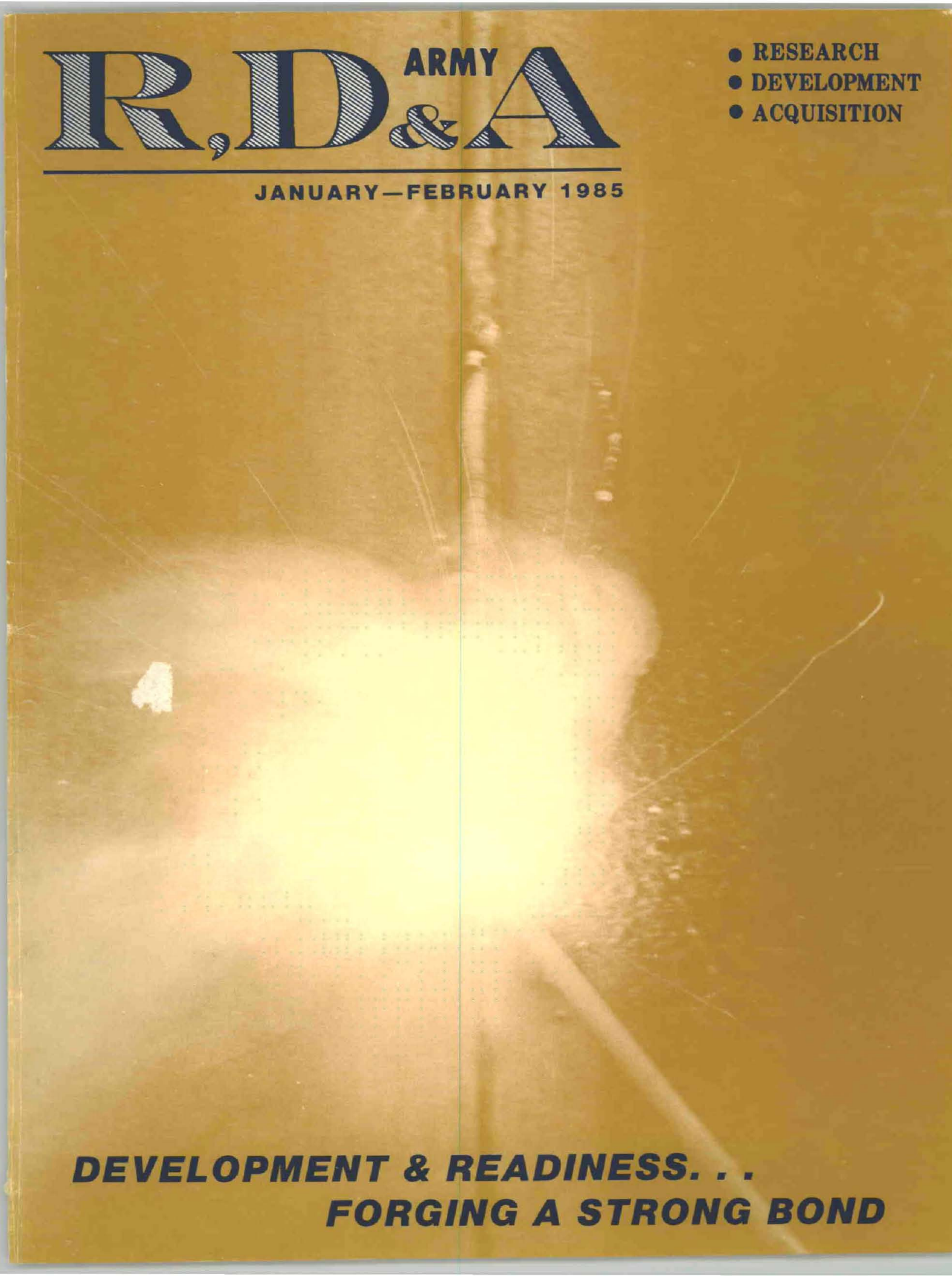
ARMY R,D&A

- RESEARCH
- DEVELOPMENT
- ACQUISITION

JANUARY—FEBRUARY 1985



DEVELOPMENT & READINESS. . .
FORGING A STRONG BOND

R,D&A ARMY

Vol. 26 No. 1 JANUARY-FEBRUARY 1985

OFFICIAL MAGAZINE OF THE RDA COMMUNITY, established 1959

ABOUT THE COVER:

The front cover photograph is intended to be symbolic of the theme of this issue of the magazine—the establishment of a strong bond between the Army's development and readiness communities. The back cover shows an artist's conception of a space based, kinetic energy weapon, one of the technologies under consideration for use with the Strategic Defense Initiative. Cover designed by Christine Deavers, HQ AMC Graphics Section.

FEATURES

DEPARTMENTS

DISTRIBUTION is based on requirements submitted on DA Form 12-5. Army agency requirements must be mailed to the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.

Distribution on an individual basis is restricted to active and reserve officers who hold initial or additional specialties of R&D (51), Nuclear Energy (52), or Procurement (97), or an additional skill identifier of 6T.

CHANGE OF ADDRESS. Individual addresses are provided by Officer Military Personnel Center, Alexandria, VA, and the USARPC, St. Louis, MO. Where active officer addresses are incorrect, individuals should contact their respective officer personnel office to ensure forwarding of correct address. Reservists should contact USARPC, ATTN: AGUZ-OEPMD, St. Louis, MO 63132.

OTHER GOVERNMENT AGENCIES requirements should be submitted directly to U.S. Army Materiel Command, ATTN: AMCDE-XM, 5001 Eisenhower Ave., Alexandria, VA 22333.

FOR SALE BY the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(USPS-584-330)

Army R,D&A (ISSN 0162-7082) (Vol. 26, No. 1) is an official Army periodical published bimonthly by HQ U.S. Army Materiel Command (AMC), Alexandria, VA 22333, under sponsorship of the Assistant Secretary of the Army (Research, Development & Acquisition); the Deputy Chief of Staff for Research, Development and Acquisition, Department of the Army; and the Commander, AMC.

Purpose: To provide a channel of communication among all members of the Army RD&A community and other government RD&A agencies; to promote the interchange of ideas and further the understanding of the RD&A process and RD&A management philosophy.

Picture Credits: Unless otherwise indicated, all photographs are from U.S. Army sources.

Submission of Material: All articles submitted for publication must be channeled through the technical liaison or Public Affairs Officer at installation or command level.

Bylined Articles: Primary responsibility for opinions of bylined authors rests with them; their views do not necessarily reflect official policy or position of Department of the Army.

Second class official mail postage paid by the United States Army at Alexandria, VA, and at additional mailing office. Forward copies per Domestic Mail Manual part 159.225. Use of funds for printing this publication has been approved by the Secretary of the Army on 1 December 1983 in accordance with the provisions of AR 310-1. POSTMASTER: Send address changes to *Army RD&A Magazine*, 5001 Eisenhower Avenue, Alexandria, VA 22333.

Interview With . . .

GEN Richard H. Thompson

Commanding General, U.S. Army Materiel Command

Q. What were your reasons for changing the command's name back to the Army Materiel Command?

A. The most central and compelling reason is that AMC is simply the best and most descriptive title for our organization. Additionally, it is brief, simple and easily understood by the other services, our allies, and the private sector. It also tends to eliminate any perceived boundary between materiel development and readiness; replacing that with an image of total life cycle responsibility and internal cohesion which represents what we are about. Lastly, and very importantly, AMC is solidly endorsed across the work force of the entire command.

Q. How would you describe your management philosophy?

A. I think I might best describe my philosophy of management by citing those characteristics or traits that I try to foster in myself and feel are important to foster in the work force.

Total frankness and candor is, in my view, mandatory. Only with direct, honest exchanges can we make meaningful progress and gain mutual respect and understanding. These communications channels must always remain open and active.

Loyalty is another characteristic which is essential to a successful organization. A loyal and people oriented management team, coupled with a work force which is loyal to the organization, is an extremely tough combination to beat and a great one to be a part of. Each of us in any good organization must fully shoulder responsibility for our actions. Our priorities must be such that the good of the organization and the Army are uppermost in our mind. Personal objectives and rewards will naturally follow if we strive for what's best for the organization.

Another feature must be accessibility of the management team. The leadership must be readily available to the work force for guidance and direction, and, needless to say, that guidance and direction must be clear and concise.

In short, it's my experience that in an organization in which lines of communication are open and frank, attitudes are positive, innovation is encouraged and loyalty is demonstrated, that organization will excel.

Q. During a recent series of "Contractors' Day" meetings you stated that one of AMC's challenges is to insure that the Army receives a quality product. What specific initiatives do you have in mind to improve the quality of Army materiel?

"Our priorities must be such that the good of the organization and the Army are uppermost in our mind."

A. Three major initiatives come to mind. The first is a program to require our contractors to control scrap and rework. We have developed what is called a Data Item Description (DID) for inclusion in contracts. It requires the contractor to measure and reduce scrap and rework costs/hours. Some of our major contractors are currently measuring their scrap and rework and fully realize the benefits of keeping these hours and costs at a minimum. Further, when these costs are reduced quality and productivity increase.

Another initiative is to hold contractors liable when we find defective products in the field. We are holding the producers liable to repair, replace or reimburse the government for costs to restore materiel to contract requirements. Our efforts have resulted in returning millions of dollars worth of material to the inventory at no additional cost to the government. This initiative is making contractors aware of our insistence that we get what we pay for.

Another initiative that I believe is going to bear fruit is

the establishment of a contractor performance data base. This data base will give us visibility of performance on a number of elements such as reliability growth, correction, testing results, and deviation and waivers. We're developing an Acquisition Integrated Data Base (AID) incorporating this data with information from each functional element for a total picture of the contractor's schedule, cost, and technical performance. We are providing an AID prototype for one of our major weapons systems, the AAH.

Q. Critics of across-the-board warranties for Army systems maintain that they could increase costs and lead times. What is your response to this and what is your assessment of this warranty approach?

A. We recognize that application of these warranty provisions could cause an up-front increase in procurement costs and lead times. However, we've always had the authorization to waive warranty requirements on individual contracts when it was in the interests of national defense to do so, or when the warranty wasn't cost effective. So, we've only bought a warranty which made economic sense. We expect that the increased cost of warranties will be more than offset by the benefits they will provide to the Army. These benefits include contractor repair or replacement of items which fail to stand up for the duration of the warranty period, and an increased contractor emphasis on product reliability which will give us less equipment downtime. We expect that the increased flexibility we have in the new legislation will make it even more certain that we get our moneys' worth out of our warranties.

As far as increases in lead time are concerned, we expect—and our experience indicates—that contract delays due to warranties will decrease as both our people and industry get used to them, and they become part of the normal way of doing business.

The Army, of course, complied fully with the warranty requirements in the FY84 DOD Appropriations Act. However, we do find that the somewhat greater flexibility which we have been given in the new law—the authorization to tailor the required warranty coverage, and to omit warranty coverage until most of the design and production bugs have been worked out—will be a great deal of help in our future warranty arrangements.

Q. You have called for an improved acquisition strategy that will get systems into production in not more than four years after Milestone I when the program go-ahead decision is made with funds in place. How do you plan to achieve this without incurring unacceptable levels of risk?

A. Although I'll admit this is a tough task to execute, I firmly believe the Army can pull it off. Let's start with the premise that we can never eliminate risk. We all take risks every morning as we drive to work. But we can reduce our risk, say by buckling up. Well, the Army's development process is no different. Risk reduction is an integral design parameter, not an afterthought.

Just as quality cannot be tested into a system, neither can risk reduction. These design parameters must be identified and assessed early enough to contribute to system design, not stifle it. I'm talking about the Concept Exploration Phase. That's what this phase is all about, and I think it's the solution to streamlining the development process. Let me elaborate. Decisions made in Concept Exploration have the greatest impact on life cycle costs of systems, and ultimately affordability of Army programs. These decisions also drive the length of our development programs. It's this fundamental concept that I'm trying to capitalize on.

By using the vast talent we have in the Army and those of our industrial counterparts to think twice, we can execute a subsequent four-year development cycle, and I mean execute once. There are lots of things we can do to shorten the process.

Sure, there are external factors we'll never control, things like political and socio-economic perturbations. These are known-unknowns, but let's not try to bite these off. Let's concentrate on internal factors we have control over. The first is to develop user requirements that identify the good enough. "Nice-to-haves" must go.

Next, we must use proven technologies in responding to these needs. Tech base activities are there for this purpose, and must be used accordingly. Once we understand what it is we're going to develop, we must use some imagination and innovation in crafting sound Acquisition Strategies.

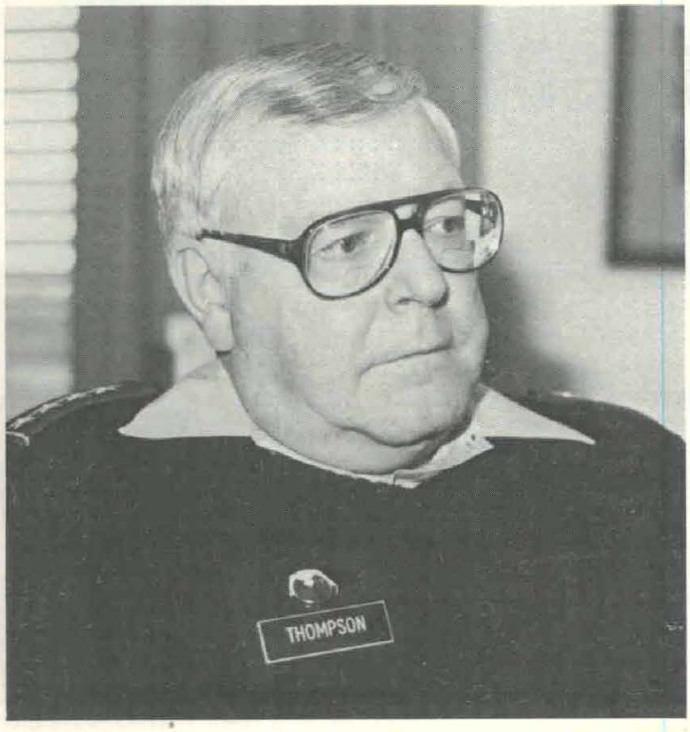
Detailed planning is a must, including concurrent planning for logistics support and test and evaluation. It requires judicious application of military specifications and standards. It also requires resistance to change. Changes defeat us . . . requirement changes, logistic support changes, test and evaluation changes, and engineering changes to name a few. They contribute to lengthened and costly programs. That's what I'm referring to by thinking twice.

Let's do the up-front, detailed planning with the entire acquisition community that's so vital to affordable and achievable Acquisition Strategies. Concept Exploration is there for that purpose, and my goal for a four-year development cycle hinges on our ability to use it properly.

Q. The RDA community has attempted better "up-front" planning in designing weapons systems for the past several years with varying degrees of success. You have asked for a renewed effort in that area. What has changed that would now make us more successful?

A. I believe we're doing several things to strengthen the need for and effectiveness of early planning. First of all, the streamlined development goals I talked about demand it. The soldier in the field demands it. That's what AMC is all about . . . support to the soldier. We haven't been as successful as I know we can be. But that's what the four-year development goal is there to do—force us into doing the early planning that we should have been doing all along. This all culminates at Milestone I with sound Acquisition Strategies and achievable requirements documents. If it doesn't, we're simply not going to go forward with programs that aren't smart and affordable. To make this

"Changes defeat us . . . they contribute to lengthened and costly programs."



happen, I've established senior level review boards at the headquarters and major subordinate command levels. It's up to these senior folks with the broad, horizontal perspectives to validate our plans as smart and affordable. I've asked them to put on their "battlefield systems integration" spectacles during these reviews, looking at each program from the standpoint of its overall contribution to the soldier's effectiveness.

By the way, the combat developers play a major role in what we're trying to achieve, and we've made them permanent members on each of our senior level review boards. By putting all these smart folks together, we'll be able to winnow out unaffordable programs that otherwise might continue. And the important point is we want to identify these before we find ourselves behind the eight ball.

Q. **Do you believe that the transportability of Army systems is a major problem?**

A. Yes, I do. But it's one we can do something about and we've got some things going to improve the situation. Basically, we've got to do three things. First, we must "lighten up" our requirements documents. Even in the idea stage, we must consider weight and size of equipment and try to minimize it. Second, we have to emphasize transportability as a design consideration. It's not the only one—or the most important—but it must be considered equally with other requirements. Finally, we must get our development community, including the contractors, to "think transportability." We're going to need some help from the rest of the Army on these, especially the first, and we're working that. The others are something we in AMC can influence.

I'm having a transportability review conducted on some 60 systems in development which will give us a good idea where we stand and how we can improve. We are already initiating some controls to insure early, detailed consideration of transportability during reviews of our systems. This has to be a joint effort between TRADOC, AMC and our contractors, but I'm confident the results will be well worth our efforts.

Q. **One of the objectives of the new AMC Acquisition Management Office is to improve writing of contract specifications. Could you expand on this?**

A. This office is establishing what we call the AMC Acquisition Integrated Data Base. The data base will include hard evidence of contractor performance on a wide range of indicators which affect the achievement of our costs, schedule, and technical performance requirements related to any one contract.

We will track indicators such as manufacturing yields, scrap and rework, test compliance, vendor quality, design change rate, and corrective action responsiveness. Systemic problems will be identified and corrective action plans developed for their solution.

Using this experience base, we will be able to identify areas where we need to improve the statement and application of contractual requirements. Examples would be contractual language for invoking environmental stress screening or for the timing of configuration control acceptance. We want to take what works best and apply it across the board; at the same time, making sure we do not perpetuate those practices that we see are not working well.

Q. **You have initiated an Army-wide information program that presents a new image of AMC. How would you like AMC to be viewed by others?**

A. There is a tendency for people to automatically attach a bad connotation to anything big. I think that this negative perception of anything large is unfortunately applied to AMC. I want to change this type of thinking as far as AMC is concerned.

Largeness is not necessarily bad. People just seem to have a predetermined position against it. The story of Jack and the Beanstalk is a good example. The giant was unjustly percieved as the villian simply because of his huge size. In reality though, who was the bad guy? The answer of course, is Jack. Jack was the one who did the stealing, ran away, and disobeyed instructions. However, because of his small size he was perceived as the good guy.

People need to look at the "whole" AMC picture. If this is done, I believe that AMC will be viewed in a more positive light, despite its large size. The Army-wide information program which we have initiated will hopefully correct a number of misconceptions regarding AMC.

MANPRINT

MANPOWER & PERSONNEL INTEGRATION

By COL John N. Tragesser

"The difference between us and the U.S. Air Force is that they man equipment and the Army equips men." (General Creighton Abrams, Army Chief of Staff, circa 1974). In a single, succinct sentence, General Abrams summed up the Army's quintessential philosophy about soldiers and machines . . . the forerunner to "people are our most important resource."

People are what the Army is all about; always have been; always will be. But, we haven't always practiced that basic tenet in everything we do and that is sometimes apparent in the way we've been developing equipment for our soldiers to operate and maintain.

