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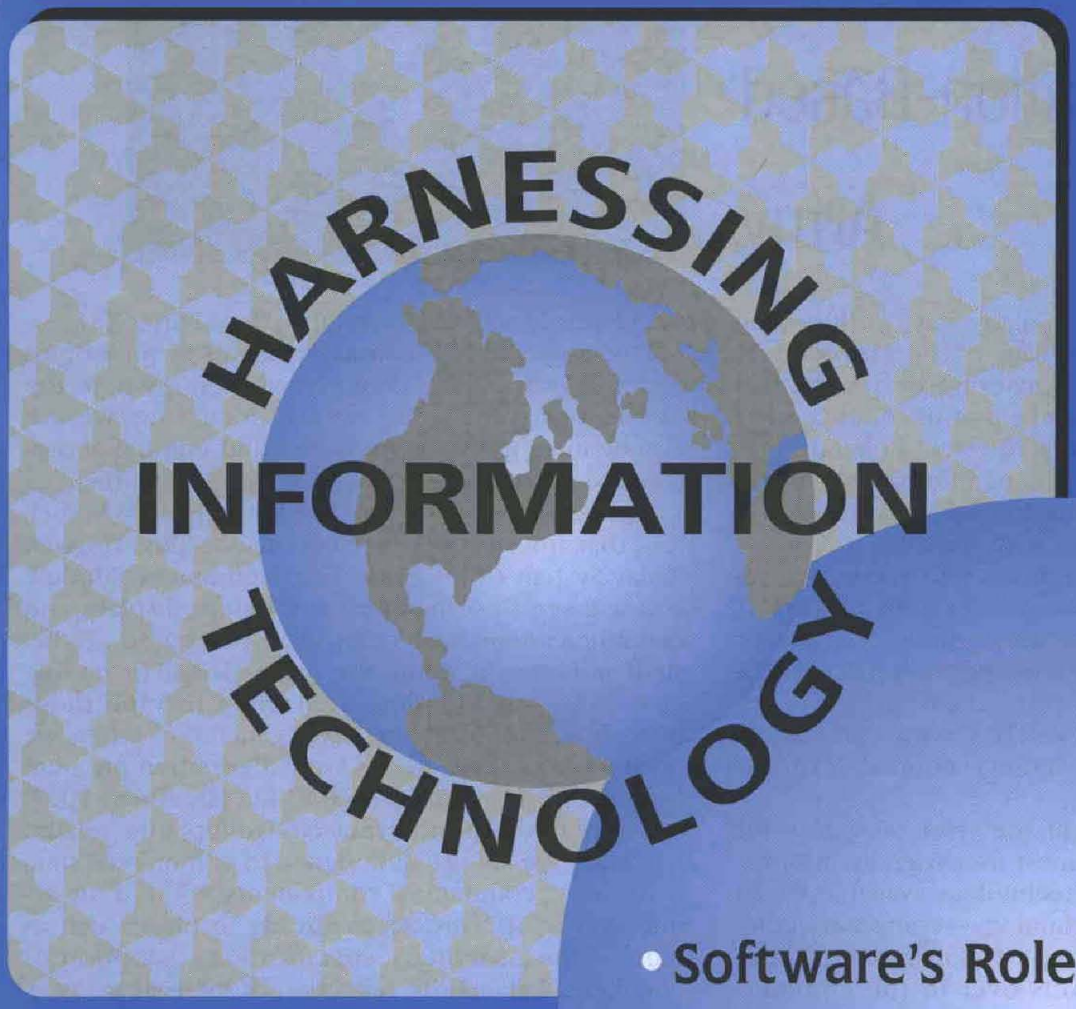
MARCH - APRIL 1996

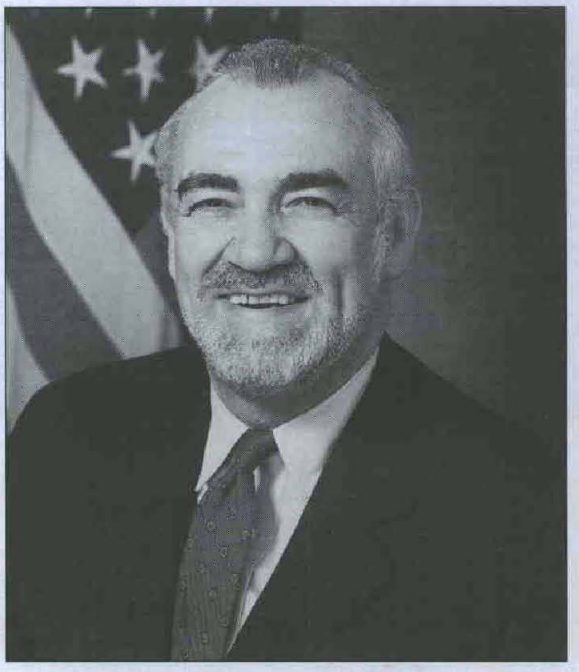


- Software's Role in Force XXI
- Digital Integrated Lab
- Software Support
- Computing Power

From The

Army Acquisition Executive...

Moving Toward An Information-Based Army



As this issue points out in many ways in the excellent articles presented, the Army of the 21st century, Force XXI, will be an information-based Army. The ability to dominate the battlefield or to conduct operations other than war efficiently will depend completely on having the pertinent information in the right hands at the right time. In military terms, this is often summarized as situation awareness.

It seems clear to warfighters and technologists alike that if commanders and decision makers at every echelon of the Army are completely aware of their total situation at all times, they will react with a course of action that will place them inside the opposing force decision cycle. Thus, with numerically inferior forces, one can achieve combat leverage dominance.

In order for this to occur, the Army must plan for and acquire the best and most user friendly information and communications technology available. We all know that information technology—computers, communications hardware, computer software, design of data base structures—rolls over in the commercial/industrial place every one to two years. Each succeeding generation is more powerful and more cost-effective than the prior generation.

The Army's acquisition process, particularly in these fields of information, must reduce its cycle time to be synchronous with the technology generation rollover. In other words, we must be able to define, acquire, and insert new information technology in our systems at a minimum of every two to three years to eventually achieve the total goals of Force XXI.

The only way we can achieve this is to acquire technology from the commercial sector, where the one to two year rollovers are occurring. We are rapidly moving in our processes and cultural acceptance to a point where we are actually doing this.

For example, if you look inside the HMMWV shelters that house the Joint Surveillance Target Attack Radar System (Joint STARS) Ground Station Module you will see all commercial computers, displays, and communications boxes that were purchased off-the-shelf and integrated into the system. It will be no "big deal," subject to funding availability, to yank those boxes out and insert the latest generation when we need to do so. Even in the Army digitization program leading to Brigade Task Force XXI in Fiscal Year 1997, the appliques and internet controllers and related hardware are almost all designed to commercial standards using commercial components. Without the acquisition reform processes already in place, such as elimination of military specifications, adoption of commercial standards, reduction of internal management oversight, we could not have done this in the timeframe we had.

In summary, to be a true Information Age Force XXI, we must, at all times, be in a position to insert the upgraded information technology into our systems. And, in order to be able to do that, we've got to use streamlined acquisition processes.

Gilbert F. Decker

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DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Acting Administrative Assistant to the Secretary of the Army
01418

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FEATURES

DEPARTMENTS

COVER

This issue highlights the role of information technology in allowing our soldiers to maintain dominance on the future battlefield.

SOFTWARE FOR FORCE XXI

By LTG Otto J. Guenther

Director of Information Systems For Command, Control, Communications and Computers Department of the Army

Introduction

As GEN Dennis Reimer, chief of staff of the Army, has said, we are in the midst of a revolution in military affairs. This revolution, like the ones that have come before it, is a set of technological, political, and social innovations that fundamentally alter the character and conduct of conflict. The information revolution, which began in the early 1970s, is signaled by the advent of precision strike weapons, space warfare, dominating maneuver, and of course, information warfare.

Force XXI is the Army's effort to define and implement our vision of a truly 21st century land force by leveraging the information revolution. An enabler of Force XXI and the use of information as a military resource is software. I believe there are some guiding principles that we must consider when dealing with software in Army systems. In addition, we must translate these principles into real-life policies that can guide the way we build, buy, maintain, and otherwise manage our software—a key component of Force XXI.

Guiding Principles

• *Software is a resource unlike any we've dealt with before.* Software is powerful, invisible, weightless, and easily modified. It does not fit into the "standard" definition of a resource, certainly not the way that fuel or ammunition does. However, I contend that software is a critical military resource. While we are used to dealing with "hard" resources, we are not so proficient in dealing with resources like software. Producing and managing software resources is complex, labor-intensive, and more susceptible to failure than traditional resources.

• *Software must by acquired using best practices of DOD and industry.* The *Report of the Defense Science Board Task Force on Acquiring Defense Software Commercially* reported numerous differences between Department of Defense (DOD) and commercial software acquisition practices. These differences exist in every phase of the software life cycle. The end result is that DOD software takes longer to develop, costs more, and is less predictable than comparable commercial systems.

The task force identified specific areas where DOD can do better in acquiring its software. These include specific recommendations in the areas of process credibility, program management, personnel, use and integration of commercial off-the-shelf software, acquisition, software architecture, and the software technology base. Some specific recommendations of the task force are to develop DOD software acquisition managers and promote the use of "best practices" in software acquisition and development. The Software Program Managers Network and the Software Best Practices Initiative have done much already to educate our people and evangelize good development practices.

This is not to say that commercial practices are better than DOD's in all aspects. The task force found that DOD does produce high quality software products in most cases, especially mission critical systems. In addition, commercial developers are not immune to schedule slips, cost overruns, and "bugs." What we need to do is implement the best practices from both DOD and the commercial sector with a focus on what the warfighter wants—highly reliable, fault-tolerant systems.

• *Requirements definition is difficult.* Requirements are hard to define in the initial phases of development. In the past, our approach has been to lock the users in a room until they say what they want the software to do, and then throw the requirements over the fence to the developers. After a number of years, the software appears on the user's doorstep. One problem with this approach is that the user may not be able to define the requirements at the level of detail the developer requires. This results in a product that may not meet the user's needs and expectations. On the other hand, if the requirements are defined too tightly, the developer's ability to innovate and provide the best, most current technical solution is limited. The software acquisition battlefield is littered with the corpses of systems that were defined down to the bit and byte, but were made obsolete by technical innovations before they were ever fielded.

In the future, software requirements development and definition will be an ongoing process, without discreet phases of "requirements definition" and "development." Instead, users and developers will work together in an iterative, recursive, spiral development process. We will use integrated product teams, joint application development teams, and IDEF CASE tools to build the software that will drive Force XXI. The use of structured analysis and design tools like IDEF are a critical part of the Army Technical Architecture and enforced at milestone decision reviews. We have tied both activity modeling using IDEF0 and data modeling using IDEF1X into the requirements definition process with the goal of reducing the life cycle maintenance and providing a facility to conduct continuous verification and validation of the requirements throughout system design and development.

• *Software maintenance is a large part of life cycle costs.* According to figures from the Communications and Electronics Command, post-deployment software and support (PDSS) accounts for about 70 percent of the total life cycle costs of software. Problem reports and "bugs," as well as changing threats, doctrine, and technology contribute to the high cost of PDSS. Some of these causes are unavoidable, but others are not.

The key to reducing the high PDSS costs of software is to build it right the first time. Today, our program managers' success is judged by what they do up until their system is fielded. After that, the system is turned over to another agency for PDSS. Program managers, under cost, schedule, or performance constraints, may field a solution that fulfills most of the requirements, and plan on fixing the rest in a maintenance release—in other words, shift the cost from the development stage to the PDSS stage. Good software development

practices up front should keep program managers from getting into the position where they have to make such a "deal" with the PDSS devil.

When configuration management is implemented starting in the beginning stages of development and carried through to the software life cycle, high PDSS costs can be mitigated. According to COL Dave Wallen, director of the Software Development Center - Washington, software developers need integrated sets of automated tools, including robust configuration management tools. Integrated tools will allow our developers to be more productive and yield code with fewer deficiencies.

Principles Translated into Policy

• *Software Reuse.* The Army reuse policy is based on the DOD Software Reuse Vision and Strategy and the Army Strategic Software Reuse Plan. A systematic software reuse approach is designed to reduce the amount of unique software that must be developed and maintained by the Army. The approach will rely on domain analysis to help identify software functionality that could be developed once and reused by multiple systems. To achieve these goals the Army is about to publish a policy on software reuse which directs PMs, PEOs, and MACOMs to implement a domain management team concept and systematic (not opportunistic) software reuse, as well as ensure reuse is domain architecture driven. The policy has received concurrence through Army staffing and is currently awaiting signature by the administrative assistant to the secretary of the Army prior to printing and distribution. The Software Reuse Initiative home page is located at: http://arc_www. belvoir. army. mil/ODISC4/ ODISC4.HTM.

• *PM Network/Software Best Practices.* The purpose of the Best Practices Initiative is to identify practices used by successful software projects, allow PMs to exercise discretion in employing best practices, employ high-leverage software acquisition practices throughout the Defense acquisition community from both government and industry, enable PMs to focus on providing good software products instead of meeting regulatory/oversight requirements, provide PMs staff training to accomplish these goals, and expand and support the efforts of the Software Program Managers' Network. The Software Program Managers' Network and Best Practices Initiative home page is located at: http://spmn. com/ or phone (703) 549-9582.

• *Software Acquisition Reform.* The Defense acquisition management process will be modified to implement best practices. See DoDI 5000. 2 and DoDI 8000. The Army is participating with the DOD Software Management Initiative (SMI) to ensure the new 5000 series reflects acquisition principles that reflect good software acquisition principles. The SMI is an implementation of the DSB report, *Acquiring Defense Software Commercially.*

The Army is working to reduce the regulatory and oversight requirements our program managers must meet. The use of integrated product teams, with members from the functional, developer, and oversight communities, is one method we have found that is successful. These teams are effective in identifying and solving problems earlier and at a lower level, reducing the length and complexity of the formal milestone approval process. The end result is that we are able to significantly reduce the oversight and reporting requirements for PMs in formal milestone reviews like the Major Automated Information System Review Council (MAISRC).

• *Use of Software Metrics.* For several years the Army has required its program managers to use software metrics to control their software development efforts (DA PAM 73-1). Our experience has shown this practice has real payoffs. Good software metrics enables program managers and our contractors to identify trends and problems early on, at the stage at which it is most cost effective to fix them. Understanding the fundamentals of metrics is key to the determination of the maturity and stability of the software. In the 21st century, software metrics will be an important management tool.

• *Data Standardization.* The purpose of these DOD and Army policies is to standardize data using the IDEF methodology so systems can share information seamlessly. DOD policies are outlined in the Department of Defense Directive 8320 series. Army policies are outlined in the Army Technical Architecture (v. 3. 1), Chapter 4.

• *SEI Capability Maturity Model/ People Maturity Model in DOD Procurements.* The design and development of software is complex and requires a good software engineering environment and process. The Software Engineering Institute (SEI) has been very successful in development of a methodology to identify an organization's capability to produce quality software. Its Capability Maturity Model (CMM) has become a *de facto* national standard that is process-based. The Army is developing policy to ensure our PMs use the CMM concepts and methodologies to develop source selection criteria. This criteria will ensure source selection authorities select the best contractors to develop Army software intensive systems. In addition, for our own software support activities, we are requiring they use the CMM to justify investments in their own improvement in software processes. We are also working very closely with SEI as they develop the People Capability Model to make this a very useful tool in examining the people aspects of organizations.

When configuration management is implemented starting in the beginning stages of development and carried through to the software life cycle, high post-deployment software and support costs can be mitigated.

Conclusion

Every day, software impacts the way our soldiers and civilians work. I don't know of any major Army automated information system, communication system, or weapon system that doesn't depend on software somewhere in its life cycle. Our 21st century force, with seamless systems from the sustaining base to the foxhole, will be increasingly dependent on quality software. In order to maintain our position as the dominant land force on this planet, we must leverage our substantial investment in software—both today and tomorrow.

CONVERTING COMPUTING POWER INTO COMBAT POWER

By MG John E. Longhouser
Program Executive Officer, Armored Systems Modernization

The following is a modified keynote address by MG John Longhouser, delivered at a Tank-automotive and Armaments Command (TACOM) advanced planning briefing for industry Vetronics (vehicle elecronics) Conference. MG John Longhouser reinforced the goals of the armored systems modernization vetronics effort and expressed concern about the U. S. Army's tendency to focus digitization efforts too narrowly on command and control—only one aspect of digitization. He also stressed that technology must allow our soldiers to maintain dominance on the battlefield, play a key role in automating war fighting functions, serve to unburden weapon systems crews, and continually enhance the Army's ability to create and maintain an unfair battlefield.

The purpose of the keynote presentation was to set the framework for leveraging digital technology to enhance war fighting tasks from a weapon systems perspective. The intent here is to further reinforce the broader application of digital technology and how materiel developers are using this technology to ensure the U. S. soldier remains a dominant force throughout the spectrum of conflict.

The Army is changing, our business of acquisition is changing, and the technologies which we in the ground combat vehicle business have depended on over time are changing. In many ways electronic digital technology is driving these changes. It is absolutely critical for acquisition managers to increase the combat effectiveness of the combined arms force by leveraging the digital power of the computer digitization in the ground combat vehicle arena. It is also essential that we leverage the Army's armored systems investment and focus on the business of placing war fighting capability in the hands of the soldiers. We must do this with minimal resources—fewer people, less time and less money—while ensuring that we provide our soldiers superior weapons that will allow them to do what they did five years ago in the Gulf. Leveraging the inherent power of information is the primary tool that will provide our forces the ability to dominate future battlefields.

Harnessing digital information to enhance combat power should not foster controversy within the ranks. It is not about experimentation versus go to war. It's not about applique' solutions versus embedded architectures. It's not about "inter" versus "intra" architectures nor communications versus war fighting. It is about bringing both ends of the spectrum together to provide an exponential increase in soldier war fighting ability. The use of information must become a combat multiplier. Harnessing digital information is about being able to win with a more combat capable new Army, a multi-dimensional Army; smaller, more lethal and more survivable.

In acquiring equipment for this new Army, we must change the way we do business. Five, 10 years ago performance was the forcing function in the acquisition process. It was the essential acquisition parameter of the weapons systems we have fielded today. Cost was always a by-product. Within today's acquisition environment, the equation must be is reversed. Cost is now the independent variable. Given pronounced budget pressures, the challenge to the acquisition community is to ensure the new dependent variable—performance—will meet the needs of the war fighter on future battlefields.

The process that the Program Executive Office for Armored Systems Modernization (PEO-ASM) is using to manage this new relationship equation is horizontal technology integration (HTI). It is a method to select high payoff technologies and leverage them across a vast Army in terms of multiple application of capabilities. HTI is an innovative acquisition process that became necessary due to a dwindling supply of dollars.

In hindsight, this is something we in the armored systems community should have been doing the last 10 or 15 years, irrespective of funding availability. A rather large number of technologies can be used to enhance our war fighting capability. The HTI process is already showing success in acquiring common driver's all weather viewers, eye-safe laser rangefinders, and display and digital hardware/software common to both the Abrams tank and Bradley Fighting Vehicle. We are now realizing all ground combat systems shoulder to shoulder on the battlefield, capable of seeing the same battlefield and integrating complementary and many times common capabilities.

PEO-ASM recently chartered a new Program Management Office for Armored Systems Integration (PM-ASI) to enhance our efforts in implementing HTI. PM-ASI will harmonize horizontal technology, to include survivability. It will also include not just products but functions. As we protect our environment and build, field and support weapon systems, work to remove halon from our combat vehicles, and eliminate paper in all of our processes, we will use HTI to increase our acquisition management effectiveness. PM-ASI allows us to form one comprehensive team on the ground combat vehicle side (Figure 1). PM-ASI works closely with other ground combat PEOs in the Army and sister Services such as the U. S. Marine Corps. They have the same HTI challenges that we have. They are part of the team in terms of integrating technology horizontally across the force. The legacy systems at TACOM also provide membership to this team.

In support of Force XXI, PM-ASI and their partners are a strong team, the center of gravity, in terms of digitally linking the ground combat vehicle community to the Army and of ensuring that we are in step and that we provide a constructive influence on the Army's final product for the digitized battlefield.

What does HTI mean to the soldier in the tank, to the squad leader on the ground?

How are we improving his capability to fight and win on tomorrow's battlefield? We are doing this in many ways. Our primary focus is derived from the Army's Enterprise Strategy. The Enterprise Strategy dictates that focus must be on the war fighter in peace and in war; at the front or in the rear. We cannot burden the soldier or the crew. We cannot transform our crews into computer operators. We must be able to take the outside world of interconnectivity and information, bring it into our systems and automate it so that it increases war fighting capability without additional burden on the soldier.

• *Own The Night And Dominate Maneuver.* This focuses on our ability to see 24 hours a day in any weather with advanced technology second generation sensors which are able to detect, acquire, distinguish enemy from friendly from non-combatants and be able to kill what we need to kill at commanding ranges while minimizing risk to our own soldiers. In support of this objective, we are migrating common second generation forward looking infrared across the force in systems such as Comanche, TOW HMMWV, Armored Gun System, Abrams Tank and Bradley Fighting Vehicles.

• *Battlefield Combat Identification (BCIS).* Simply, this is knowing who your friends are, knowing where the enemy is and engaging enemy systems effectively. Prototype BCIS systems have already been evaluated on both the Abrams and Bradley with overwhelming success.

• *Digitization.* This is the Army's main effort in its modernization vision. Despite intense efforts to clarify the digitization road map, components, and goals, it may be the most misunderstood term in the Army today.

Paramount to understanding digitization is comprehending that digitization is much more than just digital communications and message traffic flowing vertically and horizontally throughout the battlefield. Digital communication and its inter technical information architecture addresses a very small part of the demand placed on our weapon systems crews.

Figure 2 portrays a common weapons system functional breakdown which, to a degree, is applicable to a tank, a truck, a missile or an aircraft. The shaded portions represent communication pieces that provide information to other vehicles (commonly referred to as the inter piece). Everything else around this functional wheel is still dependent on digitization and represents a vast array of functions that must be collectively integrated in real time to enhance the vehicle crew's ability to dominate the maneuver battlefield (commonly referred to as the intra piece). Our challenge is to integrate these in our systems using embedded architecture while ensuring that we are linked effectively across the force and we are in compliance with the intra embedded architecture.

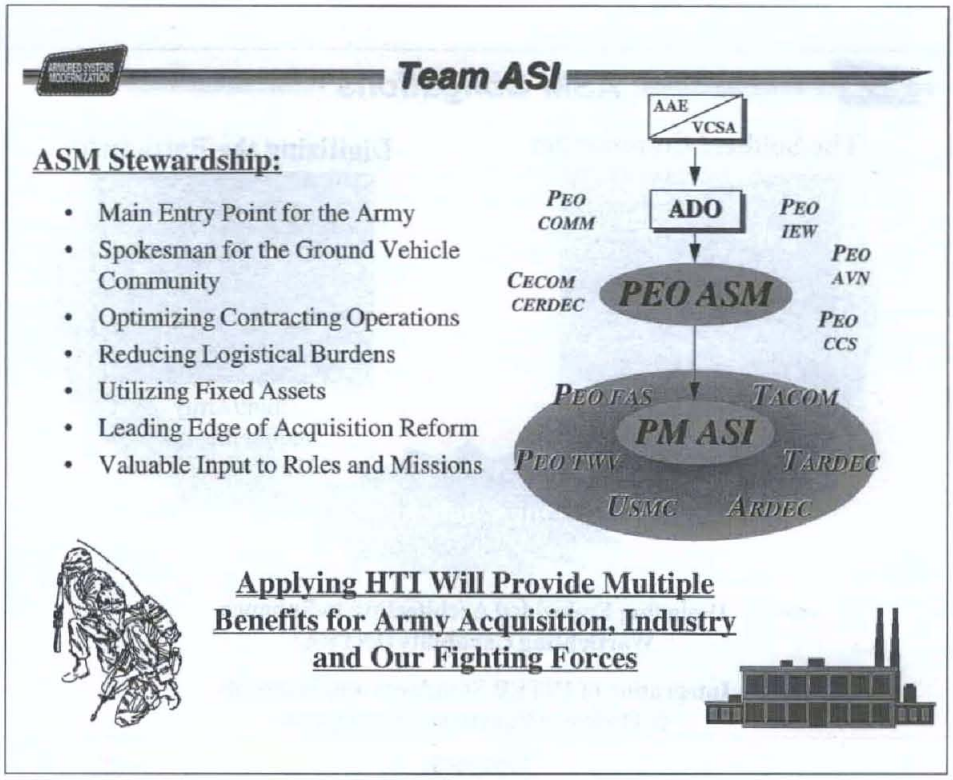

Figure 1.

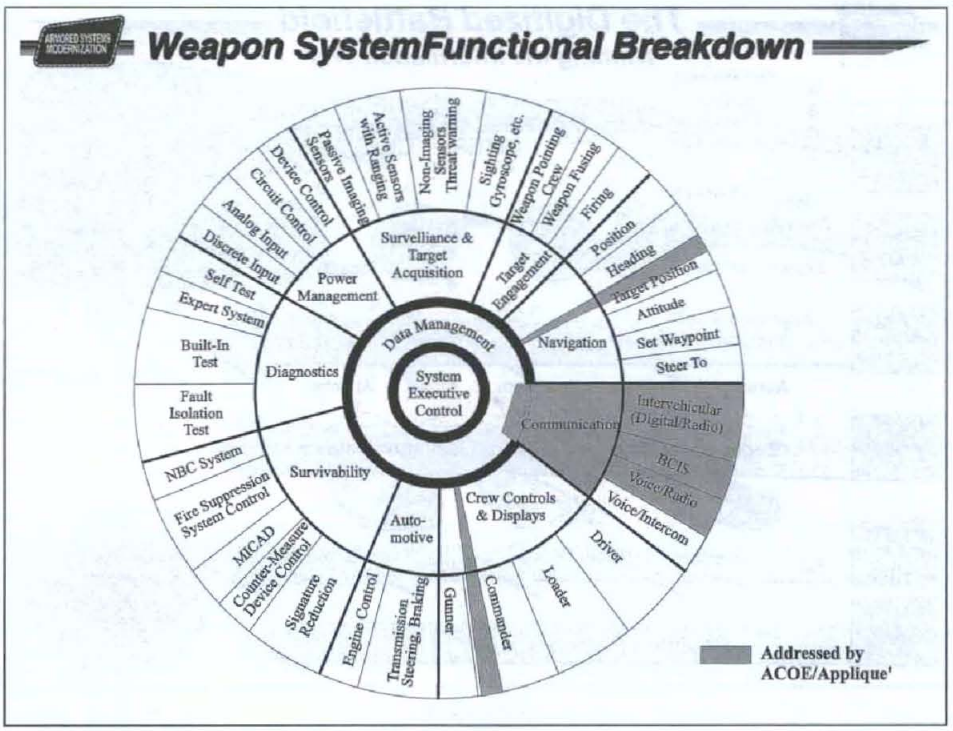

Figure 2.

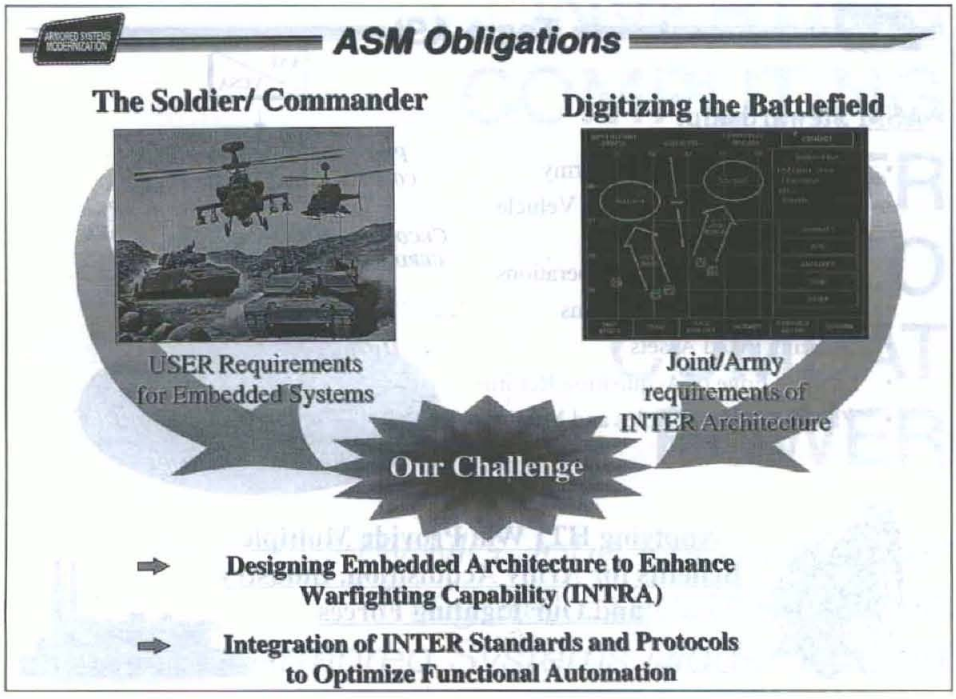

Figure 3.

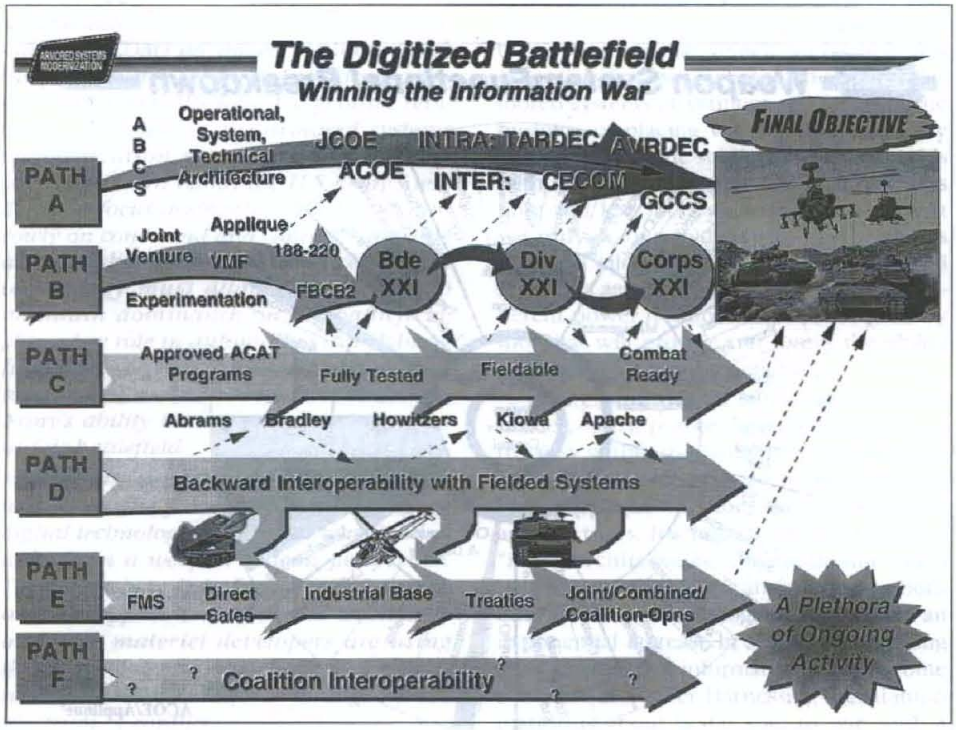

Figure 4.

