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R&D LEADERSHIP... WHAT IT TAKES TO SUCCEED

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ARMY Research Development Acquisition RD&A BULLETIN

Professional Bulletin of the RD&A Community

FEATURES

DEPARTMENTS

COVER

The domain in which the Army R&D leader functions, and key behavioral and performance dimensions required for success in the world of Army R&D are examined in this issue of the bulletin. Cover designed by Joe Day, DOIM Graphics Section at HQ AMC.

LEADERSHIP DIMENSIONS FOR SUCCESS IN ARMY R&D

By MAJ Robert J. Bonometti

Introduction

The world's most technologically sophisticated Army has been built on a foundation of unsurpassed excellence in research and development, coupled with a technologically elite national industrial base. The U.S. Army has long espoused the principle of technology leveraging to maintain smaller forces which can rapidly respond to global crises, fight outnumbered, and win. This principle will assume ever greater significance and importance during the coming decade, as the Army transitions from a deployed force to a rapidly deployable force, and as the "threat of peace" in Europe engenders even tighter defense budgets. This article examines the leadership dimensions necessary for high success in Army research and development.

An examination of this issue is timely and of considerable importance for several reasons. First, the Army's role in national defense is evolving towards a CONUS based force which can meet the challenges of rapid deployment and global crisis responsiveness. The crisis in the Mideast and the U.S. response in Operation Desert Shield serve as an example par excellence of rapid deployment, halfway around the globe, under crisis conditions. This new strategic role for the Army requires a restructuring towards lighter, highly mobile forces which can nonetheless project the highest combat power in the world. The prospect of multi-hot spot scenarios and the challenges of the non-linear battlefield will demand levels of efficiency and efficaciousness which we have heretofore not seen. The Army's technical base will provide a major piece of the foundation for the realization of Airland Battle Future capabilities.

The second reason for the relevance of this examination is the impact of fairly recent world events and the climate they have created for the 1990s. The reduced budget environment facing us will necessitate doing more with less, in terms of personnel and equipment. Troop reductions imply an even greater emphasis on technology as a key force multiplier than we have seen in the past. The challenge is to increase the "tooth-to-tail" ratio by simultaneously strengthening the "teeth" while trimming the "tail."

Fewer defense dollars implies that there will actually be fewer new systems procured, so if we are to successfully leverage technologies in our favor, we must insure that what we decide to develop and procure is the absolute best. Furthermore, we must develop an unprecedented efficient and timely acquisition system to insure that new systems are not technologically obsolete by the time they reach the front-line forces.

A third major concern is the growing technological sophistication of other armies around the world, particularly those of third world nations. The prospect of facing highly sophisticated adversaries on future battlefields may erode our technology advantage unless we remain in the forefront of the world's military technologies.

Finally, recent reforms in the defense acquisition communities, and in particular the emergence of a new Army Acquisition Corps, motivates this timely assessment of leadership characteristics for successful Army research and development. Assistant Secretary of the Army (Research, Development, and Acquisition) Stephen K. Conver has stated that he is "firmly convinced that our materiel and weapon systems are only as good as the individuals responsible for developing them and that the Army Acquisition Corps will provide this critical resource. . . .The Acquisition Corps is one of the most important facets of improving Army acquisition, and [he regards] its realization as one of [his] top priorities."

The Army Acquisition Corps includes both military and civilian components; however, the present discussion will focus on the military side of the Corps (although most of the discussion can be applied to civilian leadership as well). As one officer who has recently selected this career path, the author is particularly interested in discerning traits for success and achievement in Army R&D.

Analytical Approaches

Many detailed studies of leadership have been conducted over the past several decades. The Army has been acutely interested in such studies, and indeed has contributed significantly to this field. Diversity in the approaches to the study of leadership has produced an ensemble of leadership definitions and theories, as well as a host of taxonomic systems for leader types, traits, and functions

Characterizations of Leadership [after Stogdill, 1974]

Definitions of Leadership	Theories of Leadership	Classifications of Leadership Traits
Focus of group processes	"Great Man"	Physical characteristics
Personality and its effects	Environmental	Social Background
Art of inducing compliance	Personal-Situational	Intelligence and Ability Intelligence Judgement, decisiveness Knowledge Fluency of Speech
Exercise of influence	Interaction-Expectation	Personality Adaptability Adjustment, normality Aggressiveness, assertive Alertness Ascendance, dominance Emotional balance Enthusiasm Extroversion Independence,nonconformity Objectivity Originality, creativity Personal ethics & integrity Resourcefulness Self-confidence Strength of conviction Stress tolerance
Behaviors and Acts	Humanistic	
A form of persuasion	Exchange Theory	
A power relation		
Instrument of goal achievement		Task-related Characteristics
An effect of interaction		Social characteristics
Differentiated role		
An initiation of structure		

Figure 1.

within organizations. Figure 1 illustrates this plethora of leadership characterizations.