You might wonder if the Army lost sight of the soldier as we developed new equipment. The fact is, we really didn't. We've always put soldiers first by giving them the very best equipment our technology could produce and our defense dollars could buy.

Our principal objective has always been to field equipment superior to that possessed by the enemy. The problem is that as we built more capable, complex equipment, there was an insidiously subtle development that hasn't been recognized until recently. It has to do with an immutable law of nature . . . our equipment is only as good as the soldiers who operate and maintain it. Explaining what that law means and how it applies to the materiel development and acquisition process requires some background information.

During the 1960s and into the mid-70s, research and development took a backseat to financing the Vietnam conflict. Predictably, a great deal of our equipment became obsolete. Following Vietnam, we embarked on the most ambitious modernization program in the Army's history. More than 400 new weapons and equipment were introduced into the Army inventory. At the same time, we whetted our appetites for new and exciting technology, so our new systems are superbly capable. But, we didn't capitalize on that same technology to make equipment simple to operate and maintain. Thus, some of our new equipment places heavy demands on our personnel, especially quantitatively, and increases our operation and support costs.

We learned our lesson well: if we don't design the equipment to our soldier capabilities we pay a penalty. Technology is a double edged sword. We must provide systems which have top operational performance while at the same time provide systems that are relatively simple to operate and maintain. We must also do those tasks with fewer people. That's the challenge before us!

The good news is that we now have a sound, comprehensive plan to make it happen. It's called MANPRINT (Manpower and Personnel Integration). MANPRINT is the process that imposes human factors, manpower, personnel and training considerations across the entire materiel acquisition process. Who is involved in MANPRINT? Everybody is. The PM is ultimately responsible for bringing a successful program on line, but he can't do it alone. PMs need and get lots of help from testers, personnel managers, trainers & doctrinaires (TRADOC), logisticians, and industry. PMs are really going to need everyone's dedicated effort to make MANPRINT a success.

Let's start from the beginning with a clear explanation of what we're trying to achieve; then explain how we'll get there. The bottom line is soldier-machine interface (SMI). Our task is to put the MANPRINT on our developmental systems. MANPRINT is up-front

THE PROCESS . . .

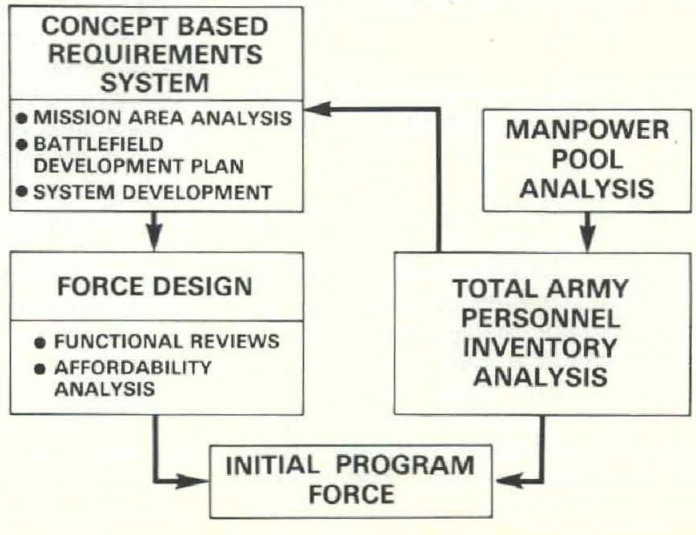


Figure 1.

recognition that the capabilities of our personnel and of the training base are limited. Thus, systems must be designed to these limitations. The end result must be superior equipment, which is simple to operate and maintain. Corollary results should be fewer soldiers for systems support, simpler soldier actions, and corresponding minimization of training base demands.

The Soldier-Machine Interface

To improve soldier-machine interface where it counts, with each new system and product improvement, we will need to do lots of early front-end analysis and planning. We're looking at a very complex process (Figure 1) by which the Army structures itself for the future. The initial step is Mission Area Analysis (MAA).

MAAs look out 10 years and tell us, based on the postulated threat, how forces should be designed and what doctrine will prevail. We do a pretty good job of that, but there's some artificiality in the process because it's not tempered by trading off the demands that force design places on manpower and brainpower. Given that our supply of soldiers is limited—quantitatively and qualitatively—and that the mix by grade/MOS/mental categories and abilities change over time, then we simply must have an accounting of these demands.

While force design and threat developers (TRADOC) are doing their thing, personnel specialists have to classify the current inventory by skill, grade, and density, taking into account the effects of retention and migration policies.

Next, a manpower pool analysis must tell us what kind of raw material is moving into the personnel inventory. If we do the inventory analysis properly, our force structure plans for the future will be the result of trade-offs against predicted personnel inventories. That puts a conscience into the process by making certain our force design, in human terms, is realistic.

All of this means that the proper signals are fed into The Army Authorization and Documentation System (TAADS). This in turn translates into realistic recruiting objectives and smart personnel policies that give proper shape to our future personnel inventory. Will the prediction be right on target? No, but it will be close enough to make knowledgeable decisions.

Once we nail down that front end process, we then have to make MANPRINT work at the system level. One way to do that is to figure out why it hasn't worked before. We think the answer is clear. Until now, MANPRINT factors never hurt us enough to pay attention. The result was a Life Cycle Management Model (LCMM) that didn't capture MANPRINT as a critical element of the developmental process.

Sure, we do human factors engineering analysis, but, that analysis is done only on major systems; further, the analysis has in the past concentrated primarily on human factors engineering with little attention given to the tougher cognitive issues of task loading, mental categories, personnel inventory projection and training analyses.

Therefore, our first action is putting MANPRINT teeth into the LCMM. We do that two ways. First, we are embedding checkpoints in every planning activity that occurs throughout the development and production cycle. At each decision point, such as Configuration Control Boards and Design Reviews, MANPRINT is elevated in terms of importance above hardware design.

Next, we're making MANPRINT a mandatory agenda item at all IPRs ASARCs, and DSARCs. If we do our planning correctly between major milestones, then we should have a good MANPRINT story to tell at the milestone review. If not, that system will return to the previous phase.

So, the message is clear. We will apply "MANPRINT" to the developmental process. Now, lets talk about when that process starts.

MANPRINT begins earnestly in Concept Exploration. Why? Because historically we find that 70 percent of life cycle costs are fixed by Milestone I. If you postpone MANPRINT until after Milestone I, when metal is bent, MANPRINT loses some of its effectiveness and that's not smart (Figure 2).

The question is, can we do MANPRINT in concept exploration? The answer is an emphatic yes! First, let's understand the dynamics of the process. Figure 3 shows a conceptual model for achieving good soldier-machine interface. There are three components. The first is *ergonomics*. It is the form, fit and function of the human body—everything from the soldier's neck down. The second component, manpower, personnel and training (MPT), deals with mental category, task loading, MOS, and training considerations. In short, MPT addresses the cognitive problem—everything from the neck up. The final component is hardware design. A major point is that all three components are

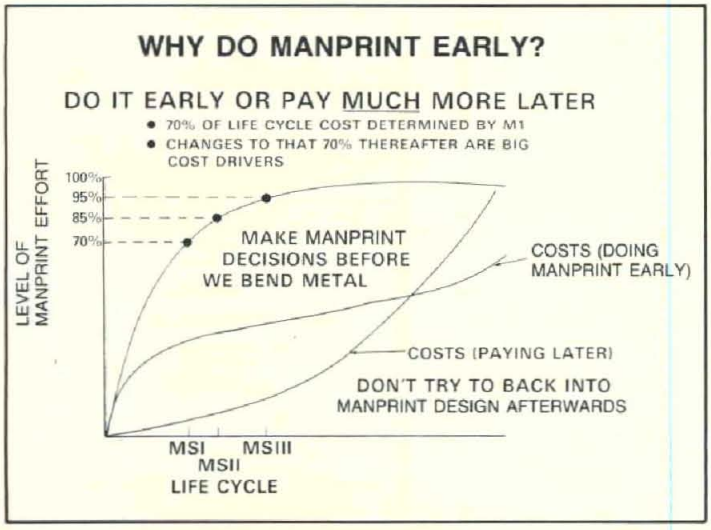


Figure 2.

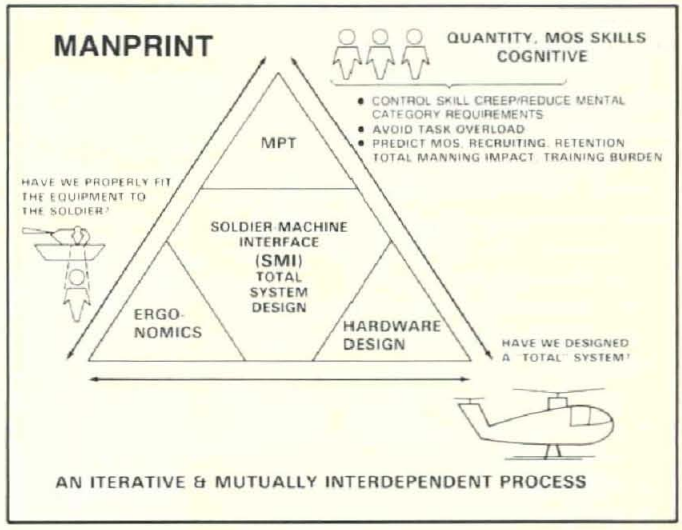


Figure 3.

mutually interdependent. When we change the hardware design, the two other components are affected . . . . and vice versa. Also, solving the equation is an iterative process, winnowing out the major flaws until you arrive at the best soldier-machine interface.

The methodology for achieving SMI remains somewhat rudimentary at this stage, but we're building for the future. Let's look at what we've got. HARDMAN (hardware versus manpower) is an analytical tool which predicts the quantitative MPT demands derived from proposed system designs. From the output, we can extrapolate meaningful recruiting, retention, and manning impacts. This data also forms the basis for feeding initial Qualitative and Quantitative Personnel Requirements Information.

On the qualitative side of the equation, an Early Comparability Analysis (ECA) will sort out the cognitive ("head space") issues as measured against the tasks envisioned for soldier operators and maintainers. ECA identifies problem tasks on current equipment that must have a design solution on the developmental system.

ECA also provides "zero sum" manpower, personnel and training data and examines, from an MPT perspective, all soldier tasks (operator, maintainer, repairer) on the current equipment. "High driver" tasks (those too costly in MPT resources) are subjected to task and learning analyses. These analyses assess the cumulative effect of all the tasks—both sequential and simultaneous—to determine an MPT or design solution. All these functions are tied together with system design and ergonomic considerations through trade off and sensitivity analyses.

The final SMI solution will be accomplished on simulators and/or mock-ups. These need not be expensive. Locally fabricated mock-ups have frequently produced surprising results. If it's a complex system with tough problems to solve, then some sophistication may be necessary. Also, both Army and industry should work the problem independently. That way, we "smart buyers" can validate industry claims.

Now, think about what I've just described. It's kind of a backwards way of doing business. We normally build complex systems, then go for expensive and complex simulators to train our soldiers because our system's SMI is unhealthy. Now we're turning that around by doing early simulation that includes SMI in the design. We debug SMI first, then base the hardware design on the simulator. The net result is equipment easily operated and maintained. The additional payoff is in operator simulators and maintenance trainer development. First, these need not be so complex because we achieved SMI. Second, the early simulators are the blueprint for training simulators. Last, we should be able to field the training simulators when we field the hardware—a turnkey package.

The MANPRINT Team

Now, let's shift to the MANPRINT team. We said before the PM is ultimately responsible for fielding a successful program, and that he can't do it alone. He needs expert help and he gets it from the combat developers, trainers, testers, and logisticians. There's nothing new here except that team, under the aegis of the revised PM's charter, now takes on MANPRINT in a serious mode.

The TRADOC Systems Manager (TSM) or a representative from the appropriate TRADOC center/school will do the MPT analyses on each system. ECA will identify high driver soldier costs requiring a design solution. The Soldier Support Center will work the manning implications by comparing HARDMAN results to ECA output. AMC's Human Engineering Laboratory (HEL) will perform human factors engineering analyses to assess the effectiveness of the total SMI solution.

The ILS manager is the focal point and management integrator of all MANPRINT actions on the part of the TSM, Soldier Support Center and HEL. After Milestone I, he's the guy who, in collaboration with TRADOC's TSM, recommends to the PM what MANPRINT options/decisions are needed.

Finally, contractors play an important role in MANPRINT. We expect them to deliver products that meet both operational and human specifications. They will be brought in early to understand our total system needs, from the operator level through all the support levels. Industry must know our O&S concepts and everything that deals with soldiers. Keeping industry in the planning loop is an essential prerequisite to success.

Summary

Gluing this grand endeavor together to make it happen (insitutionalize the process) is a management scheme, overseen by AMC Headquarters. That's our final thrust—a look back, feed forward mechanism that allows us to capture lessons learned as we go and feed those lessons forward to develop the idealized process for the future.

The "lookbacks" are built into the development process, post fielding data collection, an existing inspection/review mechanism such as the annual RDTE review, AMC's Contractor Evaluation Program and IPRs conducted by AMC's Materiel Acquisition Review Board.

If all this sounds fairly demanding and complex, you're right. But, it's not impossible. We don't necessarily expect perfection on the first go-around. It's an evolutionary process that will take time to refine and institutionalize. The important point is that we are obliged to do it, so the commitment to do it the best we can must follow. We'll do it on all systems and that includes non-development items. If we all pull together, we can make MANPRINT work and build better systems for our future Army of Excellence.

COL JOHN N. TRAGESSER is chief, Acquisition Assessment and Policy Division, Office of the Deputy Chief of Staff for Development, Engineering and Acquisition, HQ, U.S. Army Materiel Command. He holds an M.A. degree from Central Michigan University, a B.S. degree from the University of Nebraska, and is a graduate of the National War College.

The Pershing II Deployment Control Center

By Dave Harris

This is a room like most other rooms in government office buildings. At first glance it is a very unspectacular place, but it stays that way after the second glance.

A flow chart filled with horizontal lines and circles, some green, some white, dominates one long wall. Maps, diagrams and charts cover the others. There is a conference table, some chairs, but not many, several computer terminals, a large printer in near perpetual motion, a machine to make computer graphics. The carpet and wall panels are a serviceable brown.

It's a place where people work. The armed guard at the door attests to the importance of that work. So do the painted over windows behind the wall panels and the classification markings on most of the displays.

The work that goes on here is what sets this place apart from others. This is the Pershing Project Deployment Control Center where the Pershing project manager, his staff, and a supporting cast pulled in from other elements of the Army Missile Command ran the initial fielding of the Pershing II (PII) missile system through the fall of 1983.

This is the place where the staff continues to monitor and manage the actions required to replace the Pershing 1a weapon system with the much improved PII in the three battalions in Europe of the 56th Artillery Brigade and the training battalion based in the United States.

The beauty of the place lies not in the eye of the casual beholder, but in the data displayed in its charts and graphs and what the data tell the engineers and logisticians who use the data. Spread out for them is the day by day and, in some cases, hour by hour status of everything—hardware, software, tools, publications, repair parts, training—needed to get the next unit deployed and operational. This includes where it is now, where it needs to be, and how and when it will get there.

Elsewhere in the U.S. Army Missile Command—in the Patriot Project Office—there is a similar operation dedicated to deployment of that new air defense system. There will probably be others in the future as new major missile systems move from development to deployment. That's a big, difficult step but it becomes far less difficult when the two halves of the Army materiel management business, one devoted to development and acquisition, the other to readiness, blend their talents efficiently in common purpose.

Please don't misinterpret the intent of a deployment control center. It is not the new improved key to instant deployment success. It is instead, in the view of LTC Tom Pickens who set up the Pershing project operation, and LTC Jim Carter who runs it, a tool, a very valuable tool. That's a judgement made in hindsight. At the outset, they and the other people in the Pershing project had their doubts.

The Pershing government-contractor team has been together a long time. It fielded the original Pershing in the early 1960s and followed it with Pershing la a decade later.

As the time approached to field PII, the team members looked forward to it with quiet confidence. They had done their homework. They had a good Integrated Logistics Support Plan and a solid Materiel Fielding Plan. Both had been thoroughly coordinated with all the players. The meetings—and there were a great many—had all been held. The arguments had all been resolved. Everyone involved in the deployment had a single sheet of music and was ready to sing on cue.

The old hands knew they had a workable plan that would very quickly become unworkable if there were last minute changes or deviations. More than anything else, they wanted to be left alone to do their thing, but that was not to be. This was not to be a routine fielding of a new weapon system. Nothing about PII was routine.

PII had been brought along fast in a program of concurrent development, testing and production. Concurrency is a way to save both time and money in major weapons programs but there are a lot of balls in the air at the same time.

In late August 1983, PII production was running flat out, the engineering development flight test program was winding up and deployment had begun. The United States had publicly promised its partners in the North Atlantic Treaty Organization that the first PII unit would be operational by the end of the year unless there was a favorable outcome in arms control negotiations then underway with the Soviet Union. The Soviets had vowed to walk out of the negotiations if deployment began. Various groups in the United States and in Europe opposed to the deployment were conducting massive demonstrations aimed at stopping it.

Late August 1983 was, Pickens recalls with a quick grin, a busy time in the Pershing Project Office.

Things got busier after MG Jerry Max Bunyard called a meeting and told the Pershing PM and MICOM key staff people that he had been tasked by the Army Materiel Command to insure the smooth deployment of PII. Beginning immediately, Bunyard told them, every facet of deployment would be monitored. A control room—later named Deployment Control Center—would be established in the Pershing Project Office to do that and to keep AMC

quickly and continuously informed on how things were going. He left the details of how that would be done to the Pershing PM and told him he could count on every resource at MICOM's disposal to get it done.

Pickens, assistant PM for development, drew the assignment for setting the room up. Carter, assistant PM for readiness, was told to figure out how to staff the operation and run it. They had to work fast. When the boss tells MICOM to move, it moves. Within three hours, crews arrived to begin stripping the project office conference room of its furniture while others began painting the windows black. New telephone lines were run, equipment was installed.

"All I had to do was pick up the telephone and I had whatever I asked for," Pickens recalls.

The room was organized to correspond directly to the Materiel Fielding Plan, a decision which influenced other decisions relative to what information to collect and what format to display it in. Ultimately, more than 500 charts became part of the information constantly updated and available for display. All that data went into a computer at MICOM. AMC could access selected portions of the data base with its own graphics display terminal and printer.

Hardware and production status came into the control center over a computer link to the prime contractor, Martin Marietta Aerospace. Initially, data from sites in the United States and overseas, where equipment was assembled and checked out prior to shipment or hand off to the operational units, were passed by datafax.

Later, a satellite computer network was established, linking the project office, the PM liaison office at HQ U.S. Army Europe, the PM liaison at 56th Brigade HQ, the Pershing modification shop in Europe and the Martin plant. Recently, Fort Sill was added to the network for reports on fielding of the battalion based there.

Additional communication was provided by secure telephone links with all key headquarters in CONUS and Europe.

The data required to operate the control room existed in one form or another. The major action needed to meet the requirement for constant status update was to change some mindsets on the frequency of reporting.