Integrating these functions requires a radical new approach to vehicle design. The U. S. Air Force realized this requirement in the late 1940s. Faced with a myriad of new systems, designers had to integrate these new requirements in such a manner that pilots would not be burdened to such a degree that flying the aircraft became a secondary activity. Hence, the term "avionics" was born.

With the development of the M1A2 in the late 1980s, the Army enhanced the fightability of the Abrams tank by requiring the integration of multiple dynamic, interactive functions. The armored systems challenge was—and is—to integrate all vehicle war fighting technologies in such a manner as to automate these war fighting functions, thereby unburdening the soldier from tasks he currently performs as well as automatically generating and integrating additional information that the soldier previously had to manually generate. Vetronics is the integration of software and hardware to automate weapons system functions.

We know that inter is comprised of hardware and software that allows us to ostensibly dedicate paths where information can be transferred wherever it needs to be and wherever the linkages are in place. Intra takes the same technology and enables us to support weapon systems combat missions by integrating information and using this information in a real time domain in order to enhance our war fighting capability. The main point of this discussion is to realize that digitization is not high speed automated data processing but a dynamic interaction of man and machine with an objective outcome of increased combat power (Figure 3).

For example, in the M1A2, a call-for-fire can now be sent via one touch with the following automated inputs: the sender and destination identification/ frequency from the on-board memory, position from the Pos/Nav, heading from the heading reference unit, off axis from the turret azimuth drive systems and range from the laser range finder. The artillery requester need only identify the target and send a request.

Automatically, the intra architecture vehicle instantaneously "fills in the blanks" and the fire mission is transmitted. An exponential increase in war fighting capability results from this efficient application of complementary technologies. This is but one application example that was successfully demonstrated during NTC 94-7 (the first digital rotation at the National Training Center); it continues to be refined.

What is the digitization plan as the armored systems acquisition community sees it? How are we achieving the vision set forth by the Army senior leadership? We must have a plan, for any road will not get us to where we want to be, when we want to be there. It is necessary to sharpen our focus on the road map for digitization because it

follows a number of courses. There are about six paths (Figure 4).

As a caveat, just as there is no official end state to the Force XXI concept, there is also no set final objective for digitization. Activities such as working towards a common standard architecture and conducting advanced war fighting experiments help focus our efforts and "keep us on the right path," but this is a dynamic process. There will be no formal end state for the digitization effort as a whole in which we can pour concrete and lock in.

This being said, our objective as materiel developers is to provide a process that enhances the soldier's ability to dominate future battlefields. The digitization road map seeks to leverage technology and ensure efficient integration across the Army, sister Services and our allies. In this manner, our goal will be achieved, albeit in small incremental steps, but nonetheless achieved in accordance with the Army chief of staff's vision.

Path A on the top is generally under the stewardship of the Army Digitization Office (ADO) and builds the structure, the building code for digitization. The technical, operational and systems architecture lay the foundation for the structure that we will rely on in the future for digitizing the Army; for passing information through the Army horizontally and vertically as well as harnessing digitization power in order to enhance war fighting capability. Path A is also the process by which we develop the techniques, tactics and procedures for the operational architecture as well as the technical architecture. Primarily an academic endeavor, the research and effort expended in path A enable common physical change in ground maneuver force.

On *path B* are the experiments that validate the building code. To enable this physical change, an experimentally digitized force fielded at Fort Hood, TX, will evaluate war fighting capability increases generated from promising digitization initiatives derived from path A. The Army will conduct an advanced warfighting experiment at the brigade task force level in 1997. The focus of this exercise is on determining what our organizations need to look like, how our radio nets need to be configured, how our soldiers need to be trained, and how we can further leverage computing power to increase combat power. The outputs of those experiments will determine how the Army will look and fight on the future battlefield. Path A and B, intellectual and physical change, are deeply entwined. By design, these paths are a methodical and iterative approach to designing our future force.

Path C recognizes that there are emerging systems in the Army inventory today that are being developed and fielded against a digital standard that, for obvious reasons, are not the common operating architecture of the digital force. These systems need to converge towards the common operating environment that the Army is constructing. Absolutely essential to developing these systems is formulating migration plans that clearly indicate how systems currently digitized will incorporate our future common operating environment. PM-ASI is a key player in this process. Anything less than a total team effort will jeopardize our ability to ever achieve our common operating environment objective.

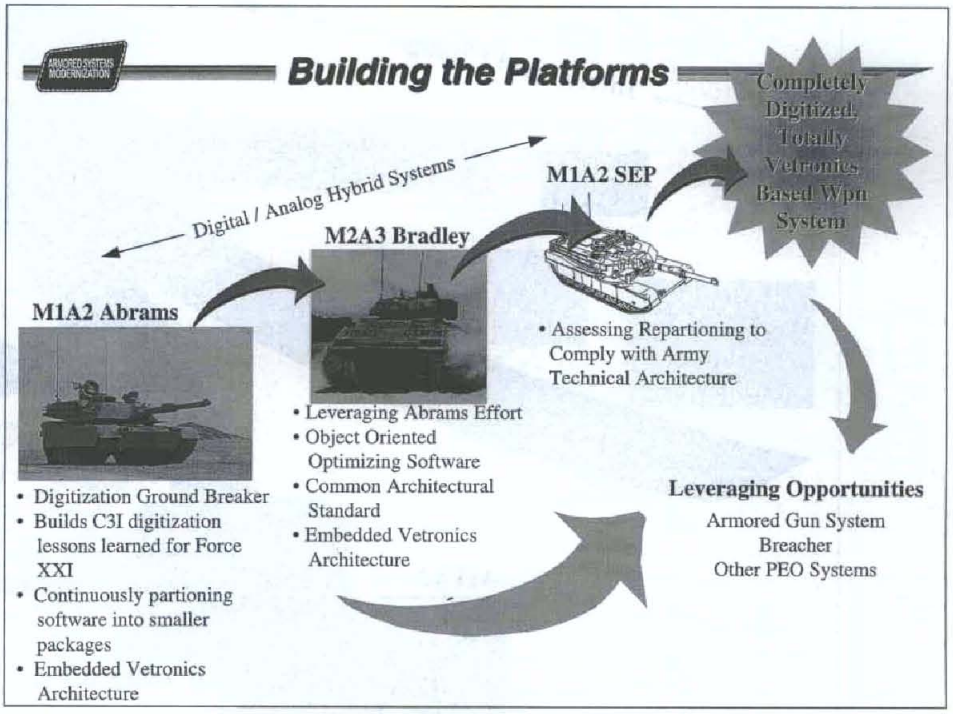

Figure 5.

Path D recognizes that many of the current and near term systems of today are in one way, shape, or form partially digitized, but came from path C and were built in isolation with unique protocols. So as we move forward with upgrades for Bradley A3, Abrams A2, the Multiple Launch Rocket System, Paladin, Kiowa Warrior and Apache, we need to be able to ensure backward compatibility with previous versions. This has not always been the case in past acquisitions. Some current systems by design are incompatible with their own legacy systems. Such an acquisition strategy is unacceptable in today's resource-constrained environment. We cannot ignore our legacy systems. Procedures must be in place to ensure backward compatibility with previously fielded systems as we continue to move forward to the common standard architecture and beyond.

Paths E and F. In an era of diminishing resources, all Services have looked to foreign military sales as a solution for technology and industrial base sustainment. As we field systems to our allies we incur modernization responsibilities commensurate with our own initiatives. In order to fight a cohesive coalition fight, it is imperative that digitization opportunities extend to all our foreign military sales customers. Just as with our own legacy systems, platforms that we provide our allies must be candidates for backward compatibility with our continuous modernization updates. Anything less than a holistic approach may paralyze our forces in a joint fight.

These discussions have focused on digitization applications currently ongoing in the Army. We are also working very closely with our sister Services to ensure the combined arms team provides overwhelming combat power on the battlefield. To this end, these same paths may be simultaneously applied towards digitizing the joint fight.

We continue to improve the M1A2 towards compliance with the ADO's intra and inter common operating environment standards. We have the Bradley A3 in full scale

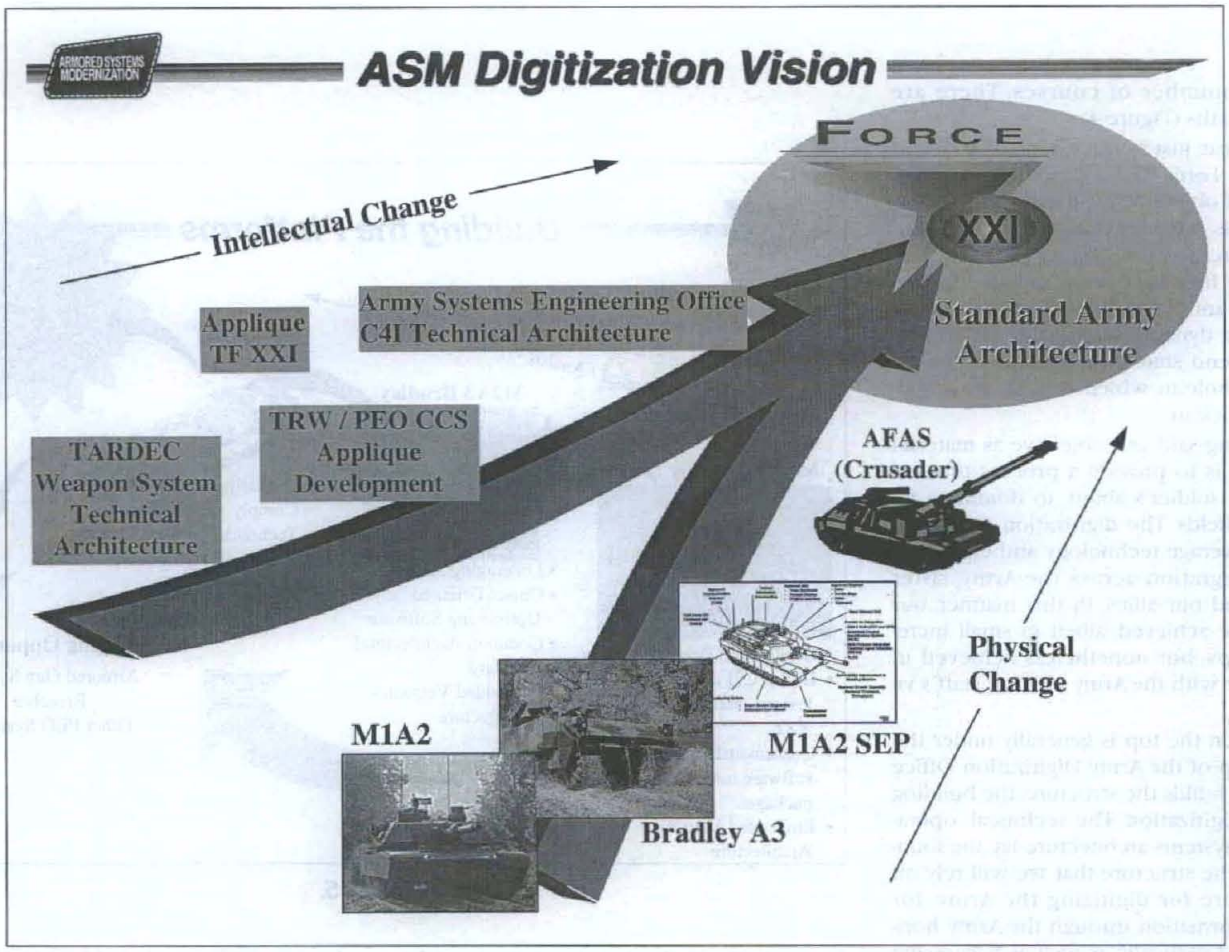

Figure 6.

development creating the initial node for the common embedded architecture. We are moving forward (Figure 5).

Let me highlight some of the things we cannot do. We cannot converge too fast because we don't have the money to change, then change over again. That's going to be the elusive art of this process. MG Rigby and the ADO are going to be pushing the experimentation, looking at the results, seeing what's good, what's unacceptable or what requires improvement and determining how best to leverage digitization resources so both the inter and intra requirements are adequately addressed. But at that point when the Army chief of staff hears from the ADO that the inter architecture is ready, the embedded architecture must be ready. That's the technical challenge. We can't burden the soldier in the process. We cannot compromise war fighting capability and we cannot stovepipe. What must we do? We must leverage the inter environment and ensure that it fully complements the intra war fighting tasks. We must pursue commonality and we must comply with the Army standards. Above all we must remain combat ready.

Digitizing the battlefield and enhancing war fighting capabilities within our weapon systems must remain synonymous. Our challenge is to be compliant with the structure that the Army is putting in place while also leveraging this structure to ensure that our soldiers can exert maximum combat effectiveness while fighting their weapon systems. We must ensure that the "whole" inside the weapon system is greater than the sum of the parts. We knew that the M1A1 was the best tank in the world. We knew the M1A1 crew in the gulf was the best tank crew in the world. The problem that was solved by the M1A2 was enabling the best tank crews in the world to take advantage of the best tank in the world. Such intellectual change is energizing the armored force as a whole. The Bradley A3 is building off of lessons learned from the M1A2.

The M1A2 Systems Enhancement Program is continuing to ensure commonality across the battlefield by incorporating an intra core vetronics architecture and protocol integration standards. The Advanced Field Artillery System (Crusader) will build upon PEO-ASM's efforts (Figure 6). Our efforts are linked via PM-ASI and the ADO to other program executive offices.

These discussions further clarify what the acquisition managers in the armored system community are thinking, planning and executing. Hopefully the war fighter sees our intent on unburdening the soldier, not by replacing his weapon with a computer, but by enhancing his weapon system through the synergistic power of computer technology. Dominating the battlefield of the future is paramount in the soldier's mind. It is the charter of acquisition managers to provide the soldier the means for decisive victory in our future conflicts.

As a young officer, I saw a poster frequently hung in company and battalion training rooms. Over the backdrop of a cemetery it stated, "Let no soldier call out from his grave 'Had I the proper training.'" As acquisition managers, it is imperative that we heed a slight variation of this theme, ". . . Had I been trained on the proper equipment."

The power of digitization will prove to be a great combat multiplier for our soldiers, but only if we in the acquisition community remain a cohesive team, sure of each other's intent and actions, and clear on our goal. Such teamwork is in place and is working now. Continued success on our part will ensure complete victory on our soldiers' behalf.

USE OF THE DIGITAL INTEGRATED LAB FOR FORCE XXI

By Dr. Myron Holinko

Introduction

The Army for the 21st century is being redesigned to better leverage information technology to synchronize its forces while increasing the lethality of its weapons systems and the survivability of the force itself. Upgrading weapon systems to capitalize on emerging digital technologies improves effectiveness and leads to the concept of employing digital technology, horizontally, across the entire force—Force XXI. Part of the risk mitigation plan on digitizing the force is a series of Advanced Warfighting Experiments (AWEs) and force level exercises to validate the digitization concept and ensure that the results meet the expectations of senior Army leadership. As a way to further mitigate risks, the Army has mandated that all of the participants in these Force XXI experiments be certified as "interoperable" with other participating interfacing systems prior to each experiment. The Digital Integrated Lab, or DIL, has been designated to certify the interoperability of systems participating in Force XXI experiments.

Force XXI Development

The DIL is a Command, Control, Communication and Intelligence/Electronic Warfare (C3I/EW) development tool that allows the U.S. Army Communications-Electronics Command (CECOM) to rapidly replicate existing and evolving tactical battlefield environments to enable and facilitate comprehensive evaluations of new prototypes, evolutionary system developments, new technologies, commercial products, and systems interoperability. It is a virtual lab that integrates CECOM's many programs and products, horizontally. It is a fundamental component for systems engineering and integration to optimize the evolution of architectures and systems for the digital battlefield. Because of its significant capability, it has been adopted by the Army for Force XXI.

DIL supports the development of Force XXI by providing a virtual prototyping environment and the capability to test the Force XXI Battle Command Brigade and Below (FBCB2) system, to include its functionality with tactical communications systems. It also supports certification of compliance with appropriate standards and procedures contained in the Army's C4I technical architecture. It provides these capabilities by electronically connecting the testbeds of the FBCB2 Appliqué developer with government testbeds. A series of experiments is being developed that incorporate the Appliqué components as part of the overall Appliqué development effort. With the networking of the Appliqué developer's testbed to the government testbeds, the implementation of critical Force XXI communication protocols and message sets can be verified.

Through informal DIL testing, C3I/EW hardware and software developers can experiment with their products in either a Task Force XXI, or another environment, prior to entering formal Force XXI DIL certification tests. The DIL also provides realistic environments for supporting the development of software throughout the software development process, beginning with requirements analysis and progressing through the design phases, code walkthrough, integration and acceptance testing. Overall, the DIL facilitates the software development process and allows interoperability to be built into the C3I/EW systems.

DIL evaluations certify that the applicable requirements of the technical architecture of Force XXI have been properly implemented within the participating AWE systems. Two important examples of implementation which must be certified as being technical architecture compliant are MIL-STD-188-220(A) and the Variable Message Formats (VMF). MIL-STD-188-220(A) specifies the physical, data link, and network layer (except Internet sub-layer) protocols which shall be used in Force XXI for data communications via SINCGARS and other data distribution radios. The VMF Technical Interface Design Plan (TIDP) specifies the format and content, to include data element standards, of the variable format message which are used for the transfer of real-time and near real-time data between Army tacti-

Upgrading weapon systems to capitalize on emerging digital technologies improves effectiveness and leads to the concept of employing digital technology, horizontally, across the entire force—Force XXI.

cal Command, Control, Communications, Computers and Intelligence (C4I) systems. The DIL also supports the evaluation of compliance with the Army's Common Operating Environment (COE). DIL certification must be obtained prior to fielding equipment to the Experimentation Force (EXFOR) site at Fort Hood,TX.

In addition, the DIL provides the U.S. Army Training and Doctrine Command (TRADOC), Army service school staffs, and battle staff with a means to experiment with and evaluate, prospective Force XXI doctrinal changes in command post exercise (CPX) environments. Figure 1 portrays several of the above concepts and functions.

DIL Certification Authority

The Louisiana Maneuvers Board of Directors assigned the Army Digitization Office (ADO) with a task to ensure that the DIL be used to develop, maintain, improve, and certify communication and digital systems for interoperability before fielding to the Experimentation Force.

The ADO issued a policy memorandum to all of the key players in the development of Force XXI. This memorandum amplified the requirement for use and availability of the DIL for experiments and evaluation between and among the C3I/EW hardware and software systems prior to participating in Task Force XXI AWE, and the follow-on division and corps AWEs. It also encouraged the maximum use of the DIL, both within and between PEO/PM programs, systems already fielded, and science and technology programs.

Recently, Army Vice Chief of Staff GEN Ronald H. Griffith, and Assistant Secretary of the Army for Research, Development, and Acquisition Gilbert F. Decker promulgated the DIL Policy and Procedures in support of Force XXI with the statement that,"...obtaining DIL Certification is mandatory for all Command, Control, Communications, Intelligence and Electronic Warfare systems participating in Force XXI Advanced Warfighting Experiments..."

DIL Force XXI Certification

The DIL certifies equipment for participation in specific experiments and exercises, and provides support to formal acquisition programs. The DIL does not eliminate or replace any Army acquisition requirements. Since the DIL is a resource as opposed to another layer of acquisition authority, the DIL promotes and facilitates development and fielding of the Force XXI systems by complementing the efforts of formal test organizations. The DIL process provides the Force XXI systems with enhanced resources to design, develop, integrate, and verify interoperability. The DIL provides software and system developers an additional capability to verify interoperability. The DIL certification process allows the ADO to determine the nature and scope of interoperability problems in Force XXI systems prior to field exercises and experiments.

DIL certification evaluates the intra-Army Force XXI interfaces prior to the field exercises and experiments. This can be considered as a logical first step that an Army system should take prior to seeking Joint certification by the Defense Information Systems Agency (DISA)/Joint Interoperability Test Command (JITC). JITC and formal Army testers, such as TECOM and OPTEC, are invited to observe DIL certification and use DIL certification as data points towards certifications or supporting evaluations.

DIL Certification Process

DIL certification verifies that an interface, system, system component, or platform

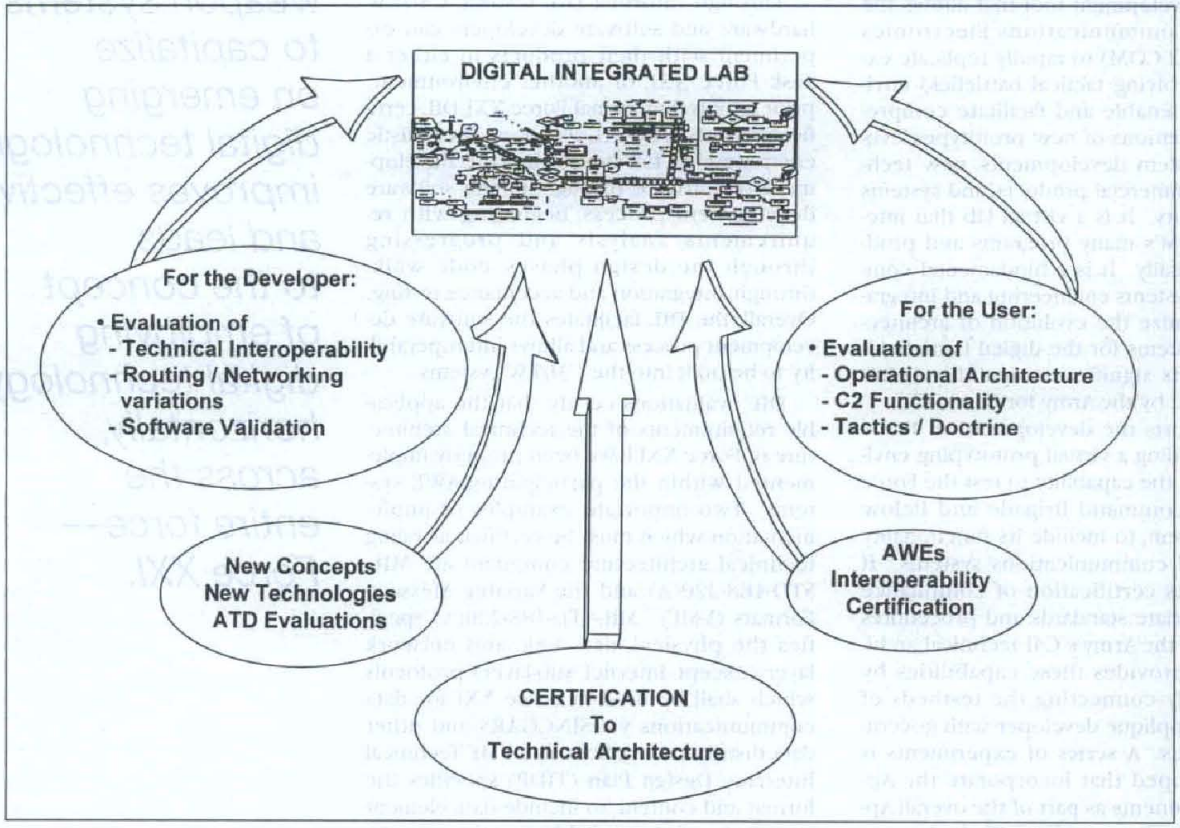

Figure 1.
Digital Integrated Lab Functions.

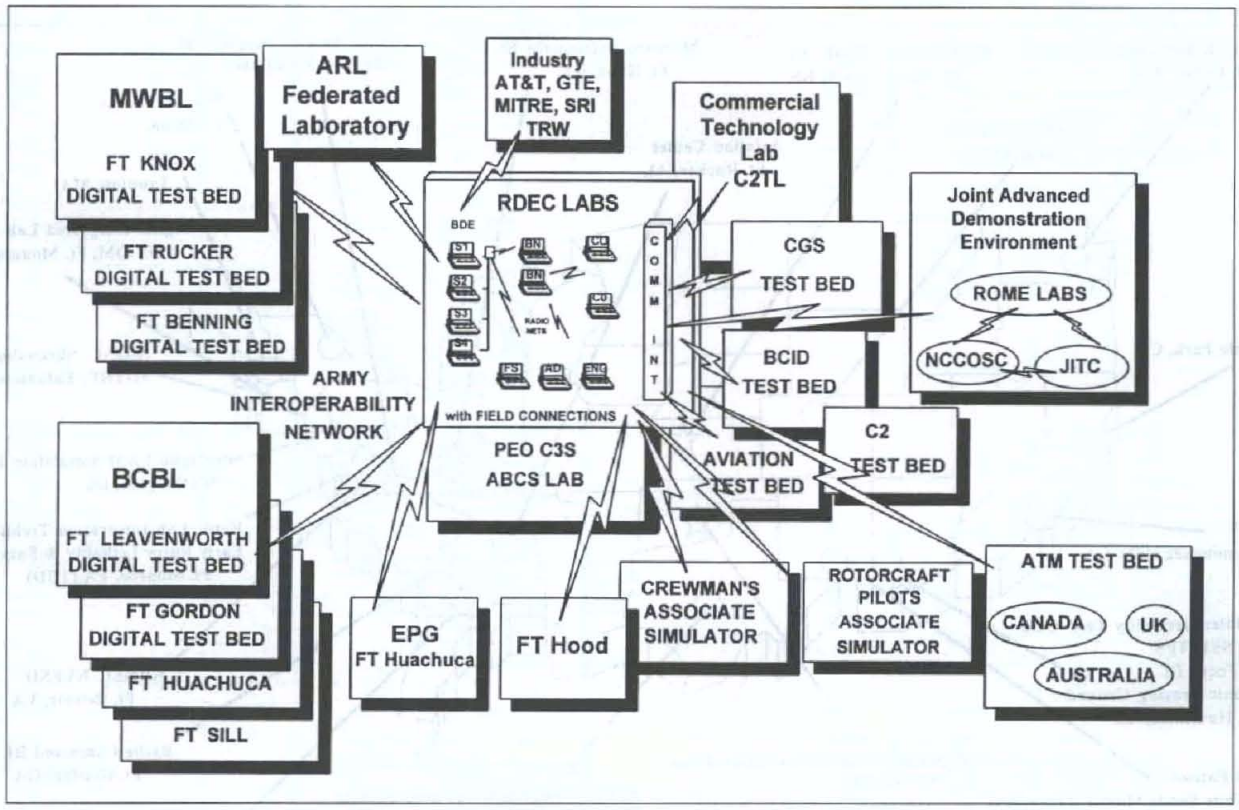

Figure 2.
Digital Integrated Lab Facilities.

performs in accordance with a specification, standard, or other published document, and is suitable to participate in a Force XXI AWE. The certification process begins with the identification of the certification requirements; the resulting certification criteria is driven by the system architecture and the message implementations and exchanges that have been established for the AWE. The second phase includes the execution of the certification procedures, the real-time collection of the test data, the analysis of the collected data, the production of preliminary test reports, and the publication of a draft DIL certification report.

The last phase of the process is the analysis of the draft certification report by the Analysis Review Board (ARB), a group chaired by the DIL director and composed of representatives from the ADO's office, the system engineer's office, and representatives of the systems/platforms that participated in the experiment/AWE. After analysis of the data, the ARB will recommend certification, or not certification, of the system/platform. The DIL director will forward a technical certification report of the experiment to the ADO, who, after consulting with the system engineer, will make the final recommendation to the EXFOR working group for the AWE participation decision.

DIL Infrastructure and Facilities

The DIL is comprised of distributed interconnected government and contractor laboratories and testbeds, battle labs, field sites, and simulations (See Figure 2). These facilities contain actual fielded systems, representative suites of fielded systems, and developing systems. Linking these resources allows the replication of the horizontal and vertical flow of information. The central core of the DIL can be rapidly reconfigured to meet the needs of an AWE or a customer, and, once reconfigured for a customer, can be electronically extended to the place that best meets the needs of that customer. DIL efforts will improve system performance and quality by identifying interoperability issues early on in system design, and providing the materiel developer with opportunities to modify and adjust the system without major programmatic impacts.

In terms of a high level architecture, the DIL has chosen to implement the "distributed architecture" that has been proven to be effective for this type of testing by the DOD Service and joint testing communities. The concept of a distributed test system is based on the cost effectiveness of being able to utilize a facility or system via remote access instead of having to either bring the system or facility to a central location or having another facility or system built at the central location. This distributed architecture normally has three components—a central core, the remote facilities and/or systems, and the communications network that ties it all together.