Success as a leader in a given environment clearly depends to some extent on the characteristics (physical, social, cultural, intellectual, etc.) of that very environment in which the leader functions. It is equally apparent that leadership in general requires certain common fundamental attributes such as vision, integrity, self-confidence and competence. Nevertheless, leadership characteristics can be "fine-tuned" to optimize performance for a given class of situational environments. As a simple illustration, suppose we consider a three component model of leadership consisting of intellectual, physical, and moral attributes. Few would argue that the optimal mix of these components would differ between a football coach and a hi-tech laboratory director (see Figure 2). Just as mechanical structures and electrical circuits must be "matched" to achieve optimal power transfer, so also must a leader complement his or her environment for optimal performance.

The objective of this article is to examine the domain in which the Army R&D leader functions, and to elucidate the key dimensions of leadership which can "fine-tune" performance in this environment. It should be noted that this undertaking is not intended to be a study of personality traits nor an exchange theory analysis; rather, it is intended to be a first-order examination of key behavioral and performance dimensions for leadership in the world of Army R&D.

Leadership Dimensions

To ascertain the characteristics of the successful Army R&D manager in the coming decades, we must first investigate what is important for success in this field, and why it is important. Specification of the leadership traits themselves will then follow naturally from this foundation.

The single most important role of the Army R&D manager is that of integrator. It is the officer in uniform, responsible for the ultimate success or failure of an Army R&D venture, whose vision must broker the world of the technologist with the world of the soldier. The integrator must be technically fluent as well as militarily astute. He or she must understand the requirements of the front-line commanders and their soldiers, the current and evolving state of tactics and doctrine, and the needs of the Army's materiel support infrastructure. This myriad of military factors must be correlated with the current state-of-the-art in technology, as well as the latest developments and trends at the leading edge of science and research.

It is important to recognize that an Army R&D leader, serving as a major system program manager or program executive officer, will most likely not create or invent the solutions to most requirements. Nevertheless, technical competency is absolutely essential for a thorough understanding of technology issues and tradeoffs, and decision-making in the R&D world can only be intelligently and successfully performed by knowledgeable officers. Furthermore, R&D leaders require a solid technical foundation in order to make the correct investment decisions which will achieve significant return on investment for taxpayer equity as well as produce military systems which are second to none in the world.

An Army R&D manager must also be capable of performing in the role of an entrepreneur. In this capacity, an officer is given the exciting opportunity of defining and managing a future-oriented investment. Initiative and creative zeal are vital.

In most acquisition efforts, a well-defined requirement is articulated, and a solution is formulated by the Army's materiel acquisition community. This approach is sometimes referred to as "requirements pull" acquisition. But there is another mode in which the Army R&D manager must operate, particularly if he or she is managing basic research or early development programs. This mode is "technology push," in which a new technology is identified and implemented to enhance or improve current capabilities, or to make a quantum leap forward in the art of war. The basic research discoveries which facilitate such scientific breakthroughs are often serendipitous; however, the capacity to understand the new development and its implications for the defense sector, coupled with a spirit of entrepreneurial drive and initiative, are essential to capitalize on a new discovery as quickly as possible.

The ability to identify and manage the implementation of the latest breakthroughs in meaningfully significant timescales is a rare quality, but one that the Army R&D leader must possess to achieve the highest levels of success.

Closely associated with entrepreneurial spirit is the trait of "risk-taker." Akin to most all leadership types, the R&D manager must be capable of decisionmaking in an environment of incomplete and imprecise information; but the challenge in the R&D world is exacerbated as a result of the uncertainties inherent in this environment.