The centerpiece of the control center was and still is the time phased event plan—the collection of circles, lines, and arrows that dominates one wall. Looking very much like a pert chart, it shows all key events necessary to field the system by unit with page and line schedules developed to show how and when each key event will be achieved. All the data were loaded into a computer, updated daily, and printed out for display.

It took time to get all this in place, but within two weeks the Pershing PM and his division chiefs were holding daily meetings in the control center to review status, look for trends and in general keep a close eye on how things were going. If action was needed, action was assigned, right then. Corrective action recovery plans were monitored during the daily meetings until the item was back on schedule.

Initial staffing of the operation required 21 people, only three from the project office. The remainder came from other elements of MICOM. In the two months leading up to achieving the initial operating capability (IOC) for the first unit in the 56th FA Brigade, the center ran 16 hours a day with two shifts.

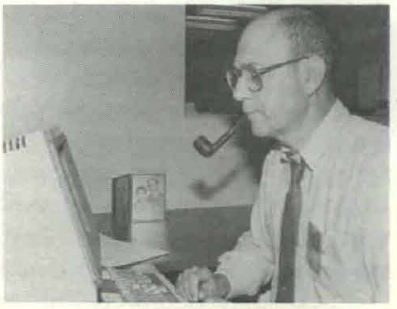
When expert assistance was needed, other elements of MICOM provided the people either in place in the control center or on immediate call. A transportation coordinator, for example, from MICOM's Missile Logistics Center, was a valued member of the control room team. So was a security specialist on loan from MICOM's Security Directorate.

Any doubts about the value of the control center to the Pershing II deployment disappeared once the place was in full operation. It took a little while longer for the project office people to realize it had a second, unanticipated benefit. Early in the deployment they had been swamped with questions. Now the questions all but stopped.

The control center staff prepared daily briefings for the MICOM commander and AMC Headquarters, which in turn kept the leadership of the Army and DOD advised on status. As it turned out, the information flowing from the project control center to its counterpart at AMC was so thorough and so timely that most of the questions were being answered before they could be asked.

The record will show that Pershing II achieved IOC on time. Subsequent events in the continuing deployment have also been on schedule. The deployment control center is a less hectic place today. Most of the time it runs on a standard eight hour shift. Staffing has been cut back.

When Pickens walked a visitor through the place one morning recently a printer suddenly came to life. Pickens explained that it was the daily message from the project office's liaison with the 56th Brigade. This one concerned a problem with some hex head bolts. It was duly numbered, as each one is, and assigned to the responsible element of the project office. Pickens explained it would be tracked in the control center until resolved by mutal agreement with the Brigade. "Routine?" the visitor asked. "No, nothing with Pershing II is routine," Pickens replied.



DAVID G. HARRIS has been public affairs officer at the U.S. Army Missile Command since September 1962. He holds a B.A. degree from Columbia College and a master's degree in journalism from Columbia University.

Strengthening the Bond Between RDA and Readiness

By Charles B. Einstein

The bond between the research, development, and acquisition (RDA) mission and the materiel readiness mission in the Army Materiel Command (AMC) is being strengthened by the Logistics Research and Development (Log R&D) Program.

A major thrust sanctioned at the highest levels, and long overdue, Log R&D is using AMC's superior technology base and its scientific and engineering talents to upgrade our current and future logistics systems. Log R&D, therefore, is viewed as the technology based component of a dramatic and substantive Army logistics enhancment effort.

When AMC Commanding General Richard H. Thompson was the deputy chief of staff for logistics he realized that Log R&D would be an excellent program to draw upon the AMC technology base to improve the Army's logistics system.

General Thompson initiated Log R&D programs at the DCSLOG level. These programs were designed to reduce item weight and cube, reduce manpower requirements and cost, improve logistics system effectiveness, improve unit productivity, and increase logistics management efficiency. As AMC commander, he continues to lead the way in vigorous pursuit of these objectives.

In a word, Log R&D is a thrust to upgrade the Army's total logistics system. It must be compatible with normal RDTE programming and budgeting, be Mission Area Analysis (MAA) driven, and be consistent with AMC's sustaining base.

Log R&D efforts are beginning to bear fruit. For example, in FY84 the Army identified about $45 million dedicated to this program. In FY85, using a narrower definition than in FY84, the Army identified about $70 million, a modest sum in an era of megabucks, but clear evidence of increased Log R&D recognition. One of the objectives is to institutionalize the effort by integrating approved projects into the mainstream of the normal RDTE planning, programming, budgeting and execution process. For FY86, the DOD has set aside $50 million for the military sevices to compete for demonstration projects designed to show quantum improvements in logistics systems. The Army expects to receive approximately $15 million.

This article will show some of the current thinking which has been going on to upgrade specific segments of the logistics process.

Log R&D proposes to solve generic deficiencies. For example, an ongoing problem is the sometimes unnecesary removal of Army aircraft from service and repetitive component maintenance of Army aircraft while troubleshooting. If a means could be devised to reduce unnecessary component/subsystem removal while simultaneously identifying the faulty component, both aircraft availability would increase and manpower and pipline resource needs would decrease.

A program is being structured that will utilize artificial intelligence technologies as well advanced diagnostic search strategies to improve troubleshooting procedures. Flight data recorders will be installed in the aircraft to aid in fault isolation of selected, troublesome subsystems. These recorders will also be used to monitor structural integrity of aircraft that are utilized beyond their design specifications, thereby extending service life which otherwise would be shortened due to safety-of-flight restrictions.

Trend analysis from these data will be used for predictive maintenance and for overall maintenance management. Selected data will be stored in crash-survivable memory for crash analysis investigations when appropriate. In addition to advanced software techniques, emphasis will be placed on utilizing such technologies as microelectronics, flat-panel displays, and fiber optic cabling and sensors.

One can easily discern that such an advanced program can apply to more than one weapon system. Plans exist to apply this concept in Phase One of selected subsystems of the UH-60A Blackhawk aircraft. In addition, during this phase the AH-64 Apache will be used to determine software requirements to improve maintenance on this particular helicopter.

During Phase Two, not only will demonstrations on the Blackhawk and Apache be continued and refined, but additional diagnostic logic developements and assessments will be performed on both the OH-58D Kiowa and the CH-47D Chinook.

One of the drivers of Log R&D is a major change in doctrine that is taking place with our Army. The new concept calls for a highly mobile, autonomous combat unit that will operate in a deep attack mode on the battlefield scenario. Further, in facing the challenges of tomorrow—we are besieged with the realities of today.

Demographic studies indicate that we will not have as many people of military service age as we have now. Also, today's logistics system is in place, cumbersome, and in great need of upgrading to support tomorrow's Army. Ideally, our future system requirements, which must be started now, have to be more efficient and in place for the Army of Excellence.

The most fertile area for examination, to discover generic areas for logistics improvements, is in the combat service support (CSS) structure. Under the leadership of LTG Robert L. Bergquist, commanding general, U.S. Army Logistics Center,

the CSS Mission Area Analysis is being vigorously conducted. In addition, in headquarters AMC, progress is being made toward conducting a logistics sustaining base (LSB) MAA to determine pressing needs for improvements in the total logistics system. The AMC self-examination, termed AMC Log 21, is another of GEN Thompson's management concerns.

An indication of the importance being placed on strengthening the RDA and readiness bond was a meeting—the first of its kind—of the Army's top combat developer representatives and top technical people.

AMC Assistant Deputy for Science and Technology Dr. Richard L. Haley, AMC Deputy Commanding General for RDA LTG Robert L. Moore, and LTG Bergquist requested that a series of meetings be conducted between logisticians who perform the MAAs and key leaders of the scientific community. These meetings were approved by HQDA. A major thrust of these planned meetings is to apply logistics R&D solutions to CSS and LSB deficiencies identified by the Mission Area Analysis.

The first of the 1984 meetings was was conducted on Nov. 7, 1984 at the Army Logistics Center, Fort Lee, VA. This meeting provided an excellent forum to discuss logistics deficiencies requiring R&D solutions. The meeting stimulated open discussions between logisticians representing CSS schools and scientists/engineers representing laboratories. Problems with the current logistics system in dealing with supply maintenance, transportation, communication, management information, and other CSS areas were presented to laboratory representatives.

A second meeting will be conducted in several months. It will be chaired and presented by the scientific community which will describe laboratory/technical capabilities in response to the logisticians' needs.

In an address presented to the Society of Logistics Engineers on Oct. 23, 1984 at Peterburg, VA, LTG Moore stated that "in the technology world we are are getting our laboratories deeply involved in the world of logistics. We expect our laboratory people to understand the Army's logistics needs. Then we expect them to build into their overall RDTE programs technology projects designed to meet the high priority logistics requirements." LTG Moore continued, "More importantly, in areas of high technology the logistics drive must come from the laboratory to the user. As our laboratory people gain increasing understanding of logistics, they will begin to find more creative ways to apply emerging technology to logistics problems." And thus, the RDA readiness bond is further tightened.

One of the pleasing aspects of the Nov. 7 CSS MAA/Log R&D meeting was to observe the specificity to which individual deficiencies were brought to light. For example, face-to-face discussions included inadequate pipline construction capabilities, vulnerbility of petroleum storage tanks, inadequate recovery vehicle capability, inadequate night maintenance capability, lack of automatic test equipment at the direct support level, and a host of other very practical problems which hamper the soldier in the field.

Another major thrust is to expand the concept of the CSS/LSB logisticians meeting in open discussion with scientific and technical professionals. Actions have been initiated which will bring together representatives of the depot system and laboratory professionals. This will greatly assist optimizing the total logistics support and sustaining base.

At last, a forum now exists which permits the logistician to openly discuss, with the technology expert, real problems which not only today's soldier faces, but those which will be encountered by the Army of Excellence in the year 2000.

The end result is that the RDA-readiness bond is being strengthened by the Log R&D Program. Our logisticians are talking with our technology base professionals. The laboratory people are finding out that working technology for logistics is every bit as interesting as the development of hardware. Many find it more exciting because they know that a specific problem which has hampered the logistics system technically is being overcome. They also know that, in many cases, the logistics payoff could mean more to the Army than the hardware payoff. We have barely scratched the surface. A recent study conducted by the Institute for Defense Analysis suggested many technologies that could be fruitfully pursued to gain logistics benefits. Areas of technology include robotics, cabling and connectors, structural composites, very high speed integrated circuits, testing technologies, and diagnostics.

Exciting times are here in logistics. Professionals in the RDA community have been challenged to get on board early and seek creative solutions to nagging problems. At this writing, identified Log R&D projects are a relative few. Increased dialogue between the logistician and scientist will surely expand efforts into many areas not yet addressed.

The bond which unites the RDA process with readiness procedures must get stronger. It will with participation by all who are interested in bringing to fruition support to an Army of Excellence in the year 2000—and it must be started on a grand scale now.

CHARLES B. EINSTEIN is a logistician permanently assigned to the Office of the Deputy Chief of Staff for Development, Engineering and Acquisition, HQ AMC. Backed by a long and diversified technical background, he serves as the primary logistics consultant and technical advisor to the weapon system staff manager for Log R&D and other AMCDE officials involved in weapon system logistics.

Designing for Supportability

By Dr. Andy Czuchry

The problem of excessive weapons systems support costs has been recognized since the mid-1960s. Even then, some people cautioned that the nation was on a course of unilateral disarmament because of staggering operations and support (O&S) costs.

The problem was further exacerbated in the late 1970s because of the rising of military manpower associated with the shift to an all volunteer force. Studies at that time demonstrated that O&S costs exceed 50 percent of the life cycle cost of the system. In some cases (C-130E aircraft over a 15-year period) the O&S costs were as high as 80 percent of the life cycle cost.

It is generally recognized that the system characteristics that drive total life cycle costs are locked in early in the acquisition process. In fact, more that 70 percent of the systems total life costs will be frozen by design decisions that are made prior to DSARC I.

Systems must, therefore, be designed so that supportability is in balance with cost, schedule, and performance. This can be accomplished only if manpower and logistics characteristics are treated as system design parameters early and continuously throughout the system acquisition process.

Why hasn't this been done before? It seems so logical. The truth is that most engineering schools never mention reliability, maintainability, manpower, personnel, training, or life cycle cost in their curriculum; let alone treat these items as design parameters. Instead, the engineering focus is on increased performance with little or no consideration of these supportability issues that are now paramount.

However, engineering education is only the tip of the iceberg. Even experienced systems designers have an insatiable appetite for increased capability. They recognize the benefits that result from algorithm enhancement, increased computational capability and improved system performance. Designers also write system requirements to capitalize on this potential. Unfortunately, they do not recognize or at least do not evaluate, the impact that the resulting complexity has on system supportability.

Military program managers (PM) also contribute to the problem. Their promotion in the early phases of system acquisition will come from accomplishment as measured against cost, schedule and performance. After all, the acquisition process is 10 to 15 years from concept to deployment.

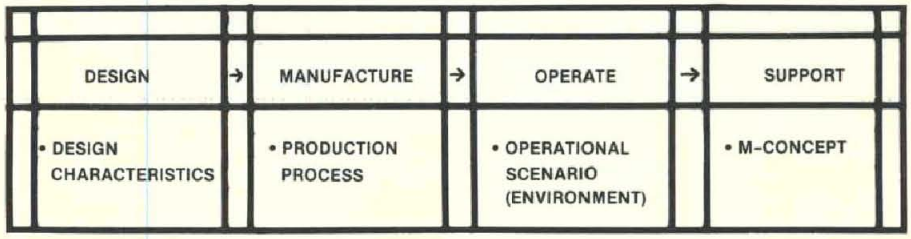


Figure 1. Sequential Thought Process

Most logistics impacts of early program management decisions are not felt for many years after the PM is long gone. In the heat of critical program decisions it's difficult to make up-front investments to realize downstream savings that occur on someone else's watch.

Today, everybody is getting on the supportability bandwagon. Congress, the secretary of defense, the services, and others are all indicating that supportability must be treated in balance with cost, schedule, and performance. Although this will help, it will not solve the entire problem. In fact, in view of our current national budget deficits, it cannot solve the problem.

Even if one could demonstrate that a Rolls Royce has a 30-year life cycle cost that is 70 percent of a Ford, few could afford the $100,000 acquisition price. The same problem confronts our nation when acquiring major weapon systems.

I firmly believe a more cosmic approach is required. The military industrial complex must take a total systems approach to the problem and design weapons systems that have *both* lower acquisition cost and lower support cost.

By total system I mean that the weapons system design, the manufacturing system, the operational environment, and the support system are all designed together. Appropriate tradeoffs are made with the objective of designing a total system with higher effectiveness, lower acquisition cost, and lower support cost.

Before you say it can't be done, just consider the evolution of digital computers of the last decade. The Japanese have proven that quality and productivity are not mutually exclusive. What I am suggesting is revolutionary, but achievable. Let me use a simplified model to illustrate the basic concept.

A sequential thought process to weapon system design is shown in Figure 1. With this approach the system is designed, a design disclosure is given to the factory, the factory develops it's production process, the factory manufactures the system, the factory ships the system to the user, the user operates the system, the system fails, and the support system restores the system through repair. This sequential process has been used for certain commercial products quite successfully.

However, for complex weapon systems, the process does not capitalize on the many tradeoffs that are available to reduce cost and enhance effectiveness. For example, if the selected maintenance concept called for a maintenance technician with a fifth grade reading-level education, the skilled designer would probably utilize more built-in-test. But to be able to make that design decision, the designer needs visibility into the downstream support considerations.

The fundamental idea of logistics support analysis is to bring the design and support system together and identify tradeoffs and design alternatives. This is a good step. But we can do more.

The additional new concept suggested here is to use manufacturing as the untapped resource to provide increased quality and performance at reduced cost. A conceptual total systems approach to weapons system design is illustrated in Figure 2. Here, design manufacturing, operations and support are treated as equal partners throughout the acquisition process. A control systems framework is helpful in illustrating how that design process would work.

At a snapshot in time, the design, manufacturing, operations and support systems are defined to a level of detail. Each element changes as we progress from the conceptual phase through demonstration/validation, full-scale develop-

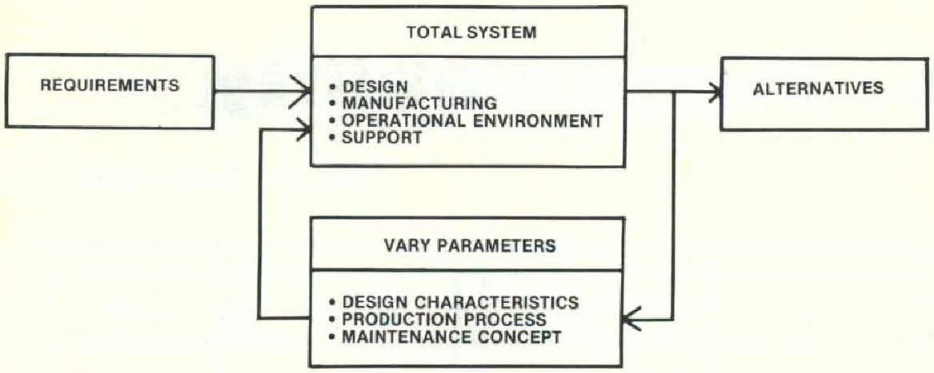


Figure 2. Total Systems Approach

ment, and production. Since these changes are coupled, we can think of the combination as the state of the total system at a given point in time.

Next, consider the requrements (both performance and support system) as boundary conditions that must be met. The design parameters, manufacturing parameters, operational environment, and support system are all modeled as control variables or constraints. In other words you either constrain these parameters, or you are free to choose them to accomplish some objective.

This leads us to the objective function which is cost effectiveness. It is noted that in setting up the problem the designer may choose to weight or constrain or include in the objective function different parameters. As long as he's consistent the process will work.

With this conceptual framework the next step is to relate the elements of the system (or system states), such as design, manufacturing, operations and support to each other. A building block approach is suggested so that gross approximations are used during the first order iteration to define the first sensitivities.

Computer-Aided Design, Computer-Aided Manufacturing, and Computer-Aided Test provide the fundamental links between the design parameters and manufacturing parameters. Computer-Aided Test provides a partial link between manufacturing and supportability, while logistics support analysis provides a good link between design and support. However, significant additional modeling work and supporting tools are required to completely model all interactions.

Although modern digital computers make the detailed modeling feasible, approximations should first be made to identify high payoff areas. The idea is to explore relationships between design parameters, support parameters and the manufacturing process to determine sensitivities to changing these variables.

First order sensitivities would be determined to assess changes in the design, manufacturing, or support variables. The intent is to focus design, logistics, and manufacturing engineers on problem areas where potential for greatest benefit (highest sensitivity) exists.

Since people are fundamentally creative, innovative solutions will result when the design, manufacturing, and supportability engineers work as a team on the identified problems.

A couple of brief examples may help to illustrate the concept. Increased reliability drives O&S costs down. However, the design engineer has always felt that increased reliability costs more upfront. This may not be so for certain manufacturing processes. For example, given sufficient production quantities and rates, flow soldering may be less costly than manual soldering and result in a finished product with higher reliability.