The DIL central core is composed of U.S. Army Materiel Command's CECOM Research, Development and Engineering Center (RDEC) laboratories that are located in the Fort Monmouth, NJ, and other geographically dispersed areas. The laboratories provide research, development, testing and evaluation capabilities, and expertise that encompass the full spectrum of C4IEW disciplines. The laboratories use a variety of means, including fiber, coax, and wireless systems, to provide intralaboratory and interlaboratory connectivity. The DIL supplements the laboratory interconnectivity with access to other facilities, including space and terrestrial communications, tactical switching equipment, tactical radios, and interfacing gateways, to support testing, ex-

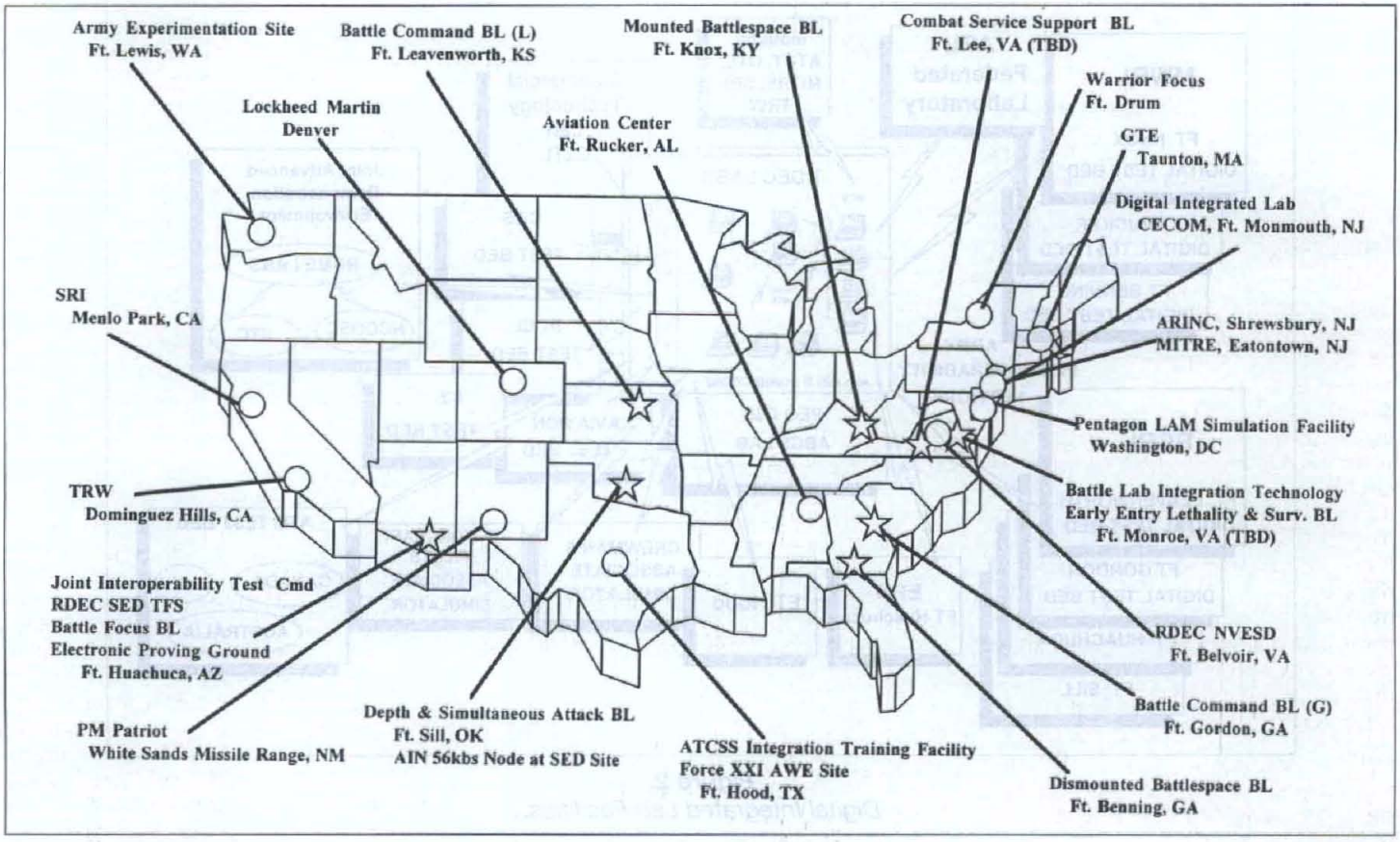

Figure 3.
Digital Integrated Lab/Army Interoperability Network Sites.

perimentation, and other functions.

The DIL uses two primary means to access the external sites—the Army Interoperability Network (AIN) and the Defense Simulation Internet (DSI). The infrastructure also supports connectivity to Army battle labs and field sites, other experimentation facilities, other RDECs, and developer facilities. The major DIL/AIN sites are depicted in Figure 3. Sites with the "stars" are the battle labs; sites with "circles" are significant government and industry locations.

Summary

The DIL, its supplemental connectivity, and its communications infrastructure provide hardware and software developers and maintainers of Force XXI with a cost effective, distributed test capability that also supports experimentation and demonstration of concepts with the Army battle labs and similar facilities. The DIL testbed allows experimentation and informal testing with new technologies and concepts during the early stages of developments. This building-block approach allows the developer to evaluate system performance on an ongoing basis rather than having to wait until completion. Together, these resources provide the Army with a significantly improved capability to perform comprehensive evaluations of new prototypes, enhance evolutionary developments, incorporate new technologies, evaluate commercial products, and improve overall systems interoperability.

DR. MYRON HOLINKO is the director, Digital Integrated Lab, U.S. Army CECOM RDEC. He was previously the program manager for the Army Interoperability Network and Army-joint interface and interoperability standards and testing. Holinko earned his degrees from Drexel University, Fairleigh Dickinson University, and Temple University.

SOFTWARE SUPPORT: CRITICAL TO THE ARMY'S FUTURE

By Dr. John P. Solomond and Dr. D. Ross Grable

Introduction

The intent of this article is to describe the current post deployment software support system and its importance to the digital battlefield. This article contains specific examples from our larger software centers and describes some of the major challenges facing the Army which, in many respects, are software-related. The requirements and challenges of software support are very similar to those for software development. Similarly, the technical methodology required for software support is largely equivalent to that for software development. This article, however, does not discuss existing and prospective policy changes because they were in the process of revision at the time this article went to press.

Background

As the U.S. Army continues to adjust to the post-Cold War environment, it may need to conduct operations anywhere in the world against forces with varying degrees of advanced weaponry, geographical and environmental conditions and unpredictable infrastructures. New conflicts, such as Just Cause, Desert Storm, Somalia, Macedonia, Rwanda, and Haiti, have provided new challenges in maintaining communications, conducting real-time threat analyses, and providing effective command and control. A key solution is to increase the use of computers and computer software on the battlefield to overcome performance and capability deficiencies resulting from unexpected and unpredictable strategic and tactical surprises or from new doctrine. In this way, we can enable commanders to react within the decision cycle of the enemy.

Nowhere is the need for automation more evident than in the fire support arena where, over the years, software has allowed the command and control of field artillery to evolve from individual vertical "stove pipe" systems operating independently on the battlefield, to a totally integrated horizontal domain that enables the commander and staff to find, process, and distribute large volumes of information more quickly and accurately. During the past 10 years, the U.S. Army Communication-Electronics Command's (CECOM) Research, Development, and Engineering Center Software Engineering Directorate has successfully delivered 11 major software upgrades for each of the TACFIRE, Multiple Launch Rocket Systems, mortar and artillery locating systems, battery computer systems, meteorological systems and forward entry systems. These upgrades accommodated new threats, new doctrine, and the introduction of new munitions into the Army's lethal arsenal. The Field Artillery Corps could not have used most of their key munitions in Desert Storm without new software that allowed the fire control teams to quickly locate and identify key targets. This new software manages new munitions, counters new threats and precisely synchronizes fire missions with ground troop movements.

Importance of Software

The Army's dependence on computers and computer software in automated weapon systems has grown dramatically over the last 2 1/2 decades. In 1970, there were only three major automated weapon systems in the Army inventory. Today, the Army is developing and supporting more than 300 distinct software intensive systems. To help manage and control the Army's vast dependance on computer software, the Army Materiel Command established life cycle software engineering centers (LCSECs).

Software Engineering Centers

The life cycle software engineering centers ensure that, for emerging and fielded software intensive battlefield systems, the software functions properly. Furthermore, the LCSECs have a continuous focus on improving the quality of the software, while establishing methods of controlling software cost and schedule.

The LCSECs serve three important roles. First, during the development of a new software intensive system, the LCSEC provides the software engineering expertise to the Army project manager (PM). The LCSECs work with the prime contractors to solve software issues. Their engineers know the state of the art regarding tools and processes and help the software contractor apply them to the development. LCSEC engineers ensure that the prime contractor is doing everything possible to develop and deliver efficient, economical, reliable and supportable software with the specified capabilities. Software experts, trained in the development and sustainment of weapon system software, provide the oversight, on behalf of the PM, of the prime contractor's software processes and emerging software products. As the PM's software focal point, they manage the software cost/schedule metrics and provide an independent and unbiased government analysis and assessment of the status of the software development. They also act as the PM's interface to other technical software organizations.

The second role of the LCSECs is post deployment software support (PDSS). After initial fielding, the responsibility for full time software support shifts to the LCSEC using a combination of government and contractor support (approximately 15 percent government, and 85 percent contractor). Depending on cost and technical considerations, contractor support to the LCSEC is usually provided through a competition resulting in either the original prime source or a support contractor who was involved during development. The ability to compete PDSS support in this manner, rather than leaving the system with the original developer, has repeatedly resulted in enormous cost savings, while affording the Army the ability to retain a highly qualified government and contractor support staff. Army systems typically stay in the field for approximately 20 years and experience significant "evolutionary development" driven by doctrine, threat and interoperability changes. As we move to an all digital battlefield, the insertion of integrated computerized components, into already existing platforms and into current and future systems, will require more than a knowledge of single system or application.

The third role of LCSECs is to develop and acquire the best methods for developing, testing and fielding software products.

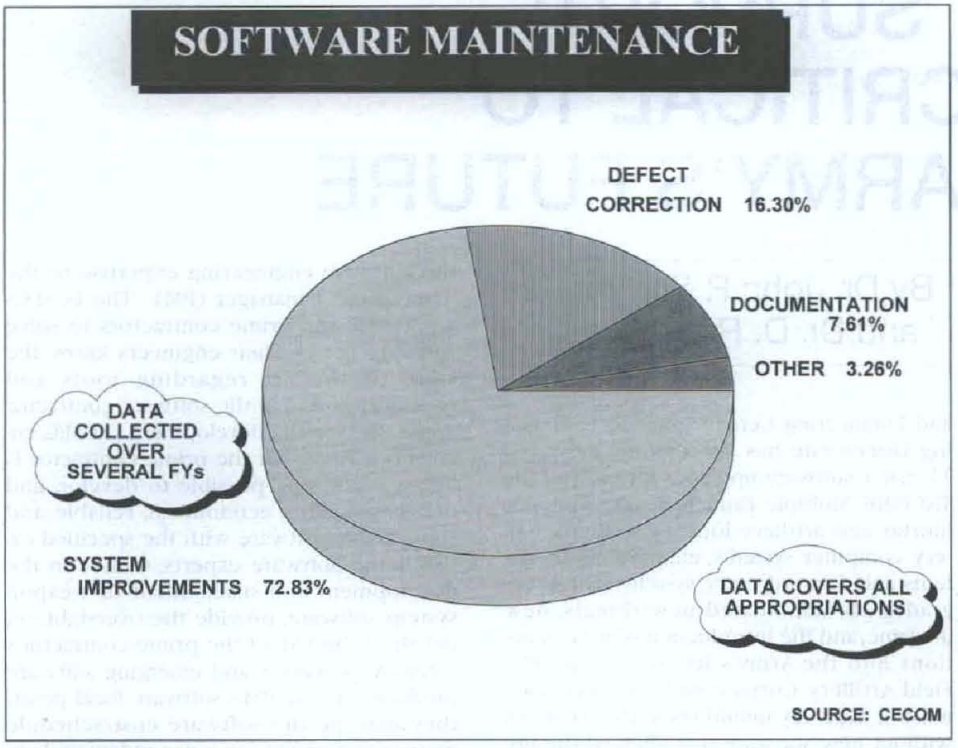

Figure 1.

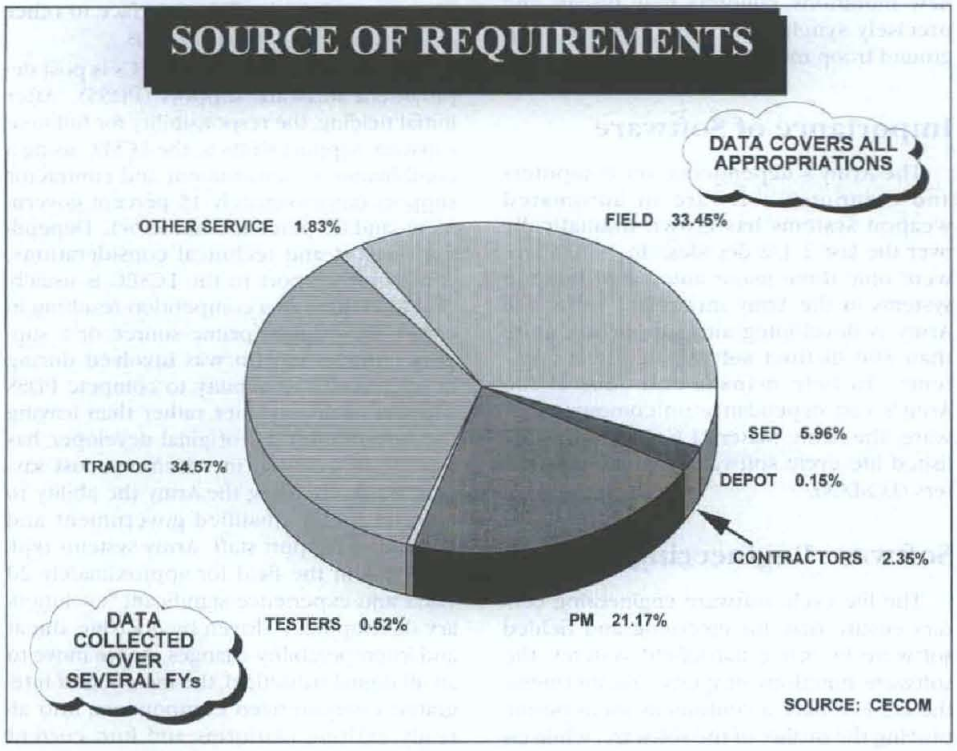

Figure 2.

The practical application of software in Army weapon systems is not possible without a good software engineering process. The digital battlefield, for example, will require common and open architectures. The development of most open architectures requires a detailed knowledge of Army software intensive systems and the application of sound software engineering processes. It also requires appropriate support tools in the development of these systems. Furthermore, the LCSEC prototyping labs define and develop interoperability requirements, interface points, integration specification and software protocols. This is a significant contribution to the Army's digitization effort.

Software Support Requirements

Typically, most software support efforts are based mainly on changes in requirements due to changes in tactics, doctrine, threat, or safety critical issues. In response to these changes, PDSS allows the Army to respond to changing conditions and requirements on the battlefield. Modification to the Patriot system during Desert Storm is an excellent example. False returns from friendly aircraft caused by radar backlobes was an unknown but critical behavior of the system that had to be corrected through software modification to the deployed system.

Software maintenance, requiring code revision and documentation changes, is not just correcting defects ("fixing bugs"). Rather, as Figure 1 illustrates, based on CECOM empirical data, almost three-fourths of the effort is for system improvements or enhancements, while only one-sixth of the effort is for defect correction. This is consistent with the examination of the source of requirements and requirements changes. As seen from the CECOM data summarized in Figure 2, some two-thirds of all requirements changes originate from either the field user or user representative—the U.S. Army Training and Doctrine Command.

Sample Initiatives

The Army LCSECs are continually striving for improved procedures to refine and enhance software support. They are using risk management techniques as well as methods for assessing software process maturity. Risk management is a rapidly maturing discipline used for the identification and control of possible threats or risks to a program. Threats may occur during the acquisition, development, or support phases of a system's lifecycle. Inadequate software risk management can cause many high-risk software problems. Since risk management deals with the probability that there will be a failure somewhere in the development or

support phase of a system, identification, and abatement of these high-risk probabilities before and during a system's acquisition is essential for program success.

CECOM's Software Engineering Directorate (SED) conducts software process risk evaluations on all major software acquisitions. SED teams of expert software engineers conduct on-site risk analysis at all the valid bidder sites. Every process required to meet the government's proposal is measured for technical, management and cost risk. The contractor's process maturity is evaluated using the Software Engineering Institute's maturity model that guides the SPRE team in its objective evaluation. The SED decides the contractor's total risk classification by evaluating both risk probability and risk impact. This classification ensures that the winner has an adequate risk abatement program that identifies and chooses methods for averting and monitoring these risks.

The Multiple Launch Rocket System (MLRS) launcher test bed at the U.S. Army Missile Command (MICOM) SED provides unique capabilities for supporting MLRS systems. The MICOM SED is comprised of a variety of battlefield missile systems and numerous engineers with experience in maintaining hardware and software for many systems. The test laboratory reproduces and studies MLRS problems reported from the field, and recommends corrective action as necessary. The test laboratory then tests the software from the prime contractor before it is fielded. This has revealed many problems that testing at contractor facilities failed to detect. For example, when a Fire Finder radar at White Sands Proving Ground relays a message to corps level at Fort Sill, a message is relayed to battalion level at MICOM SED, then another is sent to battery level at MICOM SED, after which an actual launcher and simulated launchers respond for a simulated counter attack. Such exercises have helped correct many errors throughout the system. After system software has been corrected, software fielding teams are dispatched to MLRS units across the globe to deliver and install upgraded software. Software revisions or upgrades vary from six to 18 months depending on the urgency and complexity of the upgrade.

1994 Acquisition Streamlining Act

The intent of Public Law 103-365, commonly called the Federal Acquisition Streamlining Act of 1994, is to develop a more equitable balance between government-unique requirements and the need to lower the government's cost of doing business. One way these objectives are addressed is the increasing emphasis on commercial practices, products and services. The act prescribes, for example, the use of commercial items first, and then nondevelopmental items (NDI); and, if neither of these is available, the government could specify government-unique equipment. The Army has been an advocate of this approach for years and has used it successfully on programs such as Mobile Subscriber Equipment, and the Army Tactical Command and Control System. Five pilot programs are currently designated within DOD to test commercial-type acquisition procedures, including the Army's Fire Support Combined Arms Tactical Trainer. Under this legislation, federal procurement policy will allow DOD to conduct tests of alternate and innovative procurement procedures in nine specific areas for four years by waiving certain provisions of law and regulations. The implementation plan calls for eight major goals and many sub-goals. One of the key goals is to "Improve the Systems Acquisition Process" and the first sub-goal is to use commercial practices and procedures to acquire military-unique items.

On June 29, 1994, Secretary of Defense William J. Perry issued a memorandum outlining DOD's policy on this goal. Concerning military specifications and standards, the policy states: "that performance specifications shall be used when purchasing new systems, major modifications, upgrades to current systems, and nondevelopmental and commercial items, for programs in any acquisition category. If it is not practicable to use a performance specification, a non-government Standard shall be used." This idea fits in well with the software development precepts used in the LCSECs, since software development requirements are better defined in terms of capabilities rather than specifications. Waivers for the use of military specifications and standards must be approved by the milestone decision authority. The memo further directs: "the reduction of government oversight by substituting process controls and non-government standards in place of development and/or production testing and inspection and military-unique quality assurance systems." Next, we describe how the LCSEC's apply these concepts of acquisition streamlining in software development and support.

Applying Acquisition Reform

Software's usefulness is related to its complexity, conformity, changeability and invisibility. These properties, in general, are not shared by hardware and are the basis for the unique challenges associated with software. In fact, today's software intensive systems, especially military weapon systems, are even more labor intensive than the predecessor systems of 10 years ago. Due to software's critical nature, the government must be informed of major software issues and must be able to assess software development progress, quality and cost throughout the life cycle. Management must be informed properly through definitive schedules, specified milestones, measurable products and evaluation criteria.

The goal of the new acquisition legislation is not "no government oversight" nor is it necessarily "less government oversight." The goal is to make industry and government more efficient and cost effective in producing and sustaining systems that the government requires. The government must now, more than ever before, be an "educated consumer." Fewer specifications and fewer documentation requirements will require more selective oversight.

The following recommendations describe several items which can be called for in contracts and can make a great deal of difference when the system is in PDSS. Notwithstanding public law requiring the Ada language and Army policy mandating Ada, it is a good choice as the source language for technical reasons as well. In general, Ada software is more maintainable and helps facilitate improved software engineering, among other features.

For systems having software requirements that are relatively stable, and known with some degree of certainty, there are specific advantages to using performance specifications in requests for proposals. For example, rather than specifying a development methodology for the contractor, the acquiring agency should write a specification for the system's software environment. Thus, the Army maintains the ability to maintain the software without specifying detailed requirements for the software's design.

However, care must be taken to ensure that the environment as delivered contains adequate documentation to maintain both the software and the environment. The MICOM SED has prepared a template for a software development environment specification. It contains requirements for operational concepts, weapon system requirement's maintenance, configuration management, architectural analysis and metrics. It also describes the rationale for design decisions, guidelines for modification capabilities, error tracking, time and space requirements, and treatment of commercial off-the-shelf software.

Army Technical Architecture

With the arrival of the digital battlefield, the Army needs to provide open, flexible and interoperable information infrastruc-

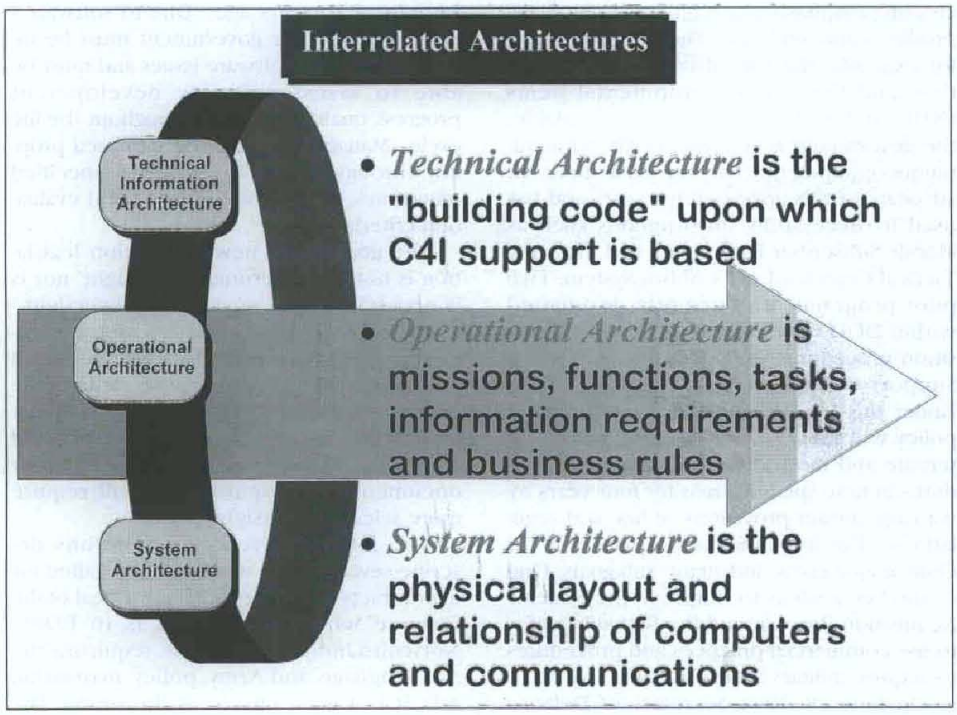

Figure 3.

tures in the future. Again, software will be the key to this infrastructure and software support will be critical to its effectiveness. The Army technical architecture (see Figure 3), is the framework, much like a "building code," for the definitions, standards and protocols for all system design and acquisition for the infrastructure. The technical architecture represents the minimum set of rules governing the arrangement, interaction and interdependence of the parts or elements that together may be used to form an information system, whose purpose is to ensure that a conformant system satisfies a specified set of requirements.

The technical architecture includes six major elements: Human-Computer Interfaces, Information Standards, an Information-Processing Profile, an Information Transport Profile, Information Modeling and Data Exchange Standards, and Weapon System Standards.

The Human Computer Interfaces define how the interface behaves and ensures uniform behavior of the interface to different applications on the same platform or for the same application on different (computer) platforms.

The Information Standards, to include standard data definitions, are required to ensure that the Army Battle Command System elements can exchange and use information automatically.

The Information Processing Profile includes standards, conventions, interfaces, and methods to be used for the design, implementation, operation and configuration management of domain- specific application software, generic application software and commercial off-the-shelf open-system products.

The Information Transport Profile includes communication and network conventions and protocols to support the transport of bits across heterogeneous communication systems and between heterogeneous computing systems. This would enhance communications among systems such as the Mobile Subscriber Equipment, the Enhanced Position Location Reporting System and the Single Channel Ground and Airborne Radio System. It would enable a seamless communications network with data being automatically and dynamically routed from sender to recipients.

The Information Modeling and Data Exchange Standards consist of both information processing modeling, as well as data modeling.

Finally, Weapon System Standards are necessary to provide command and control capabilities that will require gathering, processing, and communicating data to the war fighter. These standards will specify the processing of real-time data associated with any particular military mission. Since weapon systems can gather data in the seamless architecture, they too must interact and interoperate within the Army technical architecture. Each of these areas will require adequate yet necessary software support to provide effective and long-term impact on Army information flow.

Conclusion

This article shows the importance of software support to the Army, particularly in view of recent initiatives relative to acquisition reform and the impact of acquisition reform in developing software specifications. They have described the relative impact of requirements specifications and presented data showing the source of software requirements, as well as the relative impact of system improvements vice defect correction on the Army's burden for software maintenance. They have also briefly described the Army technical architecture and show that it is largely software intensive and reflects another reason for increased attention to software development and support within the Army.

DR. JOHN P. SOLOMOND is the senior software engineer at HQ, U.S. Army Materiel Command's Office of the Deputy Chief of Staff for Research, Development and Engineering. He is a registered professional engineer in Virginia and holds B.S. and M.S. degrees in electrical engineering from Carnegie Mellon University, and a Ph.D. in industrial/systems engineering from Texas A&M University.

DR. D. ROSS GRABLE is a scientist at the Army Missile Command. As a member of the faculty at the University of Alabama, he received his B.S. degree in mathematics and physics and M.S. and Ph.D. degrees in computer science from the University of Alabama in Huntsville.

U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND ONE YEAR PROGRESS REPORT

By BG Russ Zajtchuk
Commanding General
U.S. Army Medical Research and Materiel Command

On Nov. 3, 1994, we established the U.S. Army Medical Research and Materiel Command (USAMRMC) with a ceremony on the Blue and Gray Parade Field at Fort Detrick, MD. The "stand-up" ceremony followed a thorough analysis of the medical research and medical materiel requirements of the Army. The reorganization was consistent and concurrent with the reorganization of the U.S. Army Medical Command. The purpose of our reorganization was to improve the Army Medical Department's (AMEDD) ability to prevent illness and injury in deploying forces, to equip the Army's medics to provide the best possible combat casualty care, and to introduce logistics systems that enhance medical readiness.

In its first year, the USAMRMC has made significant progress in realizing the benefits of the reorganization. The bottom line is that the command, now a research and materiel command, is better structured to manage the medical materiel acquisition program and readiness responsibilities in support of the Army of the 21st century.

One of the most important aspects of the reorganization is the restructuring of the executive leadership of the command. Under the new system, we have established, within the command group, a deputy for research and a deputy for materiel. The organizational enabler to assist the deputies for research and materiel is the newly organized Medical Systems Integration Office (MSIO). The MSIO will be the executive-level staff office most responsible for guiding the command in meeting customer demands for medical products, systems and logistical support.

As a result of this redesign initiative, management improvements within the command include new emphasis on risk assessments, affordability assessments, market analysis, and technology surveillance, all promoting stable and cost-effective acquisition programs. Aggressive prototyping and technology demonstrations, commercial off-the-shelf (COTS) products, and non-developmental items will figure more prominently in our acquisition investment strategies to meet our customers' demands.

The reorganization will also enhance coordination and control of all aspects of the acquisition lifecycle, including technology base, advanced development and logistics. Previously, the U.S. Army Medical Materiel Agency (USAMMA) and the U.S. Army Medical Research and Development Command (USAMRDC) were both field operating agencies, reporting along parallel lines to the surgeon general. The two agencies communicated separately with the AMEDD Center and School, the combat developer.

The transition from independent field operating agencies to a consolidated major subordinate command provides a single venue for improved communication among the key players in medical materiel acquisition—the combat developer, the materiel developer, and the logistician. The role of the combat developer in the requirements determination process will be facilitated by the command's transformation.

In addition to the above organizational initiatives, my role as deputy for medical systems to the assistant secretary of the Army

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for research, development and acquisition (RDA), provides a framework for enhanced effectiveness at the Army secretariat level. This participation lends visibility and relevance to the medical materiel acquisition program, resulting in greater balance to the total Army acquisition effort.

I believe we have a made a credible start toward redesigning the command's research, materiel development and logistics core competencies in providing more timely medical solutions for military requirements to protect and sustain the force.

I am equally happy to report other recent customer-focused accomplishments of the command during the past year. The spectrum of progress includes measures adopted in telemedicine, infectious disease management for soldier survivability, and improvements in strategic logistics planning. Some of the highlights are:

• **Telemedicine Support in Contingency Operations.** The Military Advanced Technology Management Office (MATMO) is a newly-established center for rapid prototyping and demonstration of new technologies that have potential for improving military medical care on the battlefield, in field hospitals, and in our fixed hospitals overseas and in the continental United States. Demonstrated applications include prototype systems to enhance the life-saving effectiveness of the combat medic and the forward hospital through real-time voice, video and data communications links. These systems have potential for significantly reducing combat losses on battlefields of the future. Aggressive prototyping of systems, and the assessment and demonstration of new off-the-shelf technologies are consistent with the streamlined acquisition system mandated by DOD Directives 5000.1 and 5000.2. At this relatively early stage of telemedicine system development, we are encouraged by the performance of these systems as demonstrated in support of contingency operations in Somalia, Haiti, Croatia and Macedonia. Medical support of U.S. forces in Bosnia will feature a telemedicine network linking clinics in Bosnia with fixed facilities in Germany and in the U.S.

