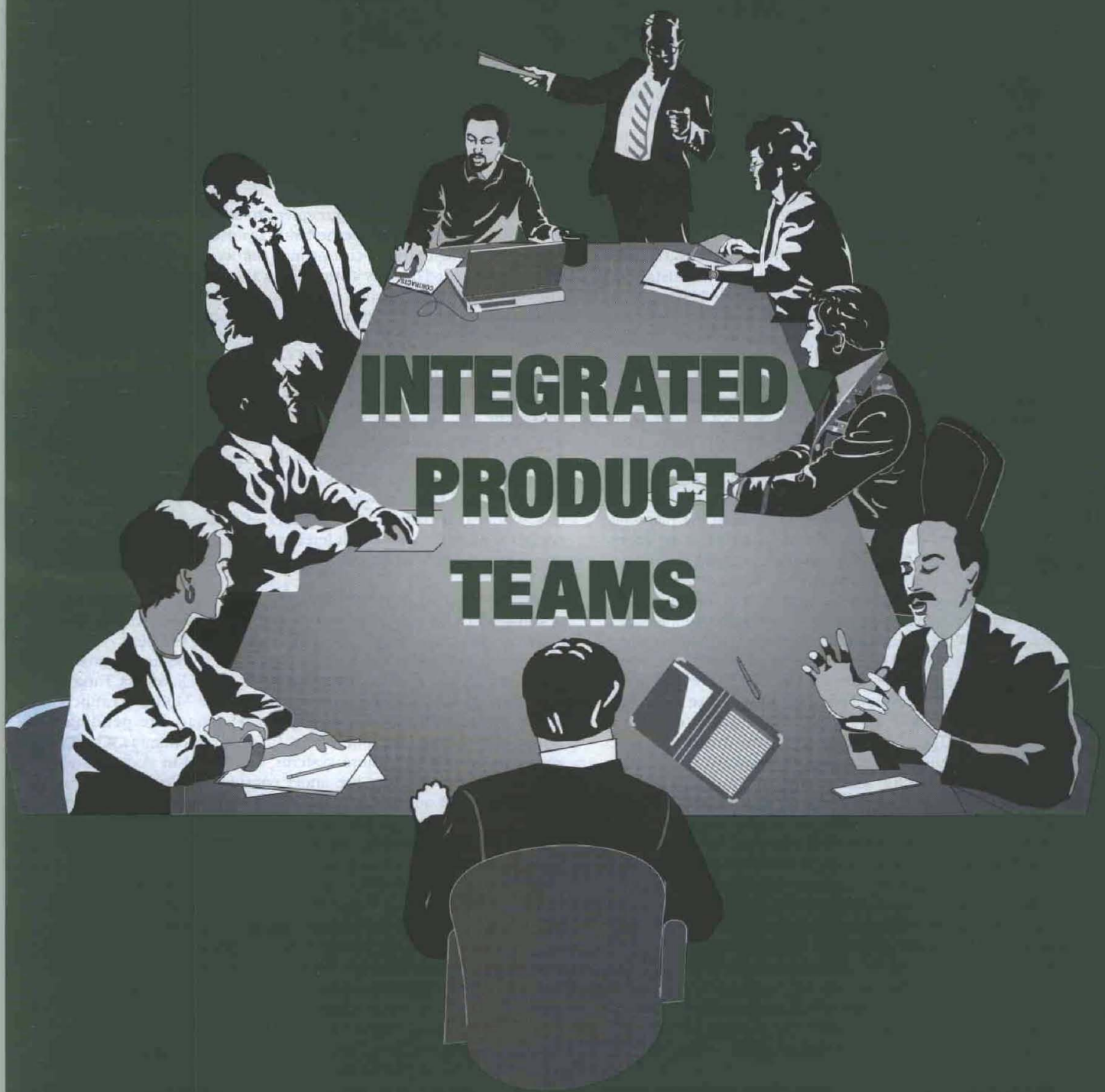
Headquarters Department of the Army
PB-70-95-6

ARMY RD&A

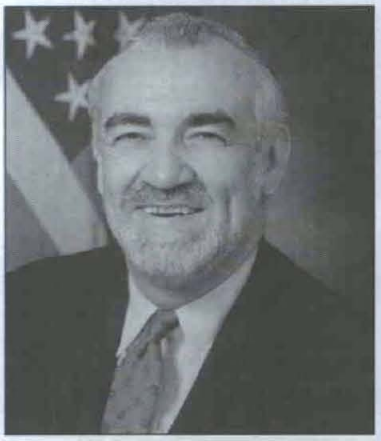
NOVEMBER - DECEMBER 1995



INTEGRATED PRODUCT TEAMS

From The Army Acquisition Executive . . .

INTERNATIONAL SECURITY ASSISTANCE



This is an exciting issue that focuses on the Integrated Product Team (IPT) concept and includes an interesting feature by Dr. Kaminski. I am pleased with the response from PEOs, PMs, and the overall acquisition work force in learning and embracing the IPT philosophy. It's all about teamwork. Government and industry must work together to identify and resolve issues early and build successful programs so that we provide the soldier with the best we can offer.

The IPT approach is not limited to our shores. Perhaps the ultimate IPT is in the area of international security assistance. Recently, Lieutenant General (retired) Claude M. Kicklighter was named the Deputy Under Secretary of the Army for International Affairs (DUSA(IA)), serving as the focal point for international activities, including security assistance. This is a very important and very timely decision.

We live in an increasingly global economy. Imports and exports of goods and services make up nearly 25 percent of our GNP today compared to just 10 percent a few decades ago. Multinational interests are pursued by almost every industry in the world, and certainly by our own industries here at home, especially our defense industry.

This poses a whole new set of challenges for both the planning and acquisition aspects of security assistance, which is far more complex than the rather straight forward environment of Foreign Military Sales (FMS). As a team, the Army's Security Assistance Directorate and both acquisition personnel in government and in the defense industry, pursue opportunities for international sales to approved allies. What we are finding, however, is that our allies are demanding additional participation in the nature of those sales.

This additional participation takes many forms. For example, there are proposals for co-development, where we share the development costs with our allies up-front. The Medium Extended Air Defense System (MEADS) is one case. Participation also takes the form of our defense industry teaming with companies in the country where we might make the sale. Because the U.S. government cannot get involved in offsets, it takes the form of countries to whom we might make the sale asking the contractors for offsets, including providing them other forms of assistance beyond material goods, such as establishing service and maintenance operations in their country or training services or any number of programs.

Therefore, the security assistance environment overall requires integration across all the traditional stovepipes. We are currently struggling to ensure that the proper coordination and appropriate integration take place. I think we all recognize the complexity of the problem. Our new DUSA(IA) will carry a large coordinating load. But, we must all work together to look for trade-offs and quid pro quos in a coordinated way to ensure that our defense industry can continue to have a fair share of market participation internationally.

We have had some success internationally, especially with Abrams and the Bradley. The foreign sales helped, in many ways, to keep our modernization programs going. In late September, the first M1A2 of 218 was handed off to the 35th Brigade of the Kuwaiti Land Forces. In the Kingdom of Saudi Arabia, we have fielded 350 of 400 Bradleys and 120 of 315 M1A2s. In Egypt, the co-production of 524 M1A1s has been a very successful program. More than 250 tanks have been produced for the Egyptian Army on schedule.

In May, we completed an agreement to sell 30 Apache AH-64Ds to the Royal Army of The Netherlands against severe competition from the German/French consortium, Eurocopter and their Tiger attack helicopter. This was a very politically charged environment. The sale was accomplished by ad hoc teamwork that included many, many players from me at my level to the Secretary of Defense to the President.

The second case was the sale of 67 AH-64D Longbow Apaches, worth nearly $4 billion, to the United Kingdom in July. The coordination requirements were, again, almost as complex as those of the Dutch sale. The same bases had to be touched. It was further complicated, however, by the fact that two U.S. weapon systems remained viable candidates against the Eurocopter Tiger up until the final U.K. selection. Obviously, the official position of the Department of Defense was support for both American competitors. Within that framework, a number of tradeoffs and asked for concessions had to be considered and made. Longbow Apache was selected. Once again, the ad hoc teamwork sold an American product.

What is required, in my opinion, is a proactive strategy and tactics instead of ad hoc coordination, with the understanding that there may be unique differences from one case to the next.

Many opportunities are out there. Sweden is looking at attack helicopters. Spain is considering buying utility helicopters. Turkey is looking to tank modernization. Sales of the Multiple Launch Rocket System (MLRS) to Norway and Denmark are pending. Patriot is under consideration by the United Arab Emirates. What is important here is that these systems, developed in cooperation with our defense industry, are under consideration or in competition. We must do our best to adopt a proactive strategy which supports American foreign policy, increases national security, and assists American industry. I recognize that it is complex, but it is important.

Let me cite two reasons why this is so important. One, we are no longer preparing for global war. We are preparing to fight and win smaller, regional conflicts, carried out in varied terrain, often in cooperation with our friends and allies. System interoperability is the future for our coalition forces. Two, we recognize that arms sales do make contributions to the maintenance of our defense industry. Declining force structure and declining budgets have resulted in profound changes in the defense industry. The government, especially the Army, must work together to help maintain the vitality of our industrial base.

Gilbert F. Decker

NOVEMBER-DECEMBER 1995
PB 70-95-6

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

Army RD&A (ISSN 0892-8657) is published bimonthly by the Office of the Deputy Director, Acquisition Career Management. Articles reflect views of the authors and should not be interpreted as official opinion of the Department of the Army or any branch, command, or agency of the Army. The purpose is to instruct members of the RD&A community relative to RD&A processes, procedures, techniques and management philosophy and to disseminate other information pertinent to the professional development of the RD&A community. Private subscriptions and rates are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 or (202)512-1800. Second class official postage paid at Fort Belvoir, VA and additional post offices. POSTMASTER: Send address changes to DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101, FORT BELVOIR VA 22060-5567. Articles may be reprinted if credit is given to Army RD&A and the author. Unless otherwise indicated, all photographs are from U.S. Army sources. Approved for public release; Distribution is unlimited.

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00924

Research Development Acquisition ARMY RD&A

Professional Publication of the RD&A Community

FEATURES

DEPARTMENTS

COVER

One of the immediate and fundamental changes in Defense acquisition reform is implementation of the integrated product team concept. It places emphasis on application of a cross-functional team approach to maximize program success.

INTEGRATED PRODUCT TEAMS

One Important Step Forward In Military Acquisition Affairs

By The Honorable Paul G. Kaminski
Under Secretary of Defense
For Acquisition and Technology

Editor's Note: The following remarks were presented as the keynote address by Dr. Kaminski during a DOD Integrated Product Teams (IPT) Conference, July 20, 1995, at the Defense Systems Management College, Fort Belvoir, VA.

Introduction

It is a great pleasure to be with you today. Perhaps it is fitting that we meet on this date—July 20th. On this day in 1969, America first landed men on the moon—Neil Armstrong took "one small step" and mankind took "one giant leap."

Today, I look forward to seeing us take one more not so small step towards what I hope will become one giant leap forward in military acquisition affairs. The giant leap we are seeking is a change in our Defense acquisition culture. It is easier said than done. When it comes to cultural change—and what's at stake is meaningful acquisition reform—its been my sense that...

- it is easy to talk about why;
- harder to talk about how;
- and even harder to *do*.

We're done talking about why—today we're going to share our ideas on how to implement an integrated product team approach to oversight and review of acquisition programs. We've convened this off site to develop a common understanding within the department [DOD] on how we will implement the IPT concept.

IPT Objectives

The department's senior leadership—Secretary Perry [secretary of Defense], Deputy Secretary White [deputy secretary of Defense] and I—are all committed to successful implementation of the IPT concept. Earlier this year, on April 28, I issued a memorandum directing an immediate and fundamental change in the role of OSD and component staff organizations in performing oversight and review of acquisition programs. In that memorandum, I laid out the following objectives for forming integrated product teams:

- Creation of an acquisition system that capitalizes on the strengths of all participants in the acquisition process to develop programs with the highest opportunity for success;
- Fostering the early, active and constructive participation of OSD and component staff organizations with program office teams to develop a sound and executable acquisition strategy and identify and resolve issues as they arise, not during the final decision meeting.
- Transforming historically adversarial relationships, especially between headquarters staff organizations and program office teams, into productive partnerships; and
- Placing renewed emphasis on the importance of working as a cross-functional team to maximize *overall performance.*

IPT Concept

Given these objectives, let me share with you some of my thoughts on what IPTs are—I have asked Noel Longuemare [principle under secretary of Defense for acquisition and technology] to cover this topic in greater detail in a moment.

Integrated product teams are committed to program success. The teams are responsible for delivering a product—to field systems for the warfight-

The Program Manager's Bill of Rights and Responsibilities

Program Managers have the RIGHT to:

- A single, clear line of authority from the Defense Acquisition Executive.
- Authority commensurate with their responsibilities.
- Timely decisions by senior leadership.
- Be candid and forthcoming without fear of personal consequences.
- Speak for their program and have their judgments respected.
- The best available training and experience for the job.
- Adequate financial and personal resources.

Program Managers have the RESPONSIBILITY to:

- Accept program direction from acquisition executives and implement it expeditiously and conscientiously.
- Manage their programs to the best of their abilities within approved resources.
- Be customer focused and provide the user with the best, most cost-effective system or capability.
- Innovate, strive for optimal solutions, seek better ways to manage, and provide lessons learned to those who follow.
- Be candid about program status, including risks and problems as well as potential solutions and likely outcomes.
- Prepare thorough estimates of financial and personnel resources that will be required to manage the program.
- Identify weaknesses in the acquisition process and propose solutions.

To signify our support for the Program Manager and our commitment to the Program Manager's Bill of Rights and Responsibilities, we affix our signatures below.

_____

Program Executive Officer

_____

Acquisition Executive

_____

Defense Acquisition Executive

As the Program Manager, I have full program responsibility and accountability. I pledge to do everything in my power to warrant the rights granted to me and to fulfill these responsibilities.

_____

Program Manager

er. The objective will always be to provide the warfighter with more capability, sooner and at less cost. Integrated product teams include representatives from all the appropriate "oversight" functional disciplines working together with a team leader to ensure we build successful and balanced programs.

The two most important characteristics of IPTs are empowerment and cooperation—trust n' teamwork by another name. The teams must have full and open discussions with no secrets. Team members must be empowered to speak for their superiors in the decision-making process.

The bottom line is that we must shift our process from one of oversight to "early insight." We need to make sure OSD and component staff expertise is made available to the program manager early on so that we prevent problems, rather than try to identify them in a "gotcha" fashion at the Defense Acquisition Board (DAB) review itself.

We should be building in quality and excellence from the start—not trying to inspect it in two weeks before the DAB. In my mind, this is one of the important value-added contributions that the OSD and component oversight staffs must provide. The ultimate measure of a well-executed team approach to the DAB process is whether all issues have been resolved so that there need be no DAB meeting.

At this point, let me stress that being part of an IPT does not compromise a functional member's independent assessment role. I will continue to hold team members accountable for ensuring each program has a workable approach—we are not getting rid of the independent assessment function.

Individual members must continue to perform an independent assessment and satisfy themselves that a program is executable, but I expect this to be done early and in a constructive way. We are not working constructively as an integrated team if we have to wait until the DAB meets to surface "surprises."

I also expect stakeholder behavior—when concerns are raised in a constructive way, they should be accompanied with workable suggestions and practical solutions. As we institutionalize IPTs, we should remember that we're implementing a process to secure early insight—not event-driven oversight. For this reason, I expect that the department's functional staffs will fundamentally shift their roles from sequentially checking on a program beginning six months prior to a milestone decision point, to continuous participation on an integrated product team.

Although not directly related to the use of IPTs, a concept we have been trying to emphasize and to institutionalize in an IPT framework, is that of "tailoring." There is lots of flexibility in the 5000 series directives—the issue is to incentivize change away from a "one-size-fits-all" classical mold. We must tailor not only the acquisition strategy, but the acquisition approval process, to fit the specific circumstances of individual programs. There is no reason to treat every program identically from a management standpoint. But there is every reason to tailor management to specific program circumstances.

Need for Cultural Change

I've been in my job for a little over nine months now...and it has become obvious to me that we will need to transform the risk averse culture that has grown up within the department over the years. I can not *direct* this cultural change—we need "buy in" by all of you, the major stakeholders. Unless this occurs, we will not develop the trust n' teamwork that it takes to implement the IPT concept.

The department's top leadership must create a climate for reasoned risk-taking—otherwise we will never exploit the opportunities that may be within reach. This morning I had the honor and privilege to meet with the acquisition executives, program executive officers and the ACAT 1D program managers and present them with their "Program Manager's Bill of Rights" certificate. [see page 3.]

The Program Manager's "Bill of Rights" explicitly lays out what program managers can expect from their acquisition chain of command as well as what we expect from them. This certificate, taken alone, is symbolic. What matters is not what we say so much as what we do—actions speak louder than words. People will be watching us and asking whether we are in fact doing what we said we were going to do.

Summary

In conclusion, my thoughts regarding the department's IPT initiative can be best summed up as follows:

- We need *Continuous Insight,* not *Oversight*—quality has to be built into programs from the start.
- We must emphasize *Prevention* over *Cures*—Let's identify and resolve problems early and constructively...the goal is *no* DAB, not *"Gotchas."*
- We must focus on *Program Success,* not *Functional Area Performance*—our job is to provide more for the warfighter...systems that work, faster and cheaper.

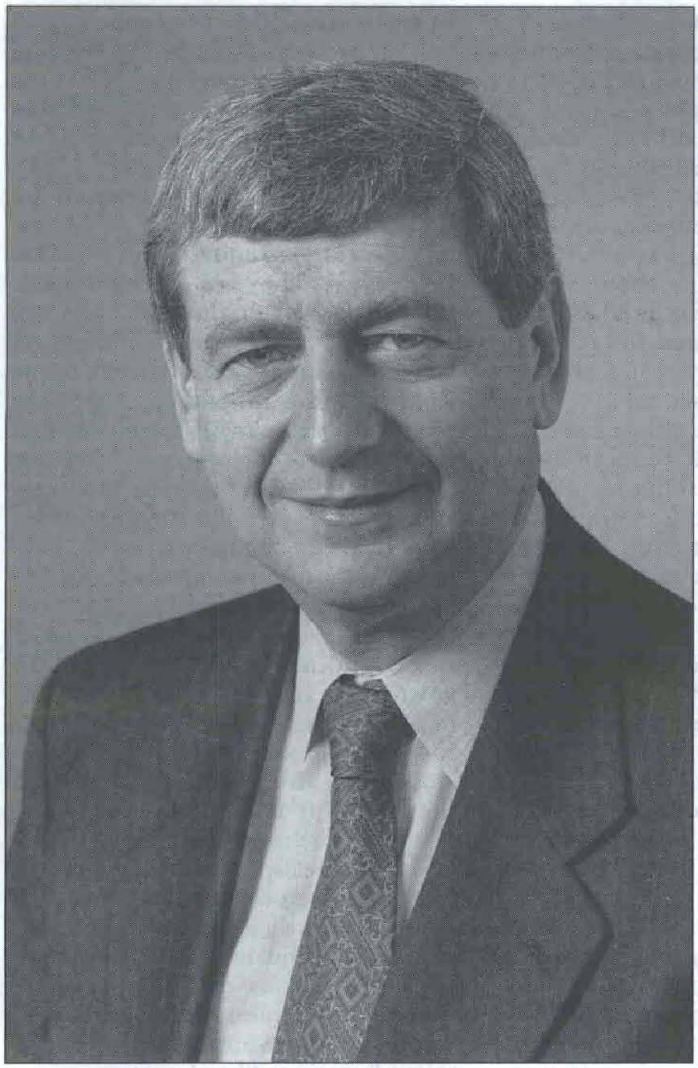
As we move through today's agenda, I believe these points will continue to surface as recurring themes.

Twenty-six years ago, one man took the final step in a journey that began nine years earlier. That journey was completed only after many other steps were taken by many others—both individuals and organizations. In the process, the nation built a successful, mission oriented, trust n' teamwork culture—one that culminated in the Apollo 11 mission to the moon. By the way, this is the same culture that also brought the Apollo 13 astronauts back home safe after an explosion early in the mission.

Today, we will stop talking about why we need to change our culture and start talking about how to implement change—it will be one small step taken by many—for some it may also be a giant leap. It will not be easy. We still have many issues to resolve. We do not have all the answers or even have all the questions. I encourage you to get your questions out on the table today so we can address them and move forward.

This must be a team effort among warfighters, program managers, and functional staffs. I ask you to work with me to become agents of change in creating a legacy for U.S. forces in the year 2010.

Thank you all.



Michael T. Smith

AN INDUSTRY PERSPECTIVE ON INTEGRATED PRODUCT TEAMS

By Michael T. Smith
Chairman, Hughes Aircraft Company

"The use of IPTs is a 'win-win' for both top- and staff-level OSD and PMs. . .the resulting benefits will be reaped by all over time. However, learning the process and becoming comfortable with it also requires time. Be assured that the leadership in OSD—career, political and military—strongly supports the IPT process and is committed to making it work"
—Dr. Paul Kaminski Aug. 14, 1995

Secretary of Defense William Perry and Under Secretary of Defense for Acquisition and Technology Paul Kaminski underscored the critical importance of Integrated Product Teams (IPT) last spring in a series of memos and statements on reengineering the acquisition process. In July, they followed up by sponsoring a day-long offsite on IPTs at Fort Belvoir called "Institutionalizing Integrated Product Teams: DOD's Commitment to Change." The offsite brought together the acquisition leaders of OSD and the military for a single purpose: to promote IPTs as a permanent element in the DOD.

The objective of DOD's reengineering of the acquisition process is to provide our nation a capable defense at an affordable cost. IPTs reduce cost by changing the structure of how industry works in a way that maximizes both the potential and efficiency of organizations and people. While there are differences in approach among the many government organizations and companies, all are seeing positive results. However, from the industry perspective, there are two very important points to remember: first, successful IPTs require more than just the formation of teams, and second, it takes

As part of the Integrated Product and Process Development, integrated product teams bring together the right people with the correct resources at the right time to accomplish defined objectives in minimum time and cost.

time to achieve tangible results.

As part of the Integrated Product and Process Development (IPPD), IPTs bring together the right people with the correct resources at the right time to accomplish defined objectives in minimum time and cost. Whether the objective is improved execution of programs (the emphasis of Dr. Kaminski's initiative), or the development and manufacture of products and services, the process and the rewards are the same. Industry is far enough along in the implementation of IPTs to be able to show positive dividends: we are seeing significant reductions in costs, development schedules have shortened, engineering changes are fewer and manufacturing rework/repair/scrap rates have decreased. Our product is better and cheaper, and the customer is happier.

Instead of "supervising," the emphasis now is on owning and improving the processes, selecting and continually developing the people who work within our teams, making sure our teams have the right mix of knowledge and skills, and providing the right tools and technologies at the right time.

For two years, Hughes has been implementing the IPT concept and incorporating it as the way of doing business. We espouse the IPT philosophy because our customers believe in it and want it, and because we have seen it work. But for IPTs to be successful, they must be driven from the top down.

Early indications of IPT use at Hughes show strong returns. IPTs proved invaluable in the F-22 Common Integrated Processor program. Hughes was able to exceed desired development cost cuts by more than 10 percent, reduce engineering change rates by more than 50 percent and reduce rework/repair/scrap by more than 50 percent. Similarly, IPTs on the Enhanced Position Locating and Reporting System VHSIC program reduced manufacturing costs by more than 40 percent and reduced life cycle product costs by more than 25 percent.

However, implementing IPTs requires more than just reengineering the way industry organizes its work teams. The process requires us to rethink every aspect of the way we work. The new culture demands common processes and standardized tools that enable both horizontal and vertical integration—a concept that is difficult to comprehend from the perspective of the old stovepiped organizations where most of us learned the ropes. Instead of "supervising," the emphasis now is on owning and improving the processes, selecting and continually developing the people who work within our teams, making sure our teams have the right mix of knowledge and skills, and providing the right tools and technologies at the right time. A complete transformation of the IPT style isn't easy and it won't happen overnight.

Empowered, trained and well-led IPTs with clear objectives are industry's best opportunity for global competitiveness. They are the right arena for concurrent engineering and the superior forum for early identification and control of risk. The Defense acquisition initiative to make cost an independent variable (CAIV) demands that CAIV be one of the objectives and metrics of IPTs, especially in the early stages of requirements generation, demonstration and design.

The industry processes that need to be reengineered go beyond the traditional focus on engineering, manufacturing and material management. To get the maximum benefit, industry must align the infrastructure processes such as finance, business development and information technology so that they support IPTs. Leadership must model the behavior we are expecting of our teams, especially behaviors that foster trust, communications and empowerment. Finally, industry needs to develop and manage the human resource processes with the same degree of commitment that we have traditionally given to our Manufacturing Resources Planning systems.

One of the key ingredients in the IPPD process is the importance of customer involvement. Customers provide a wealth of knowledge, experience and timely guidance. Properly structured, customer involvement increases the value of industry efforts while reducing the cost of development, manufacture and support. The partnership of DOD and industry on IPPD not only aligns work teams and processes, but provides the greatest potential for reduced costs and unmatched competitiveness in the international market place.

Will Rogers said "It's no good being on the right track if the train behind you is moving faster than you are." IPPD and IPTs are the right culture and structure to propel industry forward, to keep us ahead of the international competition, both in the market place and on the battlefield. I believe that the Defense electronics industry is fully committed to making IPPD and IPTs work, and we know that the future of America depends upon our success.

TEAMING FOR INTEGRATED PRODUCT AND PROCESS MANAGEMENT

By Gilbert B. Langford

Background

The Department of Defense has been working to find the best methods for reengineering the acquisition oversight and review processes. As a result, on May 10, 1995, the secretary of Defense directed that the concepts of Integrated Product and Process Development (IPPD), and Integrated Product Teams (IPT) be applied throughout the acquisition processes to the maximum extent practicable.

The Army has been active in developing improvements in acquisition practices. The thrust to make improvements is not new. What is new is the adoption of fundamentally different concepts to drive these improvements. During 1991, the Army Materiel Command (AMC) initiated a three-year series of concurrent engineering (CE) workshops. Through the workshops, and the Army Acquisition Improvement Principles, CE concepts were expanded to reflect system life cycle. This resulted in recognizing that, not only simultaneous technical activities are required, but also activities by all other functional interests in the system's life cycle. Consequently, the CE workshops were followed by the currently ongoing, Integrated Product and Process Management (IPPM) Working Group. The concepts of multidisciplined and integrated work processes have become key elements for acquisition process improvements. These principles have their origins in CE concepts. Concurrent, cooperative action by people representing a range of disciplines is required for the most effective operation of the Integrated Product Teams.