Another example is associated with linking the product design and maintenance concept. In order to reduce maintenance man-hours required for repair, the removable subsystems must be designed for easy access. If the manufacturing engineer could show significant production cost savings through the use of robotics, the product could be designed to accomodate both the maintenance requirements and manufacturing process at reduced acquisition and support costs.

Many additional areas can be identified by simply listing the manufacturing tradeoffs that have production cost impacts, such as the supportability tradeoffs that have O&S cost impacts and the design tradeoffs that have cost effective payoffs. Next, the links and sensitivities are identified using the conceptual model outlined here. The goal is to focus the total design team on the total system problems that have the greatest potential payoff.

If significant results are obtained, as I believe they will be, more detailed models will be developed and the analysis method will be refined. Simulations will be developed to assess the detailed interrelationships between design, manufacturing, and logistics support. New skills, new tools, new capabilities will be discovered as the needs are surfaced.

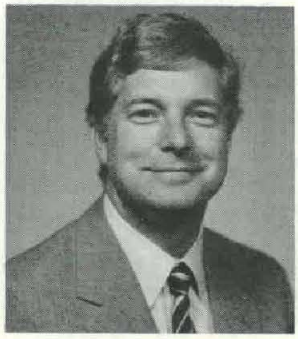
However, if filling these needs is profitable, then the needs will be met. Notice how companies were born to fill the Computer-Aided Design need. Computer science programs were created at universities to satisfy the demand for software designers and developers. The same result would occur if decision makers would adopt the philosophy suggested here. As long as it's profitable, a self-fulfilling prophecy would be realized. Sure, it will take capital investment, but that didn't stop the revolution in computers.

Just think of the tremendous investment that the very high speed integrate circuit technology demands. Yet, many electronics companies will make the investment or be forced out of the business. Investments will be made when the results are profitable or necessary to stay in business.

This article outlines an approach for overcoming the staggering O&S costs associated with major weapon system acquisition. A total systems approach is suggested for treating design manufacturing, operations and support as equal partners in the system design process.

An initial framework for conducting tradeoffs is suggested. The objective is to capitalize on new manufacturing technology to produce systems that cost less to acquire and less to support while providing required performance.

The fundamental concept is that manufacturing technology is essentially an untapped resource. If a total systems approach is taken, this manufacturing potential could provide a means for designing affordable, supportable weapon systems in the future.



DR. ANDY CZUCHRY is manager, second source programs, Raytheon Co., Lowell, MA. He directs engineering, manufacturing, and marketing activities to capture major build-to-print programs and expand production and technology bases. A recent graduate of the Defense Systems Management College Program Management Course, he holds a B.S. degree, an M.S. degree and his Ph.D. from the University of Connecticut.

Operations Research Conferees Address Excellence in Army Analysis

Programs, problems and achievements associated with Army operations research and systems analysis were discussed by more than 300 civilian and military personnel from the United States and abroad during the 23rd Annual U.S. Army Operations Research Symposium (AORS) at Fort Lee, VA.

Sponsored by the U.S. Army Materiel Command, the meeting was co-hosted for the 11th consecutive year by the U.S. Army Logistics Center, the U.S. Army Quartermaster Center and Fort Lee, and the U.S. Army Logistics Management Center. This year's theme was "Excellence in Army Analysis."

The Army Operations Research Symposium is intended to provide a stimulating forum for the Army's operations research/systems analysis (ORSA) community relative to the needs of both the analyst and the user. Arrangements for the 23rd AORS were handled by the U.S. Army Materiel Systems Analysis Activity (AMSAA), Aberdeen Proving Ground, MD.

Symposium Chairman Keith A. Myers, director of AMSAA, called the meeting to order and encouraged the attendees to acquaint themselves with some of the conference topics they may not be familiar with in order to gain a broader perspective. He then introduced keynote speaker LTG Robert L. Moore, deputy commander for research, development and acquisition, HQ, Army Materiel Command. Myers noted that the general has been a keen supporter of the Army's analysis community.

AMSAA Director Kieth A. Myers

LTG Moore began his remarks by stating that he is in the analysis business himself because he depends on a large number of people to provide him with a great deal of data. He also said that he has learned a lot from AMSAA and its personnel.

Commenting on the theme of the symposium, he stated that the Army of excellence is here to stay. He added that he was pleased that the Army had returned to its basic value sets—love of God, country, and the family. This, in fact, he said, is reflected in the quality of personnel entering the Army. However, in order to maintain this momentum, it is going to be necessary for the Army to defend its positions and stand up to its critics, he explained.

Moore emphasized the need to synchronize the thought process before contracts for a new system are awarded, and to give more attention to front-end issues. Said he: "We must do our homework up front and we must do it right." If this is not done, it causes many problems later, he stressed.

The general noted that operations research is sometimes applied when it shouldn't and it is sometimes not applied when it should. However, he said that it is a violation of trust not to call on the expertise of the ORSA community at the outset of a new program. Commanders are paid for their judgement, while ORSA people are paid for their analytical abilities and it is important to keep this in mind, he added.

Moore stressed repeatedly that the operator and the maintainer of equipment must be key considerations when designing a new system. This is because of the expanding use of high technology and the complexity associated with it. Those in industry and the Army, he continued, must make sure they don't overdesign equipment so the average soldier can't understand it, operate it, and maintain it. We must be sensitive to the man-machine interface, he said. He stated also that the production process should be designed when the piece of equipment is designed.

LTG Moore explained that one of his current thrusts is to make sure that the basic research that is now being done will be applicable to the future battlefield. If we are going to have an Army of excellence, he continued, the operations research community must also learn to speak the user's language.

He called on the audience to lay out facts in a clear and simple manner, to always quantify the risk factors, and to state where problems are and where solutions may occur. Moore closed his presentation by emphasizing the importance of the integrated battlefield and the necessity of keeping it in mind when designing equipment. He also cited the importance of MANPRINT. This is a high priority Army effort to integrate human factors, manpower, personnel and training elements into the entire materiel acquisition process.

The second general session of the symposium was devoted to a series of presentations which provided status reports on the Army's Model Improvement Program (AMIP). COL Kenneth Wiersema, director of the Army Model Improvement Program Management Office (AMMO), began by stating that on balance he believed that significant progress has been achieved in the program. He went on to outline the several objectives of the program and its accomplishments.

The overall objective of the AMIP is to improve the combat simulation models used to support Army analysis. Supporting objectives include improving the consistency and responsiveness of models by achieving better functional representations of the components of air and land combat, and, by linking a hierarchy of models to develop consistent representations. The program also seeks to reduce the proliferation of multiple special purpose or single system models, and to establish a management system for the AMIP. The AMIP is developing model specific data base management systems based on analytic model requirements and top-down structured designs. The development of model programs to support training simulations is another part of the AMIP.

COL Wiersema noted that technical guidance for the AMIP is provided by the Army Models Committee, chaired by the deputy under secretary the Army, operations research. The principle achievements of the program include the development of at least one model in each level of the hierarchy, the establishment of a well structured set of software

standards, the start of a combat simulations software/hardware research program, and the adoption of a data management structure. Future objectives call for completing models currently under contract, analyzing the benefits of concurrent processing for Army analysis and implementing a distributed data base management system. COL Wiersema introduced a series of brief status reports on the three major models in the AMIP and the related data management work.

MAJ Dave Hoffman, from the TRADOC Systems Analysis Activity, presented a discussion of the Combined Arms and Support Task Force Evaluation Model (CASTFOREM). This is a battalion task force model with representation down to weapons system level. CASTFOREM is currently operational and is a stochastic type model. It is currently being used to support its first analysis program.

LTC William Tilton, assigned to the Combined Army Operations Research Activity, spoke on the Corps Division Evaluation Model (CORDIVEM). It is a deterministic model with resolutions down to maneuver battalions plus selected corps/division level systems, such as air defense, Intelligence and Electronic Warfare, and attack helicopters. The CORDIVEM model has recently achieved production status.

A synopsis of the Force Evaluation Model (FORCEM)—was provided by Walley Chandler from the Army Concepts Analysis Agency (CAA). FORCEM is a deterministic theater level model which is in the final stages of production testing. FORCEM, as is CORDIVEM, is structured to accept input from lower echelon models in the AMIP hierarchy. FORCEM will be used to support analysis required by the DA staff and to generate scenarios for lower echelon models. The FORCEM model will be applied to its initial study in January 1985.

Under Secretary of the Army James R. Ambrose

AMIP Speakers (l, to r.) COL Kenneth Wiersema, MAJ Dave Hoffman, LTC William Tilton, Walley Chandler, and J. D. Johnston.

The final AMIP presentation, by J. D. Johnston from the AMMO, dealt with data management initiatives. Several reports, including the *Review of Army Analysis of 1978,* stated that insufficient resources exist to service the many different model related data requirements, and that there is a perception of poor quality due to the inability to trace the origin of data. Three coordinated efforts at AMSAA, the Intelligence and Threat Analysis Center (ITAC), and the Jet Propulsion Laborator (JPL), are in progress to resolve these requirements.

AMSAA is developing a system to permit the user to view data as a weapon/munition combination effectiveness against specific targets. A system under development by ITAC will address the production and management functions related to threat data. The third effort, which is being produced by JPL, under AMIP contract, is a listing of data element names, definitions and sources. The JPL work, referred to as a data directory, will permit the user to determine data needs for specific models and will identify where the data can be obtained. Each of these data components are scheduled to start prototype operation during FY85.

Under Secretary of the Army James R. Ambrose opened the final general session of the conference with a special presentation dealing with a number of subjects related to the important role performed by the operations research community. He also discussed some areas needing improvement.

He noted at the outset that the various disciplines represented at the conference were highly valuable to the Army in establishing requirements for new systems. However, he stated that when requirements are developed, more effort should be given to determining incremental costs and the value of making a change. Some of the programs he discussed included the High Mobility Multipurpose Wheeled Vehicle and the 9mm pistol.

He said that numbers are used a lot in documents and studies but that they sometimes become a meaningless goal. He added that statistical uncertainties are sometimes not adequately identified. Ambrose also noted that in attempting to standardize, the Army sometimes delays needed product improvements and that items become obsolete.

The Under Secretary explained that the Army has an important effort aimed at improving its studies. Congress, he continued, is concerned about the DOD's failure to communicate and improve its studies efforts. He offered the following suggestions for effective communications:

- Use plain and simple English.
- Tell it like it is and don't mask adverse information in unclear terms.
- Be persistent and don't assume that a problem will be resolved merely because it has been stated. It is important to "keep at it" until it is resolved.
- The nature of the Army's position requires common sense. The Army is in a highly competitive business and communications and credibility are very important.

Another general session speaker—Deputy Under Secretary of the Army for Operations Research Walter W. Hollis—spoke on the 1984 "Review of Army Analysis Extended." This review, which was undertaken at the direction of the under secretary of the Army, was a follow-on of the 1978 review of Army analysis.

The purpose of the latest review was to "identify means to improve the contribution made by analysis to illumination of issues of interest to the Army and to the solution of Army problems." Objectives were to assess the implementation of actions of the 1978 review and to identify actions to: improve identification of problems whose solutions would be highly beneficial to the Army, improve the quality of analysis, improve the productivity of analysis, improve organizational arrangements of the analysis community, and improve support to the Army in the field.

The 1984 review of Army analysis resulted in numerous detailed recommendations. However, the following is a brief synopsis of the overall findings:

- The recommendations of the 1978 review of Army analysis have almost all been implemented, although to varying degrees, with results that are perceived to be beneficial to the Army.
- The activities comprising the Army analysis community are in the main properly assigned and have the proper mission and are very useful to the Army.
- Substantial improvements in Army analysis can be achieved in study program management, study and model integration, quality of analysis, support to certain functional areas, and in interfacing analysis with other related activities.

In addition to general session presentations, the 23rd Operations Research Symposium featured eight concurrent special sessions devoted to discussions of contributed technical papers on a wide range of subjects. Titles and chairman of the special sessions were: *Readiness, Sustainability and Support to Forces in the Field,* Tom Edwards, U.S. Army Logistics Center; *Testing and Field Experiments and Exercises,* Dr. Darrell Collier, U.S. Army TRADOC Combined Arms Test Activity; *Command, Control, Communications, Computers, Intelligence on the Battlefield,* Arend H. Reid, AMSAA; *System Effectiveness and Survivability on the Non Benign Battlefield,* John W. Kramar, AMSAA; *Recent Advances in Operations Research Methodology and Evaluation Techniques and Other Selected Topics,* Dr. Robert Launer, U.S. Army Research Office; *Force Design Planning, Programming and Modernization,* COL Fred E. Gantzler, U.S. Army Concepts Analysis Agency; *Integrated Battlefield Systems Analysis,* Cyrus E. Baker, Jr., U.S. Army TRADOC Systems Analysis Activity; and *Manpower, Training and Personnel Management,* COL Walter R. Shope, HQ, Department of the Army.

Army Systems Analysis Award

One of the highlights of the Annual Operations Research Symposium was the presentation of the Army Systems Analysis Award by the deputy under secretary of the Army for operations research. Comprised of an engraved plaque and a citation certificate, the award may be given annually to an individual and to a group (military or civilian personnel) for outstanding achievements related to operations research/systems analysis activities.

The 1984 award, presented only in the group category, recognized achievements associated with the Resource Constrained Procurement Objectives Study. This effort was conducted by a study team of the Office of the Deputy Chief of Staff for Operations and Plans.

The study team developed an automated model to determine the cost-effective mixes and allocations of Army conventional munitions under alternative allocation priorities and resource constraints. The model meets a critical need by the Army Staff for a comprehensive, quick-response tool to aid in making decisions for munition program procurement and allocation.

The current method of munition program allocation is essentially a manual procedure based on a consensus of the Army Staff. However, Army Staff members must respond rapidly to frequently changing priority and resource guidance throughout the PPBES cycle.

Recipients of the Army Systems Analysis Award are operations research analysts in the Army Concept Analysis Agency's Resource and Investment Analysis Division. They are: Ronald J. Iekel (study director), Dr. Charles R. Leake (assistant study director), Joel Levy, Ola C. Berry, MAJ James M. Engoglia, Joel S. Gordon, and CPT(P) Alton C. McKennon, Jr.

Deputy Under Secretary of the Army for Operations Research Walter Hollis (far left) presents Army Systems Analysis Award to recipients (l. to r.) Ronald J. Iekel, MAJ James M. Engoglia, Dr. Charles R. Leake, Ola C. Berry, Joel Levy, Joel S. Gordon, and CPT (P) Alton C. McKennon, Jr.

INNOVATION:
The Tough Requirement

By Army Chief of Staff GEN John A. Wickham, Jr.

We are living in a rapidly changing and hostile world. New technologies are developing faster than our materiel acquisition process is able to integrate them. Demographic trends are yielding a shrinking manpower pool from which we must compete for quality recruits. At the same time, economic cycles—often driven by dwindling natural resources—are intensifying political tensions around the world. Thus, the threats that present challenges to the United States Army are more diversified and more sophisticated. Faced with these changes and threats, how will the Army be successful?

At the moment, the Army is undergoing the most extensive modernization effort in its history. That effort contains the products of past innovation such as turbine engines for the M1 tank, night vision devices for soldiers and equipment, extensive adaptation of electronics and computer technology for C³I systems, light infantry divisions, and the high-tech division to name just a few. However, more innovation will be required in order to meet the challenges of the future, especially to develop our doctrine, organizations, tactics, training, materiel and leaders. We must stretch the benefits of all the resources that are entrusted to our care to achieve the maximum return on our investment.

With any bureaucracy institutional dilemmas exist in the Army that tend to dampen our ability to innovate successfully. This article, using Army aviation as an historical example, examines the process of innovation and suggests some approaches for overcoming the debilitating effects of these dilemmas. As we proceed, we should keep in mind the following quotation from the book, *In Search of Excellence:* "The new idea either finds a champion or dies . . . No ordinary involvement with a new idea provides the energy required to cope with the indifference and resistance that major technological change provokes . . . Champions of new invention display persistence and courage of heroic quality."

The Lessons of History

In 1983, my predecessor and I decided to organize a new combat branch—Army Aviation. This event completed a process of innovation that began in World War I and that had to overcome numerous challenges along the way. The first challenge was how to observe artillery fire from the air. The end of World War I found aerial observation in the military services at a crossroads. The hydrogen-filled, captive balloon was to be phased out because it was vulnerable to attack by hostile fighters and anti-aircraft fire.

Having bought its first airplane in 1909, the Army developed the fixed-wing aircraft for aerial observation on the battlefield. The Army Air Corps was created in 1926, and it furnished the planes and pilots while field artillery units provided the air observers to adjust artillery fire. Doctrine specified that artillery observation planes should be attached to Corps headquarters, and they would provide direct support to subordinate units on a mission-by-mission basis.

The doctrine had serious shortfalls. For example, the requirement for aircraft to have secure, hard surface runways meant that airfields were located at long distances from the front lines. Thus, responsiveness to combat units was usually slow. Upon arriving at the front lines, the air observer then had to locate the guns and enemy targets—using additional precious time—when time-on-station for target acquisition was limited in any case. These deficiencies were well known, and they inspired much complaining but little else. The inertia of the "system" was stifling the needs of the users. There was no real champion for a new idea—nor were there any resources.

However, with the outbreak of World War II, a champion and the resources emerged. Field artillery units were desperate for better observation of artillery fire from the air. Their clamor attracted the attention of the civilian aircraft manufacturers of that era. Being aggressive businessmen, they entered the "marketplace" and placed civilian aircraft (with company pilots) at the disposal of senior field commanders in every large-scale Army maneuver conducted during 1940 to 1941.

During manuevers, the old way of doing business was invalidated. Instead, the observation aircraft landed at field headquarters sites, well forward on the battlefield, rather than distant airfields in the rear. Response to the front-line combat units improved significantly. Inevitably, the

idea began to emerge: why not make air observation organic to field artillery units?

The Air Corps "experts" were opposed to such a heretical idea. Opponents claimed that the field artillery couldn't fly planes from roads and small fields; if they could, they couldn't perform maintenance in the field; and, even if they could fly and maintain the planes, they'd be shot down the first day that they flew in battle. The Air Corps was not about to let the air observation mission slip from *its* hands. They were out to protect their "turf." The "system" was still attempting to prevail over the needs of the users.

Despite strong opposition, the idea of organic air observation for field artillery units would not die. The field commanders who had been well served during the maneuvers were enthusiastic in their support. Air observation for field artillery fire support was a combat multiplier that was not going to go away.

The outbreak of World War II created a sense of urgency and provided the impetus for change. The chief of field artillery soon tested at Fort Sill the applicable doctrine, tactics and maintenance. Test personnel consisted primarily of volunteer field artillery officers and enlisted personnel having civilian pilot licenses.

The aircraft manufacturers sent experienced people to help. The tests proved that artillery units needed organic aircraft, pilots, and observers. Fire support on the battlefield was about to take a measurable step forward. On June 6, 1942, the War Department issued a directive establishing "Organic Air Observation" for the field artillery.