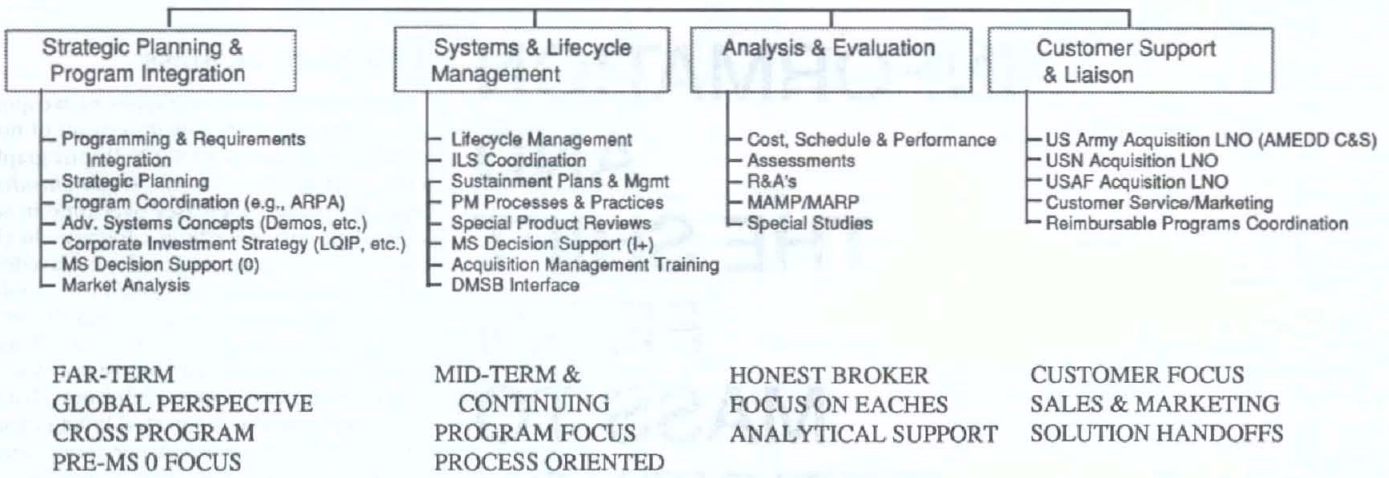
• **Hepatitis A Vaccine Licensure.** One of the most impressive recent events is the licensure of a vaccine for hepatitis A. Many years ago, researchers at the Walter Reed Army Institute of Research (WRAIR) produced a prototype for a hepatitis A vaccine. The Smith Kline Beecham company improved and refined the developmental vaccine. When the vaccine was ready for clinical trials, WRAIR managed the trials in Thailand, in conjunction with the Thai Armed Forces Research Institute of Medical Science, as they have conducted broad scale trials on many other drugs and vaccines before. The new vaccine will significantly reduce illness in U.S. soldiers deploying to areas where hepatitis A is endemic.

• **Ebola Virus and Other Highly Hazardous Infectious Disease Investigations.** Researchers from the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) continue to support worldwide investigations of infectious diseases. In the past year they have supported the World Health Organization and the U.S. Centers for Disease Control and Prevention in investigating an outbreak of Ebola virus in Zaire. USAMRIID scientists are also conducting an initial investigation of a potential therapy for Ebola virus infection. Researchers have traveled to Venezuela and Colombia to support efforts to control an epidemic of Venezuelan equine encephalitis (VEE). They provided materials, methods and training for performing definitive diagnostic assays for the VEE virus. Progress continues in this important area of research.

• **Global Surveillance of Emerging Infectious Diseases.** Epidemics of unusual life-threatening diseases like Ebola virus in Zaire and Hantavirus Respiratory Syndrome in the U.S. have stirred federal interest in monitoring emerging infectious diseases. In addition, there is concern that many antibiotics are losing their effectiveness due to growing resistance among infectious organisms. The USAMRMC is playing a leading role in a DOD initiative to monitor emerging diseases that threaten U.S. military personnel and other travelers. Global surveillance initially will link electronically all Army and Navy infectious disease research labs overseas with DOD research labs in the U.S. Eventually, operational preventive medicine units and health care delivery facilities will be integrated into the network. Surveillance will be linked to active responses to introduce control measures to limit the spread of disease. The DOD effort is a key part of a federal effort on global surveillance and response that involves the Department of State, the Department of Health and Human Services (the Centers of Disease Control and Prevention and the National Institutes of Health), the U.S. Agency for International Development and international agencies.

• **Product License Application for Tularemia Live Vaccine.** Materiel developers at the U.S. Army Medical Materiel Development Activity submitted a product license application for Tularemia Live Vaccine. The Tularemia Live Vaccine was developed as a medical countermeasure to ensure the sustained effectiveness of U.S. forces in a biological warfare environment. Tularemia is an endemic and epidemic bacterial disease threat associated with a significant incidence of human disease. In the military context, it could seriously disrupt mobiliza-

MEDICAL SYSTEMS INTEGRATION OFFICE



tion and the conduct of combat operations. Army scientists have conducted clinical studies of the vaccine since 1965. The vaccine has been proven safe and effective in more than 5,000 volunteer subjects, and we anxiously await the Food and Drug Administration's decision for approval of its use.

• **Army Superior Unit Award for Institute of Surgical Research.** The U.S. Army Institute of Surgical Research (USAISR), or the Army Burn Unit, received the Army Superior Unit Award during the past year for its treatment of burn injury patients. The USAISR is a unique research organization that allows AMEDD to provide state-of-the-art care for military burn patients. The USAISR sent deployable teams to Pope Air Force Base, NC, immediately after a tragic aircraft accident left dozens of soldiers severely burned. The USAISR teams stabilized the most critically injured patients and moved them back to their specialized burn care facilities at Brooke Army Medical Center. Their advanced treatment methods led to a very high survival and return to duty rate among the burn patients. This institute is the centerpiece for trauma care research in AMEDD. Its work will enhance soldier survivability on future battlefields.

• **Technology Transfer.** The USAMRMC maintains one of the most active technology transfer programs in the federal government, with more than 100 cooperative research and development agreements (CRDA) in place. Many of our CRDAs are with small, high-technology companies in the biomedical industry. The agreements make accessible to the command the energy and creativity of these entrepreneurial companies and their talented scientists. Other CRDAs, with leading universities and pharmaceutical companies, help the USAMRMC leverage academic and industry strength in biomedical research. These strategic relationships keep AMEDD at the leading edge of biomedical research and technology. They also benefit the non-government partners, who gain access to Army medical laboratory facilities, databases, and expertise. Army cooperation with academia and industry in biomedical research has a direct impact on medical product development capabilities, for the benefit of the soldier and the general public.

• **Strategic Medical Logistics Planning.** The medical logistics community has established a plan for seamless, worldwide support to deploying forces. Medical logistics support for Force XXI is organized to respond to strategic, operational and tactical missions. The USAMRMC is the single Army agency responsible for coordination of medical logistics support. Under the auspices of the USAMRMC, the U.S. Army Medical Materiel Agency, the U.S. Army Medical Materiel Center, Europe, and the 6th Theater Medical Materiel Management Center (a U.S. Forces Command unit headquartered at Fort Detrick), established a multi-organizational strategy resulting in seamless, flexible support of deploying forces. Like the forces it supports, the USAMRMC has global medical logistics power projection capabilities to address wartime and humanitarian mission requirements.

The adaptation of business practices such as customer focus, just-in-time inventory, cost awareness and resource tradeoffs, and data gathering in support of decision making all insure continuous improvements in medical logistics support to war fighters.

• **Technology Assessment, Review and Analysis.** Under the USAMMA, medical logisticians and clinical engineers have begun to offer a service to medical commanders, policy makers, and planners about capital investment decisions. This group of clinical engineers and logisticians review and analyze current and future requirements for major medical equipment purchases such as computed tomography scans, magnetic resonance imaging, and other costly medical equipment and systems. Based upon their analyses, they propose the best investment strategies and solutions to meet the requirements. These assessments offer a new method of controlling costs and maximizing the use of scarce available funds for capital equipment expenditures within the AMEDD.

The past year was exciting, challenging and difficult. It ended with the loss of a great American, a treasured friend, General Maxwell R. Thurman. His dedication to AMEDD was equal to his dedication and commitment to the rest of the Army and our country. Two months before he died he wrote, "The mission of the Army Medical Department is to provide world-class combat casualty care to America's most precious resource—its sons and daughters in peace and war."

The U.S. Army Medical Research and Materiel Command is dedicated to fulfilling that mission. We will continue to be all we can be, and we will succeed.

INFORMATION AND THE SHIFT FROM MASS TO EFFICIENCY

By MAJ Jay W. Inman

Winston Churchill commented in his *History of the English Speaking People* that the chroniclers of the 1300s and 1400s failed to recognize the sweeping changes rushing toward their society. He described how war-making changed within those two centuries from an emphasis on efficiency to an emphasis on mass. What nations thought about war, how they projected their power, and how they paid for their adventures dramatically changed the nature of political power and government. In this period, teaching a soldier how to fight with gunpowder weapons could be measured in months, as opposed to the average 12th century knight's training that took years.

Rulers from the 1300s onward developed the ability to cheaply gather and project their forces. This, in turn, demanded more efficient banking and revenue collection methods because rulers no longer had years to build up their war chests. As a result, governments centralized their power and expanded their banking systems to control their much more massive military and bureaucratic structures and pay for their wars. CNN's coverage of the Gulf War was in many ways the ultimate visual expression of this mass and lethality. Yet, Desert Storm also demonstrated the benefits of making war with information as opposed to mass. This implies a shift as dramatic as that experienced by the writers of the 1300s and 1400s with ripples spreading outward from that event that have the potential of equally dramatic change. Citizens and soldiers are already rethinking how our nation will fight future wars, simulate conflict, create wealth and even govern itself.

General V.A. Denisenko wrote in a military journal of the Russian Federation that the "intellectualization of reconnaissance and strike systems, automated control systems, and combat support systems have made it possible to first, make decisions in real time, and second, integrate those decisions into a single reconnaissance, command and strike system." He further discussed the need for smaller, more efficient forces able to fight and win against more massive opponents. In a word, Denisenko described the ongoing shift of emphasis in warfighting from mass back to efficiency. Though this seems like a new idea as we move from 486 processors to Pentium-based computers, we can still find historical examples of similar shifts that had an equally decisive impact on the United States. Representative Newt Gingrich had just such a concept in mind when he wrote in an article for the 1982 Army Simulation Symposium, "You must understand the past before you can conceive the future." In particular, this article examines how General Ulysses S. Grant and General George Marshall dealt with important changes, managed vast increases in available information, and improved the efficiency of their forces. Both men used information to configure their forces, maneuver against their enemies and win critical campaigns.

Efficiency vs. Mass

Killing capacity and ranges of weapons are perhaps the most obvious proof of how warfare is changing. COL T.N. Dupuy graphically portrays in his book, *Understanding War,* the parallel increases over time in soldier dispersal and killing capacity. In the Age of Muscle (swords, Longbows, Javelins), the average dispersal per soldier in combat was approximately one meter and the theoretical killing capacity of a man was 75 men per hour. At the beginning of the Age of Gunpowder, this dispersal did not change very much but the theoretical killing capacity increased to 100 men per hour. Introduction of smooth bore artillery bumped up this dispersal to 20 meters per soldier and the killing capacity to nearly 500 men per hour. By World War II and the Industrial Age, the dispersal per man was a little over 20 km and the theoretical killing capacity was at around 1,100 men per hour. Parallel to this development is the fact that training time decreased in length and cost. Teaching a soldier how to shoot a rifle simply took less time than training a young man how to ride and fight in full armor. All of these developments shifted military power away from efficiency to mass because mass was suddenly cheaper.

Present day forces at the beginning of the Information Age disperse their soldiers over even more ground and rates of killing per hour are moving off Dupuy's charts as units become smaller, ranges increase, and one shot equals one kill. This continued increase in lethality is bringing us back full circle to the idea that efficiency is more important than mass. Russian military thinkers, in fact, refer to Desert Storm as the beginning of "Sixth Generation Warfare." They believe that allied victory in the electronic/information phase of that conflict was what gave coalition forces such an astounding victory over Saddam Hussein. In their articles and journals, they describe how relatively small, cheap, and efficient coalition units destroyed the incredibly massive Iraqi forces. These Russian authors conclude that accurate and well-managed information is now one of the most precious battlefield commodities. Since history shows that efficiency was once more important than mass, that is where we will now look in order to find important historical examples that can help us understand the problems we will face.

Grant and the Mini-Information Revolution of the Mid-1800s

Grant first marched to war in the 1830s in a style familiar to soldiers of the American Revolution and the 30 Years War. Strategy and tactics were mostly refinements of the "Napoleonic" school of military thought and few commanders attempted to refine this system of maneuver. His Army changed dramatically after the Mexican-American War, but there is little evidence that Army leaders recognized this fact in the opening days of the Civil War. Quite simply, newer and faster methods of moving forces and information had accelerated the tempo of combat. Few seemed to understand this and the Union army marched off to take Richmond in 1861 using the same tactics of 20 years earlier from the War in Mexico.

The critical change that Grant was able to absorb, but which other Mexican War veterans could not, is that the telegraph and railroad provided information about the entire theater of war. The impact on the Army was such that commanders at the highest levels suddenly had a wealth of information at their fingertips that was not even conceivable in the Mexican-American War. As a result, this information was largely misunderstood and ignored. Only Grant in the West experienced success and he accidentally stumbled onto the secret. His use of the railroad, waterways and telegraph to coordinate and support combined arms operations against the Confederacy was one of the most important advancements in the art of war in the time between Waterloo and Appamatox.

When Grant took command in the East, he continued to apply what he learned by coordinating the attacks of the Army of the Potomac with those of the other Union armies. Using information obtained across vast distances, he responded to Confederate movements and got inside Lee's decision cycle. This was critically important because Lee's most important skill was the ability to coordinate tactical movements and maneuver against his enemies. In other words, Grant took away Lee's strength by acting more quickly on information and forcing the Confederate commander into static positions.

Grant also used Sherman in a role very similar to Eisenhower's use of the Air Force against Germany in World War II. He ordered Sherman to march through Georgia, taking the war to the people of the south and destroying their ability to sustain war against the Union. Like the Eighth Air Force, Sherman's role in shortening the Civil War can not be underestimated. What makes Grant one of the military giants to emerge from the Civil war was not his genius or charisma, though he was certainly a very smart and capable leader. His stature is more a result of being able to pull together many different elements from across vast distances and use his command authority to coordinate their activities. He became a master at using information assets to envision operations and win not just battles but entire campaigns that ranged from the Mississippi River to the Atlantic Ocean.

Marshall's Information Strategy

Seventy years after Civil War guns fell silent, Marshall reorganized the Army's information collection and information management efforts. In the late 1930s, this had to occur quickly because war in Europe demonstrated the dramatic and ongoing improvements in system accuracy and accompanying increases in lethality. In fact, the War Department staff in 1939 was a cumbersome organization that had problems talking to itself, not to mention units in the field. Yet, by 1945, what Ernie Pyle wrote in the Pacific was read a week later in the European edition of the *Stars and Stripes*. Marshall is the visionary leader responsible for this transformation. Though his changes were intended to control a massive Army, he imposed information efficiency on a disorganized clutter of forces that in 1939 only had the potential of being successful.

Marshall began his second day as chief of staff with a daily strategy session that included all his primary staff officers. More than 60 different men reported directly to the chief in this first meeting. Handling all of them as he simultaneously moved the Army out of its World War I mode of thinking would probably have killed a lesser man. In a few weeks, the chief decreased the number of attendees at his daily meetings to a more controllable five or six primary staff officers, himself, and the secretary of war. This "pyramiding" of the primary staff with the chief at the top, but subordinate to the secretary forced similar changes on each of the sub-staffs. This agony of reorganization came just in time. Beginning in late 1939, the Army would leap in size and capability with similar leaps in the quantities of information flowing back and forth between field commanders and the War Department.

Marshall literally forced a miracle on the U.S. Army. He desired nothing less than the creation of a modern force able to take on all comers in mechanized warfare. To get there from where he started in 1939 required a new way of thinking about information. On the one hand, he had to make his commanders begin thinking in terms of continuous mechanized warfare. On the other hand, he had to train other commanders how to sustain combat forces with fuel, ammunition and food. Though Industrial Age resources allowed commanders to concentrate on mass and ignore efficiency, Marshall only had to mention a few names of World War I offensives to turn his commanders away from applications of massive force that failed to consider efficient tactics and methods. He arrived just in time to force commanders to relearn efficiency in their use of force. Marshall was perhaps the most capable, determined, and innovative leader in this period of transition from Beleau Woods to Normandy.

Conclusion

Grant and Marshall, in their separate days, both imposed efficiency on an outdated and ossified army that lacked the capacity to quickly use information. Though their contributions are different, they fit each other like a hand in a glove. Grant used "data processing" to maneuver across the south, destroy the Confederate ability to wage war, and support the widely scattered forces under his command. Marshall created "superiority in information" by reorganizing the Army staff. This staff, in cooperation with its Navy counterparts, then achieved "information dominance" over the Japanese and German military. Like Iraq in Desert Storm, Japan and Germany lost their war long before the shooting stopped. Russian thinkers and writers call this process the "Intellectualization of the Battlefield." Like Grant and Marshall, they see information as the product of something much more than the click of a telegraph, the shuffling of papers, or the double click of a mouse button. "Intellectualization" is a term that goes beyond the hardware to imply a new way of thinking about war, power projection, wealth, and efficiency. The fact that this will happen in a near real time environment will force us to be very efficient as systems and methods rapidly become obsolete. Like the army that followed Grant in the Civil War and Marshall in World War II, we are part of an information revolution that will change the nature of our force.

MAJ JAY W. INMAN is a network systems administrator at the TRADOC Analysis Center, White Sands Missile Range, NM, and has a master's degree in history from New Mexico State University. His previous assignments include commander of Headquarters and Headquarters Battery, V Corps Artillery, commander of Charlie Battery, 3-35 Field Artillery Battalion, and liaison officer to the 12th Panzer Division. Inman is a functional area 53 Officer.

PROCUREMENT ISSUES FOR MISSION CRITICAL COMPUTER SOFTWARE

By CPT Keith R. Edwards

Introduction

Since the 1960s, the weapons being developed, produced, and maintained in this country have relied heavily on computer resources (hardware and software). Unfortunately, the government's ability to effectively and efficiently procure these systems has not advanced at the same pace. Alarmed by the increase in procurement difficulties and failures, the government has invested much time and energy into uncovering the root causes. Time and again, mission critical (specialized) computer software (MCCS) is determined to be at the heart of the problem. The Department of Defense's (DOD) ability to effectively and efficiently contract for these items will directly effect the future readiness of the armed Services.

This article examines several contracting (and management) issues key to the effective and efficient procurement of mission critical computer software in major weapon systems. Methodologies to enhance the procurement effort are discussed.

"Effective procurement" is here defined as the degree of success experienced in achieving procurement objectives; "Efficient procurement" refers to optimized resource utilization and processing time, and minimized cost as related to procurement action/activity. The term "mission critical computer software" refers to embedded computer programs whose failure to perform properly may result in loss of the weapon system, loss of life, loss of mission capability, or severe personal injury.

From the myriad of issues impacting the procurement of MCCS, the author limited his investigation to several that are both considered "key," and are readily influenced by the action/inaction of the contracting officer/program manager.

Background

Digital computers and their accompanying software were in their infancy in the 1950s and only just began appearing in weapon systems in the 1960s. The F-4U "Phantom" was the last jet fighter aircraft to rely purely on "hardware" control linkages (push-pull rods and hydraulic actuators). As shown in Table I, this contrasts sharply with the 5-7 million lines of code (software) that will be required to keep the Air Force's Advanced Tactical Fighter (ATF) aloft.

The flexibility afforded by digital systems cannot be remotely approached by analog systems. In essence "hardware" is replaced by "software" whenever feasible. This trend will continue into the foreseeable future.

Examination of the current state of affairs with regard to MCCS highlights some revealing, and sometimes, undesirable attributes:

- *Most new weapon systems are extremely complex. This is due to a combination of several factors.* For example, extremely demanding requirements tend to both "grow" in scope and "shift" in focus. Also, tight schedules and even tighter budgets tend to negate elegant and simpler solutions. And finally, there are too many contractors not fully skilled in software engineering techniques.
- *Most systems are delivered late, have cost overruns and rarely meet performance requirements upon initial delivery.*

In an article written by software expert James Kitfield, the author cites a recent speech by Air Force GEN Bernard Randolph, chief of Air Force Systems Command. Char-

Table I.
Weapon System Software Complexity Comparison.

WEAPON	LINES OF SOFTWARE CODE*
F-4	0 (VIRTUALLY)
F-16D	236,000
C-17	750,000
B1-B	1.2 million
ATF	5-7 million
SDI	25 million (est.)

*Lines of code are often used to describe the complexity of a software program. It should also be noted that a doubling of the lines of code does not necessarily equate to a doubling of complexity, and more likely results in a program 10 times more complex.

acterizing software as the "Achilles heel" of weapons development he said, "On software schedules (development) we've got a perfect record: We haven't met one yet."

To begin to correct the shortcomings cited, one needs to have a full appreciation of the reasons why they presently exist. Historically, there have been some areas of software development and procurement that have been particularly problematic. Some of these are an environment of loose/nonexistent management oversight, uneven application of standards, and a lack of a disciplined engineering approach to software development.

Management oversight shortcomings are rooted in the fact that many PM offices lack the technical capability to carry this out effectively. Since they know very little about MCCS development, they focus their efforts in the areas where they have more expertise, usually hardware development. Software development is left to the contractor's software management personnel and, unfortunately, these individuals are often left out of the program development "decision loop." Additionally, from a contractual perspective, often contractor software engineering supervisory positions are not specifically called out, the end result being a lack of appropriate supervision for programmers.

DOD MCCS development and procurement has also been plagued by an uneven application of standards. This is not to say that standards do not exist, because, in fact, they do. Over the last 20 years, DOD has promulgated numerous directives, instructions, specifications, and standards regarding the development and procurement of MCCS and related systems. Of particular note are DOD-STD-2167A and DOD-STD-2168 which, for several years, governed the procurement of MCCS. More recently, DOD-STD-498 has been implemented, a variant of which will likely be adopted as the industry standard. With Secretary of Defense Perry's June 29, 1994 Memorandum *Specifications and Standards—A New Way of Business,* clearly the trend is away from rigid, formalized DOD standards. Industry "best practices" are to be adopted whenever feasible.

Yet another pressing problem for MCCS procurement is the lack of a disciplined "software engineering" approach to development. Software development has long been looked at more as an "art" than a "science." However, there are now clear indications that "software engineering" principles are becoming the industry standard or norm. The establishment of the Software Engineering Institute (SEI) and subsequent SEI assessments of potential software contractor capabilities are two such indicators. Though recently coming under fire as too limited, manual in nature, and cumbersome, the SEI assessments are a step in the right direction from the perspective of DOD procurement policy.

The above cited factors: lack of management oversight, uneven application of standards/lack of standards, and the lack of a disciplined software engineering approach to software development must all be addressed by the PM and/or CO if they are to bring about more effective and efficient MCCS procurement.

Addressing the Shortcomings

• *Management Oversight.* Sufficient and effective oversight begins with education and training for the personnel involved. The PM Course at the Defense Systems Management College is a clear example of this. This type of education and training should be available to all personnel involved with software development and procurement. This shortcoming can be further mitigated through contractual specification of contractor provided software engineering management personnel with the requisite skills and experience needed to supervise the technical effort.

Another tool available to the program office is the use of an independent verification and validation (IV&V) organization to monitor the software development process. The use of this type of entity should be addressed in the Test and Evaluation Master Plan (TEMP) for a procurement, but must also be called out in the development/production contract. The role of the IV&V organization is simply to ensure for the government that the contractor is performing his duties as specified by the contract.

Additionally, contract type needs to be considered when deciding how an MCCS product will be procured and the requisite level of oversight. The main determinant when deciding the type of contract is, of course, risk assumption. In this regard, the contract employed is a function of the type of buy, or the developmental stage of the product, being contracted for.

For production-type buys where designs have been stabilized, the fixed price type of contract is typically employed. The main advantage to this type of contract in this scenario is the limited administrative overhead required. Here, the contractor assumes the technical, schedule, and cost risk.

Where development and design efforts are required, the cost reimbursement type contract usually yields the most satisfactory government-contractor relationship. Here, the contractor is relieved of the cost risk associated with the developmental program. Additionally, the contractor is free to explore innovative approaches that may result in marked improvements to both the developmental process and the final product. The disadvantage is that there is no cost control and administrative overhead activities and costs are typically much higher. Most agree, however, that in the case of MCCS procurement, the additional administrative activity is desirable and the costs are well worth it. The "bottom line" is cited in the FAR. It states that contracts, "may be of any type or combination of types that will promote the Government's interest..."

• *Application of Standards.* Moving now to the need for an even application of standards for effective MCCS procurement, the author need only cite an instance where this was not accomplished, to show its importance. In the instance of the Air Force's C-17 aircraft, the General Accounting Office (GAO) cited numerous instances where the Air Force program office either did not enforce standards or even apply existing standards. An excerpt from the May 1992 report follows:

> *Because of its mistaken assumption that software would not be a large part of the C-17's development, the Air Force did not make Military Standard 52779A a part of the full-scale development contract. Consequently Douglas Aircraft was not required to establish—and in fact did not establish—the type of software quality assurance program required by military standards.*

As of the date of the report, the C-17 program was a full two years behind schedule and $1.5 billion over its 1985 estimate of $4.1 billion. The point to derive from this observation is not that problems are coming about because of an inherent lack of standards. In many cases, the difficulties and failures are being experienced because of a failure to apply or enforce existing DOD standards.

Indeed, DOD has gone to great lengths over the last 20 years to ensure that software development/procurement standards exist and are adequate. Most recently, DOD-STD-498 was implemented to replace all pre-existing standards for MCCS procurement. This latest standard will eventually be replaced by an IEEE or commercial standard. It is even less restrictive or formal than the previous MIL-STD-2167A. The general intent is to allow further "tailoring" of activities and documentation to specific projects. The idea is to reduce redundant and "zero value-added" efforts and products, while still applying a framework in which to operate. Incorporation of "best" commercial practices is implicit in this change.

• *Software Engineering Environment/ Approach.* The last area that this article ex-

plores is the software engineering approach/environment. If the PM and CO are to optimize the MCCS procurement effort, they need to pay particular attention to this last aspect. Because of the limited scope of this article, the author intends only to highlight some key initiatives and/or mechanisms at the disposal of the CO and/or PM. These, if properly employed, can go a long way in ensuring that the software development/procurement environment is optimized. These mechanisms include the software development capability and capacity review (SDCCR), the software capability evaluation (SCE), and metrics application.

A software development capability and capacity review can be used in conjunction with the source selection process. Its purpose is to review and assess an offeror's capability and capacity to develop the software required on a particular weapon system program as defined in the RFP.

As described in ASD Pamphlet 800-5, *Software Development Capability and Capacity Review*, the review process accomplishes three objectives. Through the process, the acquisition team gains an in-depth understanding of the offeror's software development methods and tools. Second, the capability and capacity of the offeror to develop the required software is determined. Third and last, the review process elicits from the offeror a contractual agreement in which he agrees to implement the methods, tools, practices, policies, and procedures which form the structure and discipline for the development process. Another, possibly more comprehensive way to assess an offeror's software development capability is through a software capability evaluation.

This software capability evaluation has been used successfully by the Naval Air Development Center, the Air Force Electronic Systems Division, and the Army Communications and Electronics Command. Developed by the Software Engineering Institute at Carnegie Mellon University, this method determines the strengths and weaknesses of a contractor with respect to a maturity model, the capability maturity model (CMM). A process assessed at Level 1 (initial) in this model is characterized as unstable and unpredictable. At the other end of the spectrum, the Level 5 (optimizing) process is described to be one where, causes of poor performance are identified and eliminated, the process is continually improved, and the process capabilities are continuously enhanced.

The SCE is similar to the SDCCR in its execution, carried out primarily through the use of a comprehensive questionnaire, interviews with software development and management personnel, and facility visits. Though criticized by many field experts as being too inflexible, incomplete in its coverage, and cumbersome, the SCE is still seen by many as an excellent tool for procurement personnel.

The final issue that this research paper examines—the application of metrics (measurements)—is of paramount importance for the effective and efficient procurement of MCCS. Here more than anywhere else, the CO and/or PM must be attuned to the adequate and appropriate use of these mechanisms.

Software metrics may be divided into three areas: management metrics, quality metrics, and process metrics. Process metrics are those that deal with the techniques, tools, procedures and policies of organizations. The SCE is a clear example of an evaluation that utilizes process metrics. Quality metrics are those concerned with product attributes which affect performance, user satisfaction, supportability and ease of change. Some examples of quality metrics include error density, reliability, portability, and expandability. Both of these types of metrics can be thought of almost as subsets of management metrics, the indicators which help determine progress against plan. These indicators are selected from various "drivers" which have an impact on the required effort, its cost, and schedule.

The program office should both establish a baseline to measure against and develop a plan for metric formulation and application. The intent here is to attempt to estimate the pertinent parameters and determine the level of "breakout" needed when measuring critical components. The bottom line objective is to provide adequate insight into the software development process. A few recommended metrics that are appropriate for all programs are listed in Table II.

Although there are many other metrics available to the CO/PM, the list in Table II highlights those that should be made available to the PM on at least a monthly basis. Though attempts should be made to minimize the administrative effort needed on behalf of the contractor, these metrics will prove invaluable to the program office in detecting early trouble, adjusting plans effectively, and forecasting future progress.

Conclusion

Effective and efficient procurement of MCCS presents government personnel with many challenges that demand our utmost attention and efforts. As has been discussed, government procurement personnel can go a long way in ensuring that the government is truly getting its money's worth when it comes to MCCS. Paramount in this effort is that appropriate contract types are constructed and agreed to, appropriate standards are applied and enforced, and software engineering principles and concepts are in place. To do anything less is unacceptable. This is especially true in today's environment of shrinking resources.

Table II.
Software Development Metrics.

- SOFTWARE SIZE AND COST STATUS
- MANPOWER APPLICATION STATUS
- COST AND SCHEDULE STATUS
- RESOURCE MARGINS
- QUANTITATIVE SOFTWARE SPEC STATUS
- DESIGN AND DEVELOPMENT STATUS
- DEFECTS/FAULTS/ERRORS/FIXES
- SOFTWARE PROBLEM REPORT STATUS

CPT KEITH EDWARDS was a student at The Naval Postgraduate School in Monterey, CA, when he wrote this article. He has 10 years of experience in operational Army aviation assignments. He was scheduled for assignment to the office of the PEO, Aviation, St. Louis, MO, at the time he submitted this article for publication.

ARMY ACQUISITION LEADERSHIP*

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Dr. Kenneth J. Oscar

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MG Jan A. Van Prooyen

Deputy Assistant Secretary for Plans, Programs and Policy and Deputy Director, Acquisition Career Management
Keith Charles

Deputy for Combat Service Support
BG Roy E. Beauchamp

Deputy Assistant Secretary for Research and Technology and Chief Scientist
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Warren, MI
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M1A2 Abrams Tank System
Warren, MI
Product Manager
LTC George B. Patten

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Warren, MI
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Armored Gun System, Armaments (AGS ARMT)
Warren, MI
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*This listing is current as of presstime.