Introduction

Concurrent engineering is a systematic approach to integrating the design of products and related processes. For example, a design engineer could complete the design of a product, and even build an engineering model which demonstrates the required performance, without any significant consideration of the processes, facilities, costs, and people required for volume production. Soldiers require many of these products, not just one, regardless of the superior performance of the engineering model. Also, these products must be repaired and maintained in the field, and finally disposed of at the end of useful life. Consequently, to ensure that the product will meet performance standards, as well as production, support, and disposal standards, a multidisciplined team should consider all of these characteristics together, from the beginning of the acquisition process, and throughout the life of the product—the weapon system. This technique causes the developers to consider all elements of the product life cycle from concept through disposal, including quality, cost, schedule and user requirements. Figure 1 depicts development of the concept.

In the Army, CE has evolved to Integrated Product Development, then to IPPD, and now, IPPM. IPPD describes the efforts of the materiel developer, or contractor, to design and develop a product with an Integrated Product Team (IPT). It is intended to avoid the implication that the application of this concept is limited to the engineering function. IPPM describes the Army concept for managing the system acquisition process. The IPPM concept draws on the systems engineering tools and overlays a management concept that encourages the use of IPTs. The most desirable Army IPT includes industry representation. Likewise, the most

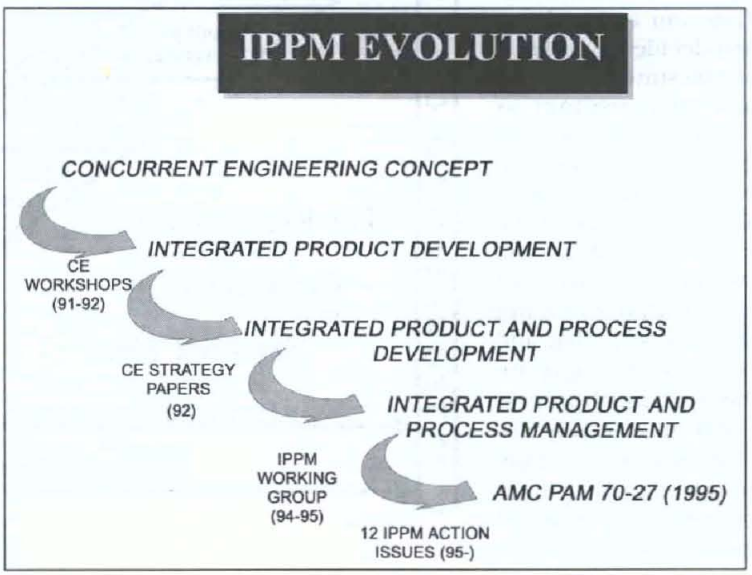


Figure 1.

desirable industry IPT includes Army representation. The Army interacts with the contractor's IPPD process, in its role as a customer, through the application of IPPM practices. Army responsibilities involve establishing performance requirements, managing total program progress and evaluating product quality. The responsibilities extend throughout the product life cycle. This article focuses on the IPT that is internal to the Army. Interactions with the contractor's IPT are discussed. Also considered is the relationship of the program IPT to the Department of Army (DA) IPT as the Army Systems Acquisition Review Council (ASARC) Coordination Team (ACT).

IPT Concept and Objectives

The Integrated Product Team influences the results of all phases of the life-cycle. Team actions result in the simultaneous trade-offs of all factors such as: requirements, design, process, performance, and support. This is accomplished in the team's multidisciplined working environment, and continues *throughout the system's life cycle.* This contrasts with sequential, trade-offs by function, and subsequent recycling, which is a characteristic of past conventional acquisition practices. Figure 2 shows a comparison of span time of these processes.

One example of this recycling is the case where our design engineer works independently from manufacturing counterparts to complete the detailed drawings and specifications of the product, and then passes them to the manufacturing function to produce. Manufacturing then decides that significant new capital investments will be required to make this product as designed. So, the product is sent back to our design engineer for design rework to make it compatible with existing production capabilities, resulting in schedule delays and excess costs. These delays and additional costs could have been avoided by being attentive simultaneously to design and production. This scenario may be repeated when this sequential process results in a later and more costly discovery, and an Engineering Change Proposal must be introduced to fix a design deficiency for field repair, as well as a retrofit product already in the field. Fortunately, the IPTs of best value contractors now work to avoid these types of scenarios. The ability for the rapid, early examination of the total impact of alternatives, is one of the strengths of the IPT.

The objective is to sustain the Army's technological effectiveness, even with declining resources, through the application of IPPM concepts. This will result in superior weapon systems which are affordable by the American taxpayer. The IPT makes IPPM happen. The Army IPT will be most effective for interface interactions with the contractor's IPT. The essence of IPPM is that all functional areas be integrated from the beginning of the program and, for the total life cycle. The vision statement in AMC's *Concurrent Engineering Strategy Paper,* of May 6, 1992, states the result to be achieved with IPT as follows:

> *A technologically superior Army, with world-class equipment provided in the shortest possible time through streamlined engineering processes, multidisciplined teams and integrated design of products and processes while simultaneously lowering product costs and improving product quality to ensure the best value for both our soldiers and the American taxpayer.*

IPT Composition and Empowerment

The team should include representatives from all of the elements that are responsible for the various functions that influence the design. A listing of the functional parameters should be developed by the IPT or its equivalent office. Assigning people to the team is not sufficient to assure effective functioning of the IPT. Team members should be qualified in advance for the IPT through training and experience. Teams will go through several phases as they mature from a collection of individuals to a cohesive unit. Both team continuity and training should be required. The individual multidisciplined team members usually have a limited level of experience working with individuals from other disciplines. A free flow of information between the IPT and industry experts should be encouraged, also. The IPT of the Best Value

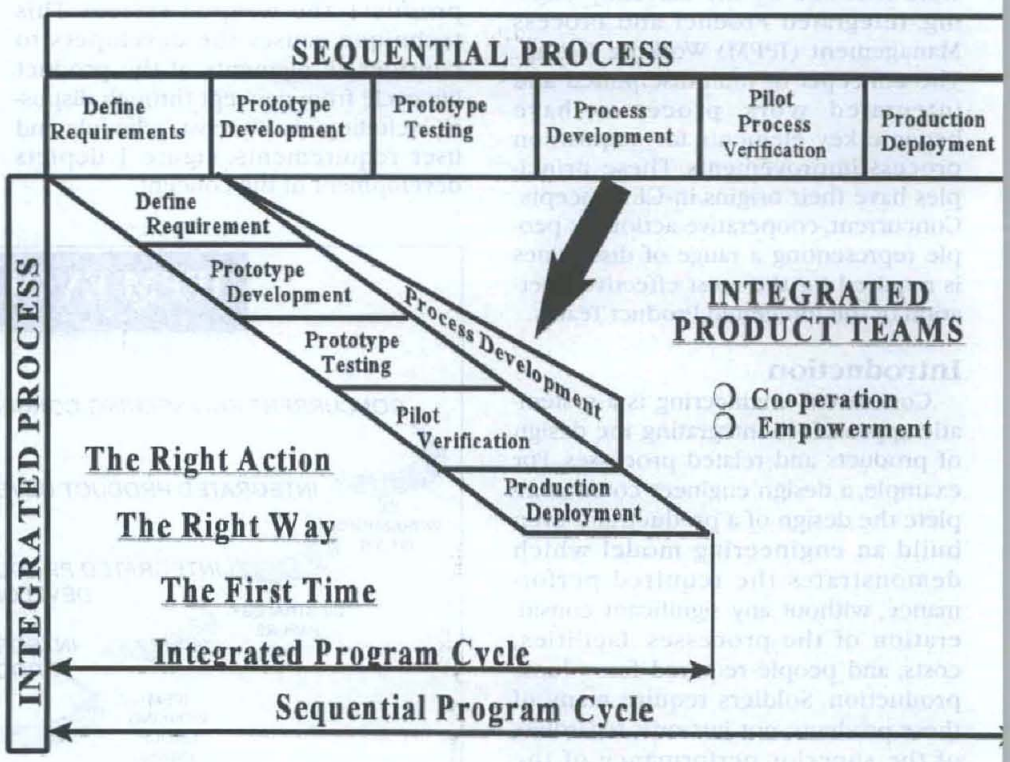


Figure 2.

contractors can provide working models for the Army IPTs, and improve the effectiveness of interface relationships.

The ideal IPT would have both contractor and Army membership. The objective would be to emulate the best commercial practices which may be found in joint ventures, or in the relationships with an Original Equipment Manufacturer (OEM), and the industrial suppliers of major subassemblies and key components. For example, it is essential to the OEM for key suppliers to be involved in the planning, development, production, and support of this item, which will go to market in competition for market share. In contrast with Army acquisition, the OEM in the commercial market receives no financial return from the customers until the point of sale of the end-items. This is when the efficiencies gained from customer-supplier teamwork payoff.

Our challenge in the Army is to approximate this idealized model, as closely as possible, within applicable statutory and regulatory constraints. The guidance in *AMC-P 70-27, Vol. 2,* states: "A free flow of ideas and information between the (Army) IPT and industry experts should be encouraged. Program managers are encouraged to apply innovative methods for contractor representation on their IPTs. This operational guidance may be tailored to match the specific needs of the project." A memorandum of understanding could be established for IPT representation by contractors and the Army, at the discretion of the program manager and the contracting officer for respective, contractor and Army IPTs.

IPT members must interact constructively in free and open discussion on issues. This must take place in a cooperative, give-and-take mode of operation by team members with trust and mutual functional respect. The objective will be to seek optimum alternative actions, which will satisfy the requirement rather than standing on unyielding functional opposition. This creates a "win-win" situation which will also lead to the early identification of unresolvable issues for consideration beyond the level of team empowerment.

It is essential for IPT members to be empowered to make decisions as representatives for their functional organizations. Training, education, and experience is critical to the success of the IPT member. These empowered functional representatives speak for their functions and ensure that sound decision making is practiced that the program manager can rely on. The empowerment should be supported by a team charter. An excellent example of this is the Concurrent Engineering Team Charter structure used by the U.S. Army Armament Research Development and Engineering Center for the CE team for the XM(TBD) Mortar Fire Control Systems, an Acquisition Category (ACAT) III program. This charter identifies: purpose, applicability, explanation of terms, mission, concept of operation, participating organizations and personnel, responsibility and authority, and special considerations. The charter includes the definition of the core IPT composition. The charter also covers member responsibility and authority, as well as that for support functions to the IPT.

The IPT charter should be tailored to fit the program assignment. The essence of a team is common commitment, which is consistent with the mission defined by the team charter. There have been many examples of teams that are established to accomplish a specific objective. The majority of these have been structured by function or discipline. This is exemplified by a team composed of engineers to fix a problem which was discovered after the hardware failed to meet some requirement. Similarly, team activity is caused by changes in some requirement, and the team composition is predominantly single-disciplined also. The multidisciplined IPT should be the agent for the avoidance of the need for unexpected fixes, as well as the agent to maintain the stability of requirements. The mission statement of Team Comanche includes: "ensure that all decisions are made with the full-cycle perspective—i.e. don't neglect training, sustainment, manufacturability,...." All IPTs must maintain the goal of taking the right action, the right way, the first time, i.e. zero recycling.

IPT Actions By Acquisition Phase

Army program IPTs represent horizontal integration throughout the acquisition life cycle. The keys to success of the IPTs are empowerment and cooperation. It is imperative that IPTs focus on early identification and resolution of issues. Currently, ACAT I programs have the primary attention by DOD for the application of IPTs. However, ACAT II & III programs also benefit greatly from the application of integrated practices for hardware and software. *AMC Pamphlet 70-27, Vol. 2,* provides guidance on the operational application of integrated product and process management and on best value contracting.

The AMC pamphlet provides guidance for IPTs for each phase of the life cycle. This includes guidance for team composition, and team member functions. Worksheets, similar to detailed checklists, are displayed for each phase of the life cycle. These worksheets show the key actions and approaches for the IPTs from Pre-milestone 0, through operation and support for the application of IPPM concepts. The elimination of Milestone IV will simply result in the roll-back of the Phase IV Worksheet into the Phase III Worksheet, i.e., a consolidation of the actions and approaches.

The worksheets for actions and approaches by the IPTs have been designed to address the IPPM concept, and to assure a streamlined best value approach to Army acquisitions. However, these worksheets do not address the entire spectrum of support required by a program during different stages of the life cycle. They do foster a greater sensitivity to the IPPM concept, for avoidance of non-valued-added requirements, and to help with program tailoring.

IPT actions ideally take place in the same location. However, the diversity required in team composition may cause this to be impractical on a continuous basis. The personal acquaintance of team members is important for effective interaction by team members. Virtual collocation can work through electronic networking tools, after the personal acquaintanceship phase has been accomplished in team formation. Team members must develop the "we" rather than "I" for their interpersonal communications. The diversity of the multidisciplined team, suggests that an IPT facilitator be considered to support the team leader.

The program IPTs, discussed here, are horizontally-integrated. New management practices will result in DA and DOD staff IPTs. These are vertically-integrated IPTs which are intended to provide a continuing visibility and insight to programs. This will simplify the milestone review and decision process for the Milestone Decision Authority (MDA). To make this happen, the horizontal program IPTs will have an ongoing interface with the vertical DA and DOD IPTs.

Consequently, the AMC IPTs will have an additional interface during each program phase, rather than only at the milestone decision point. A discussion of the DA vertical IPT is next.

DA IPT as the ASARC Coordination Team (ACT)

Dr. Paul G. Kaminski, under secretary of Defense (acquisition and technology) has directed a fundamental change in the role of the Office of the Secretary of Defense (OSD) and component staff organizations currently performing oversight and review of acquisition programs. "Rather than checking the work of the program office beginning six months prior to a milestone decision point, there will be participation early and continually with the program office teams, resolving issues as they arise, rather than during the final decision review. This will move the process away from hierarchical decision making to a process where decisions are made across organizational structures by integrated product teams".

Army Acquisition Executive Gilbert F. Decker has directed that all programs will have a single overarching IPT. For ACAT ID programs, the responsibility for the overarching IPT for program oversight and review belongs to OSD. For ACAT IC and ACAT II programs, the ASARC Coordination Team (ACT) has the same functions as the overarching IPT. The ACT will have the role also, of preparing the ACAT ID program for an ASARC level review. The Army ACT vertically links with the PM's program IPT.

As a result, the horizontal IPTs for program execution will add a new interface of the vertically-integrated DA IPT for program insight and review. Insight will result from ongoing knowledge of the programs by the Milestone Decision Authority (MDA), rather than the single point ASARC. The intent is to improve oversight intelligence through gaining insight that adds value to the process. This is a change from oversight management to participative management.

At this time, the vertically-integrated IPT concept and composition is new. However, this fundamental change should avoid costly surprises at milestone decision. Army guidance in *AMC-P 70-27* will be updated for impact on Army program IPTs and IPPM.

The ACT will participate early and continuously with Army program IPTs. The ACT will prepare a modification of the integrated program summary. ACT will be vertically-integrated with Army program IPTs for milestone decision, and ACT will pre-ASARC, horizontally scrub each program.

These changes are designed to gain significant increases in the efficiency and effectiveness of acquisition practices in DOD and the Services. The Army continues to "lean forward in the foxhole".

Conclusion

Recently, General Motors announced plans to speed vehicle development and reduce such costs by 25 percent by 1997, with the objective of continuing to improve beyond that. The current industry standard for new-vehicle development is 36 months. Ford Motor Co. has set a goal of cutting new product development time to 24 months. Motorola's "Flip Phone," and Boeing's 777 were developed and produced in an integrated team environment. Industry has pioneered in the application of integrated teaming. Needed changes in culture have evolved with integrated teaming practices, resulting in significant improvements in operating efficiencies.

The Army is already achieving positive results through the use of multidisciplined teams. Examples of these positive results include:

- Hellfire transitioned two-thirds of prototype parts to production without change.
- The development/production program for the M1A2, by traditional sequential process planning, was seven to nine years. Concurrent, multidisciplined, customer/contractor teaming results in a three- to five-year span time.
- The Close Combat Anti-armor Weapon System Project Office chartered the joint team Tube Launched Optically Tracked Wire Guided (Missile), Improved Target Acquisition System (TOW ITAS). Soldier users have been an integral part of the ITAS project.
- The Close Combat Tactical Trainer (CCTT) program's statement of work (SOW) required the contractor to use a system design process that concurrently integrated the efforts of all functional areas, including producibility engineering and planning, software/firmware, product assurance, test and evaluation, logistics, and configuration management.
- The Associate Product Manager for Bradley A3 is the nominal government IPPM team leader. Members of the government IPT are also representatives on the contractor's product development teams.
- The Composite Structures Development Team, of the Composite Armored Vehicle program, is a true IPT, as it includes representatives from three directorates of: the Army Research Laboratory, the Training and Doctrine Command, the Defense Contract Management Command, the test and evaluation community and the contractor.

So, several Army programs have been off and running with IPTs tailored to the program requirements and maturity of the program. IPPM and associated IPTs are essential for the Army to do things more smartly and with less resources.

Most of the principles and practices discussed here are reflected in *AMC-P 70-27*. The Army will build on this as a baseline for improvement. The initial update to *AMC-P 70-27* is planned for March 1996. This will include the results from current work by the IPPM working group on 12 issues which require resolution to further facilitate the application of IPPM. New guidance associated with the DA, ASARC Coordination Team will be added as appropriate. Additional updates of this pamphlet will reflect new "lessons learned" in carrying-out IPPM. The guidance provided will assist the Army to ensure the best value for both our soldiers and the American taxpayer.

GILBERT B. LANGFORD is the chairman of AMC's Working Group on IPPM. He holds a degree in mechanical engineering from Purdue University, an M.S. in management from Rensselaer Polytechnic Institute and is a member of the Army Acquisition Corps. Langford is also a graduate of the Program Management Course.

HANDS ON TRAINING THROUGH APPRENTICESHIPS AND INTERN PROGRAMS

By Dr. Jerry G. Davis,
CPT Jaimy S. Rand
and Jim Pollard

Introduction

Not many high school students get to spend the summer working in an advanced weapons research laboratory, or better yet being assigned an "honest-to-goodness" individual research project while mentored by a "world-class" rocket scientist. It happens every summer at the University of Texas at Austin. Thanks to the early work of several university leaders, strong support from George Singley (the former deputy assistant secretary of the Army for research and technology), and funding from the Army Materiel Command, the Army was able to satellite an ongoing university program to make this experience a reality for several graduating high school students and cadets from the U.S. Military Academy at West Point.

One of the federated laboratories under the Army Research Laboratory umbrella, the Institute for Advanced Technology (IAT), located in Austin, TX, has a mission to develop advanced technology weapons systems for the Army of the 21st century. The IAT, which is an autonomous operating element of The University of Texas at Austin, employs more than 25 scientists who are highly regarded experts in various engineering disciplines. In fulfilling its role, the IAT annually sponsors apprenticeship and internship programs to facilitate the intellectual development of scientists and leaders of the future. This year, two internship programs occurred concurrently, providing an opportunity for the participants to interact with each other as well as with the scientists who mentor them on academic and professional levels. This year's participants included six cadets from the U.S. Military Academy and two recent high school graduates who were selected for their superior scholastic achievement and potential for academic success at the collegiate level.

Background

The IAT mission focuses on the hypervelocity physics, hypervelocity launch, and pulsed power issues of advanced weapons. Scientists and technicians within the technical divisions of IAT are addressing the issues surrounding development of an electric gun, the launch of its projectiles, and required power systems. Many such issues were addressed this summer by the internship participants. The areas studied spanned the entire range of electric gun functions, from modeling of systems supporting and powering various components of the gun to conducting actual railgun experiments in a laboratory setting.

DOD Science and Engineering Apprenticeship Program

The high school graduates' program began first. Its official title is the Department of Defense Science and Engineering Apprenticeship Program. It lasted nine weeks, from June 6 to August 17, 1995. Scientists from the Hypervelocity Physics and Hypervelocity Launch Divisions were identified to serve as mentors for each of the participants. During the summer, each participant was given an issue for concentration. Their work primarily consisted of learning the background of the problem at hand, conducting tests, gathering data, and writing compre-

As they progress academically toward their respective technical degree fields, the high school graduates will remember their detailed assessment of an advanced technology application with a military purpose.

hensive technical reports outlining their findings. Participants not only gained an extraordinary amount of knowledge but also contributed substantially to ongoing research at IAT. The summer apprenticeship program ended with each participant presenting a technical briefing and report to the mentors and fellow participants apprenticed at other laboratories within the university's applied research laboratory domain.

Gregory White, mentored by Dr. Chadee Persad, did extensive initial research into the gouging effect created on the rails of the electric gun during launch. He took measurements of the gouges using various instruments ranging from a Wyko Rough Surface Tester to a simple metric ruler. He was able to analyze the data using sophisticated software such as NIH Image, DADisp Worksheet, and Cricket Graph. This research contributed to the overall effort by establishing connections explaining the occurrence of the gouging effect, and identifying potential methods for taking gouge measurements.

Mike Demkowicz, mentored by Darrel Barnette and Dr. Mehmet Erengil, conducted research on the dynamics of light gas gun barrels by studying barrel motion effects on projectile flight behavior. Demkowicz specifically concentrated on the yaw of the projectile and potential causes for that effect. Additionally, he investigated yaw effects on projectile penetration and on longer projectile flight paths. After a thorough review of potentially applicable theory, he was able to further limit the scope of possible causes for the yaw.

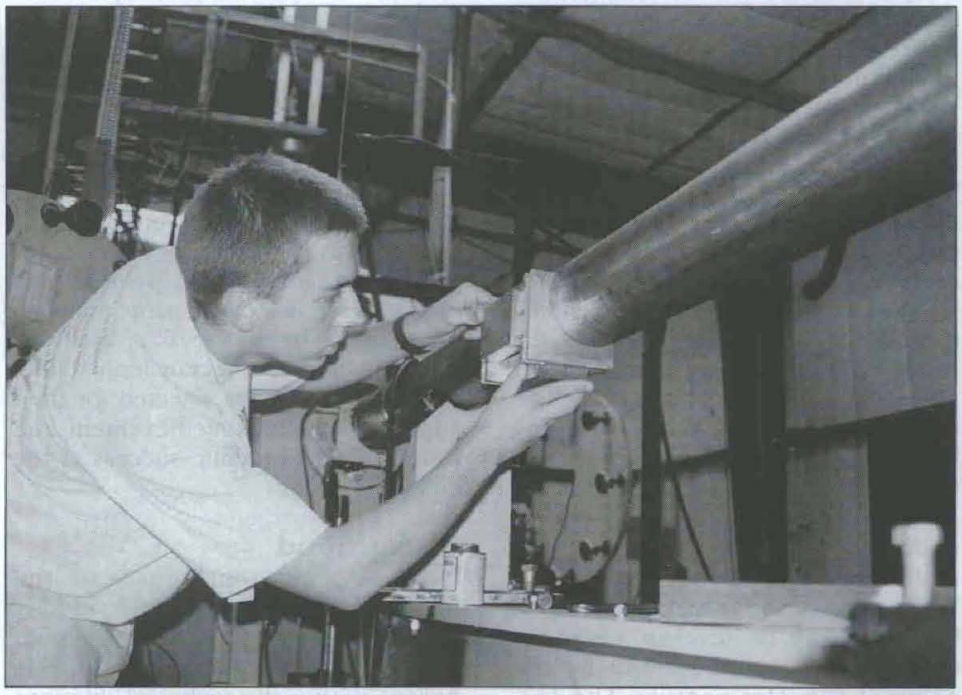
Academic Individual Advanced Development Program

Approximately halfway through their program, the high school participants were joined by six West Point cadets. Interaction between these two groups allowed for the sharing of valuable technical information by both groups. The cadets, who were fulfilling summer intern-type training requirements, officially referred to as Academic Individual Advanced Development (AIAD), were assigned to the IAT for a three week period (July 24 -August 11). They, too, were assigned specific mentors and given problems to investigate. Given the limited time to conduct research, the cadets' contributions were also remarkably substantial.

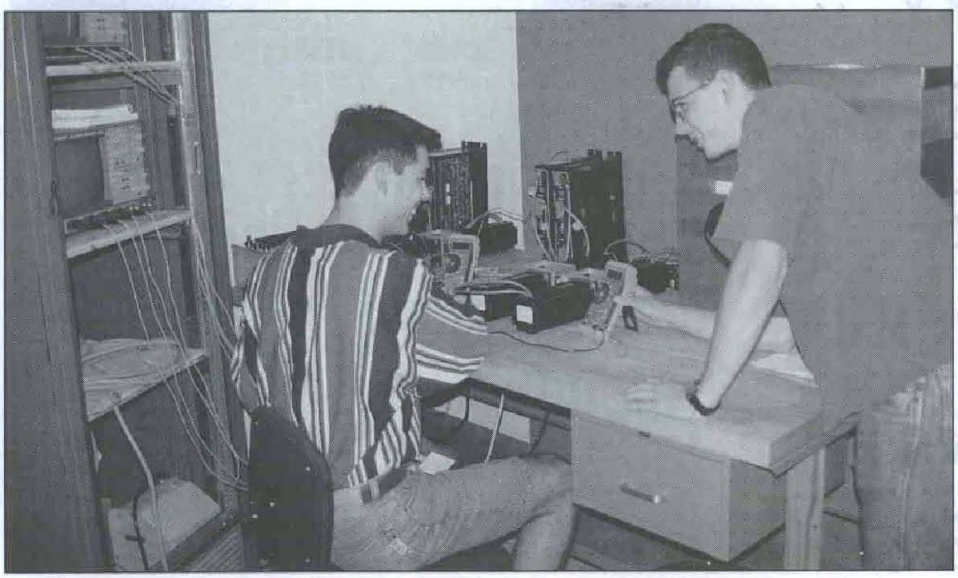
CDT Andre Abadie (class of 1996) worked with two other cadets, John Frederick (class of 1996) and Mike Baker (class of 1997), planning missions on a terrain file downloaded from JANUS. Abadie subsequently assisted his mentor, Dr. Scott Fish, in working with an all electric vehicle simulation code created to analyze various vehicle power system parameters over the planned missions. By the end of his AIAD experience, Abadie had written programs for analysis and display of simulation results. In addition, he created 18 vehicular data files to be used in simulations on each of the mission profiles.