What did it take? It took people willing to be champions of a new idea, innovation in the field, industry-Army partnership, flexible minds and organizations, persistence, and courage. All these factors were critical to success, but it still took over 20 years to overcome the inertia of the "system."

While World War II proved the value of Army aviation in support of the ground forces, the Korean War extended those concepts and proved that aviation's potential was almost unlimited. With the introduction of newer airplanes and helicopters, the Korean battlefield spawned new ideas about air mobility and aerial medical evacuation. Yet, when the notion of helicopter fire support emerged, the "system" again was tough to overcome.

After the Korean War, various experiments, mostly unsuccessful, were conducted using armed helicopters. In December 1956, discouraged by unfavorable reports, the commander of the Army Aviation School asked COL Jay D. Vanderpool to undertake a special project to build and test weapons for use on armed helicopters.

Vanderpool started out with a few helicopters, a few rockets, and no gunsights. His biggest asset was a group of people who believed enough in the concept of armed helicopters to give up their evenings and weekends for the project. These aviation pioneers were called "Vanderpool's Fools," but they planted and nurtured the seeds that gave birth to our current family of armed helicopters.

Similarly, in the early 1960s, responding to the infantryman's lack of tactical mobility, the Howze Board was formed by Department of the Army to consider how to exploit fully the potential of rotary-wing aircraft.

As a result of the Howze Board, we formed the experimental 11th Air Assault Division (Test) which later became the 1st Cavalry Division (Airmobile). Air mobility became more and more important. By the late 1960s, no major battle was fought in Vietnam without helicopters providing transport, reconnaissance, surveillance, communications, medical evacuation, resupply, and firepower.

Our Army, by overcoming substantial internal resistance, had led the world in the development of air mobility and the use of helicopters. The prevailing factors behind this long-term process of innovation are classic teaching points to study as we strive to encourage innovation in today's Army.

First, innovation had to be mission-oriented. The innovative ideas came from the users in the field. New ideas were developed by those who understood the demands of the battlefield, and these ideas had to be tested and validated against those same standards.

This important factor is found in battlefield innovations performed by soldiers in today's Army and by our allies. As examples, there are Rangers, who parachuted into Grenada from 500 feet and turned the Cubans' own anti-aircraft guns against them; the British, who had to improvise an aircraft carrier out of a cargo ship during the Falklands War; and the Israelis who had to use remotely piloted vehicles and drones in the Lebanon War to conserve their pilots and aircraft.

Users are where the action is. They are usually younger, more imaginative, and less cautious; they have the most incentive to overcome the problems that make their jobs harder and reduce their chances of survival in combat.

Second, command climate—this was key—had to be supportive. Where the pressure existed for zero defects, no mistakes, and strict adherence to dogma, then we see that innovation languished. But in a supportive climate, we see that innovation flourished. A supportive climate let "Vanderpool's Fools" understand that their work made a difference. They realized not only that they could innovate, but also that they had to innovate. They were sheltered while their ideas grew. The typical bureaucratic concerns of "lead time," "coordination," "standardization," and so forth were somehow managed until innovation could flourish.

Third, the school system had to play a crucial role in the process. Innovation does not necessarily have to occur in the schools—often it will not. But schools must teach the fundamental competence that soldiers need to perform their jobs. The ability to innovate requires knowledge and experience. Innovation cannot spring from ignorance. And, schools must foster an innovative spirit so that our users cease imitating and make use of their imaginations.

Finally, those who pushed for change had to resist the temptation to rest on past laurels. The aviation champions were never satisfied. They kept developing the potential of aviation. They were irreverent, in a sense, because they refused to accept the conventional wisdom. They kept looking for a better way. In doing so, they developed a combat capability that is integral to the combined arms team in today's Army.

Overcoming Institutional Dilemmas

These examples from Army aviation demonstrate that we can find innovative solutions to military problems and enhance our combat capabilities. But, why is innovation the tough requirement? The answer, it seems to me, is wrapped up in three institutional dilemmas that we—and institutions like the Army—must face. These dilemmas tend to make innovation difficult; thus, we must learn to dominate them. While the dilemmas will never be completely resolved, the payoffs will be significant for any progress we accomplish.

The Materiel Acquisition Dilemma

In a rapidly changing environment, the technologies are evolving faster than our development and acquisition process can produce military materiel. On the one hand, there is a temptation to modify each item so that it is updated with the latest high-tech innovations. On the other hand, we recognize that continually changing requirements result in equipment that is never fielded and excessively expensive. How should we deal with this dilemma?

Simply stated, we must shorten the acquisition cycle. The Army and its contractors, as a team, must pay the price up front. We must construct the proper contracts with adequate funding to generate many alternative concepts.

We must get our soldiers and units involved early in the process. We must strengthen the contacts between our R&D labs and our users so that we focus on soldier needs. We must get more of the contractor engineers in the field (as the aircraft manufacturers did) to find the best solutions and to "cross-fertilize." This is where, for example, innovative concepts of composite technology in the aviation industry can be applicable to making Army equipment lighter, and therefore more deployable tactically as well as strategically.

We must get more users into the program manager staffs to keep our efforts on course. We must terminate "failures" early (without recrimination) and shift resources to reinforce our successes. And, there will be times when military, contractor, and elected officials must "take the heat" of bad publicity for justified "failures" to protect the "Vanderpool's Fools" while they do their work.

The Organizational Dilemma

User orientation and resultant innovation require responsive organizations. This tends to mean that we need more informal structure than formal, horizontal structure rather than vertical, streamlined headquarters rather than staff heavy, and top leadership knowledgeable and in touch with the action rather than insulated by multiple levels of command and staff. The intent is to shift the focus toward the requirements of the users rather than the "system."

Yet, the Army (and government) has structured its organizations to accomplish their missions in a way which is almost diametrically opposed to these characteristics. We are oriented on the demands of combat, which require multiple echelons of command and staff oversight. We are also responsive to our appointed and elected leaders, whose responsibility demands investigative oversight and control.

How can we meet the challenge of establishing an innovative environment and still retain the command and control that is mandated by the demands of combat and by law?

We must adjust our organizations to leverage the personal contact of our leaders with their soldiers. Napoleon once said, "The personality of the general is indispensable." We must look for ways to reduce our staffs and push the talent and responsibility downward, and we must reduce the number of decision makers that must reach a consensus. Otherwise staff hegemony can develop which tends to obliterate leadership and generalship. We must guard against the harmful effects of "protecting turf" when it is not in the best interests of the user.

The Standardization Dilemma

Innovation is generated and thrives in a non-standard environment. Different units might have different tactics, procedures, and materiel. Yet military experience and economy must favor standardization of doctrine, tactics, equipment, organizations, and training methods. How can we encourage doctrinal and tactical innovation in our units without overturning the essential standardization which makes us able to function effectively in combat?

The Army must relook its requirements for standardization continually, because while we gauge our adversaries they must not be allowed to gauge us. We must eliminate standardization for its own sake and retain only that which is necessary. Standardization tends to prevent the development of individuality and independent spirit.

We must capture the benefits of the newest information, manufacturing, materiel handling, and transportation technologies to make our support systems more flexible and responsive. In short, we must remember these words of MG J. F. C. Fuller: "The more mechanical become the weapons with which we fight, the less mechanical must be the spirit which controls them."

So the real challenge of innovation is always to find a better way to do business—better tactics and doctrine, better organizations, better equipment, better leadership, and better work and family environments. We must "be all that we can be." The Army's success on future battlefields will depend on our will and ability to meet this challenge.

The Strategic Defense Initiative

By LTG James A. Abrahamson, USAF

On March 23, 1984, President Reagan set the course for a possible new direction in the defense and the security of our nation. In an historic speech, the president asked, "What if free people could live secure in the knowledge that their security did not rest upon the threat of instant U.S. retaliation to deter a Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our soil or that of our allies?" He went on to direct a comprehensive and intensive effort to define a long-term research and development program with a view towards achieving the ultimate goal "of eliminating the threat posed by nuclear ballistic missiles."

The president's speech opened the possibility that, at some point in the future, we might shift from the deterrence through sole reliance on offensive retaliation to one of deterrence in which strategic defenses could play a major role by eliminating the military utility of ballistic missiles. The president's program, now known as the Strategic Defense Initiative (SDI), has as its ultimate objective to render impotent and obsolete the awesome threat currently posed by ballistic missiles.

Shortly thereafter, the U.S. government initiated two major studies to determine technical feasibility and policy and strategy ramifications. One of the better known efforts, the Defense Technologies Study, headed by Dr. James C. Fletcher, former NASA administrator, concluded that:

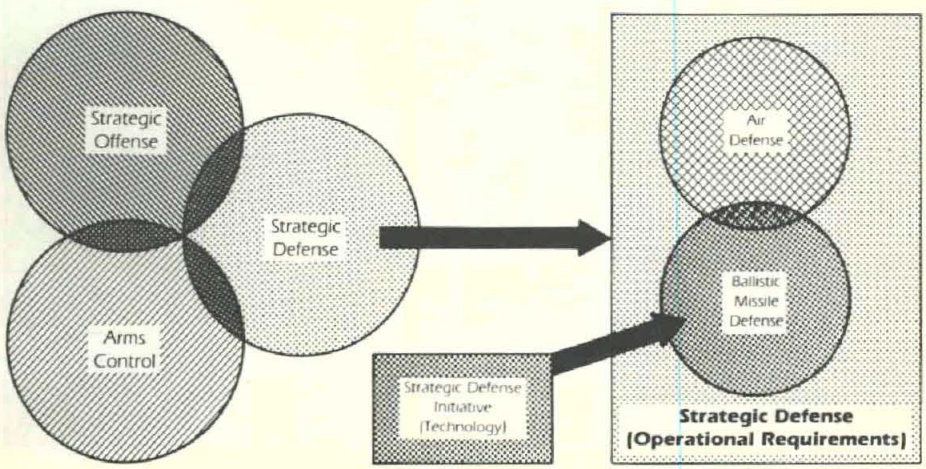
- powerful new technologies are becoming available that justify a major technology development effort offering technical options to implement a defensive strategy;
- focused development of technologies for a comprehensive ballistic missile defense will require strong central management;
- the most effective systems have multiple layers, or tiers;
- survivability of the system components is a critcial issue whose resolution requires a combination of technologies and tactics that remain to be worked out;
- significant demonstrations of developing technologies for critical ballistic missile defense functions can be performed over the next 10 years that will provide visible evidence of progress in developing the technical capabilities required of an effective in-depth system.

The policy studies concluded that by substantially reducing or eliminating the military utility of ballistic missiles, an effective defensive system could significantly enhance deterrence and stability. These technology and policy judgements were included in a report to the president which recommended beginning of a focused research effort to explore the potential of the new technologies and to provide the basis for a future president and a future Congress to make further decisions on the program in the early 1990s.

From this foundation, The Strategic Defense Initiative Organization (SDIO) was established in March 1984 and its first director was named in April. Its place in our national security apparatus is shown in Figure 1.

Given the goal as outlined by the president, the SDI will focus on the ballistic missile threat and not as a defense against air-breathing threats. As a long-term research program, the SDI has as its immediate objective to probe those technologies which might enable the development of

Figure 1
The Strategic Defense Initiative's Place In National Security Strategy



defensive systems capable of intercepting these missiles after they have been launched and thus preventing them from reaching their targets. This research will be consistent with all U.S. treaty obligations and will be conducted within the provisions of the ABM treaty. At the same time, efforts will center on non-nuclear kill approaches.

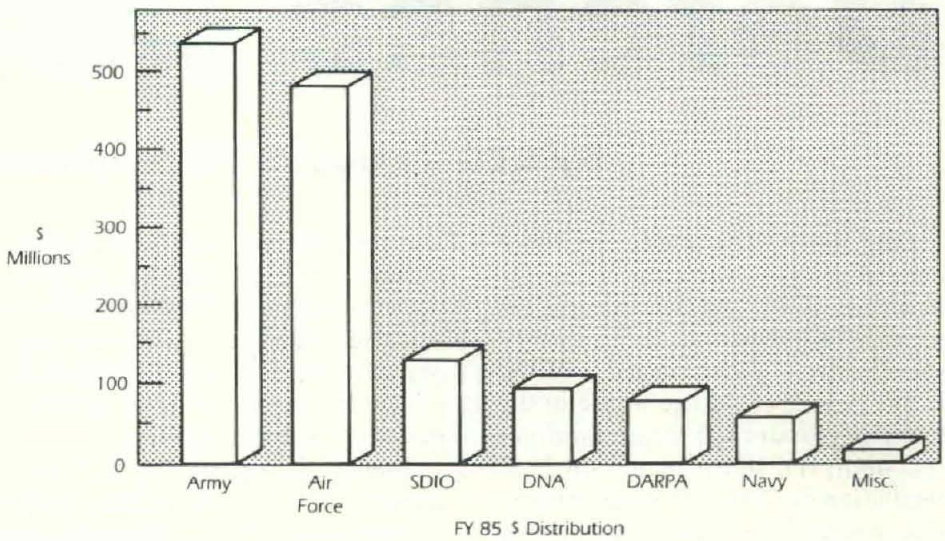
The program is not a "new start" in the usual sense. Nearly all the relevant technologies had been funded in previous years. However, not all technologies had been previously identified as being related to defense against ballistic missiles. Now, the related research efforts have been funded, coordinated, and blueprinted by the SDIO. Execution remains with the services and agencies.

The SDI had requested FY85 DOD funding of $1,777 million, an increase of $250 million over previously planned levels. Congressional action subsequently reduced this request to about $1,400 million. Funds are distributed as shown in Figure 2. It is currently estimated that funding requirements during FY85-89 will be approximately $26 billion.

To effectively control these expenditures, the program has been divided into five technology areas with a new program element having been established for each. These are: Surveillance, Acquisition, and Tracking (SAT); Directed Energy Weapons (DEW); Kinetic Energy Weapons (KEW); Systems Analysis and Battle Management (SA/BM); and Supporting Technologies (ST). Funding for each of these elements is shown in Figure 3. The program elements as structured lend themselves to the rational exploration of technologies that support the concept of defense against attack by ballistic missiles.

In such an attack, a typical ballistic missile trajectory has four phases (Figure 4). The first is the boost phase when the first and second stage rocket engines of the missile are burning and producing an intense, unique infrared signature. A post boost, or bus deployment, phase next occurs, during which multiple warheads and penetration aids—decoys, chaff, and other objects designed to confuse the defense—are released from the post-boost vehicle.

Figure 2
FY 85
Funding by Service/Agency



In the third, or mid-course phase, the multiple warheads and penetration aids travel on ballistic trajectories above the earth's atmosphere through space. Finally, there is a terminal phase in which warheads and penetration aids re-enter the earth's atmosphere and are affected by its drag.

The SDI seeks to explore technologies which will allow the engagement of hostile missiles during all these phases. This calls for a number of capabilities:

- *Rapid and reliable warning of an attack and initiation of engagement.* Full-time global surveillance of ballistic missile launch areas to detect an attack and provide data for the defense is required.
- *Efficient intercept and destruction of the booster and post-*

Figure 3
FY 85
Funding by Program Element

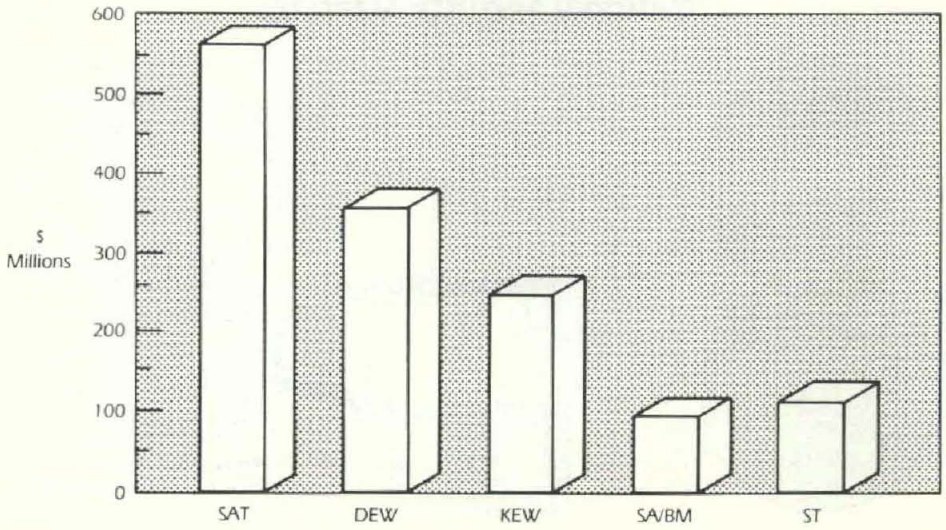
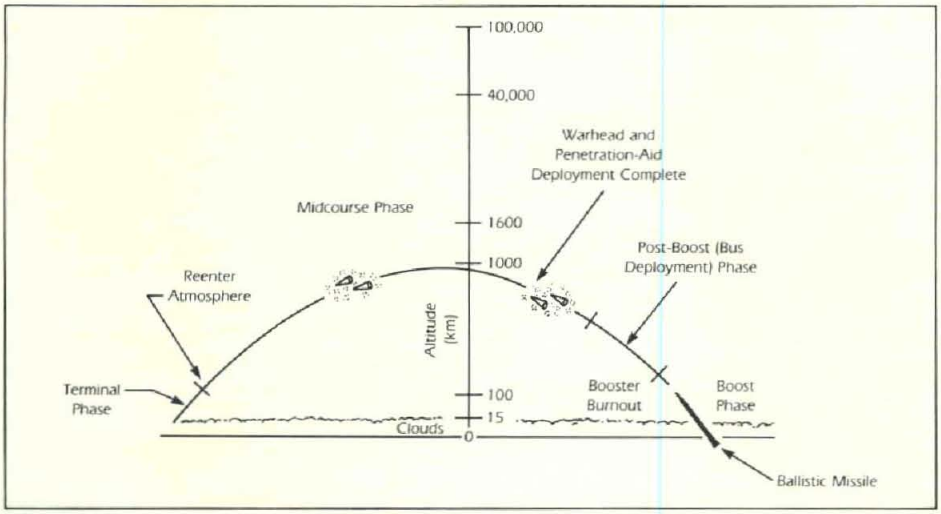


Figure 4



Phases of a typical ballistic missile trajectory. During the boost phase, the rocket engines accelerate the missile payload through and out of the atmosphere and provide intense, highly specific observables. A post-boost, or bus deployment, phase occurs next, during which multiple warheads and penetration aids are released from a post-boost vehicle. In the midcourse phase, the warheads and penetration aids travel on trajectories above the atmosphere, and they reenter it in the terminal phase, where they are affected by atmospheric drag.

boost vehicle. There is high payoff in engaging missiles in the boost phase and as early as possible in post-boost before deployment of multiple warheads or penetration aids.