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FIRE CONTROL RADAR (FCR)
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KIOWA WARRIOR
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Forward Area Air Defense Command and Control (FAAD C2)
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GLOBAL POSITIONING SYSTEM
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Crusader Resupply
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Fort Monmouth, NJ
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FIREFINDER
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Ground Based Common Sensor - Light
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Susian Vickers

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Hellfire II
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Longbow Hellfire Missile System (Hellfire LB)
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Improved Army Tactical Missile System (IMP-ATACMS)
Redstone Arsenal, AL
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Improved Brilliant Anti-Armor (IBAT)
Redstone Arsenal, AL
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CLOSE COMBAT ANTI-ARMOR WEAPON SYSTEMS (CCAWS)
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LIGHT TACTICAL VEHICLES (LTV)
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M113/M60 FAMILY OF VEHICLES (FOV)
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LTC Lauren S. Davis

SMALL ARMS
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TRAILERS
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THEATER TARGETS PRODUCT OFFICE (TTPO)
Huntsville, AL
Product Manager
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Fort Huachuca, AZ
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Thomas J. Michelli (Acting)

ARMY INFORMATION SYSTEMS (AIS)
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Thomas J. Michelli

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Edward Howe (Acting)

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LTC Ronald P. Heuler

Small Computer Program (SCP)
Fort Monmouth, NJ
Product Manager
LTC Mary Fuller

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Fort Belvoir, VA
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U.S. ARMY MEDICAL RESEARCH ACQUISITION ACTIVITY
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Commander
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COL George E. Lewis Jr.
Deputy Program Manager
Dr. Ronald E. Clawson (Acting)

Biological Systems
Fort Detrick, MD
Project Manager
Dr. Ronald E. Clawson (Acting)
Biological Defense Team Leader
Dr. Judith G. Pace
Infectious Diseases Team Leader
Dr. Richard H. Kenyon

Pharmaceutical Systems
Fort Detrick, MD
Project Manager
Dr. Ronald E. Clawson

Applied Medical Systems
Fort Detrick, MD
Project Manager
Dr. James H. Nelson

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MG Robert W. Drewes (USAF)

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COL Charles D. Bartlett

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DRPO HONEYWELL/ ALLIANT TECHNICAL SYSTEMS
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Commander
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LTC William Phillips

DPRO MCDONNEL DOUGLAS MESA
Mesa, AZ
Commander
COL Alvin D. Cantrell

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Commander
GEN Wayne A. Downing

Acquisition Executive
Gary Smith

ARMY SPECIAL OPERATION FORCES PLANNING AND REHEARSAL SYSTEM
Fort Eustis, VA
Product Manager
LTC Ronald J. Nelson

ARMY SPECIAL OPERATION FORCES A/MH-6 HELICOPTER
St. Louis, MO
Product Manager
LTC Bruce E. Gage

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Program Manager
COL (P) John C. Doesburg

Deputy Program Manager
Winifred L. Farelli (Acting)

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LTG Albert J. Edmonds (Air Force)

DEFENSE INFORMATION SYSTEM NETWORK (DISN)
Falls Church, VA
Program Manager
COL Marlin G. Forbes

DISN System Integration Project (DISP)
Falls Church, VA
Product Manager
LTC Theodore P. Mouras

CRUISE MISSILES PROJECT AND UNMANNED AERIAL VEHICLES JOINT PROJECT Washington, DC

Program Executive Officer
RADM Barton D. Strong

Deputy Program Executive Officer
Barry L. Dillon

JOINT TACTICAL UNMANNED AERIAL VEHICLES (UAV)
Redstone Arsenal, AL
Project Manager
COL Michael I. Howell

Joint Tactical Unmanned Aerial Vehicles - Maneuver
Redstone Arsenal, AL
Product Manager
LTC John H. Hug

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LTG Edward D. Baca

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MG William A. Navas Jr.

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Maureen Lischke

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MG Roger G. Thompson Jr.

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Project Manager
Jacquelyn Henderson

TRANSPORTATION COORDINATOR AUTOMATED COMMAND AND CONTROL INFORMATION SYSTEM (TC ACCIS)
Arlington, VA
Project Manager
LTC Michael C. Cox

TRANSPORTATION OPERATIONAL PERSONAL PROPERTY SYSTEM
Fort Belvoir, VA
Project Manager
Thomas Beasley III

WORLDWIDE PORT SYSTEM (WPS)
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Project Manager
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Daniel J. Rubery

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Dr. Richard M. Carlson

AEROFLIGHTDYNAMICS DIRECTORATE (AFDD)
Moffett Field, CA
Director
Andrew W. Kerr

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COL Randall G. Oliver

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Executive Director
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MG Gerard P. Brohm

Director, RD&E Center
Robert F. Giordano

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Fort Monmouth, NJ
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MG George E. Friel

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APG, MD
Technical Director
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MG James M. Link

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Research Triangle Park, NC
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Carmine Spinelli

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DCSPER
LTG Theodore G. Stroup

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NATIONAL GROUND INTELLIGENCE CENTER Charlottesville, VA

Commander
COL Robert Reuss

U.S. ARMY SPACE & STRATEGIC DEFENSE COMMAND Arlington, VA

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LTG Jay M. Garner

Deputy Commander
Huntsville, AL
Vacant

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U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND (USAMRMC) Frederick, MD

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Hank S. Gardner

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Fort Sam Houston, TX
Commander/Director
COL Basil A. Pruitt Jr.

U.S. ARMY MEDICAL MATERIEL DEVELOPMENT ACTIVITY (USAMMDA)
Frederick, MD
Commander
COL George E. Lewis

U.S. ARMY MEDICAL RESEARCH ACQUISITION ACTIVITY (USAMRAA)
Frederick, MD
Director
Greg Doyle

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APG, MD
Commander
COL James S. Little

U.S. ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASES (USAMRIID)
Frederick, MD
Commander
COL David R. Franz

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COL Joel T. Hyatt

WALTER REED ARMY INSTITUTE OF RESEARCH (WRAIR)
Washington, DC
Director/Commandant
COL Enest T. Takafuji

BLUEPRINT FOR ARMY ACQUISITION REFORM

By COL Robert S. Jeska
and Susan M. Erwin

Introduction

The Army has approved an exciting new acquisition reform plan which is described in this article. The objectives of Army acquisition reform are to encourage acquisition professionals to be innovative, to use good business judgment, and to constantly improve processes to obtain the best equipment and services possible, on time, and at the lowest overall cost. The means to achieve these objectives naturally deal with people and processes. Eliminating unnecessary overhead and institutionalized impediments requires a trained and empowered work force with the requisite tools and models with which to make local process improvements. To help guide these local efforts, this article provides a glimpse of some of the changes that the assistant secretary of the Army (research, development and acquisition) (ASA(RDA)) is pursuing.

In simplest terms, the desired outcome of acquisition reform is to get the best value for every dollar spent. Success is vital because Force XXI modernization accounts are significantly underfunded. Historically, the ratio of procurement to R&D dollars has been 3-to-1. Today, and for the near future, that ratio is 1-to-1 of a smaller RDA budget. Congress helped with new legislation last year and is working on more relief this year, but we must also help ourselves by making acquisition processes more efficient, while maintaining responsiveness to user needs.

What follows is a list of concepts, ideas and tools to aid local efforts in improving processes. They are organized and defined below by six thrust areas, as presented to Army Chief of Staff GEN Dennis J. Reimer on Nov. 22, 1995, and Secretary of the Army Togo D. West on Jan. 10, 1996. Some are already proving successful. All are being implemented in some fashion. A multidisciplined acquisition reform task force, chaired by Dr. Kenneth J. Oscar, deputy assistant secretary of the Army for procurement, is working to implement all of them in a manner that makes business sense.

1. Requirements/Budget Process

• *Use integrated process teams (IPT) early in the requirements process with unit and life cycle costs.* Combat and materiel developers, industry and staffs must work together early to develop requirements. TRADOC is staffing a new pamphlet to revise the process. Requirements must contain realistic unit cost and life cycle cost minimums and targets in order to permit trade-offs with performance targets throughout the acquisition cycle.

• *Expand the cost-as-an-independent-variable (CAIV) concept to all programs.* Acquisition documents must define performance that is affordable, not performance at any cost. The Army has two pilot programs ongoing: Crusader and the Army Tactical Missile System-Brilliant Anti-armor Submunition. The Office of the Secretary of Defense (OSD) has encouraged the use of CAIV on acquisition category 1D programs.

• *Modify cost and operational effect analysis (COEA) to include CAIV.* Integrate CAIV and COEA objectives into a single document.

• *Force XXI Wedge.* Establish a new program element of $50-$100M allowing the chief of staff to quickly capture emerging technology and battle lab requirements for timely integration into ongoing developments. Double reprogramming authority for faster new starts and program stability. The Army is working with OSD to increase Service authority to reprogram up to $8 million for research, development, test and evaluation, and $20 million for procurement. This will provide for more rapid new starts and help stabilize program turbulence.

In simplest terms, the desired outcome of acquisition reform is to get the best value for every dollar spent.

2. Reduce Overhead

• *Target single process plants.* This concept replaces multiple, DOD-unique manufacturing processes with only those required to satisfy all customers. Because the pilot program at Raytheon in Andover, MA, has proven successful, Army program executive officers have established cooperative efforts through the Defense Contract Management Command (DCMC) for implementing common processes at 10 other contractor facilities. Secretary of Defense Dr. William J. Perry has authorized DCMC to negotiate block changes by facility, instead of contract by contract.

• *Reduce excess ammo surge and backup capacity to match validated requirements.* LTG John G. Coburn, deputy commanding general, U.S. Army Materiel Command, commissioned a study to determine whether there is a less costly way to provide ammo surge and backup capability than the current method of maintaining inactive plants, which costs more than $200 million annually.

• *Size new manufacturing arsenals to match requirements.* Tailor the production capability of arsenals that make new equipment to valid needs.

• *Expand the use of fixed price performance based-contracts in base operations.* Encourage a preference for fixed price contracts, when appropriate, using performance based statements of work and past performance as source selection factors.

3. Reduce Barriers

• *Contingency contracting.* Work to enhance contracting support by raising the threshold for simplified procedures to $200,000 and expanding the definition to include all military deployments and exercises.

• *Expand the use of electronic commerce and electronic data interchange.* Move toward end-to-end paperless commerce to expedite contracting business. Get 100 percent of the Standard Army Automated Contracting System hooked up by the beginning of FY 97, and all of the Procurement Automated Data and Documentation System on line by the end of FY 96.

• *Expand the use of credit cards to include payments.* Set a goal of 80 percent for micropurchases ($2,500 and below). Work toward streamlined requirements for using credit cards for purchases up to $25,000, and an unlimited threshold for payments in instances where it makes good business sense.

• *Exempt critical Acquisition Corps personnel from DOD Priority Placement Program (PPP).* Fill certain critical acquisition positions with best qualified candidates, rather than fully qualified candidates from PPP.

• *Simplify type classification (TC)/ materiel release (MR) processes.* There are about 20 documents required for TC and 17 for MR. Nine are common documents provided at TC and updated for MR. These processes are designed to facilitate maintenance efforts and to eliminate the risk of fielding bad equipment. Achieving these ideals must balance a reasonable risk of failure with the costs of maintaining these processes.

4. Test & Evaluation (T&E)

• *Return authority to Army.* Working with the director, operational test and evaluation, select a pilot system for T&E by the Army. The objective is to return authority to the Services for test and evaluation on all but acquisition catagory 1D programs

• *Go to a single T&E process.* Combine all T&E into a single process.

• *Go to a single test/simulation/ evaluation master plan.* Leverage advances in computer technology to streamline acquisition processes. Use modeling techniques to test and evaluate system design without building a hardware prototype. Encourage the use of simulation in place of more expensive operational testing, developmental testing, and live fire alternatives.

• *Expand the use of spiral development testing to all systems.* This idea has saved time and money in testing software, particularly when the required performance is not immediately achievable. Test the fielded baseline, then test only successive improvements, not the entire development.

• *Reduce sample lot testing on production contracts.* Use process capability metrics or historical testing results to reduce lot testing requirements, while maintaining acceptable control over risk.

5. Production/Fielding Strategy

• *Expand the use of multiyear contracting for appropriate production programs.* This allows the contractor to plan for extended contract performance and pass savings to the Army; however, the Army must commit to funding outyears. Work with other Services to combine buys into single multiyear contracts. Each Service would derive pro rata volume-based discounts from the contractor. The Army is working with the Navy and Marines to combine production quantities for the Blackhawk helicopter.

• *Accelerate programs by increasing production rate.* Program "stretch-outs" create inefficient production rates. We could save money by accelerating high priority programs at the expense of lesser priority efforts.

• *Aggressively retire equipment, leasing or rebuilding where appropriate to fill the gap.* The oldest 10 percent of the equipment accounts for 30 percent of operating and sustainment (O&S) costs. We need to find ways to more rapidly retire equipment by perhaps leasing commercial equipment to fill gaps.

6. Sustainment

• *Modernize through spares.* This concept leverages normal maintenance expenditures by incentivizing the original equipment manufacturer to bundle spare parts into components and product improve components. Use spares funding not only to maintain equipment but to increase durability, maintainability and performance in a block-improvement fashion.

• *Reduce inventory by 20 percent.* Use direct vendor delivery, and various requirements-type contracts to cut order-ship time, reducing supply pipeline and corresponding inventories.

• *Reduce contract award and delivery time by 50 percent.* Improved requirements from an IPT process should reduce administrative and production lead-times by facilitating contract award and performance.

• *Revise equipment disposal process.* Change of the disposal process is necessary so the Army gets a percentage of the selling price or a trade-in discount against new equipment.

• *Create a revolving fund for O&S cost proposals.* A proposal is being staffed to establish funds for a high return on investment proposals which will save funds in the long run. Fifteen percent of the Army's share of Small Business Innovative Research Programs will be set aside for O&S cost reductions efforts. The use of 1 percent of Defense base operating funds will be allowed for new cost savings ideas for spare parts.

Summary

Constrained resources will continue to limit new developments to a few vital combat multipliers, so all aspects of the acquisition process must reflect a commitment to quality and sound management principles. Rising to the challenge, acquisition professionals throughout the Army are finding innovative ways of getting the most out of every dollar invested to facilitate the enormous modernization efforts required to equip, sustain, and maintain the dominant landforce of the 21st century.

COL ROBERT S. JESKA was the director of Army acquisition reform when he wrote this article. He holds a degree from the U.S. Military Academy, and has an M.S. in contracting and acquisition management and an M.B.A. from Florida Institute of Technology. He has also completed the PM Course at the Defense Systems Management College and the Army War College.

SUSAN M. ERWIN is assigned to a one-year developmental assignment in the Office of the Deputy Assistant Secretary of the Army for Procurement. Erwin has also served as competition advocate, small business specialist, contracting officer and career program manager.

ORAL COMMUNICATIONS IN THE SOURCE SELECTION PROCESS

By Thomas C. Meyer

Introduction

The term "best value contracting" is fairly new to government jargon, but the concept is not. Ever since George Washington's dentist gave him a choice between oak or maple dentures, the government has made acquisition decisions based on considerations in addition to price. The use of oral communication with offerors during the evaluation process leading up to those decisions is not new either. However, while there is some variation among agencies and activities, government acquisition personnel generally have tended to rely much more heavily on written communications in their best value source selections. The most often cited reason for avoiding oral communication is the fear of loss of control leading to technical transfusion and protests. History, however, suggests that the problem of technical transfusion is extremely rare, but that the lack of meaningful discussions is a frequent complaint. Oral communication, when sufficiently thorough and comprehensive, can significantly reduce this problem.

With the renewed emphasis on improving our processes, cutting costs and lead-times, and working better and closer with industry, the expanded use of oral communications in the source selection process is a technique that deserves consideration. This article deals with three applications of oral communications: oral proposals, oral presentations, and oral discussions.

Oral Proposals

Oral proposals are presentations by an offeror of his proposal and supporting information by means of a briefing or video in lieu of a written proposal. Use of oral proposals in best value acquisitions is a fairly recent initiative as agencies look for innovative ways to streamline the process and reduce time and cost for both government and industry. Pilot programs in several civilian agencies have used this approach, and a few DOD activities are also in various stages of experimentation. Most of these acquisitions have been service contracts—guard services, technical support, etc. The oral proposal covered only selected non-cost evaluation areas and was supplemented by a written proposal addressing other areas such as cost and past performance information.

Advice from those who have tried this approach include some common recommendations that should serve as guidelines for any oral proposal plan. These include:

- Schedule presentations tightly to avoid providing an advantage to any one offeror;
- Require the offeror's project manager, and key project personnel who will be responsible for contract performance, to present the briefing, not marketing staff;
- Establish a specific minimum agenda addressing solicitation requirements and evaluation criteria, and a time limit;
- Videotape the presentation and require copies of any charts or other visual materials used;
- The contracting officer and all relevant evaluation team members should attend; attendance by the source selection official should also be considered;
- Permit sufficient dialogue during the presentation to ensure effective communication and understanding of what is being presented;
- Prepare the evaluation immediately after the presentation or very shortly thereafter, preferably before the next offeror's briefing.

While there were many similarities in the several pilots conducted, there were also some differences. In the case of a NASA acquisition for guard services, offerors were asked to submit limited preliminary information on their background and experience, financial capability, past performance, and cost. This information was used to make a pre-qualification determination to invite only those meeting minimum requirements and within the competitive range to brief their technical approaches. Industry's reaction to this approach seemed to be favorable, saving their scarce resources, funds, and time, as well as the government's.

In some of the pilots, the offerors were also required to respond extemporaneously to hypothetical cases or problems presented by the government. The purpose of this "pop quiz" was to get an appreciation for the thoroughness of the offeror's understanding of the requirements of the contract and his grasp of the intricacies involved, and to minimize the influence of professional proposal writers and good "song-and-dance men."

In at least one of the pilots, the evaluators were not permitted to be present and viewed the presentations on videotape. They had no immediate opportunity to ask for clarifications or explanations of the material presented, much less subject the offeror's team to any probing questioning. It is difficult to appreciate any benefit of such restrictions. Rather, they would seem to negate important advantages of the oral proposal approach. If the video presentation was only intended to save evaluation time, limiting the proposal page count would seem to have served the same purpose.

A common concern that seems prevalent regarding oral proposals (as well as oral presentations discussed later) is the issue of whether communication by the government during such presentations will constitute "discussions" within the meaning of FAR 15.601. This concern appears to emanate from those who desire to avoid "discussions" and the FAR requirement for best and final offers. However, there appears to

be more than enough latitude in Government Accounting Office decisions to allow clarifications and questioning without trespassing into the realm of discussions and best and final offers. The *Nash & Cibinic Report* (September 1995) has a fascinating discussion of this issue.

The consensus of those who have tried oral proposals seems to be that the process worked well, saved time and money, allowed a comprehensive evaluation, and is a promising tool. It seems to be particularly suited to service contracts where the selection decision is based on experience, competence, and qualification-related criteria, rather than specific design solutions that require more detailed analyses. Other source selection streamlining initiatives should be used in conjunction with oral proposals. Limiting criteria, disciplining the fact finding process, and using oral discussions are other techniques that will help maximize the benefits of the oral proposal technique. It seems false economy to use oral proposals if other aspects of the evaluation will prolong the award decision for four or five months.

Oral Presentations

Oral presentations are briefings presented in conjunction with a written proposal, but not as a substitute. They provide an overview and explanation of an offeror's proposal structure and significant features of the proposed approach. Their purpose is to assist the evaluation team in getting a fast start on the evaluation. They are best used when proposals are large and complex or address critical or high risk technologies.

While some offerors have welcomed the opportunity to "make their pitch," with an oral presentation, others have found it a burden after a demanding proposal preparation effort. The obvious lesson is that the expected benefits must outweigh the time and expense to both the government and the offerors. In some cases presentations can be limited to specific areas only. One area that has proven to benefit greatly from such limited presentations is the cost area. Where complex cost and pricing information is required, the cost proposals invariably consist of numerous cost elements, tables, and schedules that should track to the work breakdown structure. A couple hours of across-the-table dialogue between the contractor's cost team and the government cost evaluators, walking page-by-page through the cost volume, can save days or weeks of the evaluators' time struggling to track through each contractor's unique cost system. Even conference calls can prove useful for these limited dialogues and have the advantage of saving significant travel time and expense.

There are at least two important lessons learned regarding oral presentations:

• They must be held very soon after proposals are received—within a couple days at most. Beyond that point the evaluators usually have waded into the proposal and are too far along to benefit from an overview.

• Adequate dialogue between the offeror and the government evaluators must be permitted to ensure that the presentation has been clearly communicated and understood. Overly restrictive rules on who should attend the presentations and what dialogue is permitted rarely serve any useful purpose but only confuse the evaluators, frustrate the offeror, and extend the evaluation process. As suggested above for oral proposals, attendees should be able to ask for clarifications and explanations in sufficient depth and preciseness to ensure that the government team clearly understands the meaning and intent of what it is evaluating. This does not have to extend as far as discussions within the meaning of FAR 15.601, if that is important to you.

Oral Discussions

Oral discussions include communication of suspected errors or omissions, requests for clarification, and the disclosure of deficiencies and significant weaknesses. More than any other facet of the best value process, oral discussions have been proven to reduce evaluation time, improve the quality of the evaluation, increase industry's confidence in the process, and reduce protests. This approach has been a key element in the U.S. Army Tank-automotive and Armaments Command's success in reducing its formal source selection time to 60-90 days.

Experience has shown that a thorough oral dialogue significantly improves the understanding by the offeror of the government's requirements and concerns. Just as importantly, it improves the government's understanding of the offeror's proposed solutions. Written discussions often fail to provide the depth of understanding that an across-the-table dialogue can provide, and always take longer. The ability to immediately ask follow-up questions, clarify answers, and elaborate on issues and concerns makes oral discussions an important technique to ensure meaningful discussions.

Because of these important advantages, any initiative to restrict or eliminate discussions in the interest of streamlining should be seriously questioned. Too often, the process is looked on as a concession to industry, ignoring the most important reasons for holding discussions—that is, to allow the government the opportunity to select from among proposals that have optimized their approaches to meet its performance and cost objectives. Oral discussions not only save overall time, but improve the government source selection authority's ability to make an informed decision of which proposal truly represents the best value. The alternative is to settle for selections that are less than optimum, and made without the benefit of knowing the scope or cost of corrective actions that may be necessary. Surely this adds schedule, performance, or cost risk.

Several important lessons learned should be considered when using oral discussions:

• To the maximum extent possible, the questions or issues should be provided to the offeror prior to scheduling discussion sessions to ensure understanding of the issue and the format and content expected in the response.

• Oral discussions are particularly helpful in expediting the evaluation of specific critical or complex areas of the evaluation. Don't forget the telephone as a means to discuss areas that don't merit the time or expense of travel.

• Attendance should include all relevant government evaluation team members to allow them first-hand information for the evaluation areas they are responsible for.

• The discussions should allow a thorough dialogue. Follow-up questions should be asked as they arise. The discussion must be adequate to ensure the offeror understands the government concerns and their basis, and the government understands what the offeror has proposed.

• Adequate time should be allowed prior to best and final discussion cut off to permit any necessary follow up clarification or response.

Conclusion

The use of oral communication offers significant benefits to both the government and offerors. They can save time and greatly improve both parties' understanding, thereby improving the quality of the evaluation and the selection. They also tend to increase industry's confidence in the process. While none of these techniques are new, their re-emphasis can be one of your most productive tools in improving and streamlining the acquisition process.

THOMAS C. MEYER is chief of the Systems Acquisition Assistance Team at the U.S. Army Tank-automotive and Armaments Command (TACOM) in Warren, MI. He holds a B.B.A. degree in marketing from the University of Toledo and an M.A. degree in procurement management from Webster University. He is a member of the Army Acquisition Corps, is a certified professional contract manager, and is a fellow with the National Contract Management Association.

Figure 1.
A 35-pound encased missile attached to a 14.5-pound command launch unit.

JAVELIN INNOVATIONS IN ACQUISITION

By COL Michael A. Roddy III
and Gerald S. Smith

Introduction

The thrust of this article is to report on innovations that are possible when events come together and necessity dictates. In the authors' opinions, every acquisition should be tailored to fit the situation. The business end of a program demands nearly as much attention as the program's engineering issues.

JAVELIN is a leap-ahead technology weapon system that replaces the Dragon's 30-year-old design. Just as Dragon was a significant advance over the 90mm recoilless rifle, so is the JAVELIN with its fire-and-forget imaging IR seeker a dramatic improvement over its predecessor. The JAVELIN software implementing the algorithms which permit automatic track of targets in clutter is a major factor in this unique and extraordinary weapon success.

The system shown in Figure 1 consists of a 35-pound encased missile that is attached to a 14.5-pound command launch unit. This 49.5-pound unit has a range of more than 2,000 meters and can kill any tank on the battlefield. A salient advantage over current command-to- line-of-sight missiles is gunner survivability since once he fires he can move or refire at another target. Several advanced training devices are also part of the acquisition.

Innovations

The JAVELIN rapid progress toward its first unit equipped (FUE) date was dependent on acquisition innovations. It would be nice to say everything was carefully strategized in the beginning but, unfortunately, because of our corporate ego, necessity is still the mother of invention. In the case of JAVELIN, the end of the cold war resulted in sharp decreases in production quantities with corresponding cost increases. Further, the plans for the competition of two qualified JAVELIN contractors, Martin Marietta Corporation and Texas Instruments, Inc, was not prudent because of the need to have absolute cooperation and information exchange. Also, the greatly reduced quantities would be further aggrieved by a split buy. One result was the formation of a joint venture (JV) between Martin (now Lockheed Martin) and Texas Instruments to share the program.

The teaming arrangement brought immediate benefits in improved cooperation between the two contractors who had, in the original planning, been groomed for competition. The second early benefit was the fi-

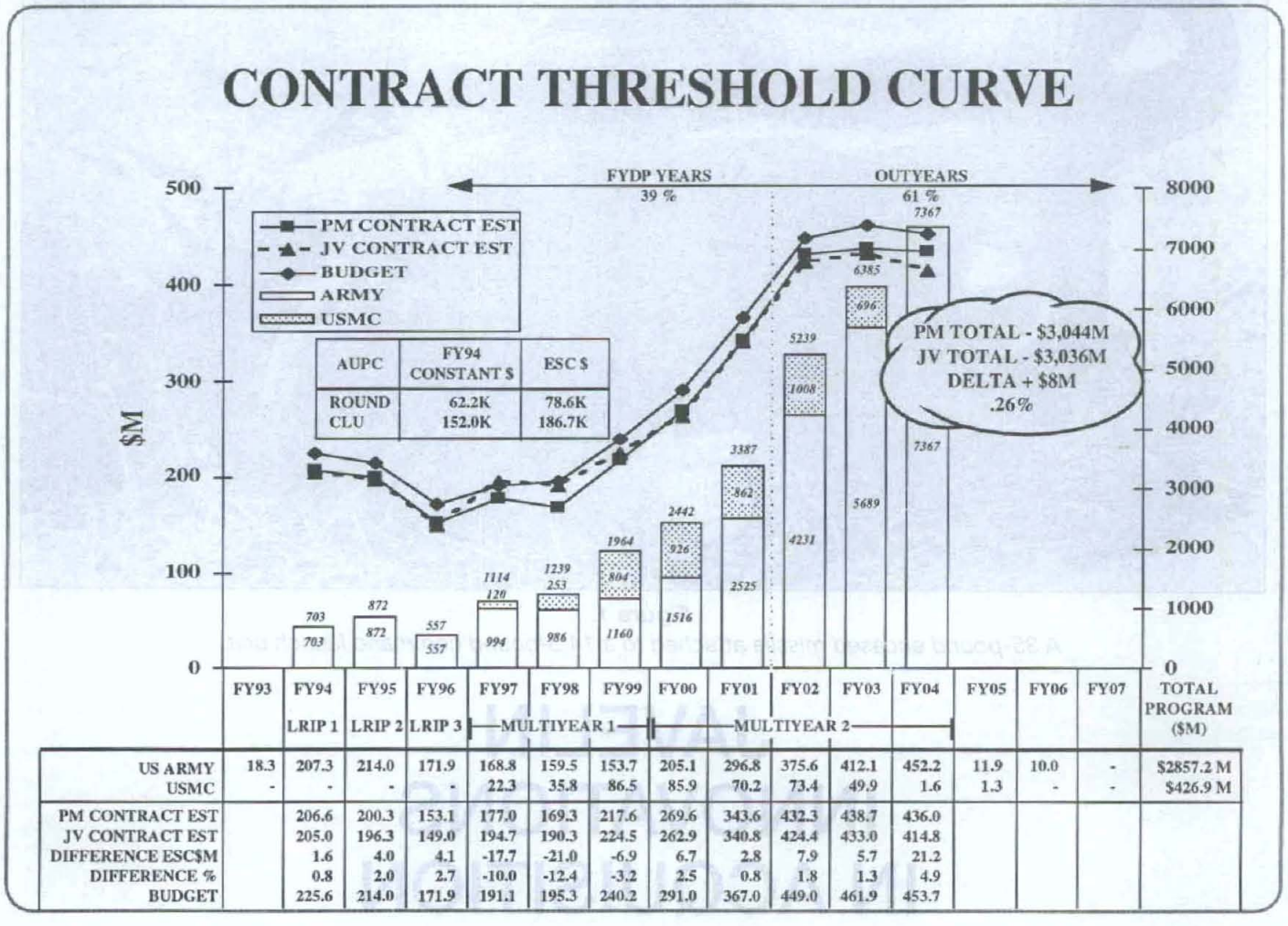


Figure 2.

nancial advantage to the JAVELIN program of avoiding the prime contractors add-on costs to subcontractors and vendor prices by the JV overhead structure. Since 65 percent of the program cost is JV purchases, this represents a sizable savings.

After overcoming difficult technical challenges and completing an extremely successful Initial Operational Test and Evaluation (IOTE), the system was ready for a production release. The 49 hits for 54 shots under countermeasures and other adverse conditions had removed any technical doubts. However, the reduction from 70,550 to 31,269 missiles had increased unit costs. The Defense Acquisition Board (DAB) release to Low Rate Initial Production (LRIP) contained a proviso that we had to drastically cut costs. To do this, we formed a cost-reduction team, appointed an assistant project manager (LTC Phillips) and worked in an unprecedented fashion with the joint venture to slash costs.

Cost Reduction

The cost reduction plan (CRP) entailed several elements. We invested in an enhanced producibility program (EPP), which was RDTE funded. The purpose was to develop lower cost designs for the missile. We requested a seven-year period for value engineering (VE) royalties. We started a second EPP that included Command Launch Unit (CLU) design improvements and a built-in-test capability to avoid purchase of test program sets. The project then looked at the Army Missile Command's (MICOM) history on savings for component breakout (Government Furnished Equipment) and system level competition. We determined that we could show a gross savings, albeit with risk, of 12 percent, if we GFE'd the purchased components. We also believed that at least a 10 percent reduction could be achieved by system competition.