After their initial work with Abadie, Frederick and Baker examined the behavior of brushless direct current machine technology and advanced motor control. They investigated a small-scale vehicle electric power distribution system that can eventually be utilized as a model for the more complex electrical system of an all electric vehicle. This research serves as the initial framework for validating the computer codes the cadets analyzed during the first week of their program.

Cadets Paul D'Ulisse (class of 1996) and Stephen Miller (class of 1997) conducted the majority of their AIAD research in a laboratory setting. Both cadets, working with their mentor, Dr.



Student Mike Demkowicz mounts instrumentation on the barrel of the IAT light gas gun to study the effects of barrel motion on the behavior of the flight package.



Cadets Frederick (striped shirt) and Baker collect transient load measurements on a small scale electric vehicle power system.

Jerry Parker, were introduced to the material analysis of the electric gun rails and to the set-up, maintenance, and modulation of the pulsed-power device used to power the gun. Each cadet was exposed to numerous issues that required recall of classroom theory as well as trouble-shooting skills. Specifically, the cadets assisted with the hands on fitting and assembly of triggering mechanisms for capacitor banks of the pulsed-power system. Additionally, they built and tested devices and assisted in the set-up that ultimately contributed to successful experimental launches from the gun.

CDT Andrew Lopshire (class of 1997), working with his mentor Dr. Chadee Persad, was exposed to both experimentation and data analysis. Lopshire was able to use a number of analytical tools to measure the launch effects on the rails of the gun. This required a thorough understanding of the laboratory environment during experimentation as well as how to utilize advanced measuring devices. The issues he examined required interaction and subsequent sharing of information with Greg White of the high school graduate apprenticeship program. This complementary relationship fostered significant contributions by both students to a field of study in which little research has yet been conducted.

Conclusion

The AIAD program ended in a fashion similar to that of the high school graduates' apprenticeship program. The cadets prepared presentations and papers for future use in an academic setting. Upon their departure, all participants were recognized for the contributions made toward the IAT's mission. The cadets carried away with them an appreciation for what they have already learned during their initial years at the academy as well as a vision of a powerful weapon that they may someday use during their careers as Army officers.

As they progress academically toward their respective technical degree fields, the high school graduates will remember their detailed assessment of an advanced technology application with a military purpose. They will also appreciate real world applications of advanced technologies. Both groups accomplished significant technical tasks that culminated in rewarding experiences not only for themselves, their mentors, and the IAT as a whole, but for future soldiers who will benefit from their hard work and achievement.

The following is a quote from Demkowicz which expresses his feelings regarding the program: "For me, the summer apprenticeship program was a valuable experience in becoming acquainted with the engineering world. I learned efficient approaches to solving problems, techniques for analyzing data, and many other valuable skills. Moreover, thanks to the program, I have already created a perspective for a career in engineering. Not only did I make an early debut in engineering circles by publishing my report, the IAT also offers potential future employment for the students who participated in the apprenticeship program. For me, the advantages of working at the IAT are undeniable. My stay at the institute was an enriching and valuable experience. I would recommend the summer apprenticeship program to anyone interested in a career in engineering."

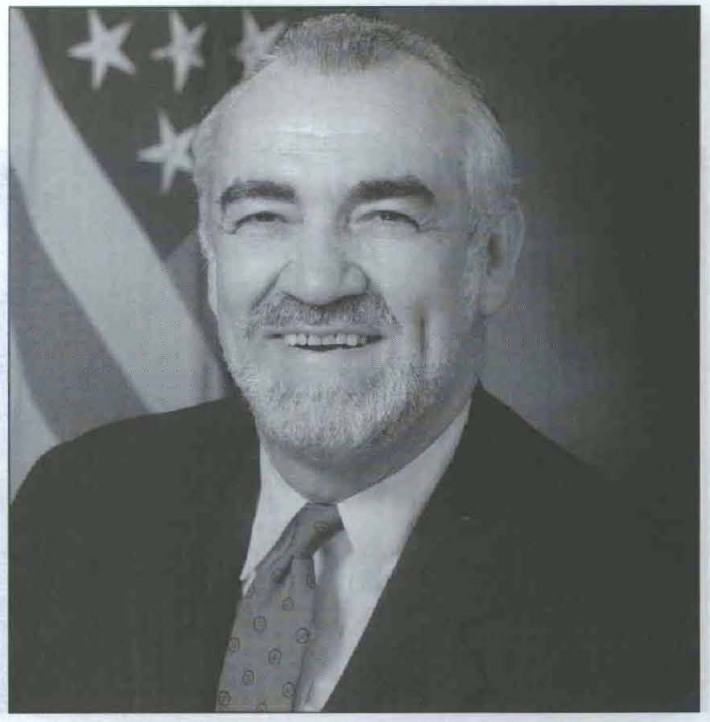
The IAT thanks this summer's participants for their enthusiasm and truly significant contributions, and wishes each one continued success. The strong pace at which technology advances, as well as the continued dominance of our armed forces, will be continued through active support of these types of programs.

DR. JERRY G. DAVIS is the assistant director of education for the IAT and one of the early IAT apprenticeship program pioneers. He is a colonel in the U.S. Army Reserve and a graduate of the U.S. Army War College Fellows Program at Tufts. He holds a Ph.D. from Ohio State University and has done post-doctoral work at Harvard.

CPT JAIMY S. RAND is an AAC member and is currently completing the Executive M.B.A program at The University of Texas at Austin. While completing her academic program she is assigned to the University's Center for Professional Development and Training where she coordinates and manages special projects for the Center, IAT and the AAC. Rand will graduate in May, 1996.

JIM POLLARD is retired from the Army with more than 30 years in active service and presently serves as education coordinator for the IAT.

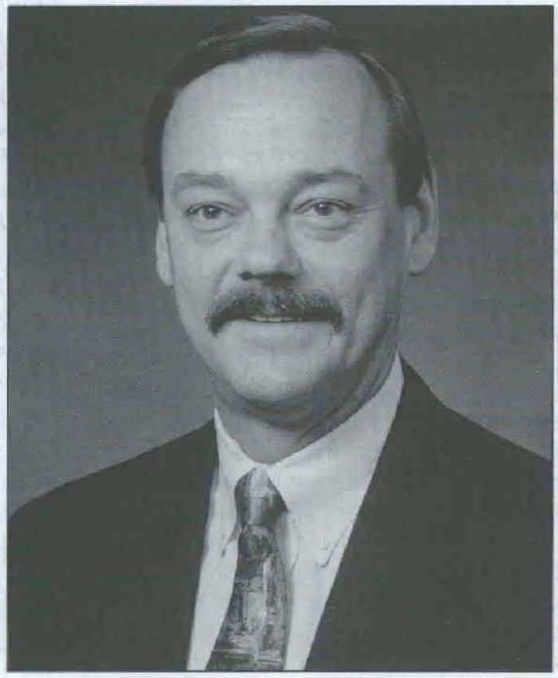
DOD, ARMY, INDUSTRY CONFEREES ASSESS ACQUISITION REFORM INITIATIVES



Assistant Secretary of the Army (RDA) and Army Acquisition Executive Gilbert F. Decker welcomed the attendees.

Key issues related to the Army's ongoing acquisition reform effort were addressed at the Association of the U.S. Army Symposium on Army Acquisition—The Road to Acquisition Reform, Sept. 12, in Falls Church, VA. Drawing more than 350 representatives from the Department of Defense, Department of the Army and industry, the conference provided an open forum for in-depth discussions on a host of topics, including contract reform initiatives, integrated product teams, and resource challenges.

Assistant Secretary of the Army (Research, Development and Acquisition) and Army Acquisition Executive Gilbert F. Decker welcomed the attendees and briefly described the status of Army acquisition reform efforts. He said, "There is no such thing as performance-based procurement if you go with the lowest qualified bidder—best value source selection is the only way."



Keith Charles, deputy assistant secretary of the Army for plans, programs and policy, and deputy director for acquisition career management, OASARDA spoke on resource management.

Decker also emphasized that acquisition reform depends on education and training, stating, "You can put out policy memos, but if you don't take the time to invest in the people who have to make it happen in the trenches, fundamental culture change won't happen." He added that roadshows, which have focused recently on performance-based specifications, have been one successful form of training and educating the acquisition community.

Keith Charles, deputy assistant secretary of the Army for plans, programs and policy, and deputy director for acquisition career management, Office of the Assistant Secretary of the Army (Research, Development and Acquisition) (OASARDA) spoke on the topic of resource challenges and government effectiveness. He appealed for greater flexibility in the personnel system if the government is to be truly effective. In addition, he noted that commercial-off-the-shelf product testing now consumes as much money and effort as live munitions testing. On a more positive note, Charles said, "The Army is doing very well on the "hill," because we spoke with one voice for the '96 budget, and industry spoke with a similar voice."

A briefing on Army acquisition improvement initiatives was presented by Dr. Kenneth J. Oscar, deputy assistant secretary of the Army for procurement, OASARDA, who stated that "Our

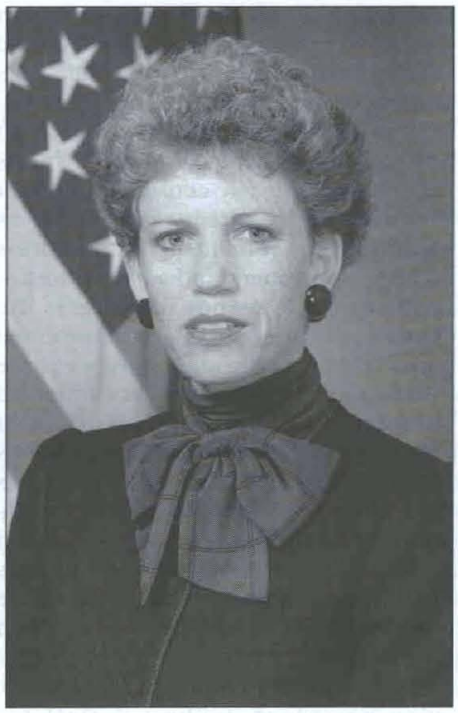
purpose is to provide our soldiers with equipment that will allow them to win decisively on the battlefield and return home safely." He emphasized that the goal is not cheaper equipment, but the acquisition of better equipment at a better price in a faster manner. He cited several efforts in pursuit of this goal, including simulation, oral communication during the source selection process, and integrated product teams. Oscar stressed that greater balance is needed in a culture where exponential growth in regulations has continued until the cost of the regulations themselves is more than any potential fraud they attempt to overcome.

LTG John G. Coburn, deputy commanding general, U.S. Army Materiel Command, described current efforts in the reform of contracting. He articulated the need to simplify requests for proposal and the benefits of partnering. "In eight years we have not had one protest where we've used a partnering type agreement," he said. Coburn added that past performance is becoming more relevant in source selection, but that data collection related to this is difficult and further complicated by mergers.

An update on Defense acquisition reform was provided by Deputy Under Secretary of Defense for Acquisition Reform Colleen A. Preston. Said she: "We are going to do things smarter, faster and cheaper, while fostering the development and maintenance of a globally competitive national industrial base by appropriately balancing the risk of fraud, waste or abuse against the cost of preventive measures; and by appropriately balancing the benefits of supporting the nation's socio-economic goals with the cost of imposing government-unique requirements on our sellers." Preston noted that there is some misunderstanding in the acquisition community regarding acquisition reform guidance. She emphasized that this guidance (such as Secretary of Defense Perry's memorandum and the process action team report it was based on) encourages the use of *performance* specifications when possible, *not commercial specifications,* as is commonly believed.

The first of two question and answer panels followed. Panelists were Keith Charles, Dr. Ken Oscar, LTG John Coburn and Colleen Preston. They responded to questions related to teaming, reconversion of ammunition plants for commercial practices, and accountability within integrated product teams. In addition, Preston responded to a question regarding the publication and implementation of metrics to measure acquisition improvement across DOD. She stated, "This is a really tough area. It is difficult to establish clear metrics where outside environmental influences can be factored out so that changes can be attributed specifically to a particular reform. For example, the services are taking reductions in their major systems programs and in personnel for budgetary reasons, so we can't necessarily tie any particular savings to the removal of MILSPECS."

Army Chief of Staff GEN Dennis J. Reimer explained his vision for the Army.



An update on Defense acquisition reform was provided by Deputy Undersecretary of Defense for Acquisition Reform Colleen A. Preston.

Army Chief of Staff GEN Dennis J. Reimer explained, in a very candid presentation, his vision for the Army, where it is headed, and the Army's modernization challenges. He said that today's Army operates with diminishing resources in a complex, dangerous, and unpredictable world. Reimer believes that after four years of difficult drawdown, the Army needs stability, and he is concerned that if the quality of life drops, quality soldiers will be lost.

Reimer added that modernization funds have dropped in recent years—and cannot afford to drop further—so money saved through the base realignment and closure process should be

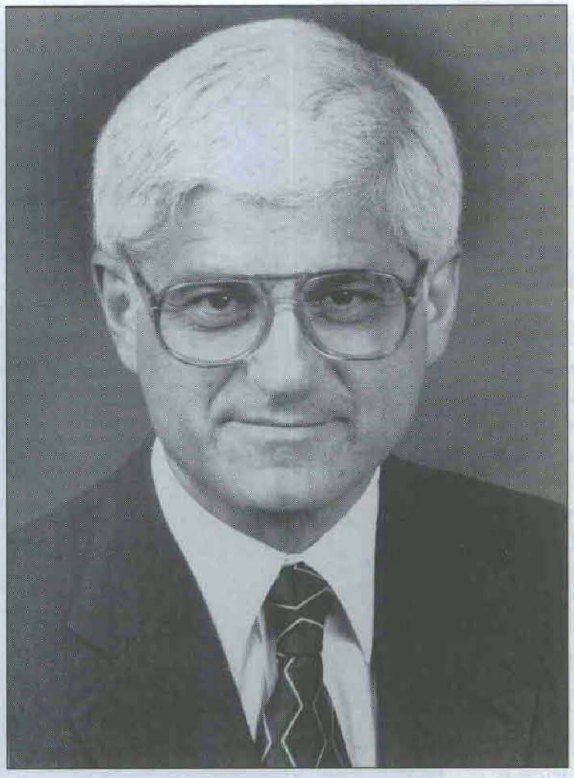
used for modernization. "We can't afford to continue running old trucks and planes—they are eating us up financially. We need to invest in newer equipment. Of course there is risk associated with doing that, but prudent risk. As we look at the world and what we have to do, we see there is a greater risk in *not* doing that," Reimer stated.

The afternoon session featured a series of brief presentations and a question and answer panel discussion by industry executives who assessed DOD's implementation of acquisition reform initiatives, including recommendations on how to improve the procurement process.

William F. Paul, executive vice president, and chairman, international operations, United Technologies Corporation, described DOD's challenge in funding planned procurements. He also cited the Government Accounting Office predictions that the DOD will actually spend $150 billion more in five years than the president has put forth in his budget. Paul noted that reform is not moving fast enough, and called for potentially more dramatic change in addition to the productive initiatives already underway. He then turned the podium over to his fellow panel members, requesting their input regarding such changes.

Recently retired Executive Vice President of Alliant Techsystems Inc. Kenneth K. Jenson opened his remarks by saying, "I can tell you with conviction that the initiatives we are trying to implement now are the most significant positive change I have seen during my 33 1/2 years in this industry." He said that contractor responsibility has increased as a result of better performance specifications thus giving rise to government savings and a better product for the user. Jenson cautioned however, that in some cases manufacturing specifications have been removed from the statement, but not from procedurals, and that this should be avoided.

John A. McLuckey, senior vice president of Rockwell International Corporation, and president of defense systems for that company, commended the Army on its pro-active approach to acquisition reform, stating that the Army is ahead of the other Services in this endeavor. McLuckey said that best value selection of contractors is a subjective process, and that a consistent evaluation of past performance is needed across commands, and across the Services. "I also believe that there needs to be a basis for throwing out certain past performance when in fact there has been culpability on the part of the Service which has contributed to performance that is less than adequate," McLuckey added.



William F. Paul, executive vice president, and chairman, international operations, United Technologies Corporation, described DOD's challenge in funding planned procurements.

Thomas W. Rabaut, president of United Defense, L.P., addressed aspects of Defense industry consolidations that require more attention, such as advanced agreements, which address who—government, industry, or both—will reap the savings of mergers. He said, "There are companies represented in this room who did mergers three years ago and who have accumulated hundreds of millions of dollars of unbilled costs because they are at odds with the government about who gets the savings." He said that DOD acquisition and management personnel can help remedy this problem by enhancing teaming and by being pro-active in the planning and implementation phases of mergers.

A briefing by Dr. Ray O. Waddoups, vice president, technical staff for advanced technologies, Government and Space Technology Group, Motorola, followed. Waddoups gave high marks to streamlining efforts such as the movement to performance specifications, which allow the Defense industry the flexibility to use more efficient commercial practices. However, these changes also present challenges to industry, including increased competition, and more liability and responsibility. Relative to training, Waddoups said: "I think it is appalling that we are paying people a year's salary to quit work when they are 55, 56, or 57 years old. If we spend that money on training, the same people could become the most valuable people in the organization."

All of the industry speakers convened into a panel chaired by William Paul. Government speakers also contributed to the discussion, which covered topics such as: the problem of valuing products at pilot facilities without cost/pricing data; the uniqueness of current reform efforts which have the support of both government and industry leaders; and standardization of practices within Defense plants.

During brief closing remarks, Assistant Secretary of the Army (RD&A) Gilbert Decker stressed, "The law says we will use past performance as some element of decision criteria in all procurements on a staged time basis, eventually down to $100,000." He said that action will be taken to make past performance an unbiased, legitimate factor, and cited an Office of Federal Procurement Policy suggestion that performance data older than three years not be used. Decker concluded by thanking all attendees for their outstanding participation.

THE ROLE OF ARMY AUTOMATORS IN MEETING FORCE XXI CHALLENGES

By LTC Earl D. Rasmussen

"What must be encouraged is a combination of skills and operational experience that leads not only to technological awareness, but also to an ability to perceive the best bridges between the technology and the mission to be served by it."

—Comparative Studies in Software Acquisition, by Steven Glaseman (A Rand Graduate Institute Book)

Force XXI is a vision which seeks to leverage information technology to change the face of battle and enhance the capabilities of our war fighters. The movement to this third wave warfare is necessary to maximize our capabilities in a fiscally-constrained environment and empower the war fighter to meet an ill-defined global threat.

Initially, we must look at the objectives of this vision of the future. The chief of staff of the Army has identified five key objectives of Force XXI: project and sustain the force; protect the force; win the information war; conduct precision strikes; and dominate the maneuver battle.

Serious consideration of any of these objectives reveals a vital automation component, without which achievement would be impossible. To meet these objectives, prepare our soldiers for the 21st century, and support joint war fighting requirements we need to exploit current and future information technologies.

This article focuses on, from an acquisition perspective, our ability to meet Force XXI objectives, and the current and future role of Army Acquisition Corps (AAC) Functional Area (FA) 53 officers in meeting the challenges ahead.

Challenges

An information-dependent distributed battlefield presents many challenges, both in developing and using future systems. Key challenges for the systems development community are: requirements definition, risk management, software development, communication protocols, and systems integration.

FORCE XXI PRINCIPLES

- Focus on the War Fighter
- Ensure Joint Interoperability
- Capitalize on Space-Based Assets
- Digitize the Battlefield
- Modernize Power Projection Platforms
- Optimize the Information Technology Environment
- Implement Multi-level Security
- Ensure Spectrum Supremacy
- Acquire Integrated Systems Using Commercial Technology
- Exploit Modeling and Simulation

The operational environment will undergo significant changes as we see the proliferation of computer technology and enhanced battlefield capabilities brought on by increased situational awareness, seamless connectivity, split-based operations, and ready access to information. The effective use of these capabilities is key to our success in the operational environment. Ideally, the overwhelming amount of available information needs to be tailored for each commander to allow timely decisions in a rapidly-moving and fluid battle environment. The distributed battlefield will require new processes to plan and fight the 21st century war.

The growth in software and computer systems, and the corresponding complexity in systems integration, highlights the importance of rethinking how we approach and staff organizations to meet system development needs. To meet future objectives and apply Force XXI principles (see accompanying figure), there must be a major paradigm shift in how we view and use the talents of computer-skilled officers. Each organization must look at its authorizations, its mission, and at future challenges to answer the question: "Do we have the talents needed for the 21st century?"

FA 53 officers who have attended graduate school address technical challenges by contributing currency, new ideas, and a war fighter operational perspective to the Army Research Laboratory; research, development and engineering centers; life cycle software engineering centers; and software development centers.

Requirements

Army automators play a crucial role in defining requirements. We must leverage not only the technical skills of these officers, but their operational basic branch competency, as well. This is perhaps the foundation for our system development efforts. Understand the user, the war fighter, validate the need, and define the requirement. This challenge demands the ability to understand technology, both that which we can develop and that which is commercially available, and to use that technology to meet the needs of the war fighter.

Combat development centers, Battle Labs, and the Louisiana Maneuvers Task Force play critical roles in developing the requirements of our future force structure. This requirement process impacts not only our ability to develop future systems, but how doctrine evolves to meet 21st century challenges. We must identify, articulate, integrate, and manage requirements effectively. Requirements should address cost effectiveness, feasibility, and associated risks. We must make optimal use of systems automation officers and their technical, operational, and acquisition skills in the requirements definition process.

Risk

Inherent in any development effort is risk. This is perhaps the greatest challenge for every program manager. It is the ability to identify and effectively manage risks that allows us to best meet the needs of the soldiers. As we leap forward, we need to understand the courses of action before us. Obviously, each course of action has risks. However, our choices must be based on thorough analysis and leveraging opportunities to provide the best systems and the best available training.

Senior leaders must be aware of current and emerging information technology. The analysis of available information technology and its impact on systems development is key to the decision-making process. A need exists to identify competing computer/information technology alternatives, perform trade-off study analyses, and identify associated risks early in the life cycle. Responsible organizations need the technical skills necessary to manage, direct, and perform these critical efforts.

Software Development

Systems are becoming more dependent on software, and on the integration of computer circuits and communications. LTG Otto Guenther, DISC4, highlighted this at a recent Software Technology Conference, stating, "Information technology-and specifically software-intensive systems—will drive us ... into the next century." In the last five years, software has grown by an order of magnitude. Future weapon systems will require even more software and more complex computer circuits. Key to creating these systems is our ability to identify and integrate state-of-the-art practices into our existing software systems development processes. Moreover, built-in quality is a must.

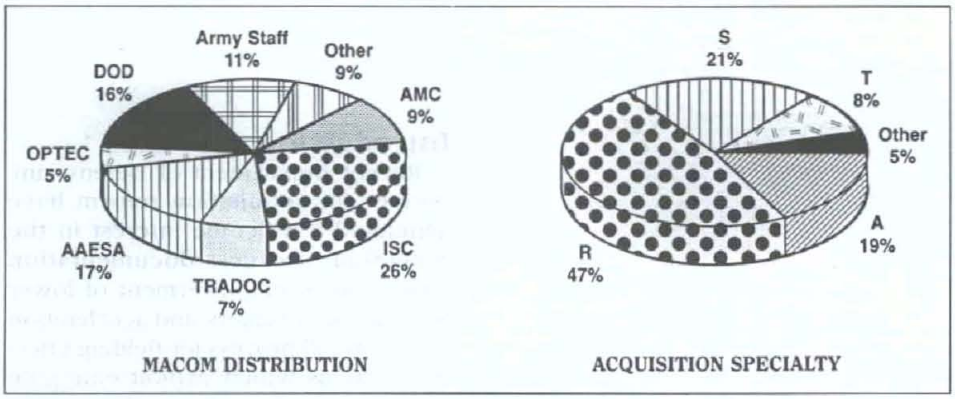
FA 53 officers who have attended graduate school address technical challenges by contributing currency, new ideas, and a war fighter operational perspective to the Army Research Laboratory (ARL); research, development and engineering centers; life cycle software engineering centers; and software development centers. In addition to contributing technically to development, officers hone their technical, engineering, and acquisition skills, and learn from the vast experience of military professional civilian engineers and scientists. Officers typically contribute quickly to development efforts either as system engineers and scientists or as technical managers.

ARL's Federated Laboratory initiative brings together government, industry, and academia to address Force XXI research areas. Each of these areas is computer and software intensive. The Federated Lab concept provides an important opportunity to integrate FA 53 skills.

The successful and effective adaptation and management of critical software practices will require a technical foundation which now exists only among systems automators. FA 53 officers must be included as an essential component of integrated product teams in systems development, and on research, contracting, and program management teams.

Communications

A key challenge lies in our ability to provide a seamless communications architecture and the ability to share information from sustaining base to



foxhole. This communications infrastructure and the supporting information technology must support a rapidly moving maneuver force and split-based operations with ever-increasing digital information requirements. The movement to air- and space-based communications and digital routing platforms will provide a basis for this evolving architecture.

The challenge is not so much in hardware, but rather software, to provide increased throughput capacity and to optimize available information. New compression, higher speed encoding techniques and protocols, network interfaces, and new distributed operating systems are needed to meet this expanding bitpipe requirement.

FA 53 officers in organizations impacting the implementation of this architecture add proven technical, operational, management, and acquisition skills and enhance the Army's credibility in interactions with academia and industry. These officers bring a total system perspective, both hardware and software, to ensure the development and implementation of a total battlespace system architecture. They can identify existing protocols, standards, interfaces, and commercial technology; and incorporate emerging technology to support the overall communications infrastructure.

Systems Integration

Systems integration will continue to increase in importance and complexity as our future combat systems evolve. Rapid changes in technology, corresponding changes in requirements, and fiscal constraints necessitate the need to maximize information technology advancements. To take advantage of these emerging technologies we must focus on commercial technology, support dual use technology, and increase efforts in horizontal technology integration. These efforts increase the need for incremental development of supporting software systems and increase the complexity of systems integration efforts.

FA 53 Expertise

Army automators understand the technical challenges of fighting and winning the information war. They are war fighters with enhanced technical talents. As discussed in the July-August 1995 *Army RD&A* article, "What is a 53? A Perspective!," FA 53 officers are trained in computer systems/information technology and acquisition management. They possess basic branch operational expertise and have the skills to address system development challenges. In short, they are equipped to support the goals, objectives, and principles of Force XXI.

Where Are They?

There are 391 FA 53 officers in the AAC distributed across organizations addressing critical software, computer, communications, and interface issues. They serve as program managers, computer scientists, computer/systems engineers, and testers. The accompanying figure shows the current organizational distribution and the acquisition career field breakdown of AAC FA 53 officers.