- *Efficient discrimination of penetration aids*. If the defense effectively identifies lightweight (cheap) decoys, the offense is forced toward large, heavy, expensive decoys with a concomitant reduction in offensive capabilities.
- *Enduring "launch to destruction" tracking of all hostile objects*. This capability is essential for unambiguous, accurate hand-over of warheads still to be intercepted and destroyed.
- *Low-cost midcourse interception and destruction*. The cost of interception should be less than the cost to the offense for warheads. This is key in general to inhibit proliferation of the offense to counter the defense.
- *Intercept and destruction of warheads as high as possible in the terminal phase*. High-altitude intercept assures that a "salvage-fused" warhead—a warhead set to detonate when intercepted—causes minimal collateral damage.
- *Battle management, communications, and data processing*. These are the critical elements that tie the defense together, facilitating coordination for maximum effectiveness and economy of force.

To move toward these capabilities, many technologies continue to be actively examined and nurtured. One of the more spectacular manifestations of these efforts was the Army's Homing Overlay Experiment (HOE) of last June 10 (Figure 5). In this test, a Minuteman I missile carrying a dummy warhead was launched from Vandenberg Air Force Base toward the South Pacific. Twenty minutes later an interceptor (kinetic energy weapon) was lofted from the Kwajalein Missile Range. The interceptor tracked the target with an infrared sensor linked to an on-board computer and struck the warhead at 20,000 feet per second (about 13,600 mph), destroying it.

As part of efforts to explore and expand higher order surveillance and discrimination capabilities, the Army entered into a contract on July 31, 1984 to develop the Airborne Optical Adjunct (AOA). It will use an off-the-shelf aircraft upon which will be mounted optical sensors from competing contractors designed to complement target data from ground based radars. The result will be enhanced discrimination along with a lengthened time in which to react, thus expanding the available battle space.

Work continues with many forms of directed energy, both ground and space based, such as chemical lasers, excimer and free-electron lasers, and

Figure 5
Ballistic Missile Defense Homing Overlay Experiment

The launch of an experimental Army missile from the Kwajalein Atoll in the central Pacific on June 10 moved the United States a step closer to a non-nuclear defense capability against enemy strategic ballistic missiles.

Minutes after its launch, the missile destroyed the target—a reentry vehicle from an intercontinental ballistic missile that had been launched from Vandenberg Air Force Base, Calif.

The homing overlay experiment program [right] is designed to validate the optical homing technology needed to develop a near-term, non-nuclear capability for destroying an attacker's nuclear missiles outside the atmosphere.

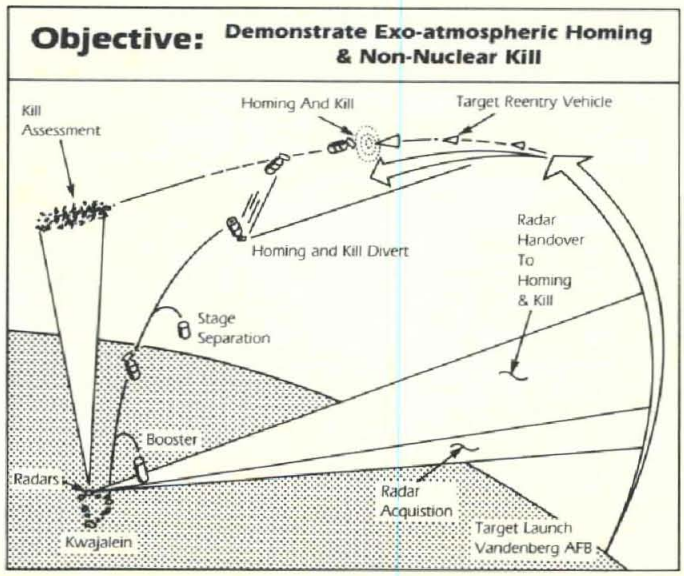
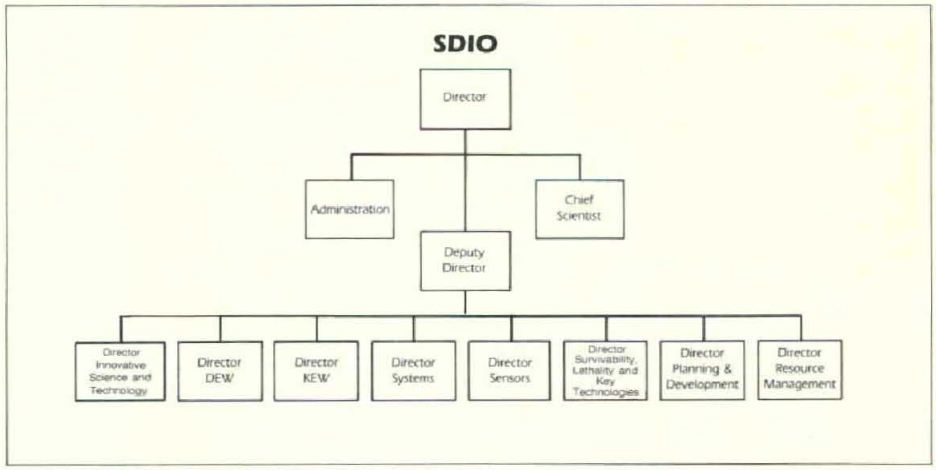


Figure 6



neutral particle beams. To augment better survivability and contribute to an enduring battle management system, development of galium-arsenide chips is well along. These computer chips, replacing silicon ones, would give better resistance to nuclear effects. A prototype hypervelocity rail gun is furthering understanding of the physics and engineering involved with building a device that will ultimately be able to launch projectiles at many thousands of feet per second, an order of magnitude beyond conventional guns.

These few examples point to the need for strong central oversight and innovative management techniques. The program management office has been established with its director reporting directly to the secretary of defense. It is organized as shown in Figure 6. As suggested earlier, this is not a program management office in the traditional sense, but rather an organization geared to coordinating and directing the efforts of the service and agency elements in the strategic defense arena. A unique management tool is evolving at the same time.

In order to develop ideas from the very best available people in industry and to deliver the product at the lowest possible cost, the SDIO set up what is termed a "horse race" contracting approach. Characterized by streamlined procedures, and contractors working at their own pace, it rewards "those who get there first with the most." It fosters wide involvement in single competitions with built in options to proceed to subsequent phases.

The first effort under this philosophy has as its goal the activation of broad-based contractor efforts to quickly evolve ballistic missile defense architecture. Specific tasks include threat and requirements definition, alternative anti-ballistic missile force architecture, system modeling and tradeoff analyses, along with system and technology assessment. Phase I of this exercise involves award of a series of $1 million study contracts by the second quarter of FY85.

The intent of these contracts is to develop an understanding of the fundamental factors driving the SDI system. Industry has been advised to take no less than three months, but no more than a year for these efforts. Phase II will involve necessarily fewer contractors to further develop the most promising ideas. The third phase will winnow competitors to the real winners and will result in creation of a ground-based test bed demonstration model of a workable battle management system.

This brief overview provided some of the background to the president's Strategic Defense Initiative and highlighted some of its salient features. Even though significant challenges lie ahead, the SDIO is moving positively toward meeting the administration's direction. In the words of the president, . . . "we're launching an effort which holds the promise of changing the course of human history. There will be risks, and results take time." The rewards, on the other hand, may be boundless.

LTG JAMES A. ABRAHAMSON is director for the Strategic Defense Initiative Organization, Department of Defense. He graduated from the Massachusetts Institute of Technology in 1955 and received an MS degree in aeronautical engineering through the Air Force Institute of Technology program at the University of Oklahoma in 1961.

Army Science Conference Address . . .

Innovation and Creativity in Army R&D

By MG Richard D. Kenyon

The following presentation was originally delivered by MG Kenyon as the keynote address during the 14th Army Science Conference at the U.S. Military Academy. It appears here in a slightly edited format. The theme of the Army Science Conference was "A Future of Excellence Through Innovation and Creativity."

Today the United States and the Soviet Union are locked in a struggle of military and technological preparedness. The Soviets have long outnumbered us in personnel and in virtually all types of weapons. Their active Army is more than twice as large as ours.

We have long been worried about the vast size of the Soviet war machine, but over the years, we consoled ourselves with the notion that our equipment was much better than theirs. Maybe this was true, but that's all changed now. The Soviets are no longer in the horsedrawn artillery era, and now we must be more concerned with their technological pace.

Today, Soviet equipment is not technologically inferior. The Soviets spend twice as much as we do for R&D, and they produce five times as many engineers. Modern Soviet equipment is as good as or better than American equipment and the Soviets are getting that equipment to their troops *now*.

The Soviets have fielded two and sometimes three generations of equipment while we have fielded only one. Much of what they have in the field today is newer than our deployed equipment and uses more up-to-date technology.

We can never realistically hope to match Soviet R&D spending or procurement. But we can and must strive to match their combat effectiveness through a vigorous R&D effort consisting of fielding our new equipment quickly, advancing our technological base development, adjusting our tactics with new developments, and coordinating efforts with our defense industry.

The Army is doing something to reduce the Soviets' qualitative advantage. New equipment is being procured and older equipment upgraded. The Army's R&D efforts of the past decade are now coming to fruition.

In equipment, the Army of excellence is becoming a reality. Today, we have systems such as the Abrams tank, Bradley Fighting Vehicle, Blackhawk helicopter, Multiple-Launch Rocket System, Stinger air-defense missile in the field, the Apache attack helicopter in production and the M16A2 rifle under development.

Producing weapons systems and other materials is not simply a matter of manufacturing and shipping new systems to our soldiers. It also involves diagnosing problem areas in existing equipment and developing necessary modifications for the future generations of the system. Major systems require a wide variety of technical products such as generators, controls, seats, armor and electonics.

A major challenge is to synchronize the maturity of these components to match system development time-lines. The light helicopter experimental (LHX) is a prime example of how we can meet this challenge. The LHX will be the Army's newest "family" of helicopters.

The LHX will incorporate many emerging technologies that are totally new to Army aviation. Lightweight composite materials will provide a reduction in the weight of the vehicle and will also assist in making the vehicle stronger while maintaining weight constraints. An advanced avionics and control system will have voice control of non-flight subsystems allowing the pilot to cue functions through voice synthesis.

The LHX will have integrated automated flight controls, automatic target recognizers and advanced communications and navigation equipment to reduce the pilot's work load. It will also have a five-fold increase in mission reliability and the latest in night vision capability, enabling it to fly around-the-clock.

The focus of LHX is clear. It is to unite the pilot, the aircraft and the mission with tomorrow's technology to produce a lightweight, low-cost and reliable weapons system for the challenge of the 21st century.

We have begun to emphasize five basic areas that we refer to as the Army's technology thrusts. They are very intelligent surveillance and target acquisition; command, control, communications, and intelligence; munitions; biotechnology, and the soldier-machine interface.

The five thrust areas have been important in focusing research and technology toward long-range modernization goals. To accomplish our goals we must have close teamwork between the Army's technology laboratories, academia, and the defense industry.

Army Labs

We rely on the Army's technology laboratories to oversee our technological goals. Scientific accomplishments within our laboratories are numerous. For example, Army researchers have demonstrated that platinum-ruthenium alloys solved the problem of fuel cell start-up at lower temperatures and thus provide for more rapid operational readiness of phosphoric acid fuel cell power plants.

Army researchers have also discovered a new method to optimize heat treatment of gun barrel forgoings which will reduce the potential failure of gun tubes on the future battlefield.

Army laboratory research and technology is paying off in soldier training, protection, health and vehicular mobility. Adoption of microelectronic technology and some of the advances in learning and motivational behavior helped in developing a $200 device that the soldier can take with him and use as a self-paced item. This device is especially useful when we teach troops a new skill, particularly the nomenclature that might be associated with parts of weapons systems which can be very complicated. The soldier hears a synthesized voice that's used interactively between the soldier and the training device. This system greatly reduces the cost of training and improves skill retention.

The excellent research performed in Army laboratories is supported by a vigorous contract program. Over half of the money that is allocated to Army research and technology is spent out-of-house with industry, with not-for-profit institutions and with universities.

Academia

It is important to recognize our colleagues in the academic community. Their contributions to our 6.1 research program have been enormous. The Army has contracts with approximately 200 colleges and universities and sponsors centers of excellence at nine universities.

Columbia University, Georgia Insti-

tute of Technology, Massachusetts Institute of Technology, and Stanford University are the joint services electronics centers of excellence. The University of Wisconsin is the mathematics center of excellence, and the University of Pennsylvania and University of Texas (Austin) are the centers of excellence for artificial intelligence/robotics.

Rensselaer Polytechnic Institute, the University of Maryland and Georgia Institute of Technology are centers of excellence in rotorcraft technology. In fiscal year 1985 we will also initiate activities to create centers of excellence in software technology.

Technical Base Breakthroughs

Army sponsored R&D efforts are vital to the Army's readiness. I would like to mention a few of the major breakthroughs accomplished by the technical base.

The first of these is night vision devices. These devices allow the individual soldier to perform his mission 24 hours a day.

Night vision goggles currently use two tubes that have an expected life of 2,000 hours at which time the goggles must be sent back to the depot to replace the tubes. Our future system will have a single tube that should last for 7,000 hours and can be replaced by the soldier.

Another night vision device uses thermal imaging. By sensing the temperature differences between objects and their surroundings, these devices can differentiate or "see" tanks, trees, people, and anything else that has a temperature signature.

Night vision equipment is on our vehicles. American industry has put it there. For example, the M1 tank has a thermal imaging night sight, the AH-64 (Apache) has night vision fire control and navigation equipment, and the TOW has night sights.

Breakthroughs are coming in electronics, especially in very high speed integrated circuits (VHSIC) technology. VHSIC will give us computers that are not only smaller, lighter, and cheaper than present computers, but a thousand times more powerful.

My last example of a major breakthrough accomplished by the technology base in the area of composite materials. The next generation of helicopters will be the first manned, massed-produced military aircraft to have primary structures constructed from advanced composite materials.

Extensive programs have been completed in composites for tailboom/vertical fin, main rotor blades, main landing gears and structure joints and fittings. Composites for helicopters in general utilize: graphite in higher strength and stiffness applications, such as longerons, frames and beams; Kevlar for skin panels; and fiberglass on surfaces which require high durability.

Utilization of these materials achieve cost savings of 15 to 50 percent over conventional metal structures and weight savings of 15 to 25 percent. In addition, they resist corrosion and are easily field-repairable.

Non-Military Applications

One of the real prizes of the Army R&D community is to have our military technological advances applied to peaceful, non-military applications. For example, Army-developed night vision goggles are used by the civilian populace to aid severely vision-impaired people.

The Night Viewing Pocketscope, a spin-off from the Night Vision Goggles, is now available to victims of night blindness. As the Night Vision Goggles became perfected, the concept of a hand-held, monocular image intensifier or "Pocketscope" was made a reality when the Army made the first unit in-house. Working closely with industry, a civilian application was soon found in the medical field to aid thousands of Americans suffering from the night-blinding disease Retinitis Pigmentosa.

Industrial Base

The requirement to meet future defense needs also demands that we maintain the industrial base. We do not maintain a large standing army on the Soviet scale, so we must rely on our capacity to mobilize forces and to manufacture equipment to sustain them.

We need the capacity to mobilize the readiness of our industrial base so critical to the credibility for our overall deterrent. Specific challenges to the industrial base include the development of robotic vehicles. A variety of robotic vehicles could be crucial on the modern battlefield.

The industrial base helps the Army's R&D effort in another important area. When the industrial base develops items for civilian use that are compatible with military uses, the cost savings to the military R&D effort are substantial. This effort must be expanded. The procurement of non-developmental items (NDI) is not new, but deserves to be continually stressed by everyone in the R&D process.

Industry can help in advanced materials research. We need lighter and stronger materials to lighten our military vehicles. For example, high strength steel laminates for tanks have the potential to increase useable strength by 40 percent, increase wear resistance by 20 percent and reduce weight by 20 percent. Kevlar reinforced hulls have the potential of upgrading armor piercing protection from 7.62mm (steel) to 14.5mm (tungsten carbide) without any increase in hull weight.

Industry must continue their research efforts in microelectronic materials, integrated circuit manufacturing, development of computers and software, basic production and manufacturing technologies, including automated control, signal processing, and telecommunications, including fiber optics.

A prime example of this is the Commercial Utility and Cargo Vehicle (CUCV), which not only serves Army needs, but those of all the services. As with the M880 series that it will replace, the CUCV is a family of commercially available, off-the-shelf vehicles adapted to meet military needs.

The CUCV consists of cargo, utility, and ambulance versions and is a four-wheel drive, diesel-powered vehicle in a nominal ¼-ton payload category for use on primary and secondary roads. The CUCV also has excellent cross-country capability.

In summary, these are challenging times for research and development. Our Army requires a materiel acquisition program that will sufficiently equip the force in a timely manner, modernize it and protect its future. The picture is brighter now than it has been in a long time and our challenge is to keep it bright. To do this we need to support meaningful research within our technological base and seek the help of the industrial base and academic partners.

In this time of tight budgets and scarce resources, it is our clear responsibility to spend the taxpayers' dollars as effectively as we can. We will continue to invest that money into winning that long twilight struggle of technological preparedness I spoke about through the innovation and creativity of our people.

MG RICHARD D. KENYON is assistant deputy chief of staff for research, development, and acquisition, ODCSRDA, HQDA. A graduate of the U.S. Military Academy, he holds an M.S. degree in aeronautical engineering from Princeton University, and has completed the Advanced Management Program at Cornell University.

Streamlining the Development Process

By Jerry L. Stahl

Can the Army really streamline the development and acquisition process? Lots of smart folks have studied and analyzed this question, but it seems there's no simple solution with a common denominator for success. Sure, we've got our success stories. If you conduct enough development programs, even Murphy is bound to miss a few.

So the *real* question isn't can we do it, we obviously can. The question is "can we do it routinely for *most* programs?" GEN Richard H. Thompson, the commanding general of the Army Materiel Command (AMC), thinks the answer is "yes."

So why haven't we got more success stories than we do? I believe there's a fundamental reason. All of us have probably had bosses who told us to "go do good work." That's a noble goal for any conscientious employee. What's missing in this task, however, is the criteria by which the boss will evaluate our product.

Like me, I'm sure you can recall instances in which you might not have initiated a project if you'd known the boss' definition of "good" ahead of time. Maybe you would have told him exactly what was needed to accomplish the task, such as additional funds, training, or professional assistance. Well, this example is as valid in the Army's materiel acquisition process, as it is in any walk of life.

Maybe if we knew how the boss is defining a successful program, we possibly wouldn't start as many as we do. However, no one ever really defined "successful" for us—until now. GEN Thompson has. He's essentially saying we must strike a balance between readiness and cost.

The Army can't afford everything it wants. Therefore, we must become hard-nose business persons and smart buyers. It also means we must be absolutely sure we're ready to enter "development." This translates into initiating only those programs that are affordable and represent true force-multipliers. Sure we must accept some risk because nothing is risk-free. But, we can be prudent managers of risk. That's what AMC is striving to do.

Our overall objective remains the same, namely getting operationally effective and supportable equipment to the field. What has changed is GEN Thompson's commitment to get this equipment in the hands of the *soldiers* when it's needed. To do this, he is emphasizing accelerated or "fast-track" programs. Beyond the importance we're placing on nondevelopment items, GEN Thompson has established a four-year development goal for all new starts.

