L.	AD	53
SMITH, Floyd B. Jr.	OD	97
SMITH, Gary S. Jr.	AV	97
SMITH, Melton R.	AG	53
STEARNS, Kenneth M.	AD	51
STEPHENS, Jay D.	FA	51
STEPHENS, Mark E.	EN	51
STEWART, Gregory E.	AV	97
STIEFEL, Jeffrey I.	CM	51
STIGALL, Beatrice	AG	97
THOMPSON, Herbert D.	AV	53
THOMPSON, Leonhard E.	OD	51
TOBIN, Vincent M.	AV	51
TUBELL, Wallace J. Jr.	OD	51
VAGLIA, James A.	AD	53
VANDEVEIRE, Stephanie G.	SC	51
VANRASSEN, Michael J.	OD	51
VERPOORTEN, Dennis M.	AR	53
VOLLMECKE, Kirk F.	IN	97
WALSH, Damon T.	SF	97
WARREN, Matthew	FA	51
WASHINGTON, Hodges L.	FA	97
WHEATLEY, Kevin L.	IN	53
WILK, Carl A. Jr.	SC	51
WILLIFORD, William S.	AD	51
WILLS, Michael D.	AV	97
WINTERS, Brian C.	TC	51
WOODS, Timothy C.	FA	97
WRIGHTEN, Lyndon F.	AD	51
WUERZ, Randy F.	OD	51

School Notes

Senior Service College (SSC) Eligibility

You become eligible for consideration by the SSC Selection Board as soon as you are a promotable major. You remain eligible until you have reached 276 months of active commissioned service. Past board results show that most selectees have two lieutenant colonel-level command or program manager reports in their file.

Command and Staff College (CSC)

We get lots of questions about why acquisition officers are "wasting" their time and the taxpayers' money by attending CSC. This attitude is being perpetuated by mentors and other senior officers who advise captains and majors that their time would be better spent getting acquisition experience in a job. You will not be a program manager if you do not get promoted. We still hold that if you are selected for resident CSC, you should attend. Here is some statistical reinforcement: *Among Acquisition Corps officers, 95 percent of resident CSC graduates were selected for promotion to lieutenant colonel by the last board while only 50 percent of non-resident CSC graduates were picked up by the same board.*

Army Acquisition Certification

At the direction of the Army acquisition executive and the director for acquisition career management, the Army has begun certifying all acquisition civilians, as required by Department of Defense Manual 5000.52-M and DOD Instruction 5000.58. Certification began with a Train the Trainers Workshop from Oct. 17-20 1994 in Herndon, VA. Representatives from all acquisition functional areas and numerous Department of the Army civilian personnel specialists participated in the workshop.

Certification will be accomplished by validating and correcting the education, experience and training history of each individual in the Army Civilian Personnel System. The Army goal was to have all qualified civilians certified by Dec. 30, 1994 and to identify additional required training for those who are not certified. New certification standards are expected to go into effect in early 1995. More information on the new standards will be published in a future issue of *Army RD&A*.

A Culture of Acquisition—Another Perspective

In her article, "A Culture of Acquisition" (September-October 1994 *Army RD&A Bulletin)*, MAJ Lillian Pfluke carefully sets up a number of straw men, and then proceeds to knock each of them down. Her premise that the Acquisition Corps needs a vibrant, proud culture makes good sense. Sadly, her arguments advocate a triumph of style over substance.

Whether LTG Forster (the current Military Deputy to Assistant Secretary of the Army for Research, Development and Acquisition) needs a me-too, more fatherly title, such as "Chief of Acquisition," or whether the *Army RD&A Bulletin* needs a less pedestrian name for its cover are subjects for otherwise unoccupied minds to debate.

The assertion that wearing a uniform provides "instant credibility" is so naive as to be breathtaking. It reminds me of the story attributed to a general officer who insisted that Army Aviators would never be accepted as full members of the combined arms team until they wore BDU-pattern flight suits. In the acquisition business, just as in the operational Army, our counterparts rightly judge us primarily by our performance, not by our outward appearances.

MAJ Pfluke's curious obsession with uniform wear is reminiscent of the perennial debate about whether Acquisition Corps officers should periodically be sent back to the operational Army for "re-greening," ostensibly because they have lost touch with their basic branches. A PM who has lost touch with his basic branch doesn't need "re-greening," he needs to be fired. And an Acquisition Corps officer who depends upon cosmetics to convey "...who you are, who [sic] you represent, what your background is, and what you stand for" is a pale imitation of an officer, indeed.

In my view, we already have a culture of acquisition in place, and it's growing each year. Simply, it's one of officers and Army civilians who are willing to roll up their sleeves and tackle the toughest challenges the business has to offer: the staffer in SARDA running the latest budget drill at 2100; the test officer crafting a test plan that protects the government's interests without imposing irrelevant or excessive requirements on the product; the logistics specialist whose effort expended in the early phase of a program makes it affordable enough to execute late on; the contract specialist trying to work through the Byzantine maze of the FAR, DFARS and numerous other seeming obstacles to efficient procurement; and finally, it's the program manager, pulling together all of the above talents, and more, in a team effort to get equipment that's needed into the hands of our soldiers.

Our Corps has conducted a series of workshops designed to enhance our skills, and to obtain feedback about how we're doing as arguably the most advanced service in the implementation of the Defense Acquisition Workforce Improvement Act (DAWIA). Could our functional area publication be better? Sure. Could our assignment officers at PERSCOM be somewhat more helpful and informative? Probably, but the bulletin board, voice mail and e-mail combine for a big improvement over the days when you couldn't get through to Infantry Branch until everyone had gone home for the evening. We're not yet as good as we can be in these and other areas, but it's certainly not for a lack of effort or focusing on the wrong things.

On the contrary, our focus should continue to be on high product value for taxpayer dollars, soldier/customer satisfaction, absolute integrity, and competent execution of our programs. The Army Acquisition culture I'm proud to be a part of is the one that looks for smarter ways to do business, that doesn't tolerate non-value-added processes and people, and which celebrates the contributions of the many dedicated individuals who make our system work despite itself. It is not one of pompoms, perky titles, and members plagued with Real Soldier Insecurity Syndrome.

There are plenty of significant challenges that face the members of the Acquisition Corps in the lean years ahead. Let's not get side-tracked by indulgent, self-absorbed niggling. Let's just get on with the mission, and be content to be judged according to our deeds. I would think that would provide a culture of which we can all be proud.

James B. Leahy Jr.
LTC, Infantry
Joint Simulation System
(JSIMS) Program Office
Transition Team
Orlando, Florida

1994 INDEX OF ARTICLES

This index is a headline listing of major articles published in *Army RD&A Bulletin* during 1994.

ARMY RD&A
ISSN 0892-8657

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