More FA 53s Needed

The quantity of FA 53 officers is not adequate to meet the challenges ahead. As software grows and the use of computer networks and components increases, there is a desperate need to increase the number and distribution of FA 53s throughout the acquisition community. This is especially critical in software-intensive systems. LTG William H. Forster, former director of the Army Acquisition Corps (now retired), foresaw the need to expand this talent base and issued this message to the acquisition community, "... I would expect a minimum of one FA 53 position in every project management office whose programs include either C3I and/or embedded software requirements. ..." The intent was not just to broaden the distribution of automation skills but to increase the skill baseline and inculcate those essential computer-based skills into every program office. This realization is a major step forward but is only an incremental one toward meeting the task ahead.

Conclusion

Senior leadership has articulated the vision for Force XXI and the direction that will lead the Army into the 21st century. There are many challenges ahead. We must reengineer our organizational practices to leverage technological advances marshaled in by the information age. As armor systems replaced cavalry and changed the battlefield of the early 20th century, so too will the ubiquitous access to information change the face of battle in the 21st century.

To ensure success of the Force XXI vision, we must bring together the technical, operational, and management expertise provided by FA 53 officers. Unless these FA 53/computer-based talents are integrated and leveraged throughout the entire Army, Force XXI will continue to be only a vision.

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WHY MANPRINT MAKES SENSE FOR STREAMLINED ACQUISITION

By Dr. Jack Hiller
and Dr. Thomas Killion

Introduction

Recent Department of Defense initiatives for acquisition reform have generated a welcome interest in the reduction of excess documentation requirements, empowerment of lower level decision makers, and acceleration of the overall process for fielding effective systems which exploit emerging technologies. Streamlining the acquisition process should not, however, cause us to relearn past lessons on the need to recognize personnel and training requirements in system design.

Demonstrations of the critical role of human performance in system operation have been all too prevalent in major industrial and Service incidents that have provoked public awareness, including: the accident at Three Mile Island; the accident at the Chernobyl nuclear power plant; the accidental shootdown of an Iranian commercial airliner by the USS VINCENNES; and, most recently, the accidental shootdown of two U.S. Army helicopters by a pair of U.S. Air Force F-15s over northern Iraq in 1994. Similarly, weapon system failures in the past, having been traced back to faulty system controls, operator or maintainer training deficiencies, or personnel shortages, led DOD to direct attention to human-system integration (HSI) requirements in systems acquisition (DOD 5000.1, 5000.2), in compliance with Title 10, Section 2434. The Army's implementation of HSI is incorporated in its Manpower and Personnel Integration (MANPRINT) program.

Origins of MANPRINT

Within the Army, the MANPRINT Program evolved from concerns about lack of adequate consideration of human factors, manpower, personnel, and training (HMPT) issues in the weapon system acquisition process. The Army Research Institute's Reverse Engineering Program, initiated in 1982 in response to guidance from General Maxwell R. Thurman, documented shortfalls in system design and performance resulting from inadequate attention to HMPT issues. (Technical Report 659, January 1995, *Reverse Engineering: Human Factors, Man-*

power, Personnel, and Training in the Weapon System Acquisition Process, David M. Promisel, C.R. Hartel, J.D. Kaplan, A. Marcus and J.A. Whittenburg, U.S. Army Research Institute for the Behaviorial and Social Sciences, Alexandria, VA). This inquiry examined four major, current programs: the initial version of the STINGER manportable air defense system, the Multiple Launch Rocket System (MLRS), the Black Hawk helicopter (UH-60A), and the Fault Detection and Isolation Subsystem (FDIS) of the M1 tank. The purpose was to examine these programs in detail to determine what was done with respect to HMPT and what else could or should have been done to improve the resulting systems, in terms of performance effectiveness with the soldier in the loop and costs.

Major conclusions from the Reverse Engineering Program for each of the systems were as follows:

STINGER

- The complexity and demands of the STINGER engagement sequence created significant training and operational problems, particularly in the areas of target acquisition, tracking and ranging, and lock- on/firing. (It should be noted that a number of the steps that contributed to the complexity of the operating sequence related to the Identification Friend or Foe process. These steps were irrelevant to the use of the Stinger in Afghanistan, thereby significantly simplifying its operation).
- Ground clearance requirements to avoid back blast and flying debris resulted in either serious limits on elevation or to use by a very small percentage of the soldier population (i.e., 98th percentile for height).
- System requirements were not fully specified in terms of soldier performance (e.g., man-portability was never defined).
- The lower mental category soldiers, who constituted a large portion of the population of gunners, could not operate STINGER to meet the required single engagement kill probability.

MLRS

- Requirements and system assessments were addressed in terms of machine, not man-machine system performance (total system performance).
- Maintenance issues led to a decision to create a new MOS (27M) for direct support maintenance relatively late in system development, increased manpower demands beyond initial planning, and a need for a maintenance training device which was to be delivered two years after Initial Operational Capability.
- MLRS Self-Propelled Launcher Loader (SPLL) personnel were initially above average in terms of mental category. There was no evidence that this was necessary or what the consequences would be if skill levels were lower.

BLACK HAWK

- Assessment of reliability, availability, and maintainability (RAM) performance and scoring criteria used during testing permitted exclusion of soldier-produced failures, resulting in unrealistically high estimates of system (i.e., man-machine) performance.
- Failure to operationally define the requirements for missions, including nap-of-the-earth and night flying, led to incomplete testing from the HMPT viewpoint. In 1984, the Army Safety Center reported that half the BLACK HAWK accidents to date were attributable to human error.
- MOS 67T (BLACK HAWK repairer) manpower was underestimated by 21 percent to 600 percent (various estimates), necessitating recruitment efforts to obtain required personnel and a significant training "surge" at Fort Eustis.
- Compensating for delays in acquisition of Mission Flexibility Kits, Peculiar Ground Support Equipment, Test Measurement and Diagnostic Equipment, and flight and maintenance simulators cost significant time, money, and effort.

M1 FDIS

- M1 requires complex troubleshooting skills, yet the MOS's selected as organizational mechanics were lower in mental aptitude than either M1 tank crewmen or the general population of soldiers Army-wide.

MANPRINT principles applied to Army design engineering create user-centered, reliable, and maintainable systems, leading to significant reductions in life-cycle costs and increased mission effectiveness.

• As early as DT/OT II, maintainers showed limited understanding of system functions, inability to identify accurately basic faults, and limited facility in using technical manuals.

• M1 Simplified Test Equipment (STE) was so unwieldy, difficult to transport, and difficult to connect to the tank that it actually discouraged its use.

• Volatility in the M1 maintenance training program severely hampered efforts to assess its effectiveness.

MANPRINT Institutionalization

The results of the Reverse Engineering Program demonstrated systemic inattention to HMPT issues and thus contributed directly to the initiation of the MANPRINT program. MANPRINT was instituted in the Office of the Deputy Chief of Staff for Personnel in 1986 to promote an integrated approach to the design of the entire systems life cycle, from R&D through post-fielding modifications. MANPRINT domains now include: Manpower; Personnel; Human Engineering; Health Hazards; Training for operators, maintainers, commanders and units; System Safety; and Soldier Survivability.

Even with the creation of MANPRINT, allocation of resources to the individual domains has been too thin to prevent new problems from inadequate attention to soldier considerations in system design. Examples include:

• After initially convening a system safety working group for the OH-58D helicopter, it did not reconvene for four years (1985-1989), during which time numerous modifications were made to the aircraft.

• Initial use of panel lighting for the Single Channel Ground and Airborne Radio System (SINCGARS) which was incompatible with the lighting requirements of the Aviator's Night Vision Imaging System (it was five times too intense) (1990).

• Inattention to the MOS's needed to operate and maintain the Command and Control Vehicle (C2V), potential for requirements for increased soldier quality for the C2V, and significant lags in training development (1993).

Recent MANPRINT Successes

On the other hand, effective application of MANPRINT to the design process can yield significant benefits. A stellar example is the Comanche Program, where an estimated $3.29 billion cost avoidance was achieved through aggressive application of MANPRINT principles. (January 1995, *MANPRINT/Human Systems Integration Influence on Comanche Design & Development Program.* S.R. Yawn, J.T. Skonieczny and J.E. Minninger, St. Louis, MO: The Analytic Sciences Corporation).

Another example is the XM93E1 Nuclear, Biological, and Chemical Reconnaissance System (NBCRS), at a cost of $1.7M per copy. Because initial workload assessments indicated operator overload, crew member tasks were automated or reassigned to other crew members when the system was reconfigured for three soldiers in place of the original four. However, the system was evaluated "not operationally suitable" during Initial Operational Test and Evaluation (IOT&E), primarily because the 3-man crew workload reduced mission performance to unacceptable levels. Using a human figure model and the Hardware versus Manpower (HARDMAN) III modeling methodology, the Army Research Laboratory assisted the product manager with the design of a modified workstation configuration which was estimated to reduce mission performance time by 12 percent and reduce operator workload to acceptable levels for the 3-man crew. The HARDMAN III modeling also allowed the Operational Evaluation Command to reduce the amount and cost of follow-on testing for the modified system.

MANPRINT in Streamlined Acquisition

Given the recent changes in the acquisition process, and to avoid problems and ensure effective application of MANPRINT to system acquisition, there is a need for: enhanced education and sensitization of program managers and decision makers to its value-added for optimizing system cost and performance; continuing influence and leverage from an independent functional proponent, to ensure that effective policies and procedures are applied; MANPRINT representation on integrated product teams and concept exploration task forces; and inclusion of relevant soldier performance data and criteria in cost and performance tradeoff analyses and milestone decision criteria.

MANPRINT principles applied to Army design engineering create user-centered, reliable, and maintainable systems, leading to significant reductions in life-cycle costs and increased mission effectiveness. Application of MANPRINT can also contribute significantly to system performance throughout the life cycle via its application to system upgrades, horizontal technology integration, and pre-planned product improvements. However, the greatest leverage can be attained by attention to MANPRINT early in the acquisition process, starting with concept formulation, requirements definition, and contract Statement of Work to avoid many problems not found by the present acquisition system until IOT&E.

Note: The authors express their appreciation to Deputy Under Secretary of the Army (Operations Research) Walter Hollis for his helpful suggestions in preparation of this article.

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INTERNATIONAL COOPERATIVE RESEARCH, DEVELOPMENT AND ACQUISITION

By Gretchel L. Hignite

Introduction

The Department of Defense (DOD) and Army have tried to improve our use of international cooperative research, development and acquisition (RD&A) for more than 30 years. Improved cooperation enhances standardization and interoperability (S&I), reduces duplication of effort, saves R&D funds through international sharing, and improves international relations. The objective of this article is to identify some Army options that may improve the international cooperative RD&A process and recommend one for implementation.

The following assumptions influenced the options I chose to meet my objective and the conclusion I reached after careful analysis of the issue and possible solutions.

- Some improvement in Army international cooperative RD&A is possible and needed.
- Our Defense budget and personnel strength will continue to decline.
- The DOD must keep costs down without compromising readiness and technological growth. International cooperation is an effective means of reducing costs and expanding technology through sharing, while increasing readiness through S&I.
- Reduction of DOD overhead by consolidation of organizations with similar responsibilities will increase due to the reduction in overall personnel strength.

The Department of Defense Directive (DODD) 3100.3, *Cooperation with Allies in Research and Development of Defense Equipment,* Sept. 17, 1963, required maximum coordination of technical objectives and programs with those of U.S. allies. After more than 30 years and multiple reiterations of our international cooperative RD&A policy, we have achieved limited success with international cooperation. We also have identified significant deficiencies in the DOD/Army international cooperative RD&A process by conducting multiple studies/audits of the process.

1992 Audit Report

The DOD inspector general (IG) published an audit report in 1992 identifying many of the current deficiencies. Since that report was published, some deficiencies have been corrected. However, in my opinion, if the audit was repeated today, many deficiencies identified in the 1992 audit would still exist. If I am correct, do the deficiencies matter to an Army with inadequate funding for national R&D? I believe it should matter more, because as technology increases, the cost of R&D increases.

It will become more difficult to develop major systems as an independent entity. In fact, many large corporations, such as Boeing, have found it necessary to share the cost of new development. The Boeing 777 aircraft was developed with Japan heavy industries sharing the cost. We can learn from industry and move toward more international sharing of R&D costs and benefits in the development of new weapon systems. This sharing would also improve the standardization and interoperability of systems, especially with our partners, who would be carefully selected. I believe the single most important element of international cooperation is improved and economical development or acquisition of standardized and interoperable (S&I) systems.

Standardized and interoperable systems support the tactical commander because they can interface easily and be maintained by common parts, supplies, and soldiers with similar training. They also enable the tactical commander to use the five logistics characteristics, e.g. anticipation, integration, continuity, responsiveness, and improvisation effectively and efficiently.

It is significantly easier to anticipate

Standardized and interoperable systems support the tactical commander because they can interface easily and be maintained by common parts, supplies, and soldiers with similar training.

your needs, integrate your forces, support your forces, respond as needs change, and improvise if systems in the field have S&I components. Field Manual (FM) 100-5, *Operations,* June, 1993, states, "Successful logistics must be both effective and efficient."

Standardized and interoperable systems increase the probability that logistics will be effective and efficient. Achieving S&I systems requires international cooperative RD&A in today's global economy. Industrialized nations may share resources and technology, but they will seldom buy from a single source because it may preclude continuity of tactical operations and increases the countries balance of payments. The preferred solution is cooperative RD&A and production.

DOD Directives

Department of Defense Directive 3100.3, was written and enacted to ensure U.S. consideration of international cooperative RD&A. Other DODDs, specifically DODD 5000.1, *Defense Acquisition,* and DODD 5000.2, *Defense Acquisition Management Policies and Procedures,* Feb. 23, 1991, have been written and enacted since, with the same objective. In addition, the U.S. Congress directed consideration of cooperative opportunities by enacting 10 U.S.C. 2350a.(e)(reference (h)). Congress indicated additional support for international cooperative RD&A with public law 99-143 (Nunn amendment) which provided funds averaging approximately $112 million for fiscal years 1987 through 1991. The Nunn funds are still provided, but they have been reduced.

Since the requirement for international cooperative RD&A is documented in multiple DODDs and public law, every acquisition executive and program manager (PM) should have considered international cooperative R&D or acquisition prior to initiating new service unique or joint developments. However, the DOD IG stated that 30 percent of PMs were not aware of the international cooperative RD&A requirements. This oversight could have been caused by differing commands perception of matrix support provided the PM.

Every major command's International Cooperative Program Office (ICPO) tends to offer different levels of service. The ICPOs have specialists familiar with the requirements of Congress, DOD, and DA for international cooperation. Unfortunately, these personnel are not usually part of the program manager's acquisition/logistics team and may not be asked to help when they could be influential in considering cooperative R&D. The ICPO specialists should be part of the PMs acquisition/logistics team from the day it is formed.

Problems

My research found adequate DOD direction and obvious Congressional support for international cooperative RD&A. However, overall support for international cooperation does not appear to be improving significantly. Therefore, I attempted to determine what other issues prevent the successful implementation of a strong international cooperative RD&A program. I identified the following problems.

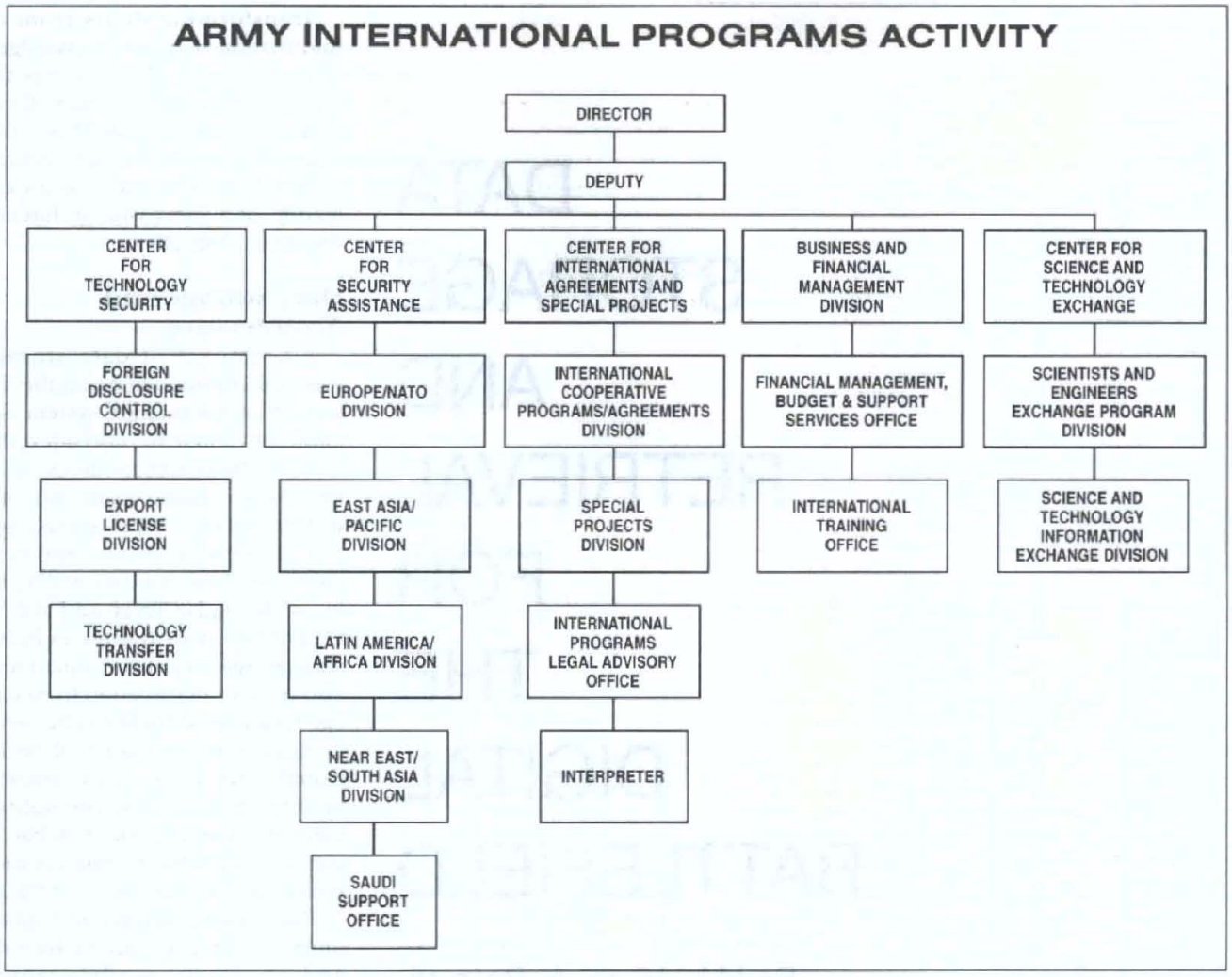
- Conflicting U.S. laws, such as the Buy American Act, title 41, U.S. code 10a, which requires Defense agencies to buy American products if they are competitive and readily available.There is also the Arms Export Control Act, title 22, U.S. code section 2753. It provides that no agreement for a cooperative project shall be entered into unless the president finds that it will strengthen the security interests of the United States and the country or organization to which defense articles or services are transferred.
- Buying foreign products or licensing foreign technology for production in the United States may adversely affect the balance of payments.
- Buying foreign products may erode our employment base.
- There may be differences in nations' requirements, policies, standards, security requirements, capabilities, or attitudes.
- The lengthy approval/disapproval process affected the accomplishment of established program milestones and, thereby, lengthened the time to get a weapon system developed and deployed. It sometimes took 2½ to three years to process an international cooperative R&D memorandum of understanding. Since schedule is a significant issue with PMs, this is a strong deterrent.

The problems listed in the previous paragraph could be overcome with significant interest in cooperative R&D. However, if there was sufficient domestic interest in a program, many PMs did not bother to try resolving issues that precluded using international cooperative RD&A.

Options

My analysis identified multiple options for consideration in achieving my objective. A partial list of available options follows.

- Identify the ICPO specialist as a member of the program executive officer/PM acquisition team in appropriate regulations/guidance.
- Centralize management of ICPO specialists so that all specialists are managed at the Headquarters, Army Materiel Command (AMC) level and have similar training and guidance.
- The Army could recommend a multi-Service (joint) command to support international cooperative RD&A and foreign military sales.
- The Army could reorganize similar to the Navy to achieve unity of com-



mand for the international cooperative R&D/acquisition personnel.

I believe the first option is partially satisfied with draft guidance that is expected to be finalized soon. Additional changes to DOD acquisition and logistics guidance to clearly spell out the desire to include ICPO specialists on the PEO/PM acquisition/logistics team from its initiation would fully satisfy this option.

The second option could be satisfied by leaving all ICPO personnel in place at their major commands, but changing TDAs to reflect AMCs centralized management.

The first and second options could be achieved fairly quickly with minor changes, regulations and guidance and relatively insignificant TDA changes. They would be the most effective in the short term.

The multi-Service (joint) command would be difficult to establish and should only be considered when coordination with each Service indicates there is adequate interest at command levels. However, since the requirements for international cooperative R&D for each Service are significantly similar, an agreement to establish a joint command could significantly reduce overhead and total numbers of personnel required by each Service. I do not feel the option should be discarded, but recognize the difficulty of moving in this direction.

I believe the last option is best and most viable as we look for long-term solutions because it is intra Army. All Army international cooperative program offices and foreign military sales should be considered for combination as a single/unified command as shown in the accompanying figure. In addition, personnel at the U.S. Army Foreign Science and Technology Center and Army laboratories that are assigned to positions related to international cooperative RD&A should be considered for incorporation in the command. This option consolidates scattered personnel resources and establishes a single source for guidance. This should enable the remaining personnel resources to be more effective and efficient. It may also enable a reduction in strength due to reduced overhead requirements.

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DATA STORAGE AND RETRIEVAL FOR THE DIGITAL BATTLEFIELD

By MAJ Victor A. Betzold

Editor's Note: The following article reflects the views of the author and should not be interpreted as official opinion of the Department of the Army or any branch, command or agency of the Army.

Introduction

Have you ever tried to retrieve a file from your personal computer, only to be rewarded with the distressing message "file not found?" Imagine thousands of sources generating enough data to fill 10,000 personal computers per day, and that each source could be of critical interest to you. Now imagine many of these sources in a hostile battlefield environment, and that you must access a file from one source that will affect the survival of 1,000 soldiers in your command. This scenario will be reality for our future commanders on the digital battlefield.

Recent articles in *Army RD&A* have included discussions of the technical architecture for the digital battlefield, the soldier's information interface, and technologies to build the force for the 21st century. The purpose of digitizing the battlefield is to provide information to commanders and soldiers on a timely basis, giving them the technological edge in their decision-making process. Clearing some of the "fog of battle" will improve the U.S. Army's success in future conflicts.

There are many elements in the concept of digitizing the battlefield. The architecture of the system will include sensors and sources of digital information, networks, computers, and a means to store and retrieve the data. The most important element is the soldier, who is the customer of the system architectures must be responsive to the needs of the customer, so that the product of the system is not simply data, but useful information.

Transforming digits from data to information requires knowledge of the soldier's needs. The data has to be in the right place, at the right time, in an understandable format. This is the foundation of an effective data storage and retrieval process, and it is an essential feature of a successful architecture for the digital battlefield.

Data Storage and Architecture

The impact of data storage and retrieval considerations on the architecture of an information system is significant, and must be considered at the start of the design. Sources of data on the future battlefield will include imagery, maps, voice communications, text communications, and real-time video. Much of this data will be generated at the squad level, and will require transmission to higher echelons for storage. Soldiers at the squad level will also retrieve information from data storage locations at higher echelons, so the communications path will be bidirectional. This leads us to consider the amount of data that the soldier will generate, how the data will be communicated to a data storage location, and which location will be used for storage.

Data storage density and speed have improved dramatically in recent years, and the cost per megabyte has decreased with improvements in technologies. Storage costs have gone down at a rate of approximately 70 percent per year per megabyte, while increasing in capacity at a similar rate. Communication network capabilities have also advanced, and computer performance increases at a rate of 25 percent per year. To make use of these benefits, the battlefield architecture must be sufficiently flexible to balance each of the major system components: the digital source, the network, the computer, and the data storage subsystem. Advances in one component will not help the customer unless the remainder of the system is capable of matching the performance improvement.

How Much Data?

A quantitative analysis of data sources is necessary to achieve a balanced architecture, responsive to the customer's needs. One estimate of data rate for a Desert Storm-type force places the volume of data at 24 terabits

(3 terabytes) per day in 1992, and 268 terabits (33.5 terabytes) per day in 2010. It is clear from these numbers that communications discipline will be mandatory in an effective architecture. The technology exists to handle this amount of data, but the probability of fielding a workable system diminishes if the amount of data is allowed to increase without control.

Consequently, we must add another important element to the concept of a digitized battlefield: prioritization of data to be admitted to the network for storage and retrieval. Undisciplined access to the battlefield network will result in excessive network traffic, and lengthy queues to access data storage facilities.

Analysis of the Army's requirements for information on the battlefield shows many similarities to the issues faced by other government organizations and many businesses. Studying the similarities and differences will result in a better understanding of the characteristics of a successful architecture. The U.S. Army will also save resources through lessons learned by others during their attempts at building a digital information system.

Similar Efforts to Digitize

NASA's Earth Observing System (EOS), the oil industry, the telephone companies, and entertainment companies competing for the video on demand market are examples of organizations confronting various aspects of the Army's digitization issues. NASA plans to acquire and store approximately 1 terabyte of data per day describing the earth's environment. The oil industry stores and analyzes terabytes of geophysical data during exploration for new reserves. Sprint, ATT, and MCI store and retrieve the source and destination of telephone calls for billing purposes. The architecture for video-on-demand will require substantial data storage resources to manage digitized motion pictures, and very high performance networks.