The clock starts at Milestone I go-ahead with funds in place. The clock stops on entry to production. Additionally, he has established a similar two-year goal for product improvement proposals and programs that integrate proven components. Now these are tough goals to meet. GEN Thompson admits it, but he's also convinced they can, and should, be accomplished.

It takes imagination, dedication, a positive approach, and especially teamwork to pull it off. It also takes the kind of folks that are willing to come forth in identifying and recommending solutions to the obstacles that are blocking the path to success. Once we have all these factors working together to overcome current mindsets, the Army will be able to collectively focus our attention on developing innovative, affordable, and achievable Acquisition Strategies for new weapon systems.

But AMC can't do this alone. It takes the entire Army team. This team includes the corporate leaders right down to the grass roots level. It encompasses all functional organizations involved in the materiel acquisition process including the materiel developers, the combat developers, the testers, the trainers, the doctrinaires, the logisticians, and the users. No one can be excluded. One weak link, and the chain breaks. The Army simply can't afford to let this happen. That's why AMC's commanding general has personally solicited the support of the Army's corporate leaders. Without that dedicated support, executing these goals at the operator level is not likely to occur.

AMC's commitment to the soldier and the "Army of Excellence" requires everyone to do his part, and early responses indicate AMC is getting the corporate commitment it's seeking. GEN Thompson now has taken the first step, but it's absolutely essential that all our actions and words reflect our personal dedication to this critical initiative.

What are the kinds of things we can do to achieve innovative Acquisition Strategies, and more importantly, to execute these strategies? It starts with our dedicated support in defining realistic operational requirements. Too many times we shoot for the "nice-to-haves," when we should be going for only the bare essentials. It boils down to the fact that we must use common sense and sound military judgment in defining the extreme outside performance envelope of equipment.

These extreme outside performance requirements represent cost drivers and potential gold plating. These types of requirements might be worthy of consideration under preplanned product improvement, but the successful program must go for the "good enough," using proven technologies. GEN Thompson's four-year development goal simply won't allow us to demonstrate new technologies during system development.

To assist in scrutinizing proposed user needs, GEN Thompson recently established senior level review boards at both the headquarters and all

major subordinate command levels. Incidentally, the user representative has been asked to provide a representative on each of the boards.

Once we've obtained and agreed on realistic requirements, we must develop master schedules that control every detail of the proposed Acquisition Strategy. We simply can't afford to allow time savings to be eroded because, for example, we didn't verify a test window early on, and ultimately find that window closed at a crucial moment. That's why it's important to determine the critical path to success, and identify the events which can adversely impact on that path. Unfortunately, this includes the administrative process. Appropriate processing and staffing goals must be established and adhered to.

We must also take great care to not permit logistic supportability to be sacrificed because of cost or schedule constraints. When we speak about affordability, we're not simply referring to specific appropriations, we're referring to life cycle costs. This reinforces the need for early integrated logistic support (ILS) planning, agreed to by the entire team, and concurrent with development of the Acquisition Strategy.

It's extremely important to carefully define our broad ILS requirements, how we're planning to achieve initial support, and how we're going to transition to the desired support concept. In a nutshell, we must design *the* support, design *for* support and support the design. This specifically includes designing equipment that "fits" the soldier. GEN Thompson's initiative on Manpower and Personnel Integration (MANPRINT) is designed to emphasize human factors, manpower, personnel and training, and to ensure these are an integral part of not only ILS, but our entire acquisition process.

Our equipment design and fielding must be faster, but we've got to capitalize on technologies that help make this equipment easier to operate and maintain by fewer soldiers. That's what soldier-machine interface is all about, and our goal is to put the MANPRINT on everything we do.

Another area which is key to streamlining the development process is our application of military specifications and standards. In the past, we've been less than attentive to this important function. For example, we can no longer afford to design equipment to meet the entire realm of environmental possibilities, especially if the equipment will encounter those conditions only 10-15 percent of the time.

We must start designing for the "expected" rather than routinely for the "worst case." We've fallen into a trap of calling out military specifications and standards as design criteria, without properly and consciously tailoring them to fit our specific needs. This is a very costly and time consuming approach and, like requirements, our senior level review boards take a hard look at this area in all our contractual instruments.

AMC must also get a better handle on change control. Unfortunately, all changes seem to be expensive. When we add to the design, the price goes up. When we take away from the design, the price also goes up. Quite simply, we must manage, or ideally, eliminate changes. Configuration management is the name of the game, and by thinking twice and executing once, we can really get some real payoffs in this area.

We must get smarter at our approach to testing. Part of this learning curve resides in doing better planning for test and evaluation (T&E), but the larger part is overcoming the mindset that "more testing is better."

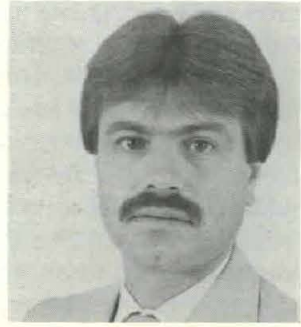
While it's true that more testing provides more information for decision making, the cost of this additional information may not provide adequate return on investment. And when one sees the same or similar tests being conducted during contractor testing, government development testing, and government operational testing, it's easy to conclude this isn't "smart" testing. These are redundant proofs of compliance, and represent a waste of precious resources.

AMC must do a better job in preparing Test and Evaluation Master Plans: ones that consciously and purposely plan for sharing of test resources and data. This also includes the acceptance and use of test data already available in the marketplace. Failure to accept this data simply because it wasn't conducted at one of our own proving grounds is unacceptable.

Just as the overall four-year development initiative requires total Army support, smarter testing requires a dedicated commitment by the entire Army test community.

In summary, GEN Thompson has given us all a real challenge. He has told us exactly how he defines successful. It's now up to the entire development and acquisition community to identify and employ every conceivable timesaving technique in every facet of our jobs. If we all can adopt this sense of dedication, imagination, innovation, and team spirit that GEN Thompson is challenging us to accept, we will not only turn the Army's success ratio around, but we'll accomplish what AMC is all about—support to the soldier in the field!

JERRY L. STAHL is an aerospace engineer in the Office of the Deputy Chief of Staff for Development, Engineering and Acquisition, HQ, U.S. Army Materiel Command. He holds a BS degree in electronics engineering from the University of South Florida, a master's degree in industrial engineering from Texas A&M University, and is a graduate of the Defense Systems Management College Program Management Course.



Army Science Board Convenes at Fort Rucker

Knowledgeable discussion and relaxed camaraderie were key ingredients contributing to the success of the Army Science Board Annual General Membership Meeting from Oct. 29 to Nov. 1 at Fort Rucker. The Army Science Board, which is comprised of senior industry, academic and retired military personnel, serves as the Department of the Army senior scientific advisory body on research and development matters to the secretary of the Army and the Army chief of staff.

The conference agenda included briefings on the results of studies undertaken last summer by selected Science Board committees, and presentations by Army officials on subjects of special interest. Board members also were briefed on topics proposed by the Army staff for the 1985 studies. In addition, the board was treated to a well received orientation by the Army Aviation Center which featured welcoming remarks by MG Bobby J. Maddox, commanding general of the center, briefings on Aviation Center programs, flights in Army helicopters, and an air assault demonstration.

The conference began with a call to order by Army Science Board Chairman Dr. Wilson K. Talley, professor, Department of Applied Sciences, University of California—Davis, followed by opening remarks by Amoretta Hoeber, principle deputy ASA(RDA). The remainder of the first day was devoted to the Aviation Center orientation.

Dr. Jay R. Sculley, ASA(RDA) opened the second day with remarks on the board's record of continued success. He gave as illustrations of the board's effectiveness the attention and sponsorship that their studies are receiving at the highest levels of the Army staff and the fact that their advice is being followed. He attributed that success, in part, to the leadership of the Board Chairman Dr. Talley, and Co-chairman Dr. Irene C. Peden. After complimenting the Army Science Board Executive Director Ronald A. Mlinarchik, and his staff for their effective support, Dr. Sculley closed his address by presenting Mlinarchik a certificate for exceptional performance.

The remainder of the morning was devoted to a classified session. Subjects and speakers were: *Space Utilization,* Lawrence H. O'Neill, chairman of the board and president, Riverside Research Institute; *Light Equipment,* Dr. Russell D. O'Neal, private consultant (former ASA (R&D); *Equipment Upgrade,* John R. Moore, vice president, Business Development Electronics Systems Group, Northrup Corp.; and *Ballistic Missile Defense Update,* Dr. David D. Elliot, vice president and director, Research and Analysis Division, SRI International. The session moderator was Richard E. Friedman, managing partner, Epton, Mullins, Segal & Druth, Ltd.

The afternoon session, moderated by Dr. Peden, professor of electrical engineering, University of Washington, covered three topics. The first, presented by Richard Friedman, addressed *Technology to Improve Logistics and Weapon Support for Army 21,* a subject of the Army Science Board 1984 Summer Study, which was co-sponsored by the commander of AMC and the Army deputy chief of staff for logistics. Dr. Wesley L. Harris, professor of aeronautics and astronautics, Massachusetts Institute of Technology, followed with a briefing on the *Light Helicopter Experimental (LHX) Program.* Dr. L. Warren Morrison, managing partner, Morrison and Associates, concluded the session with a discussion on *Intelligent Robotics.*

The conference banquet was highlighted by an address by Rep. William L. Dickinson, 2nd Congressional District, Alabama. The congressman spoke on the need for a strong defense and the overall public support of that need. Stating that, "one $450 hammer can kill the MX missile," he warned that recent disclosures of overpriced spares and components for our weapons systems can create a perception of mismanagement that will erode public support of defense programs.

The morning session of the third day was moderated by John Moore and began with presentations on another 1984 Summer Study topic sponsored by the Army deputy chief of staff for personnel. The topic, *Leading and Manning Army 21,* was presented by: Dr. Phillip

Army Aviation Center Commander MG Bobby J. Maddox converses with ASA(RDA) Dr. Jay R. Sculley at Army Science Board Meeting.

Rep. William L. Dickinson addresses the conference banquet attendees.

Sidwell, private consultant; Peter D. Weddle, director, National Security Programs, The Hay Group; and Dr. Michael A. Wantrell, vice president for academic affairs, Humbolt University, CA. The bulk of the morning was spent on this topic—the subject of much discussion which, in addition to exploring the topic, served to demonstrate the great depth of knowledge the membership has on Army matters.

Other presentations and speakers during the morning session were: *Combat Medical Support,* Dr. Stanley Jay Sarnoff, president and chairman of the board and chief executive officer, Survival Technology, Inc.; *Army Chief of Staff Task Force and Soldiers and Families Update,* Dr. Talley; *Technology Base Programs,* Richard B. Lewis, director of Army research and technology, HQDA; and a report on *Chemical Decontamination Technology* by Harry L. Reynolds, deputy associate director for advanced weapons technology, Los Alamos National Laboratory.

Lawrence H. O'Neill moderated a lively afternoon session on day three. Two topics were presented. The first was a report on how to shorten the requirements documentation process by Dr. Richard J. Trainor, president, Trainor Associates, Inc. The second was a briefing on the *AMC Laboratory Improvement Program* presented by Dr. Richard L. Haley, assistant deputy for science and technology, HQ AMC. Both talks prompted extensive discussion by the board members.

The final session of the conference covered Army Science Board reviews of selected Army labs. These reviews, requested by AMC, were the first of a series which will be conducted through FY86. Dr. Talley moderated the session. Dr. William M. Brown, president, Environmental Research Institute of Michigan, presented a review of the Avionics Research and Development Activity and Dr. John W. Knapp, dean of the faculty, Virginia Military Institute, presented a review of the Tank-Automotive Command R&D Center.

As a grand finale to the conference, the Aviation Center provided an unexpected treat in the form of an absorbing briefing on airmobile operations during the Grenada rescue operation. The briefing, given by MAJ Michael A. Dannaker from the center's Department of Combined Arms Tactics, was a highlight of the conference for many of the attendees.

Williamson Chosen as Army PM of the Year

A U.S. Army Aviation Systems Command officer received his second pleasant surprise in as many months recently when he was selected as Army Project Manager of the Year. COL (P) Donald R. Williamson, who was recently nominated for promotion to the rank of brigadier general, received the award during the U.S. Army Materiel Command's Mini-Project Manager's Conference in St. Louis on Nov. 20-21.

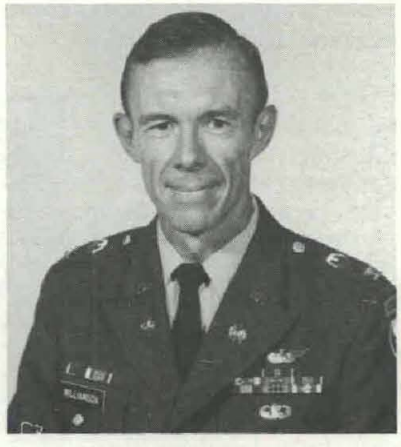
The award was presented by Assistant Secretary of the Army for Research, Development, and Acquisition Dr. Jay R. Sculley.

Williamson received the 1984 Secretary of the Army Award for Project Management Excellence for his work as project manager for the Cobra attack helicopter.

The Cobra PM Office is responsible for the support of more than 1,000 fielded attack helicopters, as well as for integration of rocket, gun, missile, fire control, and helicopter electrical equipment.

In fiscal year 1984, the office completed fielding of the last of 523 modernized Cobras and 218 AH-1S modified Cobras. The ambitious modernization program replaced Vietnam-era aircraft with the latest version of the attack helicopter. It also overhauled and updated the older models to the current configuration.

The Cobra PM is involved in a number of projects to extend the Cobra's effectiveness into the next century. These improvements include: the development and fielding of a complete night attack package for the Cobra, including a thermal imaging night sight for the TOW anti-tank missile system; development of a fleet life extension program to incorporate safety, reliability, and maintainability improvements; development of surrogate pilot's night vision trainers to allow pilots for the Army's new Apache attack helicopter to



train in lower cost Cobras; and conversion of the remaining AH-1G Cobras into the TOW-equipped AH-1S configuration.

Williamson has served as Cobra PM since July 1980. He assumed the position upon graduation from the Army War College at Carlisle Barracks, PA. Prior to his work there, Williamson served for two years as commander of the 70th Transportation Aircraft Intermediate Maintenance Battalion in Germany. In a previous tour of duty in St. Louis, from 1969-1973, Williamson was assigned to the AVSCOM Office of the Secretary of the General Staff.

The Project Manager of the Year is selected annually. A group, chaired by the vice-chief of staff of the Army, reviews the nominations and makes its recommendations to the secretary of the Army.

Over 70 PMs are eligible for the award, which was established in 1976. Aviation PMs have been the recipients for five of the nine years the award has been in existence.

From The Field ...

Night Vision Office Established

Spotlighting its capability to fight as well at night as in the day, the Army has established a Project Office for Night Vision Devices (NVD). The office will be headed by Kenneth S. Solinsky, who has been designated the Army Materiel Command's (AMC) project officer for night vision devices. He works at the Night Vision & Electro-Optics Laboratory at Fort Belvoir, VA.

The new project office will implement a new acquisition strategy for night vision devices—one that calls for purchasing the final product rather than buying parts and assembling them.

The Army plans to award at least two contracts on a five-year multi-year basis. "This should provide an incentive for producers to establish more efficient production lines which will be more cost effective because they can operate over an extended period with known production rates," spokesmen explained. "Such a multi-year contract will also benefit contractors by reducing their risk as well as enabling them to better plan their long-range production.

"This change will also reduce the over-all cost to the Army, while increasing the number of night vision devices in the hands of soldiers," they said.

According to officials, the first multi-year contracts will combine the AN/PVS-5 and AN/AVS-6 night vision goggles, the AN/PVS-4 individual served weapon sight, the AN/TV-5 crew served weapon sight, and the AN/VVS-2 driver's viewer.

As part of the same solicitation, spokesmen said, a separate contract will be awarded for engineering development of a new generation of night vision goggles, the AN/PVS-7 night vision aid.

In his new role, Solinsky is responsible for mapping "an overall strategy for development and acquisition of affordable, producible, and supportable night vision image intensification devices," according to the charter.

Solinsky, who will deal directly with the U.S. Army Electronics Research and Development Command and the Communications-Electronics Command at Fort Monmouth, will be the Army's single negotiator with industry, according to the charter.

Citing the dynamic nature of night vision device acquisitions, officials said the charter will be considered for termination in FY 92.

Army Tests Swedish Anti-Armor Weapon

The Combat Systems Test Activity at Aberdeen Proving Ground, MD, is testing the 84mm AT4 anti-armor weapon which is a contendor to replace the light anti-armor weapon (LAW) currently in use by the U.S. Army and the Marine Corps.

Manufactured by the FFV of Eskilstuna, Sweden, the AT4 will be produced under license in the United States by Honeywell Inc. in Minnesota, if the Army decides to purchase the system.

According to Ulf Molitor, project director for the AT4 with FFV, the AT4 has about three times the effective range of the current LAW rocket, has a shorter flight time than the LAW, and can penetrate up to 450mm of rolled homogeneous armor plate. The AT4 operation is similar to that of the current LAW and will not require extensive retraining of Army troops to use it effectively.

Combat Systems Test Activity Test Director Susan Whitlaw examines an AT4 anti-armor weapon launcher before firing tests.

Molitor said the AT4 system has demonstrated some significant "after-armor" effects. After the armor has been penetrated, an incendiary gas jet associated with the detonation of the warhead can detonate fuel or ammunition stored in target vehicles.

Testing at Aberdeen Proving Ground by the Combat Systems Test Activity is under the direction of Susan Whitlaw of the Small Arms, Automatic Weapons and Individual Equipment Directorate. Whitlaw said the tests involve firing several hundred AT4s. The AT4s will be evaluated under varying climatic conditions as well as against various types of armor plate.

The AT4 system weighs 14½ pounds, she said, while the projectile itself weighs about four pounds. The projectile is carried in a self-contained, throw-away launcher tube similar to the current LAW rocket. A decision on purchasing the AT4 system is expected in August 1985.

CSTA Looks At Replaceable Tank Pad Track

The standard track for the M1 Abrams tank may soon be obsolete. The Combat Systems Test Activity (CSTA), Aberdeen Proving Ground, MD, is testing a replaceable pad track for the Army's newest main battle tank.

The new track has hard rubber pads attached to metal track shoes. The Army hopes the pads will provide protection for paved road surfaces, improved traction, smoother ride, decreased vibration and increased track life. According to Ted Wheeler, M1 tank team leader in the CSTA Tracked Branch, Phase I performance testing has been concluded.

CSTA personnel installed the new track on three tanks and conducted various performance tests. The tests examined acceleration, braking, maximum speed, resistance to towing, side slope operability, and shock and vibration. The Munson Test Course at APG was the site for most of the Phase I testing. The standard track was put back on the tank, and the tests were repeated for a track comparison, Wheeler said.