The use of multiyear contracting was also assumed to save 12 percent. These and other techniques which had been successfully used on other programs, such as TOW, resulted in creation of a "best price" model cost curve (Figure 2) on a year by year basis. The contractor was then challenged to meet our best price cost projections if he wanted to retain sole source status. The advantage to the government was getting competition prices without the expense and risk of tooling and qualifying new producers. The demise of traditional level III technical data packages (TDPs) under streamlining, in any event, makes system breakout an unknown proposition.

An example of approaches used to reduce production cost was replacement of military peculiar parts. We formed a separate team with support from a group in the MICOM System Engineering Production Directorate who find replacements for obsolete electronic parts. This group, led by Bob Gibbs, had the data bases and experience to look for commercial equivalents to military parts. The process shown in Figure 3 was used and the results provided to the JV. The JV response on one component, the en-

hanced producibility missile guidance unit, is shown in Figure 4. The net savings per missile by commercialization of the guidance electronics unit was more than $450.00. The savings in the command launch unit and training equipment are expected to be even more significant.

With our limited resources to invest in cost reducing design changes, it is even more critical to provide incentives for the second and third tier subcontractors and vendor to devote their resources to VE. The JV has offered to share any VE royalties with the suppliers. The contractor contends that to get vigorous and significant results they need a waiver to the 36-month period for receiving royalties. They have proposed, as part of the CRP, to have a seven-year period— from inception—to receive royalties. Part of the justification is the low quantities in early years. The request for this waiver has been processed through MICOM and the Army Materiel Command to the Department of the Army.

The JV has hosted a major supplier meeting to foster enthusiasm for VE and the seven-year extraordinary period was a centerpiece of their speech. With our cost curve agreement, it seems a winning proposition for the government to spark the VE program with a seven-year royalty period.

After arriving at what the government thought was an accurate best price, the project briefed Program Executive Officer for Tactical Missiles George Williams, and Martin/Texas Instruments senior management on the plan. Signatures of the Joint Venture president, U.S. Marine Corps, PEO, and the Army acquisition executive (AAE) were obtained. A detailed briefing was given to Gilbert F. Decker, the AAE. His approval was obtained on Aug. 30, 1994. The plan was then forwarded to the Office of the Secretary of Defense to meet the September 1994 deadline set at the DAB.

This innovative acquisition technique required actions outside the norm for old timers (such as the authors of this article). Exposure of detailed budgets, cost models, projections of savings from breakout, competition, etc. was resisted. Only the complete support of George Williams and the AAE permitted success. Aftershocks from interest areas who had been bypassed by the rapid approval were dealt with and accommodated. We expect to do a yearly update to the plan to include changes in quantities and to clarify where needed. For example, one ingredient of the best price cost curve included hypothetical breakouts, component competition and system competition that we could and would do if the Joint Venture failed to meet the cost cure. The plan only initiates these actions if the JV does not find some way to meet the curve. The record to date is two procurement years where the contractor has submitted the traditional supported proposal for a number much higher than the cost curve but in the letter of transmittal has included a not less than number that meets our cost curve. This is revolutionary in getting a good price and avoiding the laborious and unproductive protracted negotiations in a sole source environment.

An important part of the CRP is tracking EPP return on investment and total savings. The JV assigned a senior and highly qualified engineering manager, Gary Koster, to spearhead the EPP programs. We, in the project, had a counterpart in Emil Luft. The CRP had a budget for investment in cost saving changes and a projected savings. A constant monitoring of project savings has, in some instances, caused us to kill a task with subpar results. The market, for example, may drive the original supplier to cut his cost to the bone and make the delta cost shrink even though the EPP cost did not change. The dynamic fertility of the EPP program constantly forces costs down and pushes stagnate suppliers to rethink their positions. In some instances, the return on investment caused us to look for new sources for the current design. This has been successful. For items containing proprietary design, such as the missile seeker focal plane array, we have established second sources. This has, in the case of the mis-

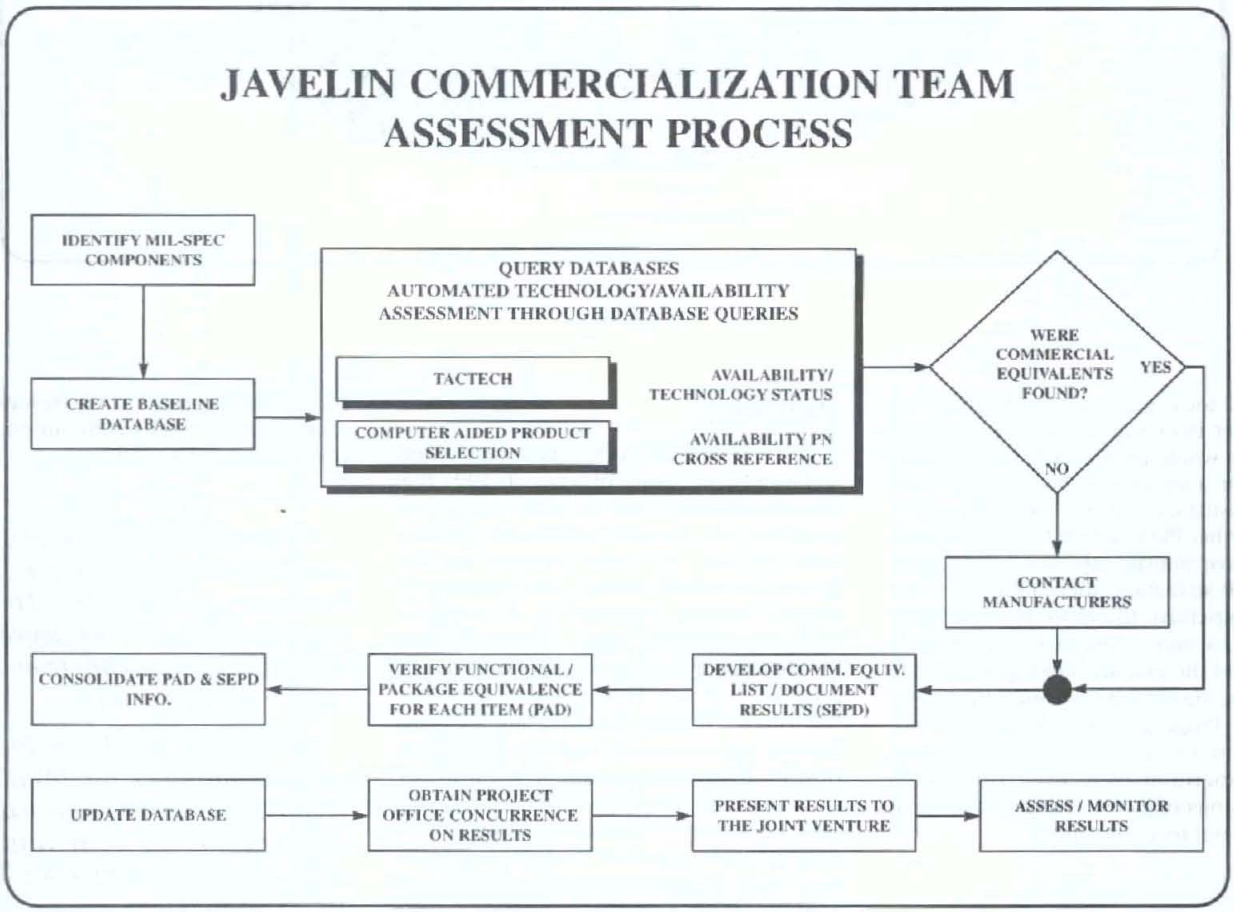


Figure 3.

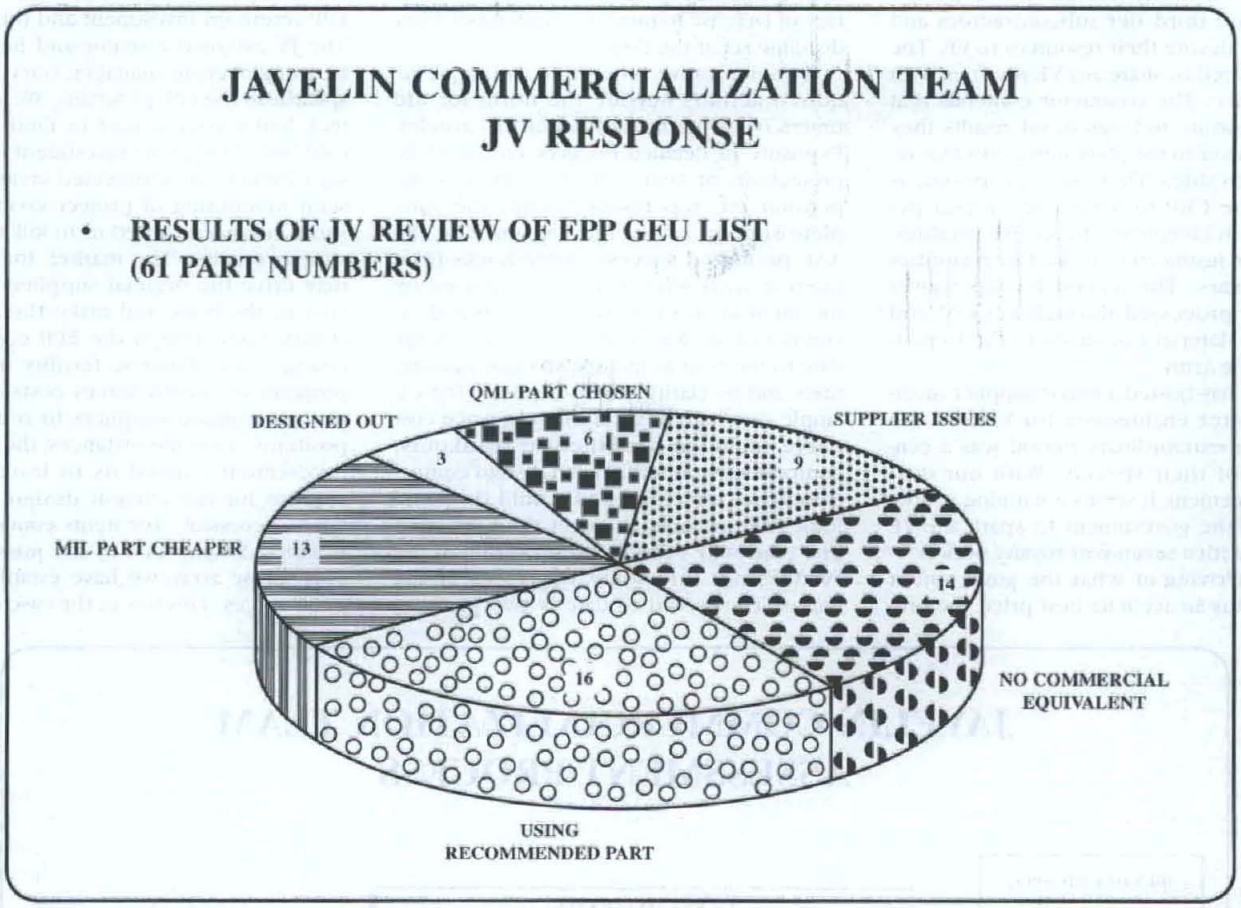


Figure 4.

sile seeker focal plane array, driven prices down faster than a quantity/learning curve calculation would predict. It is believed that the cost of maintaining dual sources with lower quantities is offset by competitive pricing. Other PEO Tactical Missiles weapon systems have emulated the JAVELIN CRP but to gain full advantage, there must be a real viable competitive threat to the contractor. The JAVELIN initial three-year low rate production and the gradual build-up to full rate give ample time to do a competitive procurement. Programs like TOW, where breakout, component competition, and system level competition were used, provided a basis for projecting cost savings in the event the JV did not meet the curve.

Summary

In summary, JAVELIN was an extremely technically successful program in 1994 that was perceived to cost too much. A team approach in the broadest sense with project, PEO, MICOM, DA, Army infantry and the Texas Instruments/Martin Joint Venture personnel working together cut $1.4 billion and three program years. The contractor has met, apparently somewhat painfully, the required cost curve. The first multiyear in '97 will be a further challenge and the proof that we can secure the benefits of competition in a team environment without the waste and risk of competitive training buys, split buys and winner-take-all buys. With your authors' combined 70 years in acquisition, there is paranoia when dealing with contractor business issues, waiting for the fish hook to appear. So far we have been pleasantly surprised at the results and will report further results with our planned multiyear buys starting in FY 97.

COL MICHAEL A. RODDY III is the project manager for JAVELIN, Redstone Arsenal, AL. He has an M.S. and a bachelor's degree in mechanical engineering from the University of Notre Dame.

GERALD S. SMITH is the deputy project manager for JAVELIN. An electrical engineer, he was previously deputy for TOW and CCAWS and system manager for Hydra-0 (2.75 Rockets).

THE DOD/RAYTHEON COMMON REQUIREMENTS INITIATIVE

By George G. Williams, James T. Steelman, and Edward M. Voelker

Introduction

For Department of Defense (DOD) and industry acquisition personnel, acquisition reform began like a shotgun wedding. The urgency was the result of a continually shrinking DOD budget. Although some individuals predicted that acquisition reform would not last, it has, in fact, endured with considerable vitality, despite some disappointing delays in achieving cost benefits.

Common Requirements

One acquisition reform initiative that is producing near-term results, however, is the DOD/Raytheon common requirements effort. The primary focus of this effort is on missile manufacturing programs of the Air Force, Navy, and Army at the Raytheon Company of Massachusetts (See Figure 1). The primary objective is to achieve significant near-term benefits in cost and schedule by establishing a common set of streamlined acquisition requirements.

Although initially targeted at only missile production activities in a single (Andover, MA) manufacturing plant, the effort was broadened to include business operations across the entire Raytheon Electronic Systems Division (RESD).

Under its current contracts, Raytheon satisfies differing Service and project requirements by either performing a unique process to accommodate each requirement or by applying the most stringent processes to all requirements. The resulting inefficiencies are spread across the customer base with penalties in extended schedules, and higher costs.

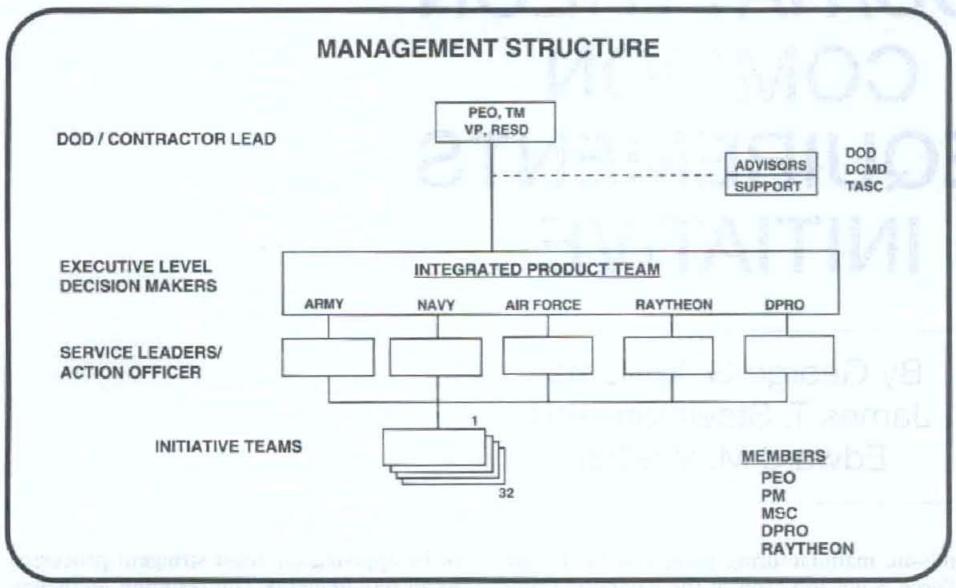
FIGURE 1

The potential benefit from this effort for the three military Services was near-term annual savings with no reduction in quality or performance. For Raytheon, the benefits were greater efficiency, and a shorter transition time to commercial practices, resulting in a more competitive posture for future business while protecting its business base.

The concern of single contractors having differing customer requirements was discussed by government and industry acquisition executives at the DOD PEO/System Command Conference in March 1995. The discussion resulted in Noel Longuemare, principal deputy under secretary of Defense (acquisition and technology), assigning leadership for a pilot effort to George G. Williams, the Army's program executive officer for tactical missiles (PEO-TM). The intent was to resolve concern at Raytheon. Williams worked with Bill Swanson, vice-president, RESD.

How could the concern be resolved? Fortunately, Raytheon had already begun a Reinvention Laboratory program with its resident Defense Plant Representative Office (DPRO). Joint teams were formed to identify opportunities for change. These teams produced 32 proposals with identified savings estimated at $16.3 million annually, plus potential for additional unspecified savings which were later estimated at $20 million annually.

On May 18, 1995, the PEO-TM convened the initial decision-maker meeting of the impacted PEOs, PMs, and major buying com-



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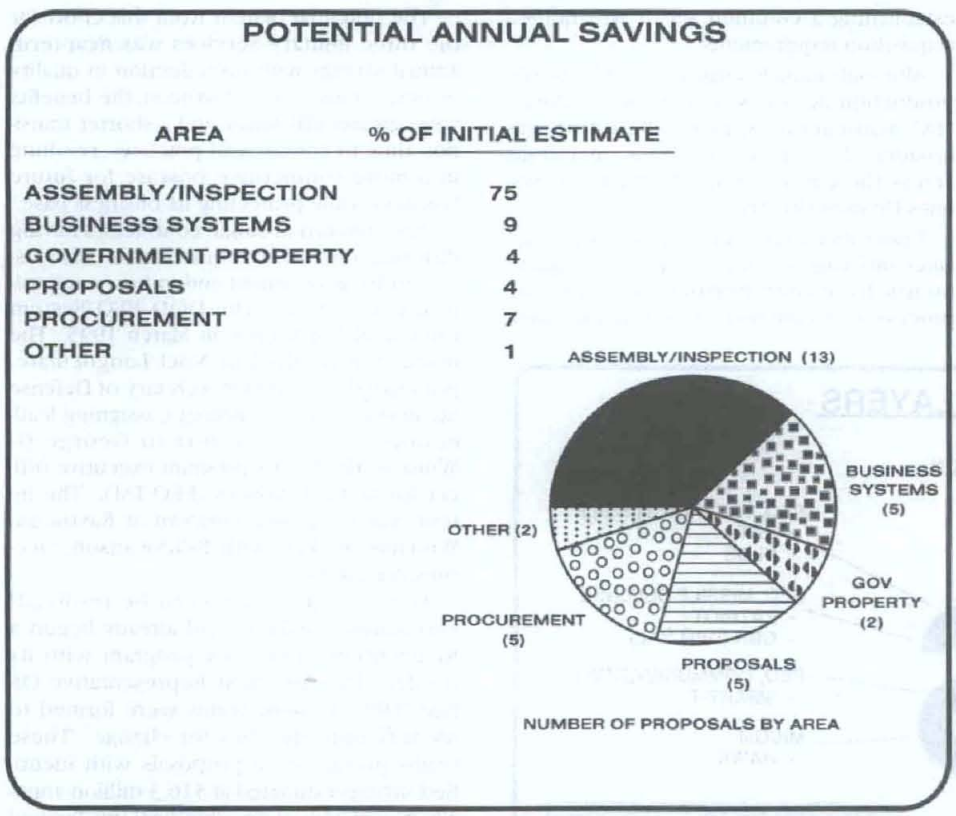


Figure 3.

mands from the three Services. At this meeting, the management structure was established (See Figure 2). A Service executive management structure, with Raytheon and DPRO participation, was established for coordination, direction, and decisions for each Service, Raytheon, and DPRO. This executive structure was supported by action officers who worked the day-to-day activities.

At the May 18, 1995 meeting, Raytheon and DPRO initially presented the 32 proposed concepts separated into the six areas (See Figure 3). The executives agreed to staff the proposals within their Service. There were some concerns but, since the proposals generally followed acquisition reforms being applied to new programs, all were acceptable in concept. Priority was on changes in assembly and test, where the greatest and most immediate savings were expected.

The challenge became one of taking conceptual proposals, incorporating government comments, and formulating realistic implementation plans. These plans would define the before and after processes, list team members for each proposal, identify the contracts involved, and contain meaningful schedules. Raytheon and DPRO drafted the initial plans which identified, from their standpoint, the what, who, and when required to implement changes.

On Aug. 15-16, 1995, teams from the three Services met with their counterparts from Raytheon and DPRO to add the actions required on the government's side. The 32 implementation plans were grouped according to priority and, again, presented to the customer decision makers on Sept. 18, 1995, with no significant exceptions.

Up to this point, the plans had not addressed cost savings rationale nor had all of the new processes been fully defined. At the September meeting, Williams tasked Raytheon to add cost rationale to each plan, improve the description of the before and after processes, and shift Service coordination of the revised plans to DPRO.

When this article was being written, staffing of the final plans was in process with the final decisions on implementation and contract change methodology due in December 1995. Implementation began in January 1996 and will be completed as quickly as possible. Savings are currently estimated at $7.7 million for instant contracts with the potential for $28 million more annually in future contracts.

Lessons Learned

Common requirements has been a learning experience for all involved. Below are some of the more significant lessons learned over the past eight months of effort to im-

plement common requirements at Raytheon.

• *Keep it Bounded!* The common requirements effort initially affected only manufacturing efforts within the Andover plant. As its benefits became known, the effort was expanded to other locations in the RESD, then to some programs outside the missile area, and to development activities. At the same time, Raytheon was implementing a consolidation of functions and personnel reducing three divisions to one. The combination of this turbulence with the common requirements activity made the effort significantly more difficult. The bottom line is that while changes with the three Services in a single plant are achievable with moderate difficulty, division-wide change is achievable only with far greater difficulty. Broader change is not recommended.

• *Multi-Service Coordination and Consensus Remains a Difficult Challenge.* This is an old lesson, but it is worth repeating. There is generally no effective mechanism for multi-Service action of this type. The public tasking of Williams by Longuemare at a meeting attended by the affected PEOs and PMs, and subsequent vigorous support by all levels of Pentagon leadership have been of immeasurable value. Raytheon and DOD customer leadership also gave excellent support, including resources to quickly evaluate and improve the proposals.

Coordination and consensus building by a teaming approach worked well at the executive level. Selection and designation of the leader and vigorous support and leadership by the other PEOs, PMs, and System Command commanders have been critical. Teaming at the working level has been significantly more difficult as a result of such factors as personnel not being closely located or fully assigned to the effort, differences among the Service cultures, and by the sometimes overwhelming difficulty posed by the details of the changes and the schedule.

• *Keep the Momentum Up!* As the scope of common requirements broadened, and the level of detail became greater, the challenge of maintaining momentum increased. What one person suggested as change was soon recognized and treated by another as a threat. Many of the initiatives adversely impacted the same people who were developing the changes. If momentum is lost, the probability of meaningful change is greatly diminished. To prevent this, leaders must stand up and say with conviction, "We are going to do this right and we are going to do it now."

• *Origin and Need of Many Requirements Were Uncertain.* Non-value-added requirements have been generated by the contractor and the government. Many of the requirements identified for change resulted from years of evolution driven by a Service's, an individual's, or the contractor's preferred way of doing business. Also, the absence of a contractual basis for some costly requirements surprised both customers and contractor. Requirements took on credibility based on longevity and "the way we do business." Many requirements which added no value became quickly identified when peer reviews were conducted by multi-Service teams with the contractor.

• *Some Projects Were Not Well Thought Out Initially.* Many projects, such as reduction of inspections, could have been unilaterally implemented by Raytheon and DPRO. Some, such as Source Control Drawings in existing programs, would cost more money to change than to leave as is. Many of the proposals evolved as better methods were derived.

• *Cost Effectiveness Must Remain a Strong Criterion for Change.* Reaching the ultimate state required for future programs as quickly as possible in existing programs is one of the reasons efforts such as common requirements are undertaken. For every significant change to achieve more efficient processes, there should be a strong cost incentive for both the contractor and DOD although the payoff may not be immediate. Many of the highest payoff changes for DOD were not cost-effective for individual programs.

Considerations of cost effectiveness must include the cost and time to analyze the impacts of change and the capitalization of change which is frequently staggering. Without the discipline of cost effectiveness, we will again find ourselves at the mercy of those who argue loudest and longest.

For equitable consideration, we considered such ideas as funding of product improvements, increased quantities of hardware, extended warranties, overhead reductions (nice because everyone benefits) and capitalization of modernization changes. If the government and the contractor desire the change, adequate consideration may simply be for the contractor to implement the change at no cost. Our guideline was "It has to make business sense."

Summary

The short length of this article does not allow adequate treatment of all the lessons learned. For many of those mentioned above, we are still in a learning mode. One critical area not discussed is simultaneous modification of contracts for cost or no cost changes. On Dec. 8, 1995, Dr. Paul Kaminski, under secretary of Defense (acquisition and technology), released a memo on a single process initiative, which allows administrative contracting officers to process changes to contractually implement technically acceptable efforts such as common requirements. The guidance requires consultation with affected customers and covers expedited class modifications for no cost changes and for cost changes without delays for negotiation of consideration. This process will be used to implement common requirements at Raytheon.

The methods we used were not magic and we found no substitute for old-fashioned hard work. As the saying goes, "The devil is in the details."

There is almost universal agreement that the DOD/Raytheon common requirements effort has been beneficial for everyone concerned. The initial group of changes, implemented in January 1996, should result in immediate cost savings for the DOD while permitting Raytheon to establish common processes for all their RESD operations. Future procurements should be less costly and Raytheon should be more competitive. Efforts are underway for similar initiatives at the top 30 Army Defense contractors.

GEORGE G. WILLIAMS has served as the U.S. Army program executive officer for tactical missiles since April 1990. He has a B.S. degree in industrial engineering from North Carolina State University and extensive post-graduate education in engineering and management areas.

JAMES T. STEELMAN is a staff engineer under the deputy for systems, Department of the Army, Program Executive Office, Tactical Missiles (PEO-TM). He holds a B.S. electrical engineering from Tennessee Technological University, and is a graduate of the Program Manager's Course, Defense Systems Management College.

EDWARD M. VOELKER is project manager for military specification reform in the Systems Technology Group of TASC, Inc. He has an M.S. degree in mechanical engineering from Drexel University, and a B.S. degree in ceramic engineering from Alfred University.

In View of Major Efforts to Digitize the Battlefield, What Role Should Our Computer-Skilled Functional Area 53 Officers (Systems Automation) Play in Achieving Force XXI Objectives?

COL Randy C. Hinds
Director
U.S. Army Computer Science School
Fort Gordon, GA

There are two perspectives from which one can view the FA 53 systems automation officer's role in the U.S. Army's pursuit of Force XXI objectives. From the commander's perspective, the FA 53 systems automation officer should represent an extraordinary asset, not only for the routine installation, operation, and maintenance of the growing diverse collection of automation systems and tools, but as a critical staff officer who can help unleash the power of information technology in the conduct of operations. Likewise, the FA 53 systems automation officer's perspective should be one of being able to offer a full range of functions and skills needed for the effective employment and utilization of automation from, if necessary, "the White House to the foxhole." In other words, the FA 53 systems automation officer must be both technically proficient and operationally competent in order to influence the commander's use of information technology across the full range of employment options.

Those perspectives should generate little argument, at least philosophically. In both cases, however, there needs to be a transition from today's reality to an objective FA 53 environment. Fundamentally, there must be a realization that the days of being just a computer "geek" (the commander's current view) or a "darn good technician" (the dominant view of the FA 53 systems automation officer) are over. The demands and expectations of all parties must be targeted on producing the information technology professional.

My many discussions with commanders and FA 53 systems automation officers indicate that there is an urgent need to change the way we do the business of automation support. Essentially, Army automation must transition from being viewed as a hobby to a recognized profession. Achieving that objective will require, at a minimum, FA 53 systems automation officers aggressively pursuing technical self-development *and* the "selling" of their expertise to field commanders. Moreover, this requirement to sell the FA 53 profession must include both education *and* demonstration of worth. Evidence that the FA 53 community may be faltering, at least on the "selling" issue, can be found in the comments made by FA 53 systems automation officers. They often express a bewilderment with what they perceive as the Army's inability to grasp the obvious importance of their skills to the pursuit of Force XXI objectives. Any profession, however, that assumes a relevance without actively marketing and proving that relevance risks becoming just another nostalgic piece of history. Unfortunately, this is the situation the FA 53 community is in today

LTC Ken Alford
Operations Officer
U.S. Army Information Systems Selection and Acquisition Agency
Alexandria, VA

Battlefield digitization obviously requires automation; therefore, the Army should use 53 officers (the Army's automators) during every step of the acquisition life cycle as it works to achieve Force XXI objectives. Three words—innovate, integrate, and articulate—outline the role automation officers should play.

- **Innovate.** Regardless of assignment, automation officers should look for new ways to gather, process, share, and disseminate information. They must understand and advocate change.
- **Integrate.** As the digitized battlefield develops, automation officers should look for ways to integrate existing "islands of automation." Automators should reduce manual data entries, enable tactical and support systems to share information, standardize information formats, automate repetitious actions, etc.
- **Articulate.** Automation officers must be able to speak clearly and convincingly—without techno-babble—to non-technical decision makers and users. Digitization, while a possible force multiplier, is a means and not an end. Successful digitization of the battlefield won't be measured by bandwidth or gigabytes transmitted. Soldiers in future wars will determine our success.

There will be an increased need for automators on future battlefields. Through innovation, integration, and articulation, systems automation officers can help keep the Army's digitization efforts effective and focused.

LTC Mark R. Kindl
Senior Computer Scientist
Army Research Laboratory
Atlanta, GA

The automation objectives of Force XXI are ambitious. As a direct consequence, I believe that functional area (FA) 53 officers face a formidable challenge in education, training, and experience. The field of automation technology has become very broadly scoped. Computer science itself has expanded into many sub-disciplines, and computer engineering is now applied to many other disciplines. As a result, significant impact in automation technology usually requires some degree of specialization. However, FA 53 officers have rarely had that option. For the most part, we have grown FA 53 gen-

eralists. While this may have served us well in the past, as the battlefield and our power projection capabilities grow more computer-dependent and complex, the need to specialize will increase. The establishment of the Acquisition Corps represented one high-level step toward specialization.

FA 53 officers will continue to need a firm foundation in computer science/engineering fundamentals. Many traditional functional roles for FA 53 officers will continue to exist, including: identify emerging automation technologies to solve problems related to both the battlefield and the projection of power to it; analyze and define requirements as well as help users to do such; understand, explain, and apply software/hardware capabilities for users; measure and manage automation development and acquisition processes; and design and implement standards and standard architectures.

However, more detailed technical knowledge and experience in a few related areas will also be increasingly necessary. These include: parallel algorithms and intelligent systems; data filtering, fusion, and decision support; data/information distribution and sharing; design of architectural standards for integration and interoperability; communications networks, protocols, and distribution systems; simulations, modeling, graphics, and the integration of real and virtual; and software engineering: formal methods for development, testing, and maintenance.