The NASA Conference on Mass Storage Systems and Technologies is a forum for presenting topics concerning digitized data management. The conference focuses on sharing experiences and research in computers, networks, and data storage hardware and software. A review of the published proceedings since the first conference in

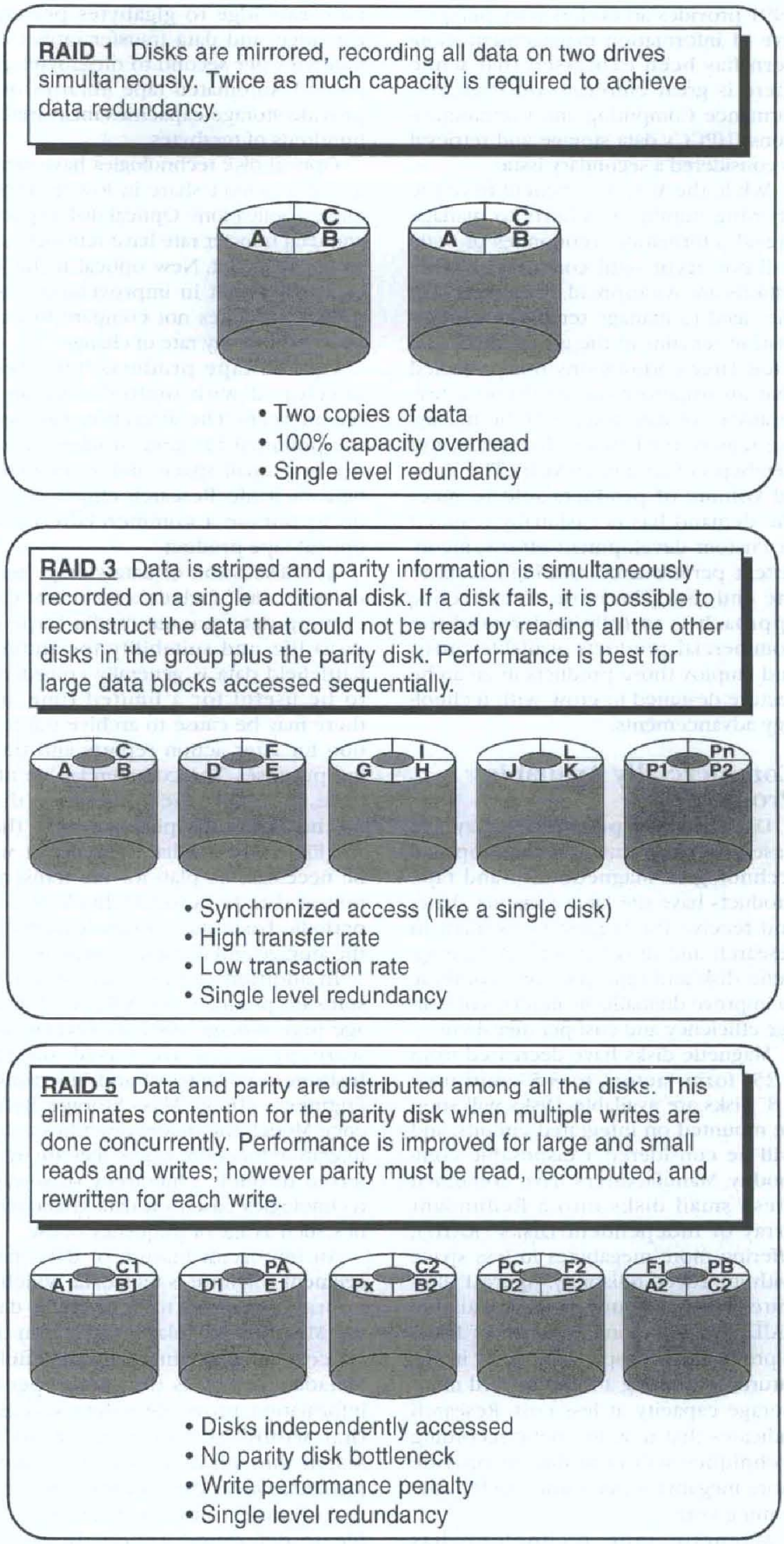

Figure 1.

1991 provides an evolutionary perspective of information management. Concern has been expressed that while there is great emphasis on High Performance Computing and Communications (HPCC), data storage and retrieval is considered a secondary issue.

While the Army can benefit from the growing number of efforts to manage digital information, economies of scale will not occur until commercial applications are widespread. Today, much of the need to manage terabytes of information remains in the government and a few large corporations. It is projected that an organization managing a few terabytes of data today will be managing tens of terabytes in five years, and petabytes of data in 10 years. The limited volume of products sold to meet the demand has occasionally resulted in custom development efforts, inconsistent performance, and high costs to the end user. The most cost-effective approach is to fully understand the commercial products available today, and employ those products in an architecture designed to grow with technology advancements.

Commercially Available Products

Data storage products today are based on both magnetic and optical technologies. Magnetic disk and tape products have the largest market share, and receive the biggest investment in research and development. Both magnetic disk and tape products continue to improve dramatically in terms of storage efficiency and cost per megabyte.

Magnetic disks have decreased from 5.25" form factors to 3.5", and now 1.8" disks are available. Disks will soon be mounted on integrated circuits, and will be considered a disposable commodity. Manufacturers have combined these small disks into a Redundant Array of Independent Disks (RAID), offering more megabytes in less space with improved reliability. Figure 1 illustrates several commercially available RAID configurations. The cost of RAID is projected to drop substantially in the future, continuing a trend toward more storage capacity at less cost. Research indicates that new magnetic recording techniques will continue to provide more megabytes per square inch in the coming years.

Magnetic tape technology has improved capacity from megabytes per tape cartridge to gigabytes per tape cartridge, and data transfer rates from kilobytes per second to megabytes per second. Automated tape libraries now provide storage capacities measured in hundreds of terabytes.

Optical disk technologies have established a market share in low and mid-range applications. Optical disk capacity and data transfer rate have remained relatively constant. New optical technologies may result in improvements, but the growth does not compare to magnetic technology rate of change.

Optical tape products have been developed with limited success in recent years. The attraction has been the potential for large storage capacities in a small space, and an extended tape shelf life. Research efforts continue to pursue a commercially viable optical tape product.

Any discussion of data storage technologies must include a comment concerning data storage media (tape or disk) life, and suitability for archive. Battlefield data is generally considered to be useful for a limited time, but there may be cause to archive information for after action reports and training purposes. The commercial life of a tape transport mechanism or disk mechanism will typically be less than the life of the media. Therefore, it will be necessary to plan for the transcription of data to newer technology on a periodic basis, due to obsolescence of the storage and retrieval mechanism.

In addition to hardware products, software products are available to manage mass storage systems. Several software products are based on the Institute for Electrical and Electronics Engineers (IEEE) Mass Storage Reference Model. The model describes a data migration function, where files are transferred through a hierarchy of storage technologies based on data characteristics, such as age or frequency of use.

An important feature of data management software is metadata, which is information used to describe a data file. Metadata will play a key role in the success of digitizing the battlefield. Metadata serves as the gatekeeper to information, providing pointers to data that would be too voluminous to search through in a combat situation. Metadata offers the customer the ability to transfer only a subset of a data file, to determine if the entire file is desired. If the customer has access to sufficient metadata, fewer unwanted data files will be retrieved, which results in less network activity, and lower demand on the storage system.

Demands of the Battlefield

While there is much to be gained by using existing data management techniques and products, it is clear that the battlefield presents a special challenge. The environment will be fast-paced, with an emphasis on mobility, reliability, and security. Mobile systems for storing large amounts of digital information are not required by commercial businesses today. The Army will need to consider this limitation during development of the data management architecture. Companies selling overnight delivery service have developed some elements of the functionality required by the Army.

The combat arms will require redundant systems, to cope with the consequences of operating in a hostile environment. Once a warfighting capability is developed with reliance on digital capabilities, it will be difficult to maintain momentum if technical performance is lost or degraded. The Army must conduct training with full consideration of contingent actions in the event of system destruction or compromise.

Data security is a frequent subject of the media today. Many stories describe the expertise of hackers entering a sensitive database, and many other events are never made public because of the amount of money lost by a corporation. The Allies' successful use of the Axis Enigma communications during World War II demonstrates how a reliance on "unbreakable" codes can be devastating. It is clear that security can be so restrictive as to limit a commander's access to essential information. Alternatively, a network with a shared data facility offers the commander maximum resources for decision making on the battlefield. Sharing digital data with our current allies will require technology transfer, and consideration of the impact of distributing state-of-the-art data processing equipment. Balancing security with the necessary access to data is critical. Enemy access to the Army's battlefield information system will produce devastating consequences.

Lessons Learned

The evolution of techniques used by organizations managing massive

Redundant Storage for Continuity of Operations

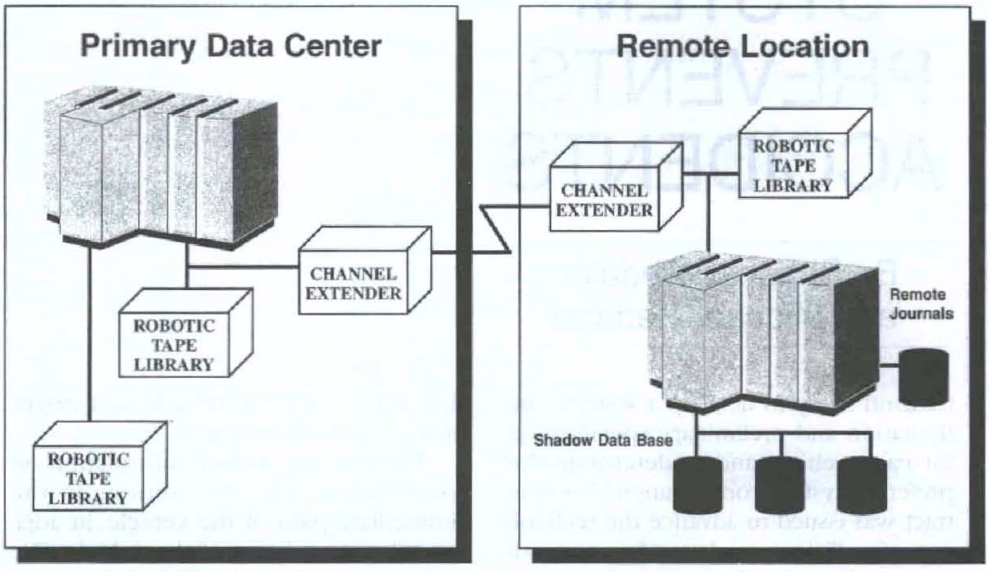

Figure 2.

While there is much to be gained by using existing data management techniques and products, it is clear that the battlefield presents a special challenge. The environment will be fast-paced, with an emphasis on mobility, reliability, and security.

amounts of data provides valuable lessons in building an information system. The transition from centralized processing to distributed processing was accompanied by an attempt at distributed data storage and retrieval. Distributed processing has achieved success, but distributed storage is being replaced by a network-centric data storage architecture.

In a network-centric storage architecture, users are linked to a central storage facility with network connections of increasing capacity. This architecture is particularly well-suited to the military, where a hierarchical command structure is already present. The central storage facility may reside at corps or Army level, operating with high performance computers acting as data servers.

With all network data centrally located, the potential for catastrophic failure of the storage and retrieval process is apparent. Businesses contending with the threat of hurricanes or earthquakes have developed remote data storage facilities, and continuity of operation (COOP) sites. A conceptual diagram of redundant storage is shown in Figure 2. COOP sites are designed to provide redundant capability while the primary facilities are repaired. The Army's network architecture may require substantial data storage in areas relatively close to the area of operations, increasing the probability of data loss. Rerouting information requests will be necessary to overcome damage to the network.

Conclusion

Data storage and retrieval is an essential component of the Army's digital battlefield architecture, and it must be included in the basic system design. To achieve an effective architecture for the battlefield, the desired product of the information management system must be determined. The product is defined by the type of information to be stored and retrieved, the desired location of the information, and access privileges to the information. From a product definition, the tools can be selected: network capacity, computers, data storage hardware, and file management software. Effective data storage and retrieval will be a lethal weapon on the digitized battlefield, providing the soldier with the right information, in the right place, at the right time.

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COLLISION AVOIDANCE SYSTEM PREVENTS ACCIDENTS

By Shaaban Abdalla
and Michael Gedeon

Introduction

Since 1992, the National Automotive Center (NAC) has been committed to accelerating the development and implementation of dual-use automotive technologies for application to military ground vehicles. Located at the U.S. Army's Detroit Arsenal in Warren, MI, the NAC has awarded 35 contracts focusing on military usage of commercial component technologies and processes in the areas of mobility, materials, electronics, robotics, and sensors.

In the area of robotics, the NAC contracted with Delco Electronics to define the operational characteristics, performance, and requirements of a collision avoidance system (CAS) for the Army's High Mobility Multi-Purpose Wheeled Vehicle (HMMWV), its Light Tactical Vehicle, and the Palletized Loading System.

Delco engineers also performed a trade-off study to develop a system configuration and preliminary specification for each vehicle and to determine the preferred system configuration. This contract was issued to advance the technology of collision avoidance for safer driving and more efficient parking and docking of vehicles. The automotive industry and various federal highway agencies are interested in CAS for both passenger cars and trucks.

The broad definition of a collision avoidance system is any system onboard a host vehicle that attempts to detect other vehicles and objects in the vicinity of the host vehicle. It also alerts the driver to impending danger. The basic concept of a CAS is that given information on obstacles, other vehicles or people near a vehicle, the operator will act with some urgency to the particular emergency or hazard. The general elements of a CAS and their interrelationships with the vehicle and driver are illustrated in Figure 1.

The sensors provide information on potential accident conditions in the immediate path of the vehicle, in adjacent lanes, and rear of the vehicle. The processor will clean up and integrate the raw returns of radar sensors installed in selected locations on the vehicle and optimize the sensitivity of the incident detection and recognition process. The processor also provides commands to the driver displays presented in visual and auditory formats. The front sensors are located on the right and left on the front vehicle at a height of 85 centimeters. The side sensors are located on each side of the vehicle facing the adjacent lane area most difficult to see in the rear and side view mirrors, the blind zones. (The location of the front and side sensors is shown in Figure 2).

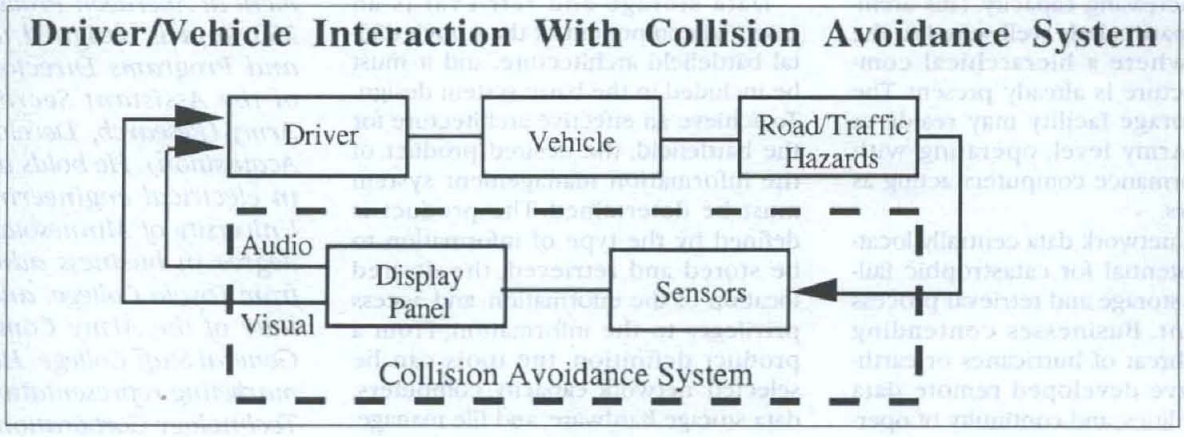

Figure 1.

Proof-of-Principle Demo

On Dec. 1, 1994, Delco demonstrated the proof-of-principle collision avoidance system on a HMMWV at the Detroit Arsenal. Delco also showcased a CAS-equipped Chevrolet Lumina van and a school bus equipped with its Forewarn Object Detection System for Detroit Arsenal personnel. Participants were given an overview of the systems and an on-road demonstration of both the HMMWV and the Lumina. Those in attendance included Bill Bauson, lead engineer-Delco, Herbert Hall, project manager-Delco, NAC Director Alexander Farkas, members of the arsenal's Vehicle Electronics Team, and the program executive officer for Tactical Wheeled Vehicles.

For CAS, the hazards vary considerably and place a wide demand on required response time. Hazard scenarios and their relative importance have been determined based on analysis of various accident data bases. Studies have shown that the major accident types are headway (vehicle moving forward), lane change/merge, and rear collision (vehicles moving backward).

Headway conflict represents one of the more time critical emergencies to the driver. In this case, the imminent collision is visible to the driver, but driver inattention and following too close to another vehicle results in insufficient driver response time to avoid the collision. Darkness or poor weather conditions also affect the driver's vision. Accidents involving lane changes and backing up typically occur when drivers fail to detect vehicles or objects to the rear or in their blind zone. Because of the low relative speeds, this conflict category is much less time critical than headway conflicts.

Delco equipped the HMMWV with a second-generation version of Delco's Forewarn collision warning system. The system uses radar detection to help drivers identify potentially hazardous situations so they can take corrective action to avoid them.

The two front detection units consist of a Monolithic Microwave Integrated Circuit (MMIC), special beam shaping antenna, microprocessor, and digital signal processor which provide control,

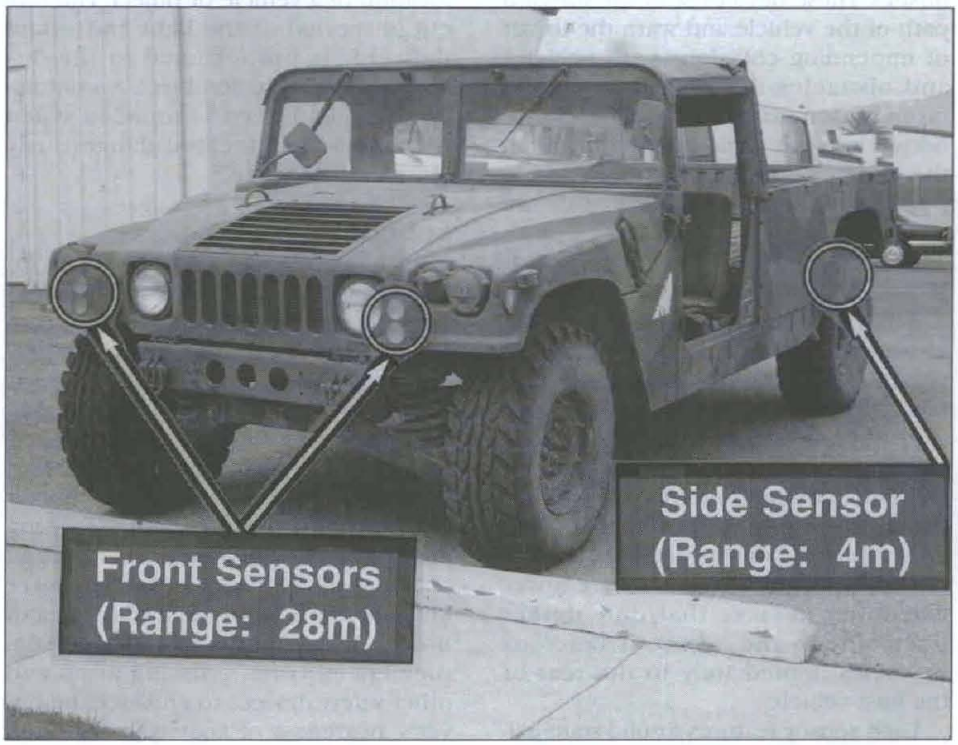

Figure 2.

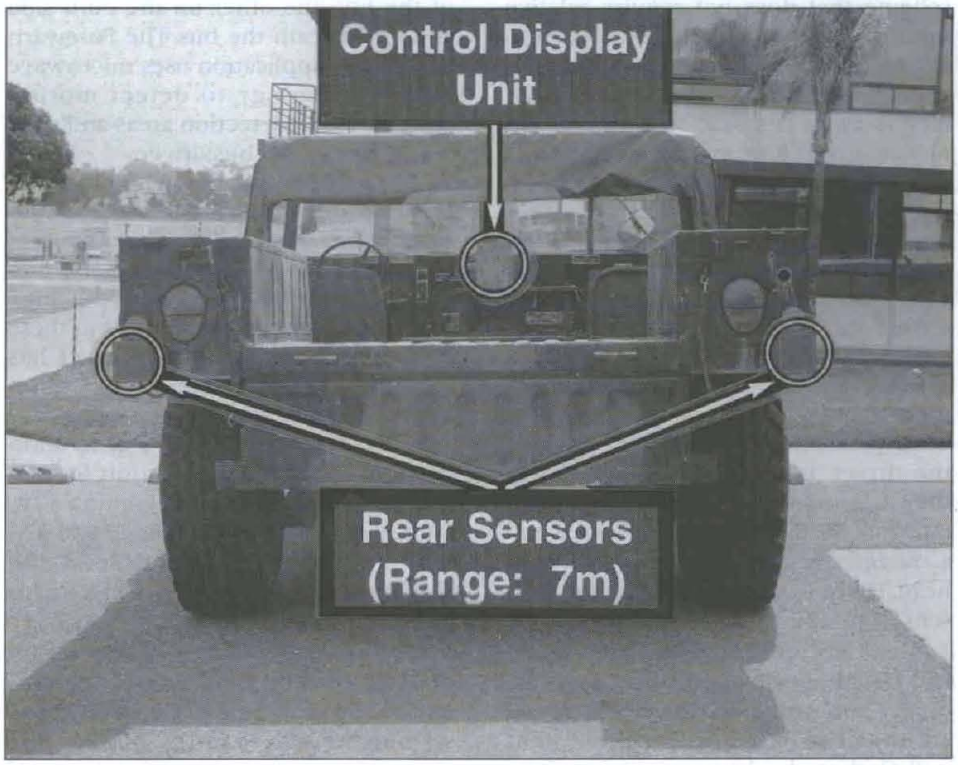

Figure 3.

self calibration, output and fault diagnostics. These devices scan the forward path of the vehicle and warn the driver of impending collisions with vehicles and obstacles in its path. A narrow beam is used that is able to differentiate between those vehicles and objects in the same lane as the host vehicle from those in adjacent lanes, or alongside the road.

Basic Detection

The basic detection unit provides visual and audible warnings to the driver and gives the driver extra time to take corrective action to avoid a collision or lessen potential damage. The side and rear detection units consist of an MMIC, antenna, microprocessor, and digital signal processor which provide control, self calibration, output, and fault diagnostics. These units are lower capability devices that only detect obstacles in the adjacent lanes or obstacles immediately to the rear of the host vehicle.

Each sensor features a solid-state gallium arsenide MMIC that generates 24 GHz radar signals and a Frequency Modulation Continuous Wave (FMCW) scheme that does not require relative motion to sense targets. Each version allows for all-weather operation. The front sensors detect objects up to 28 meters away. The side sensors pick up objects up to four meters away, or one driving lane. The rear sensors have a range of seven meters.

Power to each sensor is supplied from the Control Display Unit (CDU). The CDU contains the main power on/off and the actuating switches for each sensor. The CDU, shown in Figure 3, is located in the passenger compartment of the vehicle near the instrument panel. It is the interface between the driver and CAS. (The location of the CDU and the rear sensors is shown in Figure 3). Target detection lamps and a buzzer are provided for each sensor head. There is an on/off switch for each sensor buzzer.

The CAS sensor will provide audio and visual signals upon detection of an object and will alert the driver. Once an object is detected, a yellow light will flash and a buzzer will sound to alert the driver of the presence and location of a vehicle or object. The repetition period of the light and sound indicator is proportional to the distance of the vehicle/object. A continuous light and beep is sounded when the obstacle is located dangerously close to the vehicle.

School Buses

In addition to the CAS developed for trucks and automobiles, Delco has developed an object detection system for school buses. Delco brought a bus equipped with this system to their demonstration at the Detroit Arsenal. The significant benefit of this system is that it helps the bus driver detect motion or movement, in certain danger areas around the bus, while loading and unloading children.

From 1987-1990, 83 children were killed in and around the loading area of buses. This system is intended to supplement mirrors, crossing arms and other safety devices to enhance the driver's awareness of activity outside the bus without adding another procedure at each stop. There are two primary danger areas: one immediately in front of the bus; the other on the curb side and underneath the bus. The Forewarn school bus application uses microwave radar technology to detect motion within certain detection areas and then warns the school bus driver.

The system engages whenever the bus is stopped and the stop-arm is extended. Audible and visual warnings of movement are given by the display unit mounted near the bus driver. With automated monitoring of movement in these hard to see areas, the bus driver has more time to watch traffic and perform any other safety necessary procedures.

Delco integrated a third-generation version of the Side Detection System (SDS) on the Chevrolet Lumina van. Unlike the system on the HMMWV, which detects stationary objects, the SDS on the Lumina was designed to ignore oncoming traffic and stationary objects. In addition to the sensors on the side of the van, there is a control box in the glove compartment and red warning indicators in the outside rear view mirrors that alerts the driver. If the driver uses his turn signal, an audible warning signal will sound. The differences between the two systems shows Delco's ability to modify the system to the vehicle's environment.

In addition to pushing the state-of-the-art for commercial collision warning, CAS will benefit all Army personnel by reducing injuries resulting from rear end, front, and side collisions. Reducing or eliminating the number of collisions will also reduce vehicle maintenance and repair costs. The commercial trucking industry is also interested in employing this technology on their fleets. Project engineer Bill Bauson stated, "Delco has received favorable comments from truck manufacturers familiar with CAS."

Conclusion

The interest in the collision avoidance system, from both the military and commercial sector, indicates that it is a program with great potential. The National Automotive Center strives to identify collaborative mechanisms for supporting the effective two way transfer of automotive technology. Leveraging commercial automotive research will allow the U.S. Army to provide safer vehicles for the soldier, while reducing operating and supports costs.

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MICHAEL L. GEDEON is the manager of dual-use automotive technology at the Army's National Automotive Center. He holds a B.S. degree in mechanical engineering from Wayne State University and is a member of the Society of Automotive Engineers.

FLEXIBLE ULTRASONIC ARRAY TECHNOLOGY

By Robert Frankle and Douglas Rose

The National Automotive Center (NAC), the U.S. Army's link to the U.S. automotive industry, has taken on the challenging mission of accelerating the development and implementation of dual-use automotive technology tools and manufacturing processes that will make U.S. military ground vehicles more effective and affordable. As part of the U.S. Army's Tank-Automotive Research, Development and Engineering Center (TARDEC), the NAC has awarded 35 dual-use automotive technology contracts to commercial industries and universities. The intent of the contracts is to augment or modify non-government research and development to satisfy future military vehicle needs.