By its very nature, any R&D undertaking is an excursion into the unknown. Results are not certain, and they certainly are not guaranteed. A successful R&D manager must not be averse to risks, and must be capable of handling the stresses that are correlated with relatively high failure probabilities. Indeed, sometimes "failure" in an R&D venture is a valuable result, for it helps to define the ofttimes fuzzy boundary between the achievable and the impossible.

Of course, reckless risk-taking is unwise and unproductive, so the key here is the ability to accurately gauge the level of risk in a venture (a subjective probability assessment), to weigh that risk against the potential fruits of successful accomplishment (military utility for Army missions), and to judge the overall risk-return trade-off of the project vis-a-vis other investments which compete for the allocation of scarce resources (the program office budget!).

As international management consultant, Dr. Richard Lazar, has noted, "the real leader takes the risks that are necessary — by not encouraging a PLOD attitude (P = Play it safe; L = Look good; O = Obey the rules; D = Don't make mistakes). . . .They are role models of enthusiasm, ownership, joy, and are anxious to work long hours in the organization's drive toward victory."

Good leadership and management always rely on integrity as a cornerstone in their foundation. This precept applies just as strongly for program managers as it does for other civilian and military leaders in the Department of Defense. The Army R&D leader must exemplify the highest standards of honesty and integrity. Prior to his recent resignation, Under Secretary of Defense for Acquisition John A. Betti noted that "no one benefits from an unrealistic assessment of problems or risks. It may be 'macho' to be a 'can do' person, but when that attitude clouds good judgement, a question of integrity arises."

The R&D manager, akin to other leaders in the Army acquisition community, must honestly present and defend his programs in a realistic, balanced fashion, making every effort to avoid overselling. As defense budgets tighten, it will become all the more challenging to "sell" and "defend" one's program with objectivity and pristine integrity.

The Army R&D manager must also be a team-builder; able to mold diverse government and industry

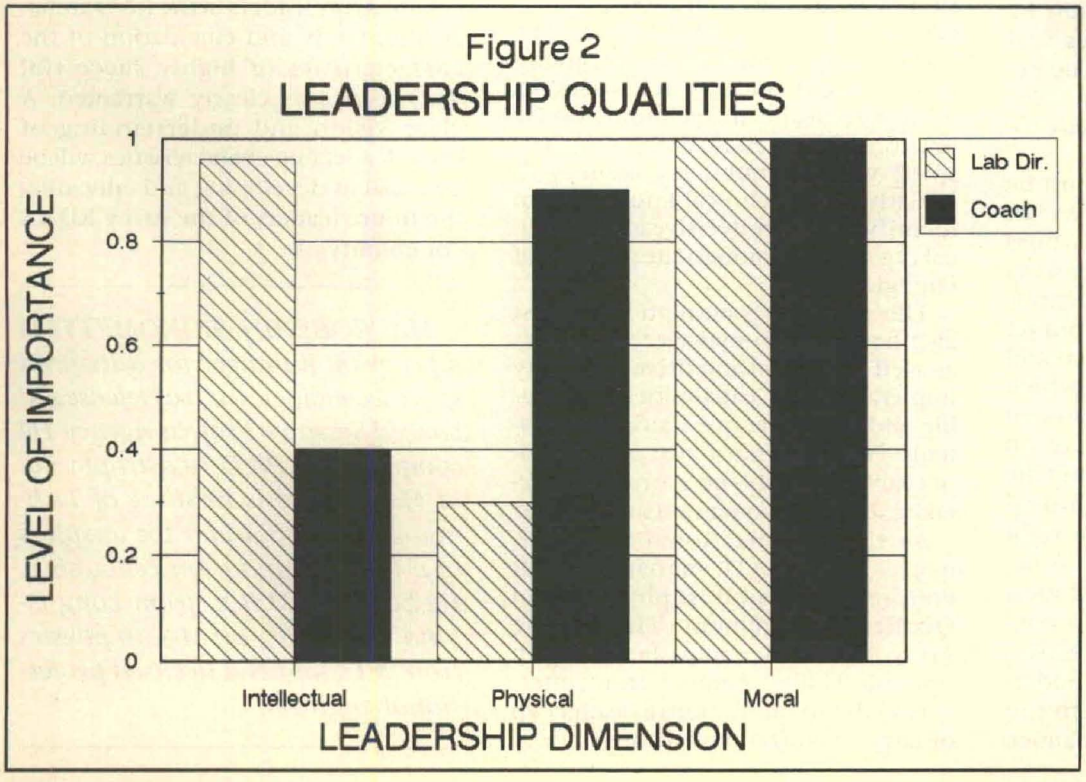

Figure 2.