Just as important to the effective application of computer technology, is the need to have a user-oriented perspective based on "muddy-boots" field experience. To develop and maintain the currency of such an array of both technical and military skills in today's high-tech environment is difficult at best, and requires an individual commitment to continuous learning beyond formal schooling.

To achieve the objectives of Force XXI will require specialized FA 53 officers in four primary leadership roles, applicable to all stages of the system life cycle:

- **Technology Transitioners:** Those who understand the capabilities of software/hardware, educate users, and help them to define testable requirements.
- **Change Managers:** Those who control and overcome the impediments of a dynamic environment to implement reliable systems quickly using current software and hardware tools and components.
- **Integrators:** Those who understand the interfaces between and implement the interoperability of multiple systems.
- **Strategic Technologists:** Those who look forward at emerging and future automation technology, evaluate, and guide the evolution of future systems.

Ideally, every FA 53 officer should strive to experience each of these roles. Realistically, most officers are more suited or more comfortable in one or two of these roles. Regardless of their current role, FA 53 officers must collaborate with each other and with users as a team. They must apply automation fundamentals and their special expertise (both military and technical) to each stage of the life cycle. This will ensure delivery of reliable interoperable baseline systems in the near-term, enroute to Force XXI target systems and beyond in the far-term.

LTC Robert L. Reyenga
Army Acquisition Corps
Distribution Manager
PERSCOM
Alexandria, VA

All officers recognize Force XXI as the vision of senior leaders for moving the Army into the next century. According to GEN Reimer, chief of staff of the Army, "We must harness the capabilities of our weapon systems and coordinate employment through a seamless information system." This vision will lead us to developing battalions and brigades in Force XXI which are inundated with automation. Technology *will* change every officer's job in the next 10 years.

To lead the Army of Force XXI, all officers of all branches must be confident in their use of the new capabilities offered by technology. In particular, these leaders must be skilled in using the systems which provide them with information needed to make critical decisions. In many cases they must be self-reliant. They must not depend on full-time assistance to operate these systems; such reliance on system operators would unnecessarily delay and filter information.

Today's systems automation officer can and will contribute significantly to achieving Force XXI objectives. They already serve as automation system designers, developers, operators and advisors. These are functions essential in putting in place the "seamless information system" required, but more is needed. Our automation officers of today must tutor their leaders, peers, and junior officers. Even today, officers who do not take advantage of available automation capabilities are a *step behind* those who do. The new role of the systems automation officer is to reach out to fellow officers, and help them develop the skills they will need to lead the battalions and brigades of Force XXI. Every systems automation officer should set a personal goal to teach some new capability to one of their fellow officers at every opportunity, every day. By assisting in the development of leaders, systems automation officers will be providing their greatest contribution to our Army's achieving Force XXI objectives.

MAJ William C. "Chuck" Hoppe
Software Engineer
Information Systems Software Center
Fort Belvoir, VA

The Army's FA 53 systems automators (dual-tracked, single-tracked, and Acquisition Corps) must and will play a pivotal role achieving the objectives of Force XXI. There is an implicit assumption here that the FA 53 community knows those Force XXI objectives. That is a critical statement and does not apply to all the systems automators throughout the force. But as the saying goes, "If the shoe fits..." The point is this, if the FA 53 community is going to play the role they should in achieving the Force XXI objectives they must understand those objectives—dominate maneuver; project and sustain; conduct precision strikes; win the information war; and protect the force. Too many FA 53s focus only on objective four—win the information war. This is but a small part of the overall campaign and only a fraction of the domain in which systems automators can and should be operating. The Army's FA 53s provide a perspective that otherwise would

not be available to those attempting to integrate the pieces of Force XXI. The military experience brought to each project and unit along with the automation expertise of each FA 53 make that officer's contribution to the project unique and perspective invaluable. If this were not so, we could just out-source all the Army's automation needs and, in the process, lose the military perspective. There is a responsibility here on the part of the officer to stay current with the doctrinal changes throughout the Army and specifically within their basic branch. These officers are the integrators of the technology they have been trained to use and the Army they have pledged to support. One of the many challenges facing the FA 53 community is that both the technology and the Army are changing rapidly. Staying current only with the technology is a trap that will leave the Army with a bunch of techno-wizards that are out of touch with the needs of the Army. Focusing purely on the changes within the Army and neglecting the changes in technology will leave the Army without qualified officers to assist in the integration of new technology to those changing needs. This is the role the Army's systems automators should play in achieving the Force XXI objectives.

MAJ Jay W. Inman
Network Systems Administrator
White Sands Missile Range, NM

FA 53s argue passionately with each other about the role of their specialty in today's Army and often refer to Force XXI concepts in an effort to define their place. I think that one of the most important things that a 53 does today is bridge the gap between yesterday's force structure and tomorrow's force design. Looking back in history, for a moment, U.S. Grant did something most of his contemporaries failed to grasp. He leaped forward in time to use the telegraph, railroad and waterways to manage information, at a then unprecedented pace, coordinate movement, develop logistical support, and execute combined arms attacks that culminated with victory at Vicksburg. He took these lessons with him when Lincoln called him east and he masterminded the defeat of the Confederacy. Reading his memoirs, you can not help but find in U.S. Grant a brilliant mind and the ability to innovate. Yet, these things did not come easy for a man who failed at everything except war. Two superb officers helped Grant find his way as warfare evolved from Napoleonic style tactics of forces to the much more information-intensive strategic movements and campaigns that stretched across vast distances. GEN William T. Sherman and BG John A. Rawlins were Grant's 53s as they helped build and lead a new type of American Army. Both men understood the technology and explained it to Grant who, in turn, used his incredibly strong will to bend these assets to his purposes. Interestingly, when Grant ordered Sherman to march through Georgia, he ordered Sherman to destroy railroad and telegraph assets...the very things Grant used to destroy at least five different Confederate armies. By 1865, Grant's quick and decisive use of the new technology and information assets enabled him to take away Robert E. Lee's deadliest weapon, the ability to maneuver. John Rawlins and William Sherman did a superb job of teaching their commander. Applying this to today, 53s are a bridge between many technology products and soldiers who use information assets. Like Sherman and Rawlins, 53s must explain and use these resources in order to guide commanders. This requires vigilant study and the investment of time and effort that often goes far beyond normal work hours. Sherman and Rawlins, after performing their normal duties by day, found most of their evenings consumed by study and energetic discussion of how to better use their information and railroad assets. Their final product was the same one for which we strive—information dominance over the enemies of the United States.

CPT Daniel M. Munoz
Assignment Officer for Army Acquisition Corps FA53 CPTs
PERSCOM
Alexandria, VA

In his guidance to the Army on Force XXI, former Chief of Staff of the Army GEN Gordon R. Sullivan wrote "The high ground is information. Today, we organize the division around killing systems, feeding the guns. Force XXI must be organized around information—the creation and sharing of knowledge which will allow commanders to apply power effectively. The purpose of the Force XXI must be to dominate, to control, to win; information will be the means to a more powerful end. It is information-based battle command that will give us ascendancy and freedom of action—for decisive results."

As the drawdown continues and we move toward developing a smaller, more lethal force, Army Acquisition Corps Functional Area 53s will play a significant role in developing the information-based battle command that GEN Sullivan wrote about. Force XXI objectives include developing a technically competent force that is able to win the "information" war. This force will be highly skilled and able to take full advantage of technology that processes vast amounts of information at lightning speed. This information will then be shared across the battle area to all components of the force allowing up-to-the-second status on friendly and enemy forces. How will we do this as we continue to face force reductions and severely declining resources? By taking maximum advantage of the resources that we do have!

At the heart of the technical advancement of Force XXI is the soldier. Soldiers in Force XXI must have proven, reliable systems. The Army will rely on AAC FA 53s to utilize their basic branch experience and technical expertise to assist in defining needs and developing requirements for future weapons systems, as well as soldier support systems. One of the most significant roles AAC 53s will serve in is the development and advancement of horizontal technology integration (HTI). The concept of HTI is to develop systems that have "shared" components that can be used across several platforms. For example, a communication system would be developed that could easily integrate into both the Comanche helicopter as well as the latest version of the M1 tank. Development of such a system must take into account the unique needs of each weapon system while ensuring that it will seamlessly integrate with the total weapon system. While the concept may sound simple, the execution will prove challenging. Other areas in which AAC 53s may find themselves serving include: digitization of the battlefield; development of the Virtual Proving Ground; and various types of simulation.

Regardless of the role they serve in, AAC FA 53s must remain focused on the objectives of Force XXI. That is essential. In addition, they must stay informed on advancing technologies while at the same time ensuring that they are best utilized in a manner that is commensurate with their abilities and technical expertise.

SPEAKING OUT

CPT John A. Ellis
Combat Development System Manager for the Advanced Field Artillery Tactical Data System
Directorate of Combat Developments
Fort Sill, OK

Bits, bytes, transmission protocols, IP addressing, client-server architecture ..... the list goes on. As the battlefield becomes more automated and complex, a major problem is a general lack of understanding of the technical requirements of making all of the various command and control systems work together. While this is the case today, it may be even more of a problem for Force XXI commanders. Systems automators (a.k.a. computer geeks) bring both tactical knowledge and technical expertise to these systems and to the battlefields of the next century.

Force XXI objectives require technical and tactical requirements be interwoven as a single entity. System automators have a major role to play in providing support to Force XXI commanders and systems and those Force XXI objectives. Key aspects of that role include:

• *Providing user requirements to system designers to make sure that fielded systems are trainable, user-friendly, reliable, efficient, and based on Army doctrine.* User input and doctrinal practices will insure that systems are accepted and trusted by system operators.

• *Insuring that technical architectures and interfaces are not only compatible between systems at all required levels, but that they fully maximize the capabilities of those systems, including communications assets.* This will assist in the development of a system of systems that is fully integrated and interoperable across echelons.

• *Serving as "smart filters" between commanders and systems.* System automators insure that commanders are not overwhelmed by extraneous data and that commanders get the information they need in order to make informed and timely decisions.

• *Assisting commanders in determining how best to maximize the capabilities of Force XXI systems.* System automators, with their technical and tactical expertise, will advise commanders on how to best use their systems to accomplish their assigned missions and tasks.

Digitizing the battlefield for Force XXI is more complicated than setting up a local area network in the workplace. Multiple systems, operating on various platforms, with a myriad of interface requirements make for a potential nightmare for commanders who must rely upon these systems. As Force XXI becomes more of a reality, system automators can help to transform this nightmare into a fully integrated and interoperable system of systems that will best serve the soldiers of tomorrow. This transformation will be brought about through technical and tactical expertise, expertise that the Army's "computer geeks" bring to the forefront of our future battlefields.

AWARDS

Dr. Brown Gets National Award

Late last year, Dr. Janet L.S. Brown, chief, Civilian Acquisition Management Branch, U.S. Total Army Personnel Command, received the Outstanding Service Medallion from the American Association of Adult and Continuing Education (AAACE). The national award was presented during the AAACE's National Conference in Kansas City, MO.

The president of the AAACE recognized Brown for serving as the editor of a special military education theme in the March/April 1995 issue of *Adult Learning* magazine. That issue highlighted military education's long and distinguished record in adult and continuing education, new technological needs, and effective partnerships between the Department of Defense and the post-secondary education community.

The Department of Education has selected the magazine as one of the top five adult and continuing education magazines in the country. As a member of the magazine's editorial board since 1993, Brown has been responsible for editing adult education manuscripts from government, academia and industry.

After being appointed chair of the Army Education Committee in 1994, Brown conceived, lobbied for and coordinated the military theme issue. The issue was a compilation of articles from the Department of Defense, Air Force, Navy and the Army. Her introductory article, "Forging Partnerships: The Military and The Higher Education Community Into The 21st Century," dramatically linked the other articles to the real need for partnerships to educate our soldiers. It also pointed out that the military program is America's single largest adult education program, which boasts nearly three quarters of a million post-secondary enrollments. Brown was also selected as the publications coordinator for AAACE's Commission on Military Education and Training during the National Conference.

Army Organizations Recognized

Two Army organizations were recently recognized for outstanding accomplishments during 1994.

The U.S. Army Armament Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, NJ, and the Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, are co-recipients of the 1995 Army Research and Development Organization of the Year Award. This award is presented for achievements related to organizational effectiveness and mission impact; program; personnel and resource management initiatives; and special accomplishments. This year, 40 Army research organizations competed.

• ARDEC is recognized for its technical accomplishments and role in supplying quality armaments and munitions to the armed forces. ARDEC's technical accomplishments include the type classification of 20 items and fielding of 17 others, and the transfer of unique technologies to industry and academia. Among these unique technologies are motion sensors to detect epileptic seizures, techniques developed in non-destructive ammunition testing for baggage inspection at airports, ammunition x-ray diagnostics for digital mammography and cubanes for use in AIDS research.

• TARDEC was cited particularly for outstanding management initiatives, which led the center to win the Presidential Quality Award as well. TARDEC reclassified jobs, wholesale fashion, netting a 45 percent reduction in overhead and a conversion of 131 supervisor positions to non-supervisor positions. Additionally, the organization has shifted to integrated product teams on all programs, improving relations with contractors.

From The AAC Career Manager...

Frequently Asked Questions

The Q&A section is designed to answer questions from the members of the Army Acquisition Corps and work force regarding acquisition career management initiatives. Questions should be e-mailed to walkerk@sarda.army.mil. Answers will be published in the following edition of the Army RD&A magazine.

Q. Must I be a member of the Army Acquisition Corps (AAC) to apply for critical acquisition positions?

A. Currently, all individuals are eligible to compete for a critical acquisition position; however, selection of non-AAC members is tentative, subject to a current signed AAC mobility agreement and written confirmation of proposed selectee's entry into the AAC. We are actively working on an AAC central announcement system.

Q. How does a civilian deputy PM get considered by the PM selection board?

A. Currently, deputy PMs and other qualified AAC members may request consideration for PM positions by submitting an AAC AUTOAPP and a generic skills, knowledge and abilities statement. A world-wide message announcing the convening of all PM selection boards is normally sent two months prior to convening of selection boards. This message lists the PM positions being considered by the PM selection board and also outlines the application procedures.

Q. Why make civilian PMs mobile? We want a contractor that has extensive experience and personnel who have many years of expertise in the area being contracted. Why not follow industry and build long-term expertise in the civilian AAC?

A. The AAC is a premier corps of leaders and managers with a broad vision of the impact of not only their individual efforts, but the influence and integration of efforts of the Army, other Services, Department of Defense (DOD), and Congress. Industry does not stabilize their employees in one particular position—they also use career progression and mobility to broaden the expertise of their employees. PM positions are limited, both in the Army and industry. We need to ensure that those who desire have an opportunity to grow and compete for these important positions. Maintaining stability of these positions will stagnate employees and will not allow us to continually infuse these positions with new ideas and concepts. AAC members will be continually challenged to perform in positions of increasing responsibility.

Q. I am concerned about fairness of my being in test and evaluation (T&E). Where does T&E fit?

A. Tests are important functions in the acquisition process. Without individuals who are skilled in T&E, we would be doing the soldiers in the field a disservice in the fielding of equipment. Also, you do not have to be limited to T&E. The AAC encourages experience across multiple career fields and commands.

Q. What about military vs. civilian? Will the military be in a better position for being selected for a PM or related position?

A. First, military and civilians are only competing head-to-head for Acquisition Category (ACAT) I and II programs that have not been reserved for military by the Army Acquisition Executive (AAE). Currently, the military component possesses the advantage because they are evaluated on potential and their assignments are centrally-managed. By centrally managing civilian assignments, we can ensure their breadth of experience, training, education and demonstrated leadership fully qualifies them for senior level acquisition positions. In the near future, civilians will be evaluated on their promotion potential. We will create a civilian version of the Officer Record Brief, called the Civilian Record Brief (CRB). This CRB will include information about past jobs, education, training, and certification status. The CRB will allow ACAT I/II PM selection boards to be able to compare the files of military and civilians during head-to-head competition.

Q. I have concerns regarding the mobility requirement. If I am not willing to be mobile, will this limit my promotion potential?

A. Absolutely. If you are not willing to be mobile, it will limit your promotion potential. You must keep in mind that there are three kinds of mobility:

- *Functional:* A new assignment that may be located within the same commuting area, but to a position in another acquisition career field; another functional area within an acquisition career field; or subspecialty with a functional area or acquisition career field.
- *Organizational:* A new assignment that may be located within the same commuting area to a different office or command level.
- *Geographical:* Relocation outside the commuting area.

Q. Can civilians get credit for military training or experience?

A. Of course. Credit will be given if it is acquisition related experience. Training such as Command and General Staff College is comparable to the civilian Army Management Staff College and credit will be given.

Q. Should scientists be in the AAC?

A. Not if the scientist is working in the 6.1 and 6.2 arena. There is an interesting point I wish to raise...Many areas outside of DOD have GS-16, 17 and 18 positions. DOD is the only federal organization that did not retain the ability to use these high GS ratings. We could use these high ratings for our senior scientists. In that case, there are scientist and technology positions that are comparable in benefits to SES, but without the management requirement or responsibilities.

Q. What about two-career families?

A. We need as much information in the civilian database as possible so that we are aware of these issues and other related situations and can make judgements accordingly. Each member of the AAC and acquisition workforce is encouraged to review their Acquisition Certification Record Brief in the Army Civilian Personnel Records System to ensure that the information is correct and current.

AAC Proponency Branch Moves to Pentagon

The Army Acquisition Corps (AAC) Proponency Branch under OASA(RDA) has relocated back to the Pentagon. Please note the new phone numbers, and e-mail addresses listed below.

LTC Mark Jones
Chief, AAC Proponency
jonesm@sarda.army.mil
DSN 225-7264

MAJ Vickie Diego-Allard
FA97 Proponency
diegoalv@sarda.army.mil
DSN 227-6293

LTC Bill Gavora
FA 51 Proponency
gavoraw@sarda.army.mil
DSN 227-0472

Dale Fradley
Civilian Proponency
fradleyd@sarda.army.mil
DSN 224-3725

LTC Earl Rasmussen
FA 53 Proponency
rasmusse@sarda.army.mil
DSN 225-7265

Tom Drinkwater
Civilian Proponency
drinkwat@belvoir-aim1.army.mil
DSN 655-5212

Commercial Prefixes: (703) 614, 695, 697 or 805 (DSN 224, 225, 227 or 655, respectively). Fax: DSN 224-3690 or (703) 614-3690. The mailing address is: OASA(RDA), ATTN: SARD-ZAC, Pentagon Rm. 3E360, Washington, DC 20310-0103.

CAREER DEVELOPMENT UPDATE

Improving Communications

Keith Charles, deputy director for acquisition career management, Office of the Assistant Secretary of the Army (RDA), has initiated a communication effort within his organization. The purpose is to develop policies, procedures and tools that allow for the timely dissemination of information concerning the Army Acquisition Corps (AAC) and acquisition work force. Several communication avenues are already in place:

• **Army publications:** *Army RD&A* magazine is the primary publication for disseminating information on acquisition career management initiatives. Copies of *Army RD&A* are routinely distributed to acquisition organizations. Be on the lookout for this publication within your own organization. News releases are also being published in the *Army Times.*

• **World-Wide Web:** The AAC Home Page provides up-to-date information on re-engineering efforts of the civilian acquisition career management program, education and training opportunities, announcements regarding centralized PM Selection Boards, and career development initiatives for military members of the AAC and acquisition work force.

• **E-Mail:** Information is also being sent via e-mail to AAC points of contact (POCs) within MACOMs and PEOs. These POCs, in turn, are passing this information to employees within their respective organizations. To verify or add a POC to the e-mail address list, contact Karen Walker at DSN 655-5366 or commercial (703)805-5366, or e-mail to walkerk@sarda.army.mil.

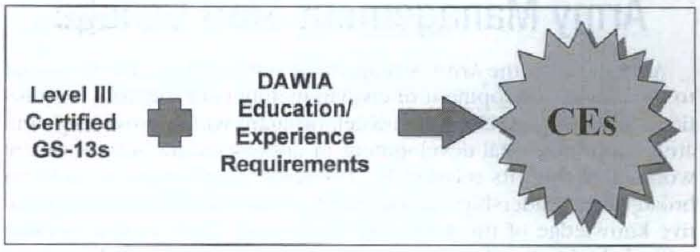
Future plans for communicating acquisition career management intiatives will include sending information to acquisition career management advocates, such as MICOM, TACOM, CECOM, and others. These advocates will be responsible for providing acquisition career management support to members of the AAC and work force.

Rosner Named AAC Policy Director

We are pleased to announce the arrival of COL Tom Rosner as the director, Army Acquisition Corps (AAC) Policy, Office of the Assistant Secretary of the Army for Research, Development and Acquisition, ASA(RDA). He succeeds COL Richard Grube. Rosner served previously as the senior military assistant to Dr. Paul Kaminski, under secretary of Defense for acquisition and technology.

Rosner's previous assignments include platoon leader, executive officer, materiel officer, DISCOM S-3, and advisor to the Saudi Arabian Ordnance Corps. His command tours include: Company A, 335th Maintenance Battalion, ASCOM, Korea; 8th Ordnance Company, 269th Ordnance Group, Fort Bragg, NC; Company B, 704th Maintenance Battalion, Fort Carson, CO; Student Officer Company (SOC) USAOCC&S, APG, MD, and the 86th Ordnance Battalion, Fort Knox, KY. Rosner's acquisition assignments include: test conductor, Roland Air Defense Weapons System, WSMR, NM; fielding team chief, Bradley Fighting Vehicle System, Warren, MI; product manager, Mark XV Identification Friend or Foe (IFF) System, Wright-Patterson AFB, Dayton, OH; Army representative to the Office of the Director, Acquisition, Education, Training and Career Development, Office of the Secretary of Defense, and Army project manager for Combat Identification Systems.

Rosner holds a B.A. degree from Saint Louis University and an M.B.A. from Florida Institute of Technology and is a graduate of the U.S.Army Command and General Staff College, Defense Systems Management College and Industrial College of the Armed Forces. COL Rosner may be contacted on e-mail: rosnert@sarda.army.mil or commercial phone (703)614-3727 or DSN 224-3727, or fax 614-3690.



RDA Corps Eligibles

In keeping with the spirit and intent of the Defense Acquisition Workforce Improvement Act (DAWIA) to develop the best acquisition leadership for the 21st century, the director for acquisition career management (DACM), together with the assistant secretary of the Army, manpower and reserve affairs (ASA(M&RA)) and the Total Army Personnel Command (PERSCOM), are reengineering development of the entire civilian acquisition work force. The DACM believes that the GS-13 population is a very important "feeder group" to fill the future top leadership positions within the Army. As such, the DACM's Office is in the process of implementing a program to develop the leadership potential of GS-13s. A phased approach will be used to accomplish this.

Phase I will require an assessment of the records of all GS-13s utilizing information in the Defense Civilian Personnel Data System (DCPDS/ACPERS). The objective is to establish a group of GS-13s who satisfy DAWIA education and experience requirements for accession into the Army Acquisition Corps (AAC) (DAWIA, Subchapter III, Paragraph 1732). Requirements include a bachelor's degree with 24 business credit hours, or 12 business credit hours and 24 credit hours in their primary acquisition career field, and level III certification in their primary acquisition career field (to capture experience requirement). This group will become known as "Corps Eligibles" (CEs). CE status will allow GS-13s to compete for GS-14 Critical Acquisition Positions (CAPs) without concern for a waiver. It will also provide priority access to cross-functional training, leadership courses, graduate degree programs, and force integration courses.

To begin Phase I, we will identify (via ACPERS) GS-13s who are in the 1102 (contracting) series, and those that have a business degree (fulfilling the DAWIA education requirement, and the 24 business credit hour requirement) and are level III certified in their primary acquisition career field. Part 2 of Phase I will attempt to incorporate all GS-13s who have a degree in a curriculum other than business and meet DAWIA requirements. To perform Part 2, we will require individual verification of business/acquisition career field credit hours.

Phase II will provide CEs, as well as other GS-13s, the opportunity to compete for board selection into a centrally-managed group of "the best of the best" GS-13s. The focus of the group will be to place members in challenging acquisition positions of a multifunctional nature, thus preparing individuals for positions of greater responsibility in the AAC.

The preceding article was written by R. Kenneth Murphy, a system analyst at Camber Corporation, Crystal City, VA, who is currently supporting the director for acquisition career management as a member of the Proponency Team of the Army Acquisition Reengineering Initiative. He holds a B.S. degree in finance from Loyola College in Maryland.

CAREER DEVELOPMENT UPDATE

Army Management Staff College

Attendance at the Army Management Staff College (AMSC) is vital to the career development of civilian members of the Army acquisition work force. AMSC is a 14-week program which provides graduate-level professional development in understanding how the Army works and what its mission is. The AMSC curriculum focuses on broad-based leadership, management, decision-making and integrative knowledge of the Army and its context. The content stresses critical thinking and active learning, intensive student self-preparation and progressive advancement to higher levels of analysis through synthesis. Students must demonstrate understanding of issues and an ability to craft intelligent choices among the difficult options facing decision-makers throughout the Army.

AMSC will be one of the quality achievement factors for future competition for promotion to GS-13 acquisition positions and the Army Acquisition Corps Competitive Development Group. In order to ensure you are highly competitive for promotion opportunities in the acquisition work force, GS-12s should include AMSC on their Individual Development Plan (IDP) and supervisors of these individuals should provide every opportunity for their attendance.

AMSC is offered three times a year at Fort Belvoir, VA,—in January, May and September—and is centrally funded by ACTEDS. Applications for attendance may be obtained from servicing civilian personnel offices (training) and must be processed through command channels. Nominees will be evaluated competitively by a HQDA selection board. The board will make selections based on its assessment of the candidates' potential to assume key leadership positions. Nomination suspense dates for FY96 and FY97 AMSC offerings are:

Class Date	Suspense Date
10 Sep - 13 Dec 96	20 May 96
7 Jan - 11 Apr 97	16 Sep 96

On the Horizon...

Army Acquisition Corps Advanced Civil Schooling

Based on recent reviews for Army Acquisition Corps (AAC) Director LTG Ronald V. Hite, several changes have been approved to better structure the current AAC Advanced Civil Schooling (ACS) Program for military acquisition officers. AAC funding for officers attending a degree completion program managed by PERSCOM (MAMB) is effective immediately. The intent is to also provide AAC funds for acquisition officers to pursue an advanced degree on their own time and/or meet what will soon become a requirement for many officers to complete six to nine graduate credit hours prior to entering a full-time and/or degree completion, with details on the execution and funding of this part of the AAC ACS Program distributed in March 1996. The AAC ACS Program will be based on requirements identified on the MAPL. The FY96 MAPL requirements support significantly increasing the number of computer science/information technology degrees and decreasing the number of business and engineering/science degrees. Plans are for all non-technical advanced degree programs attended by acquisition officers to be nominally 12-18 months and most engineering/science degrees to be 24 months in length.

ACAT III PM Course (PMT 305)

The Defense Systems Management College's (DSMC's) first offering of the ACAT III PM Course (PMT 305) was conducted Jan. 16-26, 1996. Follow-on offerings are scheduled for April 15-26, 1996, July 8-19, 1996, and Sept. 3-13, 1996. Plans are for this course to become mandatory for ACAT III PMs and deputy PMs. The ACAT III PM Course requirement is in addition to the Pre-Command Course(s) PMs attend at various branch schools.

AAC Updates

One- to two-page updates on current AAC information are distributed by the AAC Proponency Branch via e-mail on or about the first of each month. If you want to be included on the mail list for these updates, send an e-mail to the appropriate proponency officer listed on page 52 of this magazine. (See "AAC Proponency Branch Moves to Pentagon")

DOD 5000.52-M (Acquisition Career Development Program)

The revised DOD 5000.52-M dated November 1995 was approved by the under secretary of Defense (acquisition and technology) and is now in distribution. Distribution point of contact for this document is Carolyn Hinson at e-mail: hinsonc@belvoir-aim1.army.mil.

MAM Course/CGSC Area of Concentration

Efforts are ongoing to address how we can improve acquisition training leading toward DOD 5000.52-M certification provided at the Materiel Acquisition Management (MAM) Course and the Command and General Staff College (CGSC). The MAM review is oriented on meeting future (Force XXI) requirements and Defense Acquisition University (DAU) equivalency to the new ACQ 101/201 core courses. The AOC effort is oriented on adding DAU courses to Term 3 as the primary track for acquisition officers at CGSC. Details on the above subjects will be published in a future *Army RD&A* issue.

39 Graduate From MAM

On Dec. 8, 1995, 39 students graduated from the Materiel Acquisition Management Course at the U.S. Army Logistics Management College (ALMC), Fort Lee, VA. Keith Charles, deputy assistant secretary for plans, programs, and policy, and deputy director, acquisition career management, Office of the Assistant Secretary of the Army (RDA), gave the graduation address and presented diplomas. The Distinguished Graduate Award was presented to CPT Daniel Cunningham, U.S. Army Cold Regions Test Activity, Fort Greely, AK.

The eight-week MAM Course provides a broad knowledge of the materiel acquisition function. It covers national policies and objectives that shape the acquisition process and the implementation of these policies and objectives by the U.S. Army. Areas studied include acquisition concepts and policies; research, development, test and evaluation; financial and cost management; integrated logistics support; force modernization; production management; and contract management. Emphasis is on developing mid-level managers so that they can effectively participate in the management of the acquisition process.

PERSCOM Notes...

Advanced Civil Schooling

Prerequisites

For those interested in applying for the Acquisition Corps Advanced Civil Schooling (ACS) Program, you must have:

- No more than 17 years active federal service upon approval of

the ACS Program;

- An undergraduate grade point average of at least 2.5;
- A GMAT score of 500 points or better, or a GRE score of at least 500 points or better in each of the three categories. The scores must not be more than five years old; and
- A good military file and potential for promotion.