In 1993, the NAC awarded a contract to Failure Analysis Associates (FaAA) of Menlo Park, CA, to develop a flexible ultrasonic array inspection system that will help bring the benefits of lightweight aerospace composite materials to the transportation industry. The basis for this system is FaAA's Portable Automated Remote Inspection System (PARIS), which was originally designed for inspecting thin aircraft composites.

In this project, FaAA is extending PARIS to inspect thick composite materials, such as those planned for use by the Army in the next generation armored vehicle. The Army is evaluating composite materials for use in the Composite Armor Vehicle (CAV) Technology Demonstrator, because composites have structural and ballistic characteristics that meet or exceed those of conventional metallic armored vehicles at a significant savings in weight. The CAV design may include bonded fiberglass, ceramic, and signal management layers. The multiple bondlines increase the challenge of inspecting large areas of highly attenuative material. Capabilities are needed to inspect for manufacturing defects in the factory and to inspect for service damage in the field. FaAA's approach to this specific adaptation is to increase ultrasonic penetration using the following techniques: 1) Fabricating an array that operates at a lower frequency and at a higher voltage than is typically used for thin composites; and 2) Employing a synthetic pulse technique.

In a composite material, reinforcing fibers are added to a plastic matrix to produce a material that is stronger, stiffer, and lighter than plastic alone. Fiberglass is one example of a composite material that is commonly used on structures from boats to bathtubs. For many years, composite materials have been used in aerospace structures, such as aircraft and spacecraft, where weight is such a critical design consideration. Composites are widely used in the latest commercial aircraft, such as the Boeing 777 aircraft. The 777 incorporates 9 percent composites or about 10 times the amount used on the 757 or 767 aircraft. The weight saved adds 60 additional miles to the flying range of the 777.

As the cost of composite materials decreases, researchers are finding greater usage in a wide range of non-aerospace transportation applications, including automobiles. Many of the plastic components on a car are actually reinforced plastics composites. Just as in aircraft, composite automotive parts reduce vehicle weight, which improves fuel economy. They also provide greater design flexibility and improve durability, which reduces dents and dings in body panels and bumpers. Composites are also a key element to producing practical alternative fuel vehicles, such as electric cars. The batteries that power an electric car are very heavy, so other parts of the car are made of composites to keep the entire vehicle weight reasonable.

The 1993 Chevrolet Camaro and Pontiac Firebird use composites in the front fenders, doors, roofs, hatches, and bumper fascia. Reinforced plastic is also being used inside cars. The dent resistant composite doors in the Saturn are fabricated with very tight tolerances that result in a door that closes easily and sounds better.

According to a recent NASA study, as the use of composites in the aerospace and transportation industries increases, technology is needed to assess the damage and qualify repairs during manufacturing and service. Unfortunately, the fiber reinforcements that make composite materials so attractive for efficient, lightweight structures also make them heterogeneous and very difficult to inspect.

Ultrasonic inspection is frequently used to detect defects in composite structures. This testing can locate and size damage caused by impact damage and foreign objects, measure graphite-fiber material properties, and determine component thickness. Traditionally, the inspection is performed by manually scanning the surface with a single, small ultrasonic transducer. On large structures, this approach can be very tedious and time consuming. With a manual inspection using a single transducer, it is more likely that the entire structure will not be inspected and some defects may be missed.

A flexible ultrasonic transducer array, like FaAA's PARIS, represents an innovative solution to many of the problems associated with manual ultrasonic inspections. The PARIS ultrasonic inspection system consists of a flexible transducer array and the associated display and control electronics. The PARIS array has 1,024 transducer elements arranged in a 32 by 32 element matrix. The dimensions of the active area of this array are 20 by 20 centimeters, providing a total inspection area of 400 square centimeters. Inspection time for

Flexible transducer array.

this array is under one minute. The array used to inspect thin composite structures operates at 2.5 megahertz, while the array built to inspect thick composites operates at less than 1 megahertz.

An ultrasonic inspection is performed by placing the ultrasonic blanket on the part to be inspected and then using a computer to perform the inspection and acquire and display the ultrasonic data. Because the blanket is flexible, it can conform to an irregular shape, such as the curved surface of a pipe. Since each transducer in the blanket is automatically accessed by the computer, the user can be certain that the entire surface under the blanket is inspected. The inspection system is portable and can be used in factories, at maintenance facilities and in the field. Flexibility insures that the individual transducer elements self-align to the component surface, thereby maximizing the amount of sound transmitted into the component. Uniform acoustic coupling across all the transducer elements is insured by use of a vacuum system or by external force to affix the array to the component.

PARIS digitizes the complete RF waveform and processes the ultrasonic data in its computer, including time-averaging of the RF waveform to reduce noise and scanning of the waveform for flaw indications. PARIS collects both amplitude and time-of-flight information for each of three gates, which are typically set to monitor front surface, flaw, and back surface echoes. After the transducer array has been scanned, the data can be viewed in a variety of display formats.

The inspection results can be displayed as an image. Time-of-flight and amplitude images are easier to interpret than conventional oscilloscope displays and consequently less training is required to operate the system. When indications are found, the images can be transmitted anywhere in the world by modem for evaluation by experts. If a component is scanned with the array immediately after manufacture, the data can be archived and used as a baseline for subsequent field inspections. Finally, an array-based system can be developed that incorporates the advantages of a large fixed scanner into a portable instrument.

The synthetic pulse technique proposed by FaAA involves synthesizing an ultrasonic pulse by transmitting a series of stepped frequency tone bursts, directly measuring the complex Fourier coefficients in the returning echoes, and calculating the resultant broadband pulse. This method achieves both improved penetration and range resolution in highly attenuative materials.

Two features differentiate the synthetic pulse method from conventional ultrasonic inspection. The transmitter amplitude may be increased with frequency to compensate for high frequency attenuation in the test piece. In addition, the phase of the transmitted signal may be altered as necessary to compensate for any dispersive sound velocity in the test piece. Both of the above features contribute to optimized pulse shape in the returned signals, resulting in improved range resolution and penetration. Furthermore, increased signal-to-noise ratio is realized due to higher transmitted power of the monochromatic tone bursts.

FaAA has developed a prototype flexible array fabricated to inspect thick composite armor material. For fiberglass composite material, ultrasonic attenuation increases rapidly as the frequency is increased beyond about 700 kilohertz. Accordingly, a key design goal for the transducer array was an operating frequency range from 400 kilohertz to 900 kilohertz. The measured frequency response for the prototype array is approximately 350 to 900 kilohertz, which meets the design specification at both the lower and upper frequency limits. The frequency response is very flat over the bandwidth of interest resulting in good performance for synthetic pulse applications.

FaAA used the prototype array and synthetic pulse technique to inspect fiberglass panels ranging from 0.5 to 1.5 inches thick and containing urethane inserts at different depths. Future work involves incorporating these same capabilities into a full-size array.

The FaAA will deliver a flexible ultrasonic array system by the end of 1995. In addition to computer equipment, FaAA will provide a videotape documenting the performance of the flexible ultrasonic array system and a demonstration and training session for TARDEC engineers.

Leveraging dual-use technologies and encouraging organizations to work together on projects is the primary goal of the National Automotive Center. The NAC strives to consolidate and coordinate the knowledge base, networks, processes, strategies and resources needed to maximize available dual-use automotive technologies. Failure Analysis Associates' Flexible Ultrasonic Array System is just one example of the NAC's ability to stimulate the development and implementation of selected technologies and processes that have dual-use potential.

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DOUGLAS ROSE is a research physicist at the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). He holds B.S. and Ph.D. degrees in physics from Texas A&M University.

A SINGLE HYDRAULIC FLUID FOR ARMY GROUND EQUIPMENT

By Ellen M. Purdy

In consonance with on-going Army initiatives to improve rapid deployability while maintaining an effective fighting force, the Fuels and Lubricants Division of the U.S. Army Tank-automotive and Armaments Command's (TACOM) Mobility Technology Center at Fort Belvoir, VA, has developed a single hydraulic fluid (SHF). This fluid is intended to replace several military specification fluids currently required for ground vehicles and equipment. Conversion to SHF for all ground materiel eases the logistical burden for vehicles and equipment, thus increasing deployability while enhancing maintainability. SHF was developed in response to the Army's Science and Technology Objective (STO) III.P.3 entitled "Multifunctional Fluids and Lubricants" and as demonstrated below, that objective was met.

Three different hydraulic fluids are currently required, MIL-H-5606 (OHA), Hydraulic Fluid, Petroleum Base; MIL-H-6083 (OHT), Hydraulic Fluid, Petroleum Base, Operational and Preservative; and MIL-H-46170 (FRH), Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base. Each fluid exhibits specific desirable characteristics, but no single fluid exhibits all desirable characteristics.

OHA and OHT are almost identical petroleum-based fluids, except OHA has no corrosion prevention capabilities. They provide excellent low-temperature operability and swelling of seals and O-rings, yet lack good oxidative stability and are extremely vulnerable to fire, igniting relatively easily. FRH, on the other hand, has excellent resistance to fire and provides good corrosion protection, but exhibits poor low-temperature operability and, to an extent, inadequate swelling of seals and O-rings.

Because fluid performance is critical to the operation of different vehicles, all three fluids must remain in the supply system. For example, the M1A1 Abrams tank uses FRH hydraulic fluid because of its fire resistance. It compensates for the poor low-temperature performance of FRH by installing a winterization kit that preheats the fluid when the tank must operate in arctic temperatures. The M109A2 Self Propelled Howitzer, however, makes use of OHT because low-temperature capability is deemed absolutely necessary and thus sacrifices a measure of safety. In essence, both vehicles must "make do" with the fluids currently available. SHF now negates this since it meets all needs for all vehicles.

OHT had been the fluid of choice for all ground equipment because of its operational and preservative capabilities. The 1973 Middle East War, however, surfaced the undesirable characteristic of a fluid's vulnerability to the fire threat. When subjected to a source of ignition, OHT (and OHA) will rapidly ignite and continue to burn even after the source of ignition has been removed. The fluid will combust when contacted with surfaces hot enough to cause self-ignition.

FRH does not share this same vulnerability to fire because it is more resistant to combustion. While the fluid eventually will ignite, it quickly self-extinguishes when the source of ignition is removed. FRH will not self-ignite unless the temperature of a hot surface reaches 305 C (581 F). The drawback to FRH is poor operability at low temperatures and marginal seal swell. FRH has viscosities of 13,000 cSt at -40 C and 133,000 cSt at -54 C. When compared to the OHT viscosity of 3500 cSt at -54 C, it is easy to understand why vehicles perform sluggishly or not at all at low temperatures (-25 C or lower) when using FRH. FRH is based on a synthetic hydrocarbon polyalphaolefin (PAO) basestock that provides the fire resistance, yet causes the high viscosities at low temperatures. This basestock can also actually cause seals to shrink. FRH formulations contain an organic ester, which causes seals to swell to counteract the effect of the PAO basestock. The amount of ester in the formulation is limited in order to prevent the fluid from absorbing water and loose its fire resistance, thus seal swell does not occur to the same extent in FRH as in OHA and OHT.

The goal in developing a single hydraulic fluid was to include all desirable characteristics of the three fluids while eliminating their deficiencies. Other constraints also were taken into account. The fluid must be compatible with the existing fluids, metallurgy, and elastomer seals. Because of increasingly restrictive regulations concerning hazardous waste, the fluid could not contain

Based on laboratory analysis and field demonstrations, single hydraulic fluid is the single fluid that can replace existing fluids and still meet all military demands for Army ground equipment.

hazardous components. As a final constraint, all of the above had to be accomplished with the cost of the new fluid being comparable to the current fluids.

SHF uses "chemistry" similar to FRH. The fluid is primarily a PAO basestock and organic ester blend. The basestock used in SHF is a blend of 4 cSt PAO (the same used in FRH) and 2 cSt PAO. The 2 cSt PAO allows SHF to exhibit fire resistance without the high viscosity at low temperatures thus achieving the desired low temperature performance. The use of a synthetic basestock vs. a petroleum basestock improves the oxidative stability of the fluid over what is obtained with either OHA or OHT. The ester in SHF is different from that used in FRH. An isodecyl ester is used which is fire resistant, absorbs very little water under humid conditions, and has an extremely low viscosity at cold temperatures. By incorporating the 2 cSt PAO basestock and the isodecyl ester, SHF provides fire resistance, low-temperature operability, and satisfactory seal swell.

SHF has several advantages over the current fluids. It contains no components considered hazardous or toxic. The corrosion protection exhibited by SHF provides a threefold increase in protection provided by FRH or OHT. Wear protection from SHF is comparable to FRH, which is slightly better than that obtained from OHA or OHT. Seal swell in SHF (19-22 percent) is greater than in FRH (15-19 percent) but less than in OHA and OHT (19-30 percent), yet is sufficient to prevent leakage. Finally, SHF provides fire resistance comparable to FRH and low-temperature operability comparable to OHT.

SHF is fully compatible with FRH, OHA, and OHT at all temperatures allowing SHF to act as a one-for-one replacement for the fluids now used. A simple "flush and fill" will suffice when converting vehicles to SHF. The old fluid can be drained out, the hydraulic system flushed with SHF, and then refilled with SHF. The vehicle is operational without replacing any seals and/or hydraulic components. Conversion to SHF can also be accomplished by simply using SHF to top off the hydraulic systems when new fluids need to be added or changing over during regular maintenance. This method requires a longer period of time before the conversion is complete, but does not incur the up-front costs of purchasing large quantities of fluid.

The performance of SHF was recently validated in a 12-month field demonstration with the 3rd Armored Cavalry Regiment (3rd ACR) at Fort Bliss, TX. M1A1 tanks and M109A2 Self Propelled Howitzers were converted to SHF using the "flush and fill" technique, while others were refilled with either new FRH or OHT to act as control vehicles. Throughout the 12-month period, SHF demonstrated performance indistinguishable from that obtained from FRH or OHT. The SHF vehicles successfully fired a combined 2,160 practice rounds (SABOT, HEAT, and Illumination) and participated in the summer exercises at Fort Irwin, CA, with satisfactory results. No signs of system incompatibility were evidenced, and drivers and gun crews reported that SHF performed satisfactorily.

The Program Management Office for the Advanced Field Artillery System (AFAS) has also tested SHF with successful results. The test vehicle fired live rounds (top charges) at all elevations with instruments recording recoil pressures and distance, temperatures, etc. AFAS was satisfied with the fluid's performance and plans to continue testing SHF at arctic temperatures for possible use in the future AFAS vehicles.

SHF provides all of the desirable characteristics of a military hydraulic fluid while eliminating the deficiencies exhibited by the fluids currently used. Based on laboratory analysis and field demonstrations, SHF is the single fluid that can replace existing fluids and still meet all military demands for Army ground equipment.

ELLEN M. PURDY is a chemical engineer with the Fuels and Lubricants Division of the Mobility Technology Center at Fort Belvoir, VA. She is responsible for the development and standardization of petroleum products for Army air and ground equipment. Purdy holds an M.S. degree in engineering management of R&D from George Washington University and a B.S. degree in chemical engineering from the University of South Florida.

U. S. ARMY ASSISTS FEDERAL EMERGENCY MANAGEMENT AGENCY

By Dr. Angelo Mirabella, Walt Satterfield and Hugh Wood

Introduction

Last year, Deputy Secretary of Defense John Deutch explained to Congress how sharing research and technology with the civilian sector during downsizing can help maintain our military technological skills. This article illustrates dual-use applications of *training* research produced by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences and applied to the National Fire Academy (NFA) in Emmitsburg, MD. The NFA is an element of the Federal Emergency Management Agency (FEMA).

Background

In 1993, the NFA asked ARI to help upgrade its training of fire-ground command and control (C2). NFA had already incorporated ARI research on decision making (DM) into its two-week course for preparing battalion commanders. Now, it wanted to replace its mechanically-supported, labor-intensive simulation exercises (SIMEXs) with multi-media, computer-supported SIMEXs.

Longer range, NFA envisioned networking, for joint Service exercises, with the Emergency Management Institute (EMI), also at the Emmitsburg Campus. It also envisioned distributing SIMEXs nation-wide to home stations. Its initial success with Army research on DM led it to seek *additional* Army research and experience to support the foregoing objectives.

This article summarizes how NFA *has* used Army DM research. Then, it talks about ongoing cooperation between NFA and ARI to further apply military research to NFA training. (See ARI Research Report 1673, April 1995, *Computer-Supported Simulation at the National Fire Academy: Lessons Learned for Incident Command Training.)*

Dual-Use Research on Decision Making

In 1986, ARI launched research on how unit commanders use "naturalistic decision making" under the time and stress constraints of battle. Klein Associates—ARI's contractor for the effort—chose a surrogate test bed: command and control of major fire-ground incidents. Klein asked fire battalion commanders to describe incidents they had commanded. Then, he asked questions about how they had made decisions.

Results contradicted the view that good DM requires exhaustive analysis of alternatives. Klein found that commanders make decisions by responding to salient, critical cues in the fire scene, based on experience. From these data, Klein developed the theory of recognition primed decision (RPD) making. NFA used the theory to modify

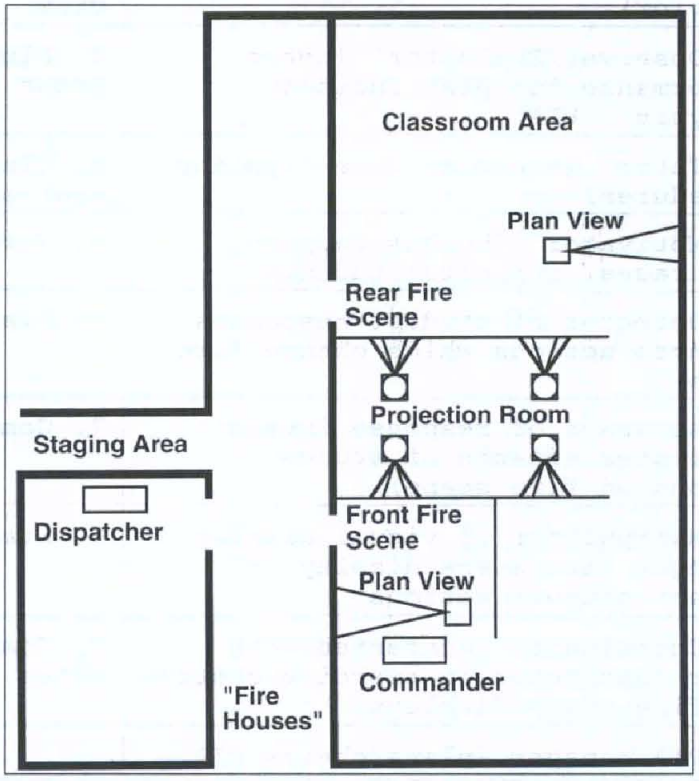


Figure 1. Simulation facilities for Major Fire Operations Course, National Fire Academy, Emmitsburg, MD.

classroom exercises and instructional materials in its battalion command training program.

NFA and ARI Cooperation

After its adoption of RPD, the NFA approached ARI for help in applying Army simulation-based training research to fire-ground command training. ARI was asked to draw on its research to assess the need for improved training technology. It was also asked to define functional requirements for improvement. Recommendations for upgrading training technology at NFA resulted.

Analysis of Training

Description of the Training Program. First, ARI assessed the simulation to be upgraded. It was part of a two-week course for preparing future battalion chiefs to command and control major fire-ground incidents. The course had 25 students and two instructors. Week 1 used lectures and class drills to teach C2 doctrines, principles, and procedures, widely accepted in the EM community. Week 2 began with a day of lectures. It continued with three days of multi-alarm SIMEXs. Figure 1 shows facilities used to conduct SIMEXs for the course.

Students initially congregated in the classroom area for a pre-brief on the upcoming multi-alarm exercise. With the help of a projected photo and plan view of the fire site, an instructor explained the exercise problem. He described the building on fire, street layout, and hydrant locations. He also explained tactics that might be used and the problems that might be encountered.

Students were then assigned roles. These included initial incident commander (IC), follow-up IC (battalion, assistant district, or district chief), tactical commander (engine or ladder company chief), company crewman, or dispatcher. Tactical commanders and their crews assembled in the fire house area; dispatchers went to the dispatcher station. Dispatchers began the play with a radio call to the initial IC (first alarm tactical commander).

The initial IC arrived on the scene with his company to set up a command post and begin managing the incident. He saw a projection of a photo of the front of a fire scene with a fire-smoke overlay. The IC then

Table 1.
Instructor Roles and Operational Sites.

Instructor Roles	Simulation Sites
1. 'Stage Director' (explains game moves)	1. Projection room: front view
2. 'Socratic Coach' (prompts correct behavior)	2. Projection room: rear view
3. 'Observer/Evaluator' (notes performance for post incident analysis - PIA)	3. Plan view projection: front scene room
4. 'Tutor' (explains fire-fighting procedures)	4. Plan view projection: rear scene room
5. 'Motivator' (builds rapport, encourages, supports students)	5. Fire House Area
6. 'Detector of student responses (detects actions which change fire scene)	6. Dispatcher station
7. 'Assessor of response impact' (estimates effects of student actions on fire scene)	7. Command station
8. 'Manipulator of visual display' (changes fire scene display to reflect student actions)	8. Staging Area
9. 'Coordinator (conferred with other instructor on exercise control and fire-scene displays)	9. Company operation sites (usually 3 to 6)
10. PIA manager (plans/chairs PIA)	

assessed the situation and assigned responsibilities. As he saw the need for more resources, he issued further alarms. Additional companies then arrived via a staging area with a higher-level IC (e.g., battalion chief) who would assume command.

• *Simulation Technology.* The simulations employed slide and overhead projectors to create the visual effects of a fire-ground scene. Students recorded their reactions to the scene on a projected plan view of the fire-ground. For example, they drew hose lines or vent holes to show how their engine or truck companies were carrying out the IC assignments.

• *Simulation Management.* Students indicated that the simulation exercises were valuable for building strategic and tactical command skills. But the exercises were labor-intensive and logistically complicated. The two instructors had to play 10 rapidly shifting and conflicting roles while physically moving among 14 simulation areas (10 operational sites; four control sites) in six separate rooms or hallway areas. Clearly, exercise control needed to be a major consideration in planning and evaluating simulation upgrades. To assist in this planning and evaluation, ARI developed a table of exercise controller roles (Table 1).

To further assist NFA planning, the Army's systems approach to training was used as a framework to recommend near and long-range simulation upgrades. Near-term, the recommendations addressed student preparation for the SIMEXs, exercise design, conduct and management, and post incident

Table 2.
Summary of Lessons Learned/Recommendations—Near Term.

Phase	Recommendation Summaries
1. Front-End Preparation	• Focus the initial lectures and classroom drills more specifically on the SIMEXs to follow. • Begin the SIMEXs by Day 3 instead of Day 1. The Army's experience with Project MDT2 indicated that front-end preparation critically impacts the effectiveness of SIMEXs.
2. SIMEX Conduct and Management	• Use Table of Instructor Roles and Operational Sites as a baseline checklist in planning, implementing, and evaluating incremental upgrades in IC training technology. • To support training in Rapid Fire Ground Decision Making (RFGDM) compile a list of critical decisions and related 'trigger' cues. • Use the list to help evaluate candidate simulation technology upgrades. Does the upgrade support the list?
3. Computer Support for Measurement and PIAs	• Examine the use of the electronic white board to record and play back student plan view responses in after action reviews (AARs, PIAs). Participants in the MDT2 AARs found that rapid playback of the two dimensional plan view of battle segments provided effective training.
4. Use of SIMEX to Train Decision Making	ARI Research Report 1673 presents a large and complex set of recommendations on training decision making. But the thrust of the recommendations is to recognize limitations of the RFGDM method and make appropriate adjustments in scenario design. Specific suggestions are made in the report.
5. Training System Assessment	• Assess training system effectiveness following instructional upgrades. • Examine the applicability of Army research on networked, training system assessment. A framework and methodology have been developed for such assessment as part of Project MDT2.

Table 3.
Lessons Learned/Recommendations—Longer Term.

Phase	Recommendation Summaries
1. Simulation Technology Upgrades	• Catalog a range of technologies to support incremental increases in fidelity and interactivity, with fully interactive, virtual reality as an end point. • Analyze simulation fidelity requirements to support use and improvement of the RFGDM training method. Two methods for doing this were suggested: ♦ Method 1: Trace backward in the chain of SIMEX causal events from critical IC decisions to related cues; then to the actions of tactical commanders and crews; finally to cues preceding those actions. ♦ Method 2: Survey student reactions concerning credibility, fidelity, and level of interactivity. Method 2 proved especially useful in Project MDT2.
2. Campus Networking	• Identify prerequisite 'single service' skills that NFA and EMI students must have for successful 'joint', i.e., networked exercises. • Identify potential disconnects in SOP and terminology between the 'services.' Prepare students accordingly before SIMEXs begin. • Enlist top-down support and commitment for 'joint' exercises. • Clearly distinguish 'single service' from 'joint service' training objectives. Design 'joint' SIMEXs accordingly.
3. Regional Networking	Long-range the NFA anticipates functioning as a focal point for distributing training across the nation. A check-list of issues was offered to be considered in evolving plans for such an outcome. Some examples: • Customer needs and constraints • Type of service to be 'sold' • Training cadre support • Hardware/software support • Compatibility with local simulation upgrades • Training system evaluation

analysis (PIA). The organization for these is summarized in Table 2, with a sample of recommendations.

Longer-range recommendations (Table 3) addressed issues in networking on campus to EMI and to fire stations across the nation. ARI learned about such issues as part of its on-going work with a Multi-Service Distributed Training Testbed (MDT2). MDT2 is designed to try out geographical distribution of unit training simulation.

In addition, a number of strategic suggestions were offered:

• Proceed incrementally by replacing the existing mechanical components with computer-based versions of those components. Army experience suggests the merit of not investing heavily in bells and whistles without understanding the human component and training system impact of such investment.

• With a view towards the future, begin to explore greater automation and interactivity, such as virtual reality.

• Plan and implement upgrades to support each phase of training. For example, use technology to prepare students for SIMEXs, conduct PIAs, and assess training system effectiveness.

Evolving Upgrades

NFA is completing plans to replace its mechanically based C2 training simulator with a multi-media system. The student IC and company crew members will play the exercise much as they did with the old system. But now, four networked Pentium PCs will be used to project fire scenes (e.g., front, rear, and sides of a building). The instructors, using a separate workstation, operated by a technician, will be able to call up changing fire scenes from a CD ROM library in response to student actions. These actions can be electronically time-tagged and recorded for PIAs.