elements into a cohesive and efficient partnership which can achieve the Army's objectives in a program. This is no small task, particularly given the disparate nature of the goals which motivate industry versus the military. The profit-oriented focus of industry is a cornerstone of our nation's concept of free enterprise and capitalism. However, the challenge for the Army R&D manager is to insure that fair contractual practices are followed which give the industry member of the team appropriate rewards for successful performance, while insuring that the ultimate purpose of the endeavor, which is to develop and deliver a warfighting system to the Army in the shortest possible time for the minimum cost, is achieved.

Managing an R&D enterprise requires leadership skills that span the spectrum from goal-oriented to people-oriented approaches. The Army R&D leader needs strong, mature organizational skills. Quite often, the R&D manager will face the challenging environment of leading resources that are derived from a "matrix" support framework. Such an environment clearly demands a mix of both goal- and people-oriented management styles.

The R&D manager must know how to marshall the requisite resources for his endeavor and motivate what may well be an ad hoc and temporary association of players. He or she must be able to deal with ambiguities and always keep the fundamental objectives of the enterprise clearly in view, despite the myriad details of day-to-day management.

A successful R&D manager must be strong in "people skills." As an example, consider the manager who is faced with resolving differences between various members or factions of his team. Typical points of conflict will often involve highly detailed and esoteric technical arguments, which frequently are laden with emotional overtones. The leader must rely on his or her technical judgement and the advice of trustworthy technical advisors in order to make the right decisions to achieve success. Nonetheless, the resolution of the technical or programmatic argument in a constructive (as opposed to destructive) fashion requires a leader who understands people and who is sensitive to resolving disputes in a positive manner.

Leaders are always expected to set and maintain high standards. Perhaps the best central framework for accomplishing this goal is the philosophy of Total Quality Management (TQM). TQM calls for continuous process and product improvement by attention and commitment to quality at all levels of the organization. The members of an R&D team are typically well-educated and self-motivated individuals, and TQM should flourish in an R&D organizational environment.

Dr. Victor H. Reis is the director of the Defense Advanced Research Projects Agency (DARPA), which is the central R&D organization in the Department of Defense. Dr. Reis has made a concerted commitment to infusing TQM throughout DARPA, noting that "it really pays off in improved performance and individual work satisfaction." Thus, a natural corollary of TQM is that it will simultaneously enhance the overall performance of the organization while admitting a participatory style of management that will ultimately be more rewarding for leaders and team members alike.

TQM is conceptually related to enlightened and humanistic theories of management and, as such, it is a management style which is ideally suited to the R&D manager's environment.

Summary

We can now summarize this discussion by citing the key leadership characteristics for Army R&D leaders. The R&D manager must be an integrator, able to meld military requirements with state-of-the-art technologies. He or she must possess an entrepreneurial spirit which combines vision with initiative and technical knowledge to identify militarily decisive technological capabilities amongst the plethora of emerging ideas.

The Army R&D entrepreneur must also have superb managerial abilities as well as the zeal and drive to rapidly implement new capabilities into viable and cost-effective battlefield systems. He or she must also possess impeccable integrity, be a prudent risk-taker, and function as a team-builder.

As the organizational standard-bearer, the R&D manager must epitomize the philosophy of Total Quality Management. Finally, the Army R&D leader must be strong in "people skills" ranging from interpersonal communications to leadership of large organizational teams.

Conclusion

The modern world demands that great captains of battle are supported by "great captains of technology." Warfare has always demanded great leadership on the battlefield, and this dominant theme in military history will remain inviolable in the foreseeable future. As warfare becomes progressively more sophisticated from a technological viewpoint, victory in battle will increasingly become more dependent on the technological capabilities of the combatant forces. This is not to say that technology alone will win battles, for it never will. However, the ultimate fate of an Army will rest on a solid technological foundation upon which well-trained and motivated troops can achieve victories under the leadership of our battlefield commanders.

The job of insuring that our Army is unsurpassed technologically belongs to the Army leadership in research, development, and acquisition. The Army's recent establishment of an Army Acquisition Corps has emphasized the importance of developing Army leaders in research, development, and acquisition to insure the preeminence of our technological capabilities in the coming decades.