Selection of Graduate Schools

The graduate school to which you apply must be an accredited university and must score at least a 2.8 on The Gourman Report, a book that provides a rating of graduate and professional programs in American and international universities. On your application, you must list three choices of schools, to include at least one from the list below:

Naval Postgraduate School - Monterey, CA
Georgia Tech - Atlanta, GA
Penn State - University Park, PA
Florida Tech - Ft. Lee, VA
University of Illinois - Urbana, IL
University of Texas - Austin, TX
University of Texas - Arlington, TX
University of Virginia - Charlottesville, VA
University of Washington - Seattle, WA

How to Apply

If you meet the prerequisites and have discussed the possibilities of ACS with your assignment officer, mail an original, signed DA Form 1618-R (Application for Detail as Student Officer at a Civilian Educational Institution), which is found in AR 621-1. Mail the following paperwork to U.S. Total Army Personnel Command, ATTN: TAPC-OPB-E (ACS Manager), 200 Stovall Street, Alexandria, VA 22332-0411:

- The DA Form 1618-R with the original signatures from the applicant and the first field grade in the applicant's chain of command.
- A copy of your college transcripts. (If you are requesting the Naval Postgraduate School, you must submit an official transcript.)
- A letter of acceptance, from the university, which must include:
  - The registration day, month, and year;
  - The day, month, year the school begins;
  - The month and year the degree will be completed;
  - Whether applicant meets resident tuition criteria or not;
  - How many credits per quarter/semester the university considers full time;
  - The cost per credit per semester/quarter; and
  - Whether "in-state" or "out-of-state" tuition will be granted.

The acceptance from the university must be unconditional. PERSCOM will obtain the letter of acceptance for those requesting acceptance to the Naval Postgraduate School.

The I-GRAD Program

The I-GRAD Program is an Advanced Civil Schooling opportunity available only to acquisition officers. This two-year program allows the officer to learn the latest in management and business concepts while earning a nationally accredited master's of business administration degree at The University of Texas at Arlington.

During the first year, I-GRAD students learn a broad array of management subjects and become thoroughly grounded in advanced business skills. In the second year, students attend graduate school part-time and complete a 10-month hands-on Training With Industry (TWI) Program with a major Defense firm in the Dallas-Fort Worth area.

This real-world experience will allow you to rapidly expand your understanding and learning of the acquisition process and prepare you for the challenges faced by the Army Acquisition Corps. This program allows you to quickly earn maximum education and experience points for your acquisition career path.

Application and Admission Process

Discuss your admissions with Jim Walther at The University of Texas at Arlington, (817)273-3649. He will assess your qualifications and arrange for an application packet to be mailed.

Next, complete your application to graduate school; attach a 200-word essay on your Acquisition Corps career goals and your academic strengths and weaknesses. Attach official copies of your transcripts from all universities and colleges and a copy of your GMAT test scores. Forward this packet with a check for your application fee to Director of Graduate Advising, ATTN: I-GRAD, UTA Box 19376, Arlington, TX 76019-0376.

Within approximately two weeks, an admission letter will be forwarded to both you and the Acquisition ACS Manager at PERSCOM. Once you receive this admission letter, follow the application procedures as outlined under the "How to Apply" section of this ACS article.

Training With Industry

How to Apply

To apply for Training With Industry (TWI), you must meet the same prerequisites as discussed in the ACS article above. Training With Industry begins in September of each year and is a one-year program. Applications will be accepted starting in October of each year for the upcoming fiscal year. In order to apply, the original copy of DA Form 1618-R (fill this form out the same way as if you were applying for Advanced Civil Schooling). In addition, applicants must submit a resume to the ACS Manager.

FY 96 Industries and Their Locations

Industry/Location	Functional Area
Alliant Techsystems Inc. - Hopkins, MN	97
Allison Transmission - Indianapolis, IN	97
Boeing Defense and Space Group - Seattle, WA	51
Carnegie Mellon - Software Engineer Institute	53
Dyncorp - Reston, VA	97
General Dynamics, Land Sys Div - Warren, MI	51
General Motors - Warren, MI	51
Hughes Aircraft - Tucson, AZ	51
Lockheed Martin - Moorestown, NJ	51/53
Loral-Vought Systems - Dallas, TX	51
Martin Marietta Missiles and Elec Sys - Orlando, FL	51/53
McDonnell Douglas - St. Louis, MO	51
Motorola - Scottsdale, AZ	51
Oshkosh Truck Corporation - Oshkosh, WI	51
Raytheon Corporation - Waltham, MA	51
Rockwell International Corp - Duluth, GA	51/97
Texas Instruments - McKinney, TX	51
United Defense - Stratford, CT	51
United Defense - York, PA	51
Westinghouse Electric Sys Grp - Baltimore, MD	51/53/97

FY 96 Colonel's Board Results

The release of any promotion list is always followed by an exhaustive data analysis to "map" the characteristics of the considered/selected population. The following pararaphs summarize the initial analysis of the FY 96 Colonel's Board.

Overall Acquisition Corps Results

Board members reviewed the files of 72 Army Acquisition Corps (AAC) officers in the primary zone. From this population, 34 were selected by the board. The resulting selection rate of 47.2 percent exceeded the Army competitive Category figure of 44.4 percent. This higher percentage indicates that the Acquisition Corps files continue to be competitive when compared to those files of basic

CAREER DEVELOPMENT UPDATE

branch officers.

Acquisition Corps results by functional area are as follows:

Functional Area	Considered	Selected	Percent
51	48	23	47.9
53	16	7	43.7
97	8	4	50.0

Who Got Promoted?

Of the 34 officers selected, 31 were current or previous centrally-selected product managers or acquisition commanders. Of the 34 selectees at the time the board convened, nine officers were serving as product managers, two selectees were serving as contracting commanders and three officers were serving in acquisition (test) commands. Only three of the 34 selectees had not been selected for Senior Service College (SSC) resident or corresponding studies prior to the FY 96 Colonel Level Board Promotion.

Trend?

Based on the analysis applied to the above information, it is apparent that those officers who complete a successful PM/Command (Number one block OER with supportive write-up from senior rater) are selected for continued service as colonels. The inflation of our current OER requires "top block" performance as a PM/commander.

Who Did Not Get Promoted?

Of the 39 officers who were not selected to the rank of colonel, 13 were former or serving PMs/commanders and the remaining 26 had not served as either a PM or acquisition commander.

Of the 39 officers who were not selected, three officers were either selected or attending resident SSC, and four were non-resident graduates.

Trend?

Clearly, centralized selection and success as a lieutenant colonel-level PM and/or acquisition commander are the keys to competing for promotion to colonel. Late selection for lieutenant colonel command (especially when the board sees no "command" reports) can lead to non-selection. In the past, these officers have sometimes been selected "above-the-zone" by subsequent boards. This year's board, however, found sufficient successful PM/commanders in the primary zone, and selected no AAC officers above the zone.

General Observations

The file quality of officers selected for promotion continues to improve. The competition is tough with insufficient colonel requirements to promote all successful PM/commanders. Early selection for lieutenant colonel PM improves one's chances for promotion to colonel.

In addition, members of the most recent colonel-level board seemed to place most of their emphasis on the "potential" comments provided by senior raters. Those officers having good, quantitative potential comments appeared to emerge more competitive than those whose OERs did not contain these comments.

Summary

As future promotion boards convene, it is imperative for officers in all consideration zones to take the time to personnally "scrub" their ORB to ensure accurate information is conveyed to the board members. Do not forget about the photo. It is recommended that if a photo is more than two years old, then it's time for a new one. Check your awards, branch and U.S. insignia etc. Attention to detail does make a difference.

Finally, as a captain/major, seek career-broadening experiences to become competitive for early selection as a lieutenant colonel PM/commander. With limited position in the PEOs, PERSCOM will need to rotate captains and majors every 24 months to ensure a sufficient pool of experienced branch-qualified officers for future PM positions.

FY 96 AAC Colonel Selectees

The following is a list of acquisition officers selected for colonel in FY 96.

BIRDSONG, George M.
BROWN, David Jr.
CAMBRON, James D.
CARMONA, Waldo F.
CARTER, Roger L.
CLIFFORD, Michael R.
DOTON, Lawrence C.
ELLIS, Andrew G.
FISHER, Edward A.
FOWLER, Charles S.
GREANEY, Kevin J.
GUNNING, Robert T. Jr.
HARRISON, Thomas M.
HASTIE, William A.
KINDL, Mark R.
LIBBY, Edmund W.
LOVE, Anthony N.
MACKIN, Joseph P.
MAUSER, George E.
MILLER, William D.
MONKS, Stephen A.
MORRIS, Richard D.
MURRAY, Joseph P.
NADEAU, Roger A.
PARKER, Leon A. III
PATRICK, Dennis L.
REEVES, Stephen V.
ROGERS, Michael W.
SCHWOEBEL, Charles G.
SWANSON, Gregory H. Jr.
SWINSON, Mark L.
WELLS, James A.
YATES, Donald R.

LETTERS

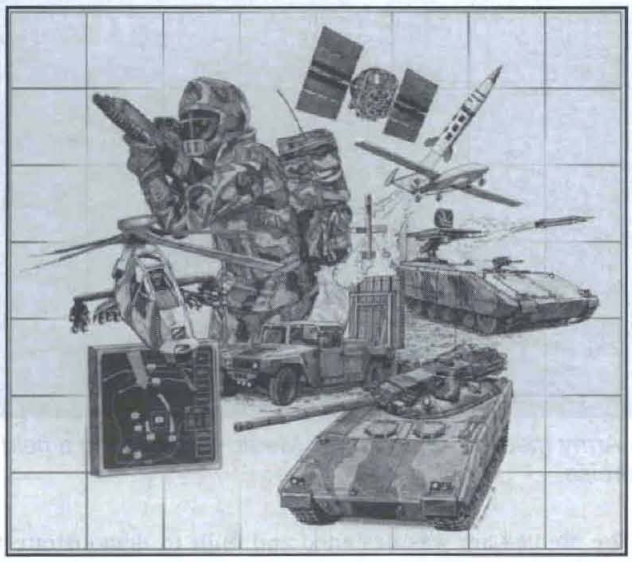
Sir,

I have in my possession a Leatherman, a very useful multiple tool knife, sheath provided. Everybody puts these on their belt. They are then covered up by the BDU blouse, field jacket and LCE (load carrying equipment). Now it is difficult to retrieve.

I would like to suggest that a pocket, appropriate size, be put on the BDU. Location might be on top of either cargo pocket on the legs, or perhaps on the upper arm, outer bicep area. I believe the pocket itself should be double or triple thickness in material, to both protect the limb and actually replace the sheath.

Thank you for considering this suggestion.

Hannu T. Puukka
(SFC USAR)



20th Army Science Conference

Conference Overview

The 20th Army Science Conference, sponsored by the Assistant Secretary of the Army (Research, Development and Acquisition) Gilbert F. Decker, will be held at the Norfolk Waterside Marriott and Convention Center in Norfolk, VA, June 24-27, 1996. The conference theme is "Science and Technology For Force XXI." This biennial event was inaugurated in 1957 to provide a forum for presentation, discussion and recognition of significant accomplishments by U.S. Army scientists and engineers in their efforts to support the combat soldier of tomorrow.

The conference will feature presentations of 160 papers and posters judged as best among those submitted by scientists and engineers. Authors of the most outstanding papers will be selected to receive special recognition and awards. Program content will be presented in concurrent oral and poster sessions.

Who Should Attend?

Defense, academia, industry representatives and U.S. Army personnel involved with new scientific initiatives and ongoing modernization activities focused on near-term and long-range U.S. Army combat capabilities are encouraged to attend. Attendance at this conference will also benefit both management and technical personnel from industry and government who have an interest in the application of new scientific and engineering technologies.

For additional information, contact Carolyn A. Keen, CPM, Director, Technical Conferences, or Brenda Vaughan, conference coordinator, Correa Enterprises Inc., 16441 Benns Church Boulevard, Smithfield, VA 23430; (804) 357-4011; fax (804) 357-5108.

Workshop Refines PM Intern Program

Keith Charles, deputy assistant secretary of the Army for plans, programs and policy, and deputy director, Army acquisition career management, assembled program management interns and their sponsors for a workshop late last year at Dam Neck Naval Air Station, Virginia Beach, VA. The workshop was held to further refine the Army Acquisition Program Management Internship Program.

Charles opened the workshop, informing the attendees of the many current initiatives designed to substantially improve the Army acquisition work force. He described the vision for the future of the acquisition work force, as he and LTG Ronald V. Hite, military deputy to the assistant secretary of the Army (research, development and acquisition) and director, Army Acquisition Corps, had approved. A significant portion of the workshop was devoted to redesigning the current Internship Program to best implement this vision. (See article on page 28 of the Jan-Feb 1996 issue of *Army RD&A*).

Workshop participants provided feedback, and shared their concerns regarding the future of the program. The current intern program will be the nucleus for an expanded, broader, goal-oriented program. The new Acquisition Leadership Development (ALD) Program, will remain extremely competitive and feature a fast-paced, meaningful developmental assignment within the Army acquisition mainstream. Graduates of the program will be reassigned to acquisition positions within the work force, resulting in mutual benefits to the Army and the individuals.

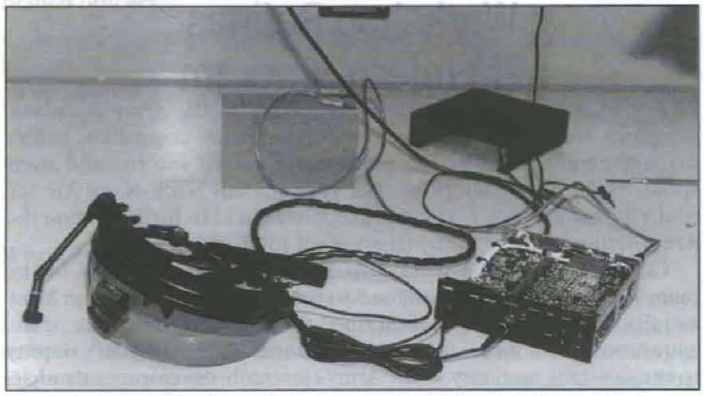
Details of the ALD program, and an invitation to compete for participation in it, were published February 1996, in a user's guide. For additional details on this, please contact Dale Fradley, (703)697-6292. Applications will be accepted from Army civilians currently serving at the GS-12 level or below, in any Army career field (acquisition or not), and possessing a graduate degree by June, 1996. Competitive selection for participation in the program will be made by a central board.

Call for Papers

The first annual Soldier Ground Mobility Symposium, hosted by the U.S. Army Natick Research, Development and Engineering Center, will be held in Framingham, MA, May 14-16, 1996. The Soldier Ground Mobility Program was formulated to provide technical enhancements to improve individual soldier strength, endurance and agility.

Topics will include: speed, strength, and agility enhancers; load bearing and handling devices; supports and braces; biomechanics; robotics; extreme environment equipment; advanced footwear concepts; and individual soldier performance models and simulations.

If you are interested in attending the symposium, please forward your name, address, phone and datafax numbers and e-mail address to: U.S. Army Natick Research, Development and Engineering Center, ATTN: SSCNC-UTV, Kansas Street, Natick, MA 01760-5017, or e-mail nfuccill@natick-emh2.army.mil or tkean@natick-emh2.army.mil or call (508)233-5237/5065/5988.



The Medic-Cam includes the visor, a lead/acid battery as a powersupply, and a control box.

Medic-Cam Brings Doctor To Battlefield Via Satellite

For a critically wounded soldier, the first care he gets from a combat medic may mean the difference between life and death. The Army Research Laboratory (ARL) has helped design a small, portable system that will put a doctor's eyes, knowledge and experience at the medic's disposal to increase the soldier's chance of survival.

The Medical Camera System or "Medic-Cam" was developed in cooperation with the Medical Advanced Technology Material Office, located at Fort Detrick, MD. Using off-the-shelf components, ARL engineers and technicians have designed a small, portable television station with the capability of broadcasting what a combat medic sees to doctors thousands of miles away who can then communicate with the medic and advise him during primary treatment.

The Medic-Cam consists of a lightweight visor worn by the medic that incorporates a miniature (7mm diameter), high-resolution color camera that links by microwave to a vehicle with a satellite link that can transmit and receive image and sound to and from doctors located anywhere in the world. The visor also has a seven-tenths of an inch, color TV display so the medic can see what is being broadcast. The Medic-Cam can also input and transmit data so it can be used to relay vital signs information.

An attached small control box contains the camera controller, microwave transmitter, and the audio and video conditioners. The Medic-Cam is capable of eight hours of operation powered by a lead acid rechargable battery. The camera, display and other components are commercially available but integrating the components required original circuitry work, according to Mark Coleman, an electronics technician for ARL's Information Sciences Technology Directorate (IS&T).

"My function was to design this technology into as small a package as possible," said Coleman, a former bio-med engineering technician at the University of Maryland's Shock Trauma Unit in Baltimore. He added that further miniaturization will be pursued. The Medic-Cam can send to the vehicle within a range of about two kilometers, Coleman said.

The vehicle known as the Mobile Medical Mentoring Vehicle or M3V, is a High Mobility Multipurpose Wheeled Vehicle with a mounted shelter that serves as a mobile studio, Coleman explained. Inside, a doctor and senior medic can coach up to four field medics using the cameras, audio and video processors, computers and microwave and satellite communications links. Medical equipment interfaces are also provided. A climate control and independent power system add to its versatility.

An Army medic demonstrates Medic-Cam during a field exercise.

The Medic-Cam was designed and built to demonstrate the Army's future possibilities in field medicine, Coleman said. "A medic is going to encounter situations where he needs a physician's assistance. The first few minutes of care are critical and during part of that time, at least, the medic will be the primary care giver. Advice from a physician during that time could save lives," he pointed out.

He added that the Medic-Cam, when equipped with Global Positioning System capabilities, can also be used to locate wounded soldiers for immediate evacuation.

The Medic-Cam has several potential applications outside of combat, Coleman said. One currently being closely looked at is to provide emergency medical assistance to victims of disasters such as earthquakes and hurricanes. Others could range from use by bomb squads to disarm explosives to providing emergency medical assistance at the scene of serious highway accidents.

"With the Medic-Cam you get continuous real-time, high quality video, audio and vital signs information that can be sent by satellite anywhere, anytime," Coleman said.

New Doctrine Covers Information Operations

A new doctrine manual on information operations aimed at helping commanders use information technologies in all operational environments will be published in early 1996.

"Field Manual 100-6, *Information Operations,* provides the Army's perspective on how we would relate to the larger environment that's called in the Department of Defense, IW, [information warfare]," said COL Michael Starry, director of future battle doctrine for TRADOC's deputy chief of staff, doctrine. "IW is an integrated strategy that considers the vulnerabilities and opportunities inherent in the increasing dependence by the U.S. and our potential adversaries on information and information systems," he said.

FM 100-6 recognizes the defensive and offensive nature of IW and describes information operations as made up of three distinct but integrated areas: command and control warfare, relevant information and intelligence and information systems.

"The environment is much bigger than just IW, shooting electrons at each other, deception and propaganda, psyops [psychological operations], and so forth. We chose the term information operations, which allows us to think in a holistic, kind of focused way about

NEWS BRIEFS

what's going on in the information business," Starry said.

The manual recognizes that most of the time, the Army will not be in combat. Rather, it will more likely be involved in peace operations or humanitarian missions.

"You can't do IW against the news media, commercial interests or business people, or local and regional governments," he said. "In those environments, you must be able to protect your information systems, not from an adversary, but just from interference. The OSD (Office of the Secretary of Defense) and joint communities are beginning to recognize this fact in their emerging policy and doctrine."

Just as air, land and sea operations are integrated and supporting parts of a combat commander-in-chief's war plan, information operations will now be included.

"Information operations is not new," Starry said. "We've been doing psyops for years. We've been doing electronic warfare for years. We've been doing physical destruction of CPs, command posts; we've been doing civil affairs and public affairs."

"What IO [information operations] does is try to draw it all together to provide a focus for the Army on information and information technologies."

The manual takes into account all information technologies available to commanders—digitized communications, satellite communications, and position navigation.

Information operations doctrine supports FM 100-5, *Operations*, the Army's capstone doctrine for all military operations. However, when FM 100-5 was published in 1993, the entire Army had not grasped the rapid and revolutionary changes in information technology.

"The ideas in FM 100-5 are still valid," Starry said. "But FM 100-6 updates FM 100-5 in a lot of ways. It has one foot in 1993, when FM 100-5 was published, if you will, and one foot in the development of the next FM 100-5."

Mobile Acoustic Source Generation System

Officially it's called the Mobile Acoustic Source Generation System (MOAS), but the people who work with it refer to it affectionately as the "Mother of All Speakers." MOAS's major component is a mobile fiberglass horn that is 56 feet long with a mouth 8 feet wide. It rests on a custom-built trailer that can be hooked up to a tractor to make one of the most unusual-looking 18-wheelers on the highway.

The Mobile Acoustic Source Generation System.

The people who work with MOAS are the seven members of the Battlefield Environment Directorate's Atmospheric Acoustic Team led by Dr. John Noble at White Sands Missile Range (WSMR), NM. Noble notes that the horn is used to perform long-range (5 to 15km) acoustic propagation experiments to study the effects of the environment on sound and to evaluate propagation modeling effects.

The horn is capable of single and multiple tones as well as tape playback and operates in the 10- to 500-hertz frequency range. It has a maximum output of 145 decibels. Unlike electronic speakers, the horn is an air-driven system and uses a 150 horsepower engine to turn a rotary compressor. This generates air flow of up to 1,200 cubic feet per minute at 4 to 8 square pounds per inch that a voice coil, built by Wyle Labs, modulates to generate sound. The voice coil varies the air flow to vary the sound. Because of the sound level, the horn is remotely operated by a computer system in a van typically 200 to 300 meters away. "It can reproduce the spectrum and level of virtually any potential acoustic target," Noble said.

A physicist, Noble came up with the concept for MOAS in 1990. He worked with the National Center of Acoustics at the University of Mississippi (where he had received his doctorate degree) where the horn was fabricated. Construction was completed in October 1992. "This is really one of a kind. A lot of engineering went into it," Noble said.

One major problem during development was overheating from the intensity of the airflow. A heat exchanger had to be built-in to cool the horn. The horn and the trailer were built together so it can be taken down and moved. "You can hook it up to an 18-wheeler and drive it on the road," Noble pointed out, although he admitted it draws stares from other motorists.

MOAS' longest trip has been to Virginia where it was used in experiments for active noise control in reducing low frequency sound for Air Force "hush houses." A hush house is where jet engines are tested, Noble explained. MOAS was used in research to suppress noise from the hush house in the direction of populated areas. At WSMR, the horn is used to broadcast the recorded signatures of tanks and helicopters to develop and validate models.

The MOAS has also been involved in modeling effects work for the Noise Assessment Prediction System, a noise abatement program. The model predicts how much noise will propagate into the surrounding community under certain environmental conditions so test operators know if they can carry on with a test that day or perhaps wait for more favorable environmental conditions.

BOOKS

Vision, Values and Courage

By Neil H. Snyder, James J. Dowd Jr., and Dianne Morse Houghton
The Free Press NY, NY 1994

Reviewed by MAJ Christopher M. Miller, project officer, Yuma Proving Ground, AZ.

Vision, Values and Courage may be just another in the long list of books published regarding visions, quality, leadership and total quality management (TQM), but don't scratch it off your reading list just yet. Neil Snyder and James Dowd, from the University of Virginia, and Dianne Houghton, from

Arthur Anderson Consultants, combine real-life stories with textbook teachings to effectively communicate the importance and roles that vision, values and courage play in the workplace today. Vision, theory X and theory Y, leadership, TQM, commitment, Wal-Mart, Disney and McDonald's—this book has it all.

The first three chapters review management, leadership and quality movements from post-World War II to the present day. To anyone initiated into leadership and TQM literature, these chapters provide an excellent review. For those who are not, the reading is easy and covers such topics as TQM principles, quality techniques, statistical process controls and introduces the teachings of "quality gurus" such as Edward Demmings, Joseph Juran and Philip Crosby. The introduction is then topped off with the life and times of Sam Walton and how his vision, leadership and quest for quality led Wal-Mart to the top of the discount retail industry. Interwoven throughout this section and the book is how vision, value and courage are the foundation to successful leadership.

"An organization is a system, with a logic of its own, and all the weight of tradition and inertia. The deck is stacked in favor of the tried and proven way of doing things and against the taking of risks and striking out in new directions." This quotation helps explain the next section on vision and commitment. The authors show the complexity and difficulty in formulating, communicating and committing to a vision. "...The deck is stacked in favor of the tried and proven way of doing things..." best sums up this section. Many view the creation of a vision as a radical departure and a threat to an organization. Thus, the authors highlight the importance of unwavering commitment, personal fortitude, and the ability to help others see and understand the vision to make that vision a reality.

Part three, in essence, is total quality management (customer focus, continuous improvement and employee empowerment). These factors combined, form the values of the organization and the leader. The authors show how an organization which understands who its customers are (both internal and external) not only focuses the employees' efforts but also focuses the vision for the organization and how it relates to those customers. Along with customer focus, emphasis is on employee autonomy and quality improvements that create a flexible organization willing and able to change and adapt to its vision. Probably the best summation of this section is a quote from the basketball legend, Larry Bird:

> *He was always telling me that I'd have to learn to adjust my game. He said the opponents would never stop testing me and that I'd always have to come up with something new...One year he told me the coaches were saying I didn't like to go to my right for a jump shot. I went home that summer and worked on going to my right. There's no problem now.*

The last chapter deals with courage and its role in achieving the vision. In short, be tenacious, believe in yourself and take the chances necessary to achieve a vision. The founder of McDonald's, Ray Kroc, said it best:

> *Nothing in the world can take the place of persistence. Talent will not: nothing is more common than unsuccessful men with talent. Genius will not: un-rewarded genius is almost a proverb. Education will not: the world is full of educated derelicts. Persistence and determination alone are omnipotent.*

For the seasoned TQM or reengineering business person, *Vision, Values and Courage,* on the surface, appears to be a rerun of some familiar themes. However, the examples listed throughout are integrated with academic theories in such a way as to strengthen one's recall of the key points. At a minimum, the book provides the knowledgeable reader with a few tools and good ideas to make the reading worthwhile. For the novice, this reading provides an excellent overview of current business practices and thinking and a strong foundation in the terminology being used today. All in all, *Vision, Values and Courage* is worth your time.

Neuromancer

By William Gibson
Ace Books, 1984,

Reviewed by Dr. Robert J. Bunker, adjunct professor, National Securities Studies program, California State University, San Bernadino, CA.

Those in the RD&A community, above all others, recognize that advanced commercial and military technology is now taking us down many new and never explored scientific paths. To understand where we are going and not be left behind, we have to keep our minds open to radically new concepts and perceptions. We must remain childlike in our ability to absorb new knowledge because as the traditional military paradigm begins to shift, we can't afford not to. One way to remain on the cutting edge of the emerging Information Age is to read those works which have had a profound effect on the reshaping of our society. *Neuromancer* represents one of those works.

It is a science fiction work which garnered multiple literary awards when it was first published in 1984. That same year, coincidentally, witnessed the introduction of the Macintosh with its pull-down windows and point-and-click interface. *Neuromancer* is significant because it provides much of the conceptual foundation for what we call Cyberspace. This concept is defined as "A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts...A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding..."

This work is also significant from a military perspective because of its story line. It teams a computer hacker, "cyberspace cowboy," with a surgically-enhanced special forces-type operative. Together, they engage in what best can be described as coordinated acts of espionage both within cyber-

space and within the traditional battlespace that we are accustomed. The unleashing of computer viruses, the overcoming of intrusion, countermeasures electronics (ICE), and the stealing of data is interwoven with traditional forms of sabotage such as breaking into secure physical facilities. The envisioned dual-dimensional operations this work provides may offer an important glimpse into future warfighting.

The book also contains multiple references to non-lethal technology. The use of foam barricades backed up by sandbag guns for riot-control purposes, as described in the book, now hardly seems the stuff of science fiction given our recent experience in Somalia during the final withdraw of the Mogadishu Port Facility. The use of a building's internal video system to produce seizures in susceptible individuals by means of a psychothropic effect was also noted as was a scenario where a computer system's permanent memory was minutely shifted—a form of information attack now referred to as "knowledge warping."

Other forms of advanced technology also appear in this work. "Wetware," computer-based implants, is a common theme as are "dermadisks," which release bio-technical substances such as synthetic endorphins which are used to overcome pain and injuries while a military operation is in progress. "Chameleon suits," which allow for reduced image and signature avoidance for the individual soldier, are also present.

While this work was first published 12 years ago, it should still be of special interest to the RD&A community. In fact, much of the "science fiction" it contains has become, or is in the process of becoming, science fact. The latter, in turn, is now providing much of the technical basis for the bold vision which we call the Army's Force XXI initiative.

A DOS User's Guide To the INTERNET: E-Mail, Netnews, and File Transfer with UUCP

By James Gardner

Reviewed by MAJ Mark A. Ernyei of the TRADOC System Managers' Satellite Communications Office at Fort Gordon, GA.

In today's information technology age, it is important for all Army acquisition officers and Department of Army civilians working in the acquisition field to have the capability of gaining and sharing knowledge with others in their related fields. One way to do this is through the INTERNET, where a wide array of information is available. However, in order to retrieve this information, you must first understand how to use the services required to gain access to the INTERNET.

A *DOS User's Guide to the INTERNET* explains these services in great detail and provides examples of how to use each one. Included with this book is software known as *UNIX to UNIX Copy Protocol* (UUCP) by Martice Kern Systems, Inc. UUCP is a communications protocol which sets the rules for transferring data from one computer to another. Gardner offers a series of easy-to-follow examples which explain the purpose and use of the UUCP software. You are somewhat limited as to the options you can perform on the INTERNET with this software, but you can get a taste of how to use file transfer (to retrieve files from bulletin boards) and Usenet news. You are also provided with the capability of sending and receiving electronic mail (E-mail) across the street or around the world.

Readers will especially appreciate the author's use throughout the book of highlighted areas called "For Your Information" (FYI). These FYIs focus your attention on excellent time-saving tips and interesting facts about the particular system you are using. They also help solve problems that you may encounter while you are working on the INTERNET.

The greatest challenge INTERNET users face is sensory overload. You can spend hours just looking through the INTERNET (often referred to as "surfing") for information that you may need at work or home. The author points out that the trick is to locate material that you can use without getting bogged down in the intimidating "noise" of the INTERNET. There are software packages available on the market that will assist you in tracking down information, but they are only a start. According to the author, experience is the best teacher in getting the maximum benefit with the minimum of wasted time.

Although a welcome addition to the INTERNET library, *The DOS User's Guide to the INTERNET* does have its shortcomings. First, the author never focuses on the available commercial networks such as CompuServe, Genie, and Prodigy. In my opinion, these are great ways to access the INTERNET and they are very user-friendly. Second, the author sometimes forgets that his readers are not all computer experts. Some of the directions in the reference pages are obviously written for the advanced user. If these instructions were rewritten in a simple and direct manner, the author could steer the novice reader/user away from much confusion and frustration.

On the whole, however, Gardner has provided a good springboard for anyone who is interested in learning to "surf the NET," and informative reading for those who wish to hone skills they may already possess.

Book Reviews

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