Conclusion

Through the Army/FEMA partnership, the NFA is gaining increased capability to keep abreast of the latest, high fidelity technology for C2 instruction. It will, therefore, be positioned to move towards higher levels of training automation. ARI is gaining experience in the application of training technology research to similar but new environments. The Army will benefit from opportunities to broaden its understanding of effective uses of that technology. Moreover, it will have access to another source of data to strengthen conclusions about new directions for training.

DR. ANGELO MIRABELLA is a principal scientist at ARI. He specializes in research and development of training for combat units. He earned an A.B. at Cornell, an M.A. at Columbia, and a Ph.D. in experimental psychology at the University of Massachusetts.

WALTER SATTERFIELD is an instructional systems specialist at NFA. He designs and develops courseware to train fire emergency personnel. He earned an A.B. in English from the University of North Carolina and an M.A. in educational psychology from the University of Texas.

HUGH WOOD is a training program manager at NFA. He is responsible for curriculum management in command and control of emergency incidents. He received an A.B. in technology management from the University of Maryland and an M.A. in human resources management from George Washington University.

What Impact Will Integrated Product Teams Have On Your Mission As A PEO or PM?

BG David R. Gust
Program Executive Officer, (PEO) Intelligence and Electronic Warfare (IEW)

PEO IEW used the IPT method to plan and execute our participation in the Task Force XXI Army warfighting experiments. In so doing we have avoided creating another division within the PEO office. IPT members have been empowered to represent their respective functional divisions (business management, operations, and systems engineering) under leadership of a lieutenant colonel assigned to this PEO office. The IPT was created in July 1995 and thus far has been a very effective and efficient manner to accomplish our Task Force XXI mission.

The project manager, joint surveillance target attack radar system (JSTARS) has utilized the IPT method to resolve two significant issues. One of these issues is acquisition strategy report and acquisition program baseline issues among the Office of the Secretary of Defense (OSD), Headquarters, Department of the Army (HQDA), and the PEO/PM. The other issue is JSTARS Army Systems Acquisition Review Council (ASARC) streamlining. In as far as a PM's mission of cost schedule and control is my mission—these issues represented the "bread and butter" of the JSTARS program to advance to a multi-Service operational test and evaluation in November 1995, and to the award of the common ground station production contract. My job was made easier in that the IPT resolved all but one issue, and I was required to run interference with only one staff office at OSD prior to the issue resolution.

COL Thomas L. Haller
Project Manager
CORPS Surface-To-Air Missile
Program Executive Office, Missile Defense

Integrated Product Teams are a management tool that can be of great value to the PM if implemented properly. There are essentially two types of IPTs: the product oriented teams established by the PM and his industrial counterpart, and the oversight and review IPTs, which should have the same makeup, established by DA and OSD for those functions. Within this framework, the IPTs can serve as an effective streamlined tool for executing a program.

The PM level IPTs are generally established to support the concurrent engineering process. Programs employing concurrent engineering principles already have IPTs to a large degree. These teams insure that all functional experts are integrally involved in the development process and all decisions made with respect to system design consider its impacts on all aspects of the program throughout its lifetime. The IPT can insure that important logistics and production type factors are considered "up front and early" and continuously throughout the program, thus saving dollars that could be wasted because of programmatic rework.

The oversight and management IPTs can greatly streamline those functions. The oversight IPT can effectively reduce PM reporting requirements and greatly facilitate the identification and resolution of program issues in a timely and supportive manner. The important thing is to have the proper representation on the IPT. IPT members must be empowered by their parent organization to be part of the collective decision making process without having to take issues back to others for final organizational approval.

A review (or overarching) IPT can also assist the PM by streamlining the review information requirements and the actual review process. The current practice of PMs carrying issues to multiple higher headquarters elements for identification and resolution of issues prior to a review can be replaced by bringing the program information to the centralized and empowered review level IPT.

As is our tendency, the term IPT is showing up associated with many meetings or working groups or even normal organizational elements that are not really IPTs. Some organizations have renamed their divisions and branches IPTs without changing the real management process that IPTs call for. Likewise too many IPTs, such as oversight and review IPTs at multiple levels, will not facilitate the streamlining desired through this new process. There will also be a tendency for some oversight organizations to use the IPT process to perform management activities that are clearly the responsibility of the PM as specified in the *PM's Charter* and Dr. Kaminsky's *PM's Bill of Rights*.

The IPT process, if implemented properly, can provide for better management at the PM level as well as more streamlined and efficient program oversight and review. Those of us implementing this concept at all levels must carefully construct the IPTs with these goals in mind while also remembering the basic chain of responsibility for the program that goes from the PM to the PEO to the acquisition executive.

COL James L. Mitchell
Project Manager, JSTARS

The use of Integrated Product Teams will require more up-front work, time and organization. For a PM, the major cost is the investment in time.

Identifying the right players is critical; only one IPT is needed, not several overarching IPTs which come into existence to relook an issue because some bureaucrat is not happy with the original IPT decision. IPT membership should be kept to a minimum and those selected must be experts in their area and empowered to make decisions for their leadership.

IPT needs focus and "rules" which must be agreed to by all early in the process so time is not wasted on revisiting previous decisions. Some of these rules include:

- Foster an atmosphere of open discussion;

• IPT members need to assume a system perspective as opposed to a functional perspective;

•The PM needs to better appreciate the functional perspective;

•Most importantly, resolve or raise—if an issue cannot be resolved at the IPT level then raise it immediately and don't waste time.

IPT members need to be indoctrinated so that all understand what the common objective is and know who the other players are. Much can be said for face-to-face discussions as opposed to e-mail or telephone calls.

The payoff for the PM is at the end of the particular process (i.e. milestone decision authority at the Defense Acquisition Board (DAB), ASARC or PEO level). Because of the up-front time invested, most if not all of the issues are resolved. Milestone documentation is kept to a minimum because the functional IPT members were involved in the process continuously from the beginning and are aware of issues/problems and their respective fixes. There's a lot less animosity and finger pointing because everyone was heard and they all had the equal opportunity to contribute or put a stop to the process using the "resolve or raise" rule.

Another possible dividend for the PM will be less bureaucratic "sniping" at the program because now the respective bureaucrat's representative was part of the process. This could result in less investigations and audits of the PM's program.

The bottom line, however, is that IPT does not mean management by consensus. It is the PM's mission and charter to develop and field a product which satisfies the performance requirements within schedule and cost constraints.

COL Rick Nidel
Project Manager For
Mines, Countermine and
Demolitions

Under Secretary Kaminski's April memorandum concerning the reengineering of the acquisition oversight and review process was a very timely document for this office and the Wide Area Munitions (WAM) Program, in particular. At about the same point in time as the guidance was released, we had realized that the procurement administrative lead time for the WAM Product Improvement Program Engineering and Manufacturing Development would cause a significant gap in the R&D activities of our prime contractor. The result of this gap could potentially mean the release of a significant portion of the contractor's current WAM development engineering team. Naturally, such a loss of expertise would adversely affect the smooth transition to the follow-on developmental program.

The procuring contracting officer and his supervisor at the Armament Research, Development and Engineering Center approached the project office with the recommendation to establish an IPT, which they felt would allow us to close the procurement lead time down to about four months. After a couple of strategy sessions with the key players of the IPT, to include the user and the WAM system contractor, an IPT was officially chartered. We held a kick-off session and convened the initial IPT meetings in early June. Reports of progress to-date are favorable and we expect to meet our milestones for contract award.

The IPT process, when completed, will have enabled us to compress the procurement leadtime from 9-12 months to about 4 months. Through the IPT, both the government and the contractor have had to lay their cards on the table; the government providing the specific amount of funding available for contract and the contractor providing the details of his resource requirements to the IPT members for evaluation.

The IPT process can eliminate the standard heel-to-toe procurement process consisting of request for proposal (RFP) preparation, contractor proposal preparation, proposal evaluation and final contract negotiations and award. The IPT can develop the RFP and the proposal and bring it to final form without the lockstep of the old process. The Functional Requirements Assessment Board requirements can also be accomplished by the IPT.

The continued support of ASA(RDA) Gilbert Decker for innovative acquisition streamlining has been a positive force for project management. The potential benefits of the IPT process, as one example of streamlining, are there to realize, subject only to our ability to apply the principles to our programs.

LTC R. Kelley Griswold
Product Manager
Multiple Launch Rocket System
Precision Guided Munitions

My product office is responsible for managing the extended range multiple launch rocket system (ER-MLRS) engineering and manufacturing development and its transition to low rate initial production (LRIP). The effort has been managed by something akin to an IPT even before the establishment of a product office.

The local ER-MLRS team, consisting of a multi-functional group of individuals trained in their individual disciplines, has met on a weekly basis since a demonstration program was funded in 1992. To keep informed throughout the week, the team makes extensive use of electronic mail. Although a habitual relationship has developed whereby the same individuals support ER-MLRS on a long-term basis, none of the members are assigned to the product per se.

From a larger point of view, the emphasis on IPTs will affect the makeup of the current team. Expansion of the team to include outside players, such as the U.S. Army Materiel System Analysis Activity, the Operational Evaluation Command, the Training and Doctrine Command system manager, and the prime contractor, is the next logical step. Although these organizations have been integral participants in the program, geographic separation has prevented their routine participation. Tools such as video teleconferencing and e-mail are critical to information sharing and increased participation.

With an LRIP in-process review (IPR) in the near future, it may be possible to take advantage of the increased emphasis on IPTs to streamline the IPR preparation and approval process. Expanding the team membership may result in fewer pre-briefings and perhaps even an efficient "paper IPR" versus a traditional formal review.

The long-term mission of this product is to transition the ER-MLRS rocket to a guided rocket and, eventually, a carrier for delivery of smart submunitions. Both efforts are in the early stages and should benefit from formation of IPTs in a manner similar to what has been so effective for the ER-MLRS program. Reduced paperwork and staffing cycles are certainly achievable as a result of this approach.

LTC Robert Gunning,
Product Manager
Longbow Apache Aircraft

We have used the IPT process on the Longbow Apache program since March 1995 in preparation for an October 1995 Milestone III Defense Acquisition Board. At the outset, let me say the process works. Negative impacts are minor and occasionally annoying but the dividends are worth the extra effort. First off, there is an investment in time. The PM must prepare monthly briefings and be prepared to

spend the extra time to inform the respective staffs (HQDA, SARDA, OSD). The PM must also answer issues that surface throughout the process. This involves a bit more exposure on some areas than you might like, but there are several advantages. The staffs have generally seen it all before in some form or fashion and they can offer some insights resulting from their broader perspective. As part of the streamlining process we were able to eliminate "no value added" and duplicative report requirements between the Army and OSD and save money. This process also allows early decisions concerning the level at which a given issue should be resolved. This can serve to your advantage. The IPT requires the staff section tasked with an action to brief their principal's position the following month. This helps resolve issues that otherwise might languish until immediately prior to a major review. In most cases, PM issues remain as such, with monthly updates to the staff.

Requests for contractor data should be passed through the PM. Laying out some basic ground rules in this area will prevent the minor problems we experienced. Over time, the IPT process builds trust and credibility between the PM organization and the staffs, thus reducing the tendency to play "gotcha" two weeks before your ASARC or DAB. Because of the leadership support, the team recognizes one goal, i.e. simplify the oversight process and get better equipment to the field sooner. The IPT requires sustained support from the staffs of the DAB and ASARC principals. When staff representatives "no show," the process breaks down and perceived issues and rumors take on a life of their own inside the building. If everyone attends, the process does provide a valuable forum to educate even would-be "naysayers." In my opinion, those whose livelihood depends on perpetuating issues rather than resolving them are no value added. Lastly, the IPT should not become a forum for neglected staff sections to hold a program hostage so long-ignored issues, which are not program specific, can get the higher-level visibility. All said, the PM has much more to gain than risk and most issues are resolved at lower levels. Briefing component and OSD staffs concurrently, speeds up the review process.

Bottom line: The key word is "Team." IPT works, use it.

PERSONNEL

Vollrath Assumes Duties As Assistant DCSPER

MG Frederick E. Vollrath, former deputy chief of staff for personnel, U.S. Army Europe and Seventh Army, has assumed new duties as the Army's assistant deputy chief of staff for personnel. MG Vollrath has more than 32 years of active duty service, which includes previous assignments as: director of military personnel management, Office of the DCSPER, Headquarters, Department of the Army; director, Enlisted Personnel Management Directorate, U.S. Total Army Personnel Command, Alexandria, VA; commanding general, U.S. Army Personnel Information Systems Command, Alexandria, VA; and deputy commander, 1st Personnel Command, U.S. Army Europe and Seventh Army.

Vollrath holds a B.B.A. degree in management from the University of Miami, and an M.A. degree in personnel management and administration from Central Michigan University. His military education includes the Basic and Advanced Officer courses at the Adjutant General School, U.S. Army Command and General Staff College, and the U.S. Army War College.

His military honors include the Distinguished Service Medal, the Legion of Merit, the Bronze Star Medal, the Meritorious Service Medal (with four oak leaf clusters), the Army Commendation Medal (with oak leaf cluster), and the Army Staff Identification Badge.

Charles Appointed Acquisition Career Management Deputy

Keith Charles, deputy assistant secretary for plans, programs and policy, Office of the Assistant Secretary of the Army (Research, Development and Acquisition), has assumed additional responsibilities with his recent appointment as deputy director for acquisition career management, succeeding Dr. Bennie H. Pinckley.

A recognized Army expert on planning, programming and budgeting acquisition programs, Charles has primary executive oversight for the preparation, justification and defense of all Army acquisition programs before the Office of the Secretary of Defense, the Office of Management and Budget, and the Congress.

Prior to joining the Department of Defense in 1985 as deputy for programs, OASA(RDA), Charles had served from 1982-1985 as deputy chief for budget preparation in the Office of Management and Budget, Executive Office of the President. Previous to that, he was chief of the Operations Analysis Branch, Office of the Comptroller, National Aeronautics and Space Administration.

Charles holds an M.S. degree from the University of Southern California (USC), a B.S. degree from Mankato State University, has done additional post-graduate work at USC, and completed the Kennedy School of Government Executive Managers in Government course at Harvard University.

Pinckley Appointed As DSMC Army Chair

Dr. Bennie H. Pinckley, former deputy director for acquisition career management (DDACM) in the Office of the Assistant Secretary of the Army (RDA), has been selected as the Army chair at the Defense Systems Management College. He had served as the deputy DACM since November 1993.

Shortly after assuming responsibilities as the deputy DACM, Pinckley commented in an interview with *Army RD&A* that his move to Washington had provided him his first opportunity to spend significant periods of time in career management coincident with his first assignment in the Pentagon.

During his distinguished career—spent largely in the acquisition and technical management arenas—Pinckley had served in numerous key positions, including chief engineer on the Hawk Missile System; project manager for the Ground Based Surveillance and Tracking System; and as deputy PEO for Air Defense.

From The AAC Career Manager...

Gavora Assigned To AAC Career Management Office

We are pleased to announce the arrival of LTC Bill Gavora to the Army Acquisition Career Management Office. He will serve as the proponent for Functional Area 51 (research and development), and as Military Acquisition Position List (MAPL) manager for the Army Acquisition Corps. Gavora came from the U.S. Army Aviation Logistics School, Fort Eustis, VA, where he served in a variety of positions. He has also served in both FA51 and FA97 positions with the Aviation and Troop Command and the Apache Program Manager's Office, St. Louis, MO, and completed the Training With Industry program with the Sikorsky Aircraft Company. He is a graduate of the Command and General Staff College, the Materiel Acquisition Management Course and the Defense Acquisition Contracts Course. Additionally, he holds a B.S. degree in transportation from Arizona State University, and an M.B.A. in management from Golden Gate University.

Civilian Project and Product Manager Boards

FY 96 Civilian Project Manager Selection Board Held

On Aug. 28, 1995, the FY 96 Civilian Project Manager (PM) Selection Board met to select civilian PMs for anticipated FY 96 vacancies. The board reviewed applications for the following four PMs.

PEO—Aviation
PM, Aviation Life Support Equipment

PEO—FAS
PM, Paladin/Field Artillery Ammunition Support Vehicle (Selection occurred at the Product Manager level for this program)

PEO—STAMIS
PM, Sustaining Base Automation

CDR—ISC
PM, Defense Communications and Army Transmission System

The tenure for these PM positions will be three years from the assignment date.

FY 97 Civilian Project and Product Manager Board Planned

The Civilian Project and Product Manager Selection Board for FY 97 vacancies is tentatively scheduled for February/March 1996. The currently anticipated project and product manager vacancies include the following:

Project Manager Vacancies

PEO-IEW
Signals Warfare

PEO-MD
Arrow

PEO-STAMIS
Integrated Logistics Systems
Joint Computer-Aided Acquisition and Logistics Support

PEO-TWV
Light Tactical Vehicles

Product Manager Vacancies

PEO-AVN
Kiowa Warrior

PEO-C3S
Common Software
Common Switched Systems
Defense Satellite Communications Systems Terminals
Global Positioning Systems

PEO-STAMIS
Unit Level Logistics System

AMC
CH-47D Modernization
Trailers

A message announcing these vacancies and any other currently unanticipated vacancies is tentatively planned for November 1995. The message will give more specific details regarding the application process.

Best Qualified Individuals For Senior Critical Acquisition Positions

The Defense Acquisition Workforce Improvement Act (DAWIA) was enacted to foster career development opportunities for both military and civilian personnel, and to ensure that there is a continued infusion of new ideas into Department of Defense acquisition programs. DAWIA directed the Secretary of Defense to fill senior critical acquisition positions (CAPs) with the best qualified military or civilian personnel.

Senior CAPs are defined as program executive officers; Acquisition Category (ACAT) I and II project managers; and ACAT II product managers.

Beginning with the FY97 Project Manager Selection Board, the Army will implement the policy and procedures to consider, recommend, select and assign the best qualified military and civilian personnel to senior CAPs. The goal of the policy is to:

a. Assign the best qualified individual to senior CAPs.

b. Increase the number of civilians in ACAT I and II PMs while preserving advancement and career development opportunities for military members of the AAC.

c. Where possible, have a military and civilian management team for the two senior CAPs in a program or project office.

d. Promote program stability, as well as the infusion of new ideas, through specified tour lengths and rotation of incumbents upon tour completion. On an annual basis, the U.S. Total Army Personnel Command (PERSCOM) will announce the convening date of a Department of the Army centralized board to select individuals for projected vacancies. Selections will be made a fiscal year in advance of assignment. All qualified military and civilian members of the AAC shall be given an opportunity to be considered by the board. Those declining consideration should do so prior to the date the board is convened. Qualified personnel are those individuals who meet the criteria in the board announcement.

It is anticipated that the FY97 PM Selection Board will implement the Best Qualified Policy for the selection of three ACAT I/II PMs.

Be On The Lookout

Be on the lookout for on-site executive seminars in FY96. Seminar topics include: Management of Technology, Acquisition Leadership and Management, and Managing Change.

The executive seminars are geared toward AAC members who are Level III certified. The AAC is currently in the process of defining and establishing a continuing education program for individuals who are Level III certified. These courses are our initial step in establishing the continuing education program.

New Certification Standards

The deputy under secretary of Defense (acquisition reform) has published new certification standards for each acquisition career field and assignment-specific training requirements for individuals assigned to specific acquisition duties. The new standards will be published in the FY96 Defense Acquisition University Catalog and are in effect from Oct. 1, 1995 to Sept. 30, 1996.

Mandatory Course Fulfillment Program And Competency Standards

The *Mandatory Course Fulfillment Program and Competency Standards Guide* has been revised. A new guide, dated July 1995, has been issued to enable acquisition workforce members to satisfy their mandatory training requirements based on previous experience, education and/or alternative training programs. Copies of the guide will be sent to all major commands, program executive officers, major subordinate commands, and other acquisition organizations. For a copy of the guide, please contact Thomas Drinkwater at (703) 805-5212 or DSN 655-5212, or e-mail drinkwat@belvoir-aim1.army.mil

On the Horizon. . .

• **Fiscal Year (FY) 97 Military Acquisition Position List (MAPL).** SARD-ZAC's message released by LTG Ronald V. Hite, director, Army Acquisition Corps (AAC) on 100800Z AUG 95 provided advance guidance for the FY 97 MAPL Review Board to be conducted in February 1996. The board will be chaired by an acquisition general officer and review 100 percent of the Army's military acquisition positions. The FY 97 MAPL Review Board will be specifically tasked to review individual position descriptions for consistency with AR 611-101 coding (FA 51, FA 53 and FA 97) and the relative percentage of each functional area with organizations. The primary product of the board's vote on each position (based solely on each one-page MAPL request form) will be an order of merit list (OML) for every acquisition grade/functional area (i.e., LTC/51, MAJ/53, CPT/97). The board's OML will form the basis for assigning acquisition officers throughout the Army. Additional information on the FY 97 MAPL should be addressed to LTC William Gavora, FA 51 proponency officer.

• **Software Acquisition Management (SAM) Courses.** The SAIS-ZA's memo signed by ASA(RDA) Gilbert F. Decker on Aug. 1, 1995 strongly supported the "high priority" of SAM courses and detailed nine critical competencies relative to software acquisition management. The Basic SAM Course (SAM 101) is nine days and will be available in the spring of 1996. The Intermediate SAM Course (SAM 201) is 14 days and will be available starting Oct. 30, 1995. The Advanced SAM Course (SAM 301) is 14 days and will be available starting Nov. 28, 1995. Additional information on SAM courses can be obtained from the AAC Home Page or by contacting LTC Earl Rasmussen, FA 53 proponency officer.

• **DOD 5000.52-M (Acquisition Career Development Program).** The revised DOD 5000.52-M is in final review and should be released by OSD during the first quarter of FY 96. The revised DOD 5000.52-M contains significant changes for every acquisition career field and "establishes experience, education and training standards for specific acquisition workforce position categories and career fields, provides for certification guidelines of acquisition workforce members and provides career paths for the acquisition workforce." Additional information on DOD 5000.52-M should be addressed to the appropriate AAC proponency officer.

AAC Proponency POCs:

LTC Mark Jones, Chief, AAC Proponency	jonesm@belvoir-aim1.army.mil
LTC Bill Gavora, FA 51 Proponency	gavoraw@belvoir-aim1.army.mil
LTC Earl Rasmussen, FA 53 Proponency	rasmusse@belvoir-aim1.army.mil
MAJ Vicki Diego-Allard, FA 97 Proponency	deigoalv@belvoir-aim1.army.mil
Tom Drinkwater, Civilian Proponency	drinkwat@belvoir-aim1.army.mil

• **AAC World Wide Web Home Page.** The Army Acquisition Corps Home Page is now accessible on the world wide web via the following address: http://www.army.mil/aac-pg/aac.htm. The AAC Home Page includes information on the MAPL, DAWIA, AAC updates, TWI, DAU courses and more. The AAC Home Page is updated on a monthly basis. The Office of the Assistant Secretary of the Army (Research, Development and Acquisition) also has a Home Page wich can be accessed via: http://www.sarda.army.mil. Suggestions and/or additional information you would like to have posted on the AAC Home Page should be addressed to LTC Earl Rasmussen, FA 53 Proponency Officer.

PERSCOM Notes. . .

Tracking Acquisition Career Field Time

Automated Tracking

Many military acquisition personnel are not aware that their acquisition time is automatically tracked at PERSCOM. PERSCOM maintains an electronic database of the military acquisition position list (MAPL). Each MAPL position is coded for a specific type of time, usually A (program management), C (contracting), R (computers and communications), S (systems), or T (testing). When an individual is assigned on orders to a MAPL position, the Total Officer Personnel Management Information System (TOPMIS) begins tracking the appropriate acquisition field time on the date the individual is scheduled to report to the gaining command. It is important to realize that the time begins tracking on the *scheduled report date.* If you should sign in early to your gaining unit, regardless of SIDPERS input, your time still does not begin tracking until the date indicated on your orders as your report date arrives.

Garbage in Garbage Out

Of course the database is only as accurate as the information that is put into it. Often, an officer is put on orders for one particular MAPL position, only to be reassigned by the gaining unit to another MAPL position. Gaining units do have the freedom to reassign acquisition officers, but it must be into another validated MAPL position and they must notify PERSCOM of the change. On the surface, this may not appear all that bad to the officer. It is possible, however, that the MAPL position the officer is reassigned to may have an entirely different career field coding. Consequently, the officer is not given the appropriate acquisition time for the job he or she is doing. In the greater scheme of things, this leads to mismatches between what MAPL positions PERSCOM believes are filled or vacant, and what positions the unit believes are filled or vacant.

Help Yourself

Officers can help themselves in several ways. First, when you arrive at your unit, verify that the command has you slated against the same MAPL position that was listed on your orders. If not, verify that you have been slated to a valid MAPL position. Then, ensure that you or your unit contact your appropriate assignment officer and update him as to what MAPL position number you are assigned against. Your assignment officer can update your MAPL position instantly, as well as correcting your acquisition experience credit overall. In addition, ensure you do periodic updates to your ORB to reflect the correct number of months experience in each acquisition category (program, education, and other). Units can help themselves, as well their officers, by ensuring they fax or e-mail periodic MAPL manning rosters to PERSCOM (CPT Scott Bosse, DSN Fax 221-8111 or bosses@hoffman-emh1.army.mil). For example, the Army Materiel Command (AMC) provides quarterly updates at a minimum to PERSCOM to ensure we are tracking the right officers in the right positions. This not only ensures we give the officer the appropriate acquisition credit, but it also helps to better track fill rates and quickly identify shortages at all grade levels.

On Station Moves

If you have been on station for a year or more and move to another MAPL position, you may not necessarily move on orders from PERSCOM. For example, your unit may move you to another MAPL position within the unit to get you different experience. When this happens, you should again ensure that PERSCOM is notified to properly track your MAPL position and experience.

Why is All This Important?

Aside from those outlined above, there are several reasons why it is important to ensure you are being tracked in the correct MAPL position. Most obvious should be that the number of months you acquire in various positions are used to determine what level you are certified at in each career field. Ultimately, of course, your career field experience impacts on whether or not you are certified as an Acquisition Corps member. In addition, your assignment officer will use your career field experience as one of the many factors in determining your next assignment. Many positions require specific types of experience.