According to Wheeler, the Abrams' automotive performance has not been adversely affected by the new track. One of the most critical tests was road shock and vibration. Results from that test showed that the new track seems to have no

Ted Wheeler, M1 tank team leader, inspects the rubber pads on an M1 Abrams tank.

significant effect on the fire control performance of the M1, he added.

Phase II tests focus on the durability of the track pad. Three M1 tanks equipped with replaceable tank pads are undergoing durability testing on the Perryman Test Course at APG. The course is a combination of paved, gravel, and both level and hilly cross country terrains. The durability phase is key to all the testing, Wheeler said. "We would like the new track to go 2,000 miles, and to be cost effective it should go that distance. The standard track goes 600-800 miles before replacement," he said. All three of the tanks being tested have logged 1,500 miles. Testing will conclude when 2,000 miles have been accumulated on each track.

Training Board Updates Field Manuals

Publication of an updated set of field manuals (FM 25-1 through FM 25-4), which provide techniques, principles and procedures for training and training management in all combat arms, combat support, and combat service support units, has been announced by the U.S. Army Training Board. The manuals are the basis for all Army training and training management and apply to both active and reserve components.

FM 25-1, *Training,* covers the philosophy and principles of training. It is for leaders at all levels. FM 25-2, *Unit Training Management,* provides the Army training management process. It is for battalion and above commanders and staffs.

FM 25-3, *Training in Units,* provides the "how to" for the conduct of training. It is for leaders at battalion level and below, firstline trainers. FM 25-4, *How to Conduct Training Exercises,* describes the conduct and use of training exercises to sustain skills. It is primarily for commanders and staffs at battalion level and above. These manuals are significant doctrinal contributions. Be sure to update your DA Form 12A (by checking block no. 159, Techniques of Military Instruction) or write the U.S. Army Publications Center in Baltimore, MD, to obtain copies.

3 Firms Will Develop MAPS Prototypes

Weapon and target acquisition systems must know their own location and orientation before they can find and fire on enemy targets. The U.S. Army Engineer Topographic Laboratories (ETL) and the Project Manager-Cannon Artillery Weapons System (PM-CAWS) are developing a generic device to meet this need.

This Modular Azimuth Position System (MAPS) will give the Army a standardized positioning/orientation capability for weapon and sensor support. Three engineering development contracts were awarded late last year for the first phase of this program.

Each of the three firms involved will build nine prototype devices, called Dynamic Reference Units. These reference units will use inertial technology and computers to obtain the position, elevation and attitudes of the systems which carry them.

The Army today uses a variety of positioning devices to get this information—devices tailored to the needs of specific weapon and sensor systems. Making and maintaining a different positioning device for each different weapon and sensor creates a cost and logistics burden.

The MAPS program, however, will support a number of different weapon and sensor systems. Potential users of the Dynamic Reference Unit include the M109 self-propelled howitzer, the Patriot anti-aircraft missile and the Firefinder counter-artillery radar.

"Our goal is to develop a cost-effective positioning system that meets the needs of as many users as possible," explained David Thacker, ELT team leader for the MAPS project.

Program officials have worked closely with the user community to meet this goal. ETL scientists surveyed weapon and sensor system developers to identify their positioning and orientation needs. They used the information gathered to establish accuracy requirements for the new reference unit and set specifications for shock, vibration, temperature and other parameters.

The reference units now being built should be ready for initial field tests next fall. The U.S. Army Test and Evaluation Command plans to start qualification testing the following spring.

PM-CAWS is responsible for the overall management of the MAPS program. ETL will continue to provide technical support during the development and test phases of the project.

MAPS program plans also call for the development of a Static Reference Unit. Developmental work on this second part of the MAPS program will begin after the U.S. Army Training and Doctrine Command finalizes a Required Operational Capability document for the static unit.

ATL Awards 16-Month Analysis Contract

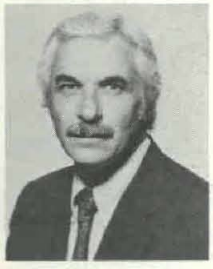
A 16-month, $130,898 contract, entitled Rotor Blade Natural Frequency Analysis for Complex Hub Configuration, has been awarded to Bell Helicopter Textron, Inc., Fort Worth TX, by the Applied Technology Laboratory (ATL), Fort Eustis, VA, of the Army Research and Technology Laboratories (AVSCOM).

"The objective of this contract is to develop improved analytical methods of determining helicopter rotor blade resonant frequencies and blade deformations associated with these frequencies," said Edward E. Austin, ATL project engineer. "This information is necessary for the design of modern rotor configurations and the prediction of rotor blade aerodynamic loads, stresses, vibration characteristics and stability."

The resulting analysis and computer analysis will be sufficiently general to permit easy modification to analyze rotor hub configurations not considered in the present effort.

Awards...

Wilkinson Gets Meritorious Service Award



Dr. Wilkinson

Dr. Edward L. Wilkinson, chief of the missile program which demonstrated for the first time the U.S. ability to "hit a bullet with a bullet" in space, has received the Army's Meritorious Civilian Service Award. The award cites Wilkinson's "exceptional initiative and outstanding skill" while directing the Homing Overlay Experiment, a key part of the Army's Ballistic Missile Defense (BMD) Program.

After nearly six years of research and development, the Homing Overlay Experiment interceptor missile successfully demonstrated optical homing, on-board data processing for guidance and control, and direct-impact destruction of an intercontinental ballistic missile while still in space.

This is believed to be the first such direct-impact intercept by any nation and was an important technology demonstration for the Strategic Defense Initiative Program. That program is the U.S. research effort to develop sound technical options in support of future decisions in whether the U.S. should develop an effective defense against ballistic missiles.

Wilkinson has been chief of the Homing Overlay Experiment project since 1980. Prior to that, he was the engineer in charge of interceptor development on the project.

TECOM Commander Receives German Award

The Federal Republic of Germany has honored MG Andrew H. Anderson, commander of the U.S. Army Test and Evaluation Command (TECOM) and Aberdeen Proving Ground, at a ceremony in the German Embassy. Representing the German Minister of Defense, Defense Attache BG Klaus Steinkopff presented Anderson with the Federal Armed Forces Cross of Honor in Gold.

According to Otto Stalmann, German liaison officer to TECOM, the Cross of Honor, in either bronze, silver or gold, is the only medal the Federal Repulic of Germany bestows on military personnel. "Very few Americans have received this award," Stahlmann said.

Anderson received the medal for his work during several assignments in Germany in the 1970s and in his dual capacity as deputy commanding general of VII Corps and commander of the Stuttgart Garrison Headquarters from 1981 until April 1984.

"During these tours of duty, and especially during your last assignment, you have exercised a lasting and positive influence on your units and organizations in order to strengthen and promote the cooperation with the German military units and civilian agencies and to deepen the contacts with the civilian population," Steinkopff said.

Steinkopff commended Anderson for fostering understanding and appreciation of the North Atlantic Treaty Organization and for his concerns for the civilian population. "All these measures and efforts have been very much appreciated by the public and the citizens and have greatly contributed to the high esteem and good reputation you enjoy in Germany today," Steinkopff said.

"You have committed yourself in an outstanding way to the benefit of the Federal Republic of Germany and have worked without restriction toward the preservation and improvement of the mutual interests of both of our countries," the German defense attache said. "In doing so, you have increased the credibility of the American commitment in defending the security of the Federal Republic."

BMD Employee Earns Excellence Award

Donald Parker

His idea for a "better mousetrap" hasn't brought the world beating a path to his door, but Donald Parker's idea is a lot more complicated than an improved mousetrap.

Parker, an engineer with the Army's Ballistic Missile Defense Advanced Technology Center (ATC), devised an improved and much less costly way of performing demonstration and checkout of a special sensor system under development at the ATC.

For his ingenuity, plus perseverance in seeing that the idea was implemented, Parker has been awarded a Department of Defense Productivity and Excellence Award by Secretary of Defense Caspar W. Weinberger.

The latest honor comes on top of earlier Army recognition of Parker's idea. Secretary of the Army John O. Marsh, Jr., presented Parker with a plaque citing him as one of the service's two outstanding suggesters of the year.

In April 1983, Parker also received a $9,634 bonus through the federal incentive awards program, which encourages employees to submit ideas for cutting costs and improving methods of doing things. The amount of the award was based upon calculated savings for the Army of $1.2 million as a result of Parker's suggestion.

His idea was for equipment and methods to test components in infrared sensor systems being developed by the Army for defense against ballistic missiles. Infrared sensors are useful for ballistic missile defense because, looking into the intense cold of space, they can detect approaching ballistic missile warheads at great distances.

Developing such sensors and associated components and performing the necessary ground tests on them once they're developed require methods of simulating what the sensors would "see" in space during a ballistic missile attack.

Parker, in 1981, was the contract monitor for an ATC project in this field. He noted that a contractor's proposed use of computer-generated tapes for simulating sensor output would require development of a special "signal processor test driver" and a recorder at an estimated cost of $1.7 million.

Meanwhile, Parker learned of a "sensor synthesizer" that had been developed by another contractor for a different ATC program. He determined that, with some modification, the existing synthesizer could do the job. The cost of the end item and modifications would be about $400,000.

Pointing out a cost-saving alternative did not end Parker's role in the adoption of the idea, however. He had to also convince all those involved that the more economical approach would be just as effective as the more costly way. "Selling" his idea took roughly a year.

The suggestion wasn't Parker's first. He has made several during his 22-year career as an Army civilian employee, beginning with one which brought a $25 award.

CRDC Employee Named 1984 Safety Engineer

Manuel Lopez, a safety engineer at the Army Chemical Research and Development Center (CRDC) has been named the Army Materiel Command's (AMC) System Safety Engineer for 1984.

AMC's Systems Safety Program presents this annual award to an engineer who excels at engineering Army materiel systems to be safe for their intended purposes.

Lopez was cited for his combined technical expertise and managerial abilities in designing a system safety program for a chemical laboratory facility. He prepared materiel safety data sheets for military unique chemical compounds, thus providing a concise reference source for safety and health information upon which safety parameters could be formulated.

A native of Puerto Rico, Lopez was awarded a bachelor's degree in chemical engineering by the University of Puerto Rico in 1979. He served as a chemical engineer for the Department of Natural Resources and the Environmental Quality Board in Puerto Rico, prior to beginning his federal career in July 1981 at the AMC Intern Training Center in Texarkana, TX.

Following graduation from the year long AMC Safety Engineer Training Program, Lopez was assigned to CRDC's Safety Office in July 1982.

Capsules...

ODCSLOG Activates Contracts Directorate

Establishment of a Directorate of Contracting and Production within the Office of the Deputy Chief of Staff for Logistics has been approved by the Army Vice Chief of Staff. The new organization provides a long-needed capability on the Army Staff and is expected to be a vital key to increased efficiency and effectiveness in contracting operations Army-wide.

It will consist of a Contracting Policies and Procedures Division, a Contract Management and Strategy Division, and a Contracting Support Division.

Provisionally activated on July 31, 1984, the directorate will be fully staffed in mid-1985. It will then be capable of executing the Armys Staff's responsibilities for an Army-wide contracting program that involves the placement of over $30 billion dollars and four million contract actions annually.

This organization will become the "Center for Contracting Excellence" for HQDA. It will support the Army's acquisition executive in all facets of contracting; provide much needed guidance, direction, and assistance to the 26 heads of contracting activities and 240 purchasing contracting offices; plus enable HQDA to develop management information systems, policies, procedures and methods necessary for effective and efficient contracting operations.

Additionally, it will maximize the utilization of automation in the procurement process and fight fraud, waste and abuse by incorporating checks and balances in the contracting process.

The directorate stands ready to provide assistance wherever needed on all facets of contracting. The overall organizational goal is to improve effectiveness in contracting operations to enable the Army to meet its challenging role of safeguarding the Nation. Stephen Lake can provide additional information on the Directorate of Contracting and Production. His telephone numbers are commercial (202) 695-2583/2681 or Autovon 225-2583/2681.

Career Programs...

Nominees Sought for ORSA Program

The U.S. Army Europe (USAREUR) Operations Research and Systems Analysis Program was established in August 1980. It provides high quality responsive analytical support to USAREUR as well as timely feedback to continental Army agencies on the scope of important activities of U.S. Army elements deployed in the European theater. The program also provides a meaningful professional development opportunity for the participating analysts.

Each year, five to seven civilian analysts in the United States are selected for a two-year tour at one of the USAREUR locations. The program is directed from Headquarters, Department of the Army, under the auspices of the Office of the Deputy Under Secretary of the Army (Operations Research). The Study Program Management Office has responsibility for recruiting of nominees, administering a selection panel of senior Army officals and ensuring a smooth transition for the selected analysts.

A call for nominees will be made to the Army major command civilian personnel offices and to major analytical agencies in the January-February 1985 timeframe. Since this program provides great benefit to the Army and is also an exceptional opportunity for career enhancement, the program management office wants to ensure that all analysts have every opportunity to compete. If you are interested in this opportunity, contact Gloria Brown, Study Program Management Office, Management Directorate, Office of the Chief of Staff Army, Autovon 227-0026 or Commercial 202/697-0026.

Razulis Chosen for Executive Training

Marie Razulis has been selected as the 53rd participant in the technical executive training program, sponsored by the Chemical Research and Development Center (CRDC), Aberdeen Proving Ground, MD.

Razulis, a chemist in the CB Detection and Alarms Directorate, has begun a three month assignment in CRDC's Office of the Commanding General, followed by a three-month assignment in the Office of the Deputy Chief of Staff for Research, Development and Acquisition at the Pentagon.

Established in 1971, the technical executive training program was designed to give practical experience in staff work relating to managerial decisions.

Razulis was awarded a bachelor's and master's degree in organic chemistry from the University of Maryland. She also holds a master's degree in business administration from George Washington University, Washington, D.C.

A past member of Toastmasters International and of the American Chemical Society, Razulis received a patent award in 1978, and Sustained Superior Performance awards in 1978 and 1984.

Correction: An article on the M249 Squad Automatic Weapon (SAW) which appears in our September-October issue, incorrectly states that the weight of the SAW is 220 pounds. The correct figure is 22.0 pounds. Additionally, the normal rate of fire was stated to be 700-850 rounds per minute. This is the cyclic rate only (the rate if the weapon was fire constantly for one minute).

Personnel Actions...

Fiorentino Named Deputy BMD Program Manager

BG Fiorentino

BG William J. Fiorentino, former project manager of the Joint Tactical Missile System, Army Missile Command, has been assigned as deputy ballistic missile defense program manager, Ballistic Missile Defense (BMD) Organization, Redstone Arsenal, AL.

Fiorentino's appointment restores the BMD Organization to a strength of two general officers in leadership positions with MG Eugene Fox serving as the BMD program manager.

Previous assignments for BG Fiorentino have included service as project manager for the Pershing Missile, inspector general of the Army Missile Materiel Readiness Command, Redstone Arsenal, AL, and he has also held several staff posts at Department of the Army.

BG Fiorentino graduated from Fordham University in New York with a bachelor's degree in physics, and was commissioned in the Air Defense upon graduation. He also earned a master's degree in engineering from the Univesity of Alabama, Tuscaloosa.

Fiorentino's military education includes graduation from the Air Defense School, the Ordnance Officers Advanced Course, the Army Command and General Staff College and the Air War College.

His decorations include the Distinguished Service Medal, the Bronze Star Medal and the Meritorious Service Medal with Oak Leaf Cluster.

Reassignments and Promotions

BG Michael J. Pepe was named deputy commanding general for procurement and readiness, U.S. Army Aviation Systems Command, St. Louis, MO, following his promotion to the one-star rank.

COL Donald R. Williamson, project manager, AH-1 Cobra attack helicopter, has been nominated for promotion to the rank of brigadier general.

COL Nicholas R. Hurst has been appointed as deputy commander, U.S. Army Armament Research and Development Center, Picatinny Arsenal, Dover, NJ. Prior to Hurst's current assignment, he served as commander, Sierra Army Depot, Herlong, CA.

COL John P. Herrling has been assigned as the new commander, 2nd Brigade, 101st Airborne Division (Air Assault), Fort Campbell, KY. Herrling served in the Office of the Deputy Chief of Staff for Development, Engineering and Acquisition, Headquarters, U.S. Army Materiel Command prior to his Kentucky assignment.

COL Brendan E. Joyce assumed command of the U.S. Army Research Institute of Environmental Medicine, Natick, MA, after having served as the Institute's executive officer since 1982.

COL Alfred T. Crumpton became commander/director of the Large Caliber Weapon Systems Laboratory, U.S. Army Armament, Munitions and Chemical Command, Dover, NJ. Crumpton was commander of the U.S. Army Research, Development and Standardization Group in the United Kingdom.

Dr. Thomas J. Welch, former deputy director, Physical Protection Directorate, U.S. Army Chemical Research and Development Center, Aberdeen Proving Ground, MD, is now the deputy assistant to the secretary of defense for chemical matters, Department of Defense.

COL Fernand A. Thomassy is the new director of physical protection, U.S. Army Chemical Research and Development Center, Aberdeen Proving Ground, MD. Thomassy's prior assignment was director for training and doctrine at the Army Chemical School, Fort McClellan, AL.

From The Editor...

FEEDBACK. One of the most gratifying aspects of our May '84 readership survey was the number of written comments we received from the respondents. About 40 percent of those who responded to the survey also took the time to make additional comments. Not surprisingly, we found those comments to be as useful as the basic survey itself. They make a difference.

Letters to the editor provide the same type of valuable feedback, while also giving us the readership's views on current RDA issues. We solicit your questions, comments, or opinions concerning the magazine or RDA matters. Our address is HQ, AMC, ATTN: AMCDE-XM, 5001 Eisenhower Avenue, Alexandria, VA 22333.

THANKS. We take this opportunity to thank an individual who has provided us cheerful, albiet anonomous, support for the past 2 years. SSG Michael S. Rivera, senior photographer, U.S. Army Audiovisual Center, is the person we have relied on to get us most of the candid photos for our interviews of the RDA leadership. He retires from active service this February.

U.S. POSTAL SERVICE
Statement of Ownership, Management, and Circulation
Required by 39 U.S.C. 3685

Title of Publication:	*Army Research, Development & Acquisition*
Frequency of Issue:	Bimonthly
Mailing Address:	HQ, U.S. Army Materiel Command ATTN: AMCDE-XM 5001 Eisenhower Avenue Alexandria, Virginia 22333
Publisher and Editor:	LTC David G. Kirkpatrick

Extent and Nature of Circulation	Average No. copies each issue during past 12 months
Total No. copies:	28,497
Mail subscription:	1,150
Free distribution by mail, carrier or other means:	27,322
Total distribution:	28,472
Copies not distributed:	25
TOTAL:	28,497

I certify that the statements made by me above are correct and complete. LTC DAVID G. KIRKPATRICK, Editor, *Army RD&A Magazine*, 26 September 1984.

DEPARTMENT OF THE ARMY
Headquarters
U.S. Army Materiel Command
5001 Eisenhower Avenue
Alexandria, VA 22333

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DoD-314

SECOND CLASS MAIL

THE STRATEGIC DEFENSE INITIATIVE