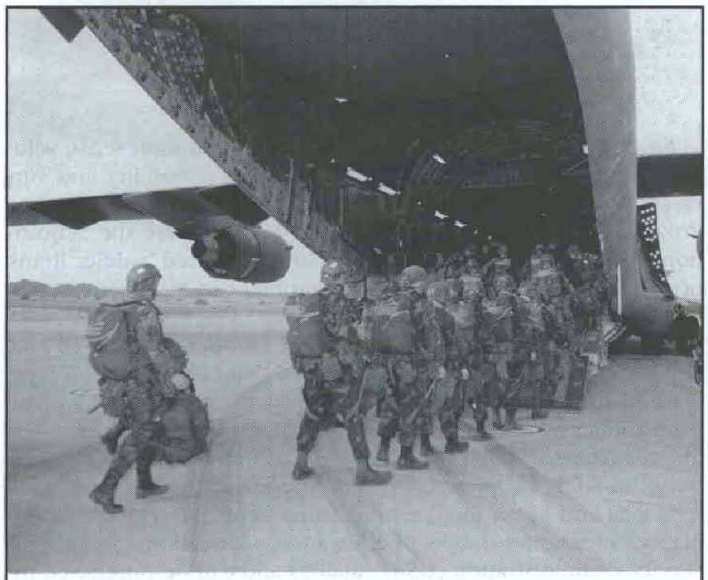
Who You Gonna Call?

As previously stated, you can contact your appropriate assignment officer to update your MAPL position and acquisition experience. In addition, the Military Acquisition Management Branch has an officer whose sole function in life (okay, he has a few more duties) is to keep your certification up to date! Our certification officer is CPT Scott Bosse, DSN 221-3130 or commercial (703) 325-3130. His e-mail address is bosses@hoffman-emh1.army.mil. CPT Bosse is eager to assist you, so don't be afraid to call! (For more information on requirements for career field certification and Acquisition Corps membership, refer to your Acquisition Corps Playbook or DOD 5000.52M.

Communicating With PERSCOM and The Acquisition Corps

E-Mail

The preferred method of communicating with members of the Military Acquisition Management Branch at PERSCOM is via e-mail. This allows us to research your questions and ensures that you get the response needed.



C-17 Aircraft Testing

Originally scheduled as a modest 10-day test, which later grew to 32 days, the Air Force's new C-17 Globemaster III aircraft visited U.S. Army Yuma Proving Ground earlier this year for a bout of intensive testing. More than 250 soldiers from Fort Bragg's 82nd Airborne Division conducted a series of mass tactical parachute jumps from the plane, the drops taking place over La Posa Drop Zone in the northern portion of YPG's Cibola Range.

System Engineer Office Included In All IPT Digitizations

The Technical Information Architecture, which is critical to Force XXI and the Army's digitization efforts, was approved earlier this year by Gilbert F. Decker, assistant secretary of the Army (research, development and acquisition) and Army acquisition executive. To assist program executive officers and program managers with Technical Architecture compliance, Decker recently announced that the Communications-Electronics Command's Army Systems Engineering Office (ASEO) will be included on all integrated product teams (IPTs) associated with digitization. The ASEO will perform technical analysis and ensure current technical specifications are incorporated in contracts. The ASEO team member will coordinate with the Army Digitization Office and the director of information systems for command, control, communications and computers (DISC4) to ensure RFPs contain the most current specifications prior to formal release of the RFP.

Proper implementation of the Technical Architecture will facilitate future standards upgrades and changes, and allow the Army to quickly capitalize on new or changed commercial and government products.

ARL Breaks Ground For $59.4 Million Facility

The U.S. Army Research Laboratory (ARL), Adelphi, MD, recently broke ground for a $59.4 million Physical Sciences Building.

Speakers at the ground-breaking ceremony included: Rep. Steny Hoyer, D-5th District; GEN Leon Salomon, commander of the Army Materiel Command; and the Honorable Gil Decker, assistant secretary of the Army for research, development and acquisition.

The 372,000 square foot building will house Army Research Laboratory facilities from Fort Monmouth, NJ, White Sands Missile Range, NM, and Fort Belvoir, VA, that are relocating to Adelphi because of the Department of Defense Base Realignment and Closure Act of 1991. The facility will accommodate about 400 personnel.

The Physical Sciences Building will contain several specialized and general laboratories. These include an ultralithography lab, display devices lab, quantum weld infrared photo detection lab, chemical science and technology lab, solid state lab, nanotechnology quantum physics lab and a computer-aided design and engineering lab.

Besides laboratories, the new building will house a research and development computer center. This center will support battlefield digitization and Army Research Laboratory elements at Aberdeen Proving Ground, MD.

Let DTIC's Recurring Reports Keep You On Track!

Information about Department of Defense (DOD) research performed by DOD and their contractors *was once* difficult to come by. The Defense Technical Information Center (DTIC) makes it easy for you to learn about these research projects through its Recurring Reports Program.

The Recurring Reports Program is a convenient, economical current awareness service that will help you discover research presently being performed in your area of interest. For only $25 per year per subject area, you can receive this information on a monthly, quarterly, semi-annual or annual basis in a format that best suits your needs.

Work Unit Information System (WUIS)

The WUIS Recurring Reports Program provides management summaries which describe the what, where, when, by whom, how and at what cost DOD research is being conducted. Information for WUIS Recurring Reports is obtained from DTIC's WUIS database. Presently, there are more than 30,000 active research and technology efforts funded by DOD that are described in the WUIS database. These projects are performed by DOD in-house or outside contractors. WUIS Recurring Reports are available to U.S. government agencies and their contractors.

Independent Research and Development (IR&D)

The information for the IR&D Recurring Reports Program is obtained from DTIC's IR&D database which contains more than 4,600 active research and development projects performed by DOD contractors on their own initiative. The information is pro-

prietary and not publicly releasable. Therefore, only DOD agencies, and other U.S. government agencies having DOD permission, are eligible to receive information from the IR&D database.

For More Information

If you would like more information about the Recurring Reports Program or would like to subscribe, contact DTIC's Product Management Branch on 1-800-225-DTIC (menu selection 6, submenu 1). They will be happy to answer your questions and get you started.

Missile Guidance Directorate Formed at MICOM

The Advanced Sensors Directorate and the Guidance and Control Directorate at the U.S. Army Missile Command (MICOM) Research, Development and Engineering Center, Redstone Arsenal, AL, have been merged into the Missile Guidance Directorate under the direction of Rex Powell. The integration of these two teams into the new organization will enable the center to sharpen its focus according to the Lead Laboratory Charter for Guidance and Control and Terminal Homing, which was assigned to the center in 1972. The Missile Guidance Directorate consists of nine major technical areas which provide the Army with a major center of excellence in missile guidance technology.

The major thrust of the directorate's mission in technology is in inertial sensors and control systems; electromagnetic sensors and seekers; and guidance information and signal processing in support of the five joint warfighting capabilities identified by the Joint Staff and Joint Requirements Oversight Council. The directorate also provides a wide range of scientific and technical support to program executive offices, program managers and other customers throughout the life cycle of the acquisition process. In compliance with guidance in the Defense Science and Technology Strategy on affordability, other directorates of the center manage supporting programs including a strong program in producibility of guidance and control components managed by the Manufacturing Technology Division of the Systems Engineering and Production Directorate. The Manufacturing Technology Division is also the Army's lead for two major efforts funded by the Advanced Research Projects Agency: the Advanced Multimissile Manufacturing Program and the Interferometric Fiber Optic Gyro Program, which support the missile guidance and control area.

Speakers Available For Environmental Training

The Defense General Supply Center (DGSC) in Richmond, VA, is the Defense Logistics Agency's (DLA's) center of excellence in the areas of environmentally-oriented products and hazardous materials programs. As such, DGSC may be able to provide a speaker from its Marketing, Chemicals Product Team or Hazardous Technical Information Service. DGSC has provided numerous speakers for various government environmental conferences.

If your agency is planning a training session or conference and would like to discuss the possibility of DGSC providing a relevant presentation, please call Stephen Perez at DSN 695-6054 or (800)352-2852 or send e-mail to sperez@dsc.dla.mil.

Solider Enhancement Program

Since 1900, the Army has actively sought common sense solutions from soldiers to enhance their lethality, mobility and survivability on the battlefield through the Soldier Enhancement Program (SEP). The purpose of SEP is to accelerate the acquisition of lighter, more lethal weapons and improved "soldier items of equipment," and get that new equipment in the hands of soldiers in three years or less.

The Army has allocated a significant number of research and development (R&D) dollars each year to purchase, test and type classify off-the-shelf equipment based on recommendations from soldiers and commanders in the field. Another sizable sum of procurement dollars is then budgeted to purchase and field those non-developmental items of equipment that pass rigorous technical and operational testing. Some items are type classified, placed in common tables of allowance publications or General Services Administration (GSA) catalogs and can be purchased by the unit commander for his soldiers using operational funds. Other items may be fielded using Department of the Army central funding and fielding dollars at no cost to the unit.

Since the inception of SEP, 139 projects have been approved and 49 completed. The following items have been fielded as a result of SEP: combat ration improvements, flameless ration heater, intermediate cold/wet glove, penlights/flashlights, M249 assault pack, sniper optics, desert BDUs, desert boots, mattax, laser/ballistic eye protection, soldier ground insulator, common rail mounts, AT4 night sight bracket, laser target pointer, intermediate cold/wet boots, individual tactical load bearing vest, Extreme Cold Weather Clothing System, and many others.

Once ideas are received they are initially screened to insure they meet the minimum criteria for a SEP proposal. SEP candidates are then forwarded to the Army Materiel Command (AMC) for a technical risk assessment. Training and Doctrine Command (TRADOC) proponent schools then evaluate the candidates to determine if an operational need or requirement exists. Those that meet the criteria, are low to moderate technical risk, and solve a battlefield deficiency or need are then planned in priority order for funding as "new starts" for the next fiscal year.

The Army will soon be accepting new start candidates for the FY 97 SEP. SEP candidates must meet the following criteria:

- Must be a soldier system item (an item of equipment that is worn, carried or consumed by the soldier for his or her individual use in a tactical environment);
- Must be commercially available (off-the-shelf with little or no modification for field military use); and
- Must satisfy an operational need or battlefield deficiency.

If it makes the soldier more effective or efficient on the battlefield, reduces the soldier's load (in either weight or bulk), enhances lethality, survivability, command and control, sustainment, mobility, safety, training, or quality of life or if soldiers are spending their own money to buy it, then it may be a strong SEP candidate.

The SEP is not an incentive award program. No monetary awards will be given for proposals that are adopted for use and result in a cost saving to the government.

For more information about the SEP, contact the TRADOC System Manager-Soldier, ATTN: ATZB-TS, Fort Benning, GA 31905-5000, commercial (706)545-1189/6047 or DSN 835-1189/6047.

Environmental Quality Awards Presented

Department of the Army individuals, teams and installations were recognized earlier this year as recipients of Department of Defense Environmental Quality Awards during ceremonies at the Pentagon.

Deputy Under Secretary of Defense (Environmental Security) Sherri W. Goodman opened the DOD award proceedings by citing the importance of the military's role in environmental protection. Said Goodman: "This year is special because the 25th anniversary of the original Earth Day invites us to look back and reflect on how far we have come in understanding that environmental protection is a good investment in our national security as well as the right thing to do. Our forces, indeed, have come a long way. They've made environmental cleanup, conservation, compliance, and pollution prevention an integral part of their work," she said.

Secretary of Defense William J. Perry echoed Goodman's speech and talked about the positive effects of the military's good environmental stewardship. Said Perry, "In a recent joint statement, a group of leading environmental organizations, including the National Audobon Society and the National Wildlife Federation, said, and I quote, 'Environmentalists rarely think of the Department of Defense as an ally, but almost unnoticed, U.S. military personnel have become major players in the battle to clean up and protect our environment. On the 25th anniversary of Earth Day, we applaud the military's environmental success."

Both ceremonies recognized installations, individuals, and teams who have significantly contributed to the military's environmental program. The DOD and the Army presented awards in the areas of natural resources conservation, environmental quality, pollution prevention—industrial, pollution prevention—non-industrial, pollution prevention—acquisition, recycling, and environmental cleanup.

Winners of both the Army and DOD awards included Valerie Morrill of Yuma Proving Ground, AZ, who received the Natural Resources Conservation Award for an Individual; the Environmental Management Team for the Project Manager, Abrams Tank System, Program Executive Office, Armored Systems Modernization from Warren, MI, who earned the Pollution Prevention Award for Team Acquisition; and Charles J. Penwell of Tobyhanna Army Depot, PA, who was the recipient of the Recycling Award for an Individual.

In his opening remarks at the Army's Environmental Quality Awards ceremony, Secretary of the Army Togo D. West Jr. emphasized the importance of each award and congratulated all present on a job well done. "On this, the 25th year of observing Earth Day and as a precursor to 25 more of them to come, I express not only our appreciation in the Army for what you, our leaders in the environmental field, have done but also our congratulations that you have taken leadership to show us the way to a better and brighter tomorrow," he stated. Secretary West paraphrased the late President John F. Kennedy and then said, "The environment is a great trust for all of us—especially for those of us in the United States Army—and its preservation is a great responsibility that you, the winners of these awards, have shouldered to the credit of all of us."

Fort Leavenworth, KS, was the first award recipient. The installation earned the Natural Resources Conservation Award for implementing an outstanding natural and cultural resources program that protects over 100 species of birds, the installation's river bottomland ecosystem with its native plants and grasses, and the prehistoric and historic settlement sites associated with the Lewis and Clark expedition and the later western trails.

Morrill earned the individual honors in the conservation category for both the Army and DOD awards, because she has been a driving force behind establishing the largest and most successful Integrated Training Area Management Program on any Army Materiel Command installation. To accomplish this task, she integrated the Yuma Proving Ground's natural environment into the installation's test mission and established partnerships with local environmental organizations.

Lake City Army Ammunition Plant (LCAAP), MO, received awards in two categories. LCAAP earned the Environmental Quality Award for an Installation for its spotless record of compliance with environmental laws, which resulted in no Notices of Violation to the installation during 1993 and 1994. LCAAP also received the Pollution Prevention Award for an Industrial Installation because of the measures it has taken to prevent pollution through the use of more environmentally benign manufacturing processes. A paint substitution program at LCAAP reduced harmful chemicals in the air by 20 tons. The plant's Paper Recycling Program netted more than 56 tons of paper and over $3,000.

James E. Gansel of Riverbank Army Ammunition Plant, CA, was singled out for the Environmental Quality Award for an Individual from an Industrial Installation. Gansel received this award for developing several successful projects, which included an interim system to remove chemicals from groundwater, extended a waterline to provide drinking water for the city of Riverbank, development of a program to remove zinc from evaporation ponds, and the development of a project to improve compliance with environmental laws.

Cristal Fosbrook of Fort Richardson, AK, earned the Environmental Quality Award for an Individual from a Non-industrial Installation. Fosbrook was noted for her successful management of major installation cleanup programs, which includes two sites on the U.S. Environmental Protection Agency's National Priorities List and $60 million in contracts for more than 200 separate sites.

Sacramento Army Depot, CA, received the Cleanup Award for an Installation. Despite extensive reductions in its workforce over the past five years, the depot is two years ahead of meeting its requirement to clean up the depot within a timeframe set by agreements with regulators. The depot is also ahead of schedule in implementing DOD's "Fast Track Cleanup" Program for installations that are closing.

The Texas Army National Guard received the Pollution Prevention Award for a Non-industrial Installation. The Guard

was recognized for developing and implementing a number of pollution prevention programs that significantly reduced waste. The programs included: diesel fuel recycling, a solvent filtration system, and a solvent distillation program—all of which greatly reduced costs for fuel and new materials and avoided potential waste disposal fees.

The Pollution Prevention Award for Team Acquisition went to the Environmental Management Team for the Abrams Tank System, which is headquartered in Warren, MI. The team was commended for making the acquisition process for the Abrams tank more environmentally friendly, assuring that the process meets the criteria of the National Environmental Policy Act and addresses the environmental requirements of all the major milestones in the tank development program. This team also received the DOD award in this category.

Tobyhanna Army Depot, PA, earned the Recycling Award for an Installation. Tobyhanna has developed a recycling program that protects the environment, conserves natural resources, and reduces refuse costs. During the past two years, the depot has greatly reduced the disposal of solid waste in landfills, increased conservation of landfill space, significantly avoided costs in refuse removal, and reduced operating costs.

Charles Penwell of Tobyhanna Army Depot earned the Recycling Award for an Individual for both the Army and DOD categories. As recycling coordinator, he made the depot a leader in recycling and an award-winning installation. Through Penwell's efforts, the depot's solid waste was reduced 72 percent in 1993 and 73 percent in 1994. Revenue generated from the sale of recyclable materials during this two-year period amounted to more than $300,000.

Army Honors Team Bradley

The Army recently rewarded a team of government and contractor personnel for saving $2.3 million as a result of business and technical innovations and efficiencies related to the Bradley Fighting Vehicle Program. The team saved money by eliminating marginal and duplicate efforts in such diverse areas as audits, inspections, tests and welding.

Presented during "Roadshow for Industry II," in Warren MI, which was sponsored jointly by the Army Materiel Command and the American Defense Preparedness Association, the award specifically focused on "Acquisition Streamlining and Government/Industry Partnering."

Pictured are members of Team Bradley. Left to right, front row, are: BG(P) Edward Andrews, commanding general, U.S. Army Tank-automotive and Armaments Command, Dave Cox, John Sheridan, Gary Arnold, David Farnan, Marcia Czar, Beatrice Foulds-Stadnika, Michael Fannin, and Hon. Gilbert F. Decker, assistant secretary of the Army (research, development and acquisition).

Back row, left to right, are: James Weber, Donald Adams, James Hankey, Thomas Cronogue, David Glowacki, David Merrill, and Ed Pool.

AWARDS

TARDEC Receives 1995 Presidential Award For Quality

Three U.S. Army Materiel Command activities are recent recipients of quality-related awards. These organizations are the Tank-Automotive Research, Development and Engineering Center (TARDEC) of the U.S. Army Tank-automotive and Armaments Command; the Armament Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, NJ; and Red River Army Depot, Texarkana, TX.

TARDEC is the first Army organization to receive the prestigious Presidential Award for Quality—TARDEC is the 1995 recipient of this award. Last year, TARDEC was the recipient of the President's Quality Improvement Prototype Award. Both awards showcase TARDEC as a leader in federal quality, demonstrating that a commitment to quality leads to better services and products and more satisfied customers.

President Bill Clinton said, "TARDEC is an entrepreneurial leader in the transformation of government. Its application of quality principles has created a high-performing and customer-driven organization, which will stand as a standard of excellence. Organizations like TARDEC deserve much praise and recognition for their success."

The Picatinny Arsenal ARDEC and Red River Army Depot are this year's recipients of the Quality Improvement Prototype Award. ARDEC is cited for the following:

- Increasing unconditional product releases from 90 to 100 percent in the last five years;
- Fielding PALADIN, with a 25 percent increase in range and 33 percent reduction crew size over its predecessor; and
- Reducing the average processing time for technical data packages from 198 days in FY 88 to 36 days in FY 94, while error rates dropped from 24 percent to less than 1 percent.

Red River Army Depot was recognized for:

- Overhauling more than 2 million track shoes and 500,000 roadwheels with a savings of about $96 million in the past 10 years;
- Saving more than $7.8 million in value engineering in FY 94;
- Saving almost $1.2 million through employee suggestions during FY 94; and
- Reducing internal regulations by 53 percent.

BOOKS

Death of Common Sense—How Law Is Suffocating America

By Philip K. Howard
Random House, New York

Reviewed by Joe Sites, vice president, director Defense of systems, Baum Romstedt Technology Research Inc., Fairfax, VA.

I recently wanted to build a 6'x 8'x 4' storage box under a deck. To be legal, I drew up the plans and had them approved. I was told what kind of material to use, that the box must have a solid concrete floor of a given thickness and that it must be joined in a certain fashion. I had to put a construction sign in my front yard and, before the project was over, I had to have the box inspected. After reading *The Death of Common Sense*, I understand why building this box involved more stringent regulations than those my father encountered when he built his house. I don't feel any better about it, I just have a better understanding.

At the other end of the scale, the book explains why many well-intentioned projects, which cost millions of dollars, end up accomplishing nothing. The book provides example after example of waste and useless effort spent to meet legal requirements. These numerous examples make the point that something is wrong and the source is a government with too many regulations. The author states that some regulations are necessary, but emphasizes that they should be few in number.

Most regulations are written with the highest of purposes, however results of their implementation are difficult to predict. Howard begins his book with an account of an attempt by the Sisters of Charity to establish a homeless facility in New York. After encountering the bureaucracy in New York, Mother Teresa gave up on this effort. The money spent on a potentially worthwhile project in New York could accomplish more some place else where the actual needs take priority over regulations. The New York bureaucracy was established with the best of intentions, but there was no flexibility to take into account the real needs of a homeless facility versus the needs of a hotel or private dwelling.

A similar situation arose when New York attempted to install public rest rooms. The rest rooms were needed, they were of an extremely excellent design, and they were going to be given to the city. The plan was not new, it had been proven in Paris. New York could not follow through. There was a regulation which said that all public facilities had to be made available to the handicapped. It was technically impossible to modify the proposed design to accommodate the handicapped. Although the regulation was designed to help the handicapped, the result was that if the handicapped can't take advantage of the promised convenience, no one can. Because of an inflexible regulation, New York still lacks public facilities which are common in other cities around the world.

The effect of regulations is to eliminate choices. Either you follow the regulation or you don't. If you do, good; if you don't, you are in trouble. All you have to know is the regulation and proceed to apply it. This is an excellent system for dealing with crimes such as theft, assault and murder. Unfortunately, "cut and dried" decisions are difficult to apply to most human activities. Good decisions require experience, knowledge and common sense to bring it all together. If regulations negate the use of these ingredients, then we end up with actions that just don't make sense.

The author cites and quotes numerous authors and provides an 11-page summary of sources. In many ways, this book reflects and amplifies the message given in *Procurement and Public Management-The Fear Of Discretion and the Quality of Government Performance*, by Steven Kelman which was also reviewed in this magazine.

Although *The Death of Common Sense* provides an excellent account of what is wrong with bureaucracy in the United States, I hope that the author is overly pessimistic. An example of his pessimism is a statement regarding elected leaders: "Elected leaders can't exercise control over bureaucrats, because the law sets out almost everything bureaucrats must do, and politicians quickly learn that no one's perspective means much in the dark shadow of all the accumulated rules and processes. They come to see their responsibility not as managing society but as piling up more legal stones." The only encouraging example Howard provides is the rebuilding of freeways in Los Angeles after the 1994 earthquake. He cites the Los Angeles event as an example of what can be done with a reduction in specifications and increase in giving more responsibility to those who do the work.

Howard makes a strong case that something should be done to make things work better, but I am not sure that I learned any specifics on what I as an individual can do. Beyond some generalities: (A person) "ought to have a say in how things are done in his life;" "We should stop looking to law to provide the final answer;" "Our public goals are too complex;" I found little instruction or suggestions on what, we the readers, can do to make things better. Perhaps, if enough people read this book there will be some who will be in a position to see what they can do to make things better.

CONFERENCES

Infrared, Millimeter Wave Polarimetry Workshop

A workshop on Infrared and Millimeter Wave Polarimetry will be held Dec. 5-7, 1995, at the Redstone Arsenal Sparkman Center Auditorium, Huntsville, AL. The workshop is sponsored by the U.S. Army Missile Command Research, Development and Engineering Center in cooperation with the U.S. Army Space and Strategic Defense Command, the U.S. Army Research Office, the U.S. Army Communications-Electronics Command, and the U.S. Air Force Wright Laboratories.

The objective of this workshop is to review progress in infrared and millimeter wave polarimetry for Defense and commercial applications including multispectral devices. The scope of the meeting includes the fundamental science of infrared and millimeter wave polarimetry as well as applications for infrared search and track sets, night sights, and missile seekers. Opportunities for technology insertion into existing systems will be explored, and the potential in robotics and manufacturing technology will be assessed. The program will include speakers from government, industry and academia.

For more information, contact Angie Cornelius at (205) 895-6343, extension 279; fax (205) 895-6089. Information is also available via the internet at: http://smaplab.ri.uah.edu/events.html.

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DSN 655-4218

U.S. Postal Service
STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
Required by 39 U.S.C. 3685)

1A. Title of Publication	1B. PUBLICATION NO.	2. Date of Filing
Army RD&A	0 8 9 2 8 6 5 7	31 August 1995
3. Frequency of Issue	3A. No. of Issues Published Annually	3B. Annual Subscription Price
Bi-Monthly (Every Other Month)	6 (Six)	$11.00 domestic $13.75 foreign

4. Complete Mailing Address of Known Office of Publication *(Street, City, County, State and ZIP+4 Code) (Not printers)*
DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101
FT BELVOIR VA 22060-5567

5. Complete Mailing Address of the Headquarters of General Business Offices of the Publisher *(Not printer)*
DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101,
FT BELVOIR VA 22060-5567

6. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor *(This item MUST NOT be blank)*

Publisher *(Name and Complete Mailing Address)*
DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101,
FT BELVOIR VA 22060-5567

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ARMY RDA, 9900 BELVOIR RD SUITE 101, FT BELVOIR, VA 22060-5567

7. Owner *(If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) (Item must be completed.)*

Full Name	Complete Mailing Address
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8. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages or Other Securities *(If there are none, so state)*

Full Name	Complete Mailing Address
N/A	

9. For Completion by Nonprofit Organizations Authorized To Mail at Special Rates *(DMM Section 423.12 only)*
The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes *(Check one)*
N/A
(1) ☐ Has Not Changed During Preceding 12 Months
(2) ☐ Has Changed During Preceding 12 Months
(If changed, publisher must submit explanation of change with this statement.)

10. Extent and Nature of Circulation *(See instructions on reverse side)*	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies *(Net Press Run)*	31,546	31,345
B. Paid and/or Requested Circulation 1. Sales through dealers and carriers, street vendors and counter sales	0	0
2. Mail Subscription *(Paid and/or requested)*	750	1,040
C. Total Paid and/or Requested Circulation *(Sum of 10B1 and 10B2)*	750	1,040
D. Free Distribution by Mail, Carrier or Other Means Samples, Complimentary, and Other Free Copies	30,742	30,256
E. Total Distribution *(Sum of C and D)*	31,492	31,296
F. Copies Not Distributed 1. Office use, left over, unaccounted, spoiled after printing	54	49
2. Return from News Agents	0	0
G. TOTAL *(Sum of E, F1 and 2—should equal net press run shown in A)*	31,546	31,345

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PS Form 3526, Feb. 1989 *(See instructions on reverse)*

ARMY RD&A
ISSN 0892-8657

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