This article highlights the leadership dimensions which characterize successful Army leaders in the R&D arena. Further study and elucidation of the characteristics of highly successful R&D leaders is clearly warranted. A clear vision and understanding of these leadership characteristics will be essential in developing and educating the future leaders of the Army RD&A community.

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By Chuck Wullenjohn

DESERT TESTING AT YUMA PROVING GROUND

"In testing military equipment at Yuma Proving Ground, we've encountered nearly every problem that might be experienced in Saudi Arabia. We've developed maintenance procedures and identified problem areas for correction. I have complete confidence in the high quality of our equipment in the Middle East."

So says COL Robert M. Baker, commander of U.S. Army Yuma Proving Ground, the Army's desert test center and one of only two general purpose proving grounds in the Department of Defense. Located in the heart of Southwest Arizona's blistering Gonoran Desert, the installation offers a parched, acid environment closely resembling that of the Middle East.

An exceptionally wide variety of military equipment is tested at Yuma Proving Ground (YPG), including aircraft armament, air cargo delivery systems, artillery/tank munitions and weapons, and tracked and wheeled vehicles of all shapes, sizes and types. The proving ground's longest running mission — harsh desert environmental testing — began in 1943 during World War II.

As a research and development facility, YPG normally tests prototype military equipment early in the development cycle to identify and fix problems before the equipment is fielded. Though individual developers make the physical modifications to the equipment, it is the extensive testing performed at YPG that pinpoints specific faults and, oftentimes, remedies.

A large variety of highly sophisticated — and expensive — equipment is maintained at YPG to gather as much test information as possible. This includes radar trackers capable of following the flight of munitions and rockets through the air and computers that perform 15 million computations per second — as the test takes place. High speed cameras shoot up to 20,000 frames of film per second and miles of fiber optic cable link remote test sites with controllers at monitoring facilities to provide all sorts of detailed information.

Though desert testing is only one of several YPG missions, environmental testing is a critical part of the research and development process. Thoroughly analyzing the performance of military equipment in its natural environment is necessary to ensure proper operation wherever it must fight. Artificial simulation methods, while useful at certain times, cannot substitute for the real thing.

"Though we can heat or cool ammunition and weapons systems in chambers, that doesn't take into account the synergistic effect of sand, dust, and solar radiation experienced in an actual desert," said YPG Technical Director William Vomocil. "If you really want to find out what happens to equipment in the desert, you need to test it there."

The most feared problems encountered in the desert result from high temperatures and swirling clouds of abrasive sand and dust. "Elevated temperatures seem to effect nearly everything," remarked Vomocil.

High heat literally "fries" electronic components, making them inoperable. Abrasive dust and sand works its way through seals and filters into moving parts to cause accelerated wear. Optical systems become dusty — making them difficult to see through. Liquids tend to evaporate faster and, in a long term storage environment, ultraviolet radiation from sunlight alters the chemical properties of nylons, rubbers and plastics.

Of course, the desert offers its share of advantages to partially offset its

A ground launched 5-inch rocket is fired into a carefully designated impact area many miles away.

drawbacks. Desert weather is marked by sunny skies throughout the year, with few rainstorms. Soldiers operating in a desert environment rarely have to fight one of their most ancient foes — mud.

The pristine air of the desert also provides a military edge. "Dust storms occasionally blow up to obscure the sky, but most of the time the desert air is crystal-clear," said Vomocil. "This means you can spot targets a long way off. Vehicle signatures also show up very prominently, partly because of the clean air but also because there is very little ground clutter."

"Low air density can also be advantageous," he said. "Because of lowered air resistance, artillery projectiles usually fly a bit further than they would elsewhere."

YPG human factors engineer Tom Sargent says, though the desert is a harsh environment, the human body can easily adapt to it — given time. "You shouldn't fight the desert," he said, "for if you do you'll probably end up losing."

"You just learn to live with it. Wear loose clothes, drink plenty of water, and take the time to acclimate to it. It takes three or four weeks to learn to roll with the punches and cope with what the desert dishes out."

While humans usually have the luxury of acclimating to desert conditions over a period of time, military hardware is expected to operate properly from the instant it hits the ground. YPG test engineers have devised tests to ensure that military equipment is fully capable of doing just that.

Desert environmental testing is divided into three primary phases: performance, mobility, and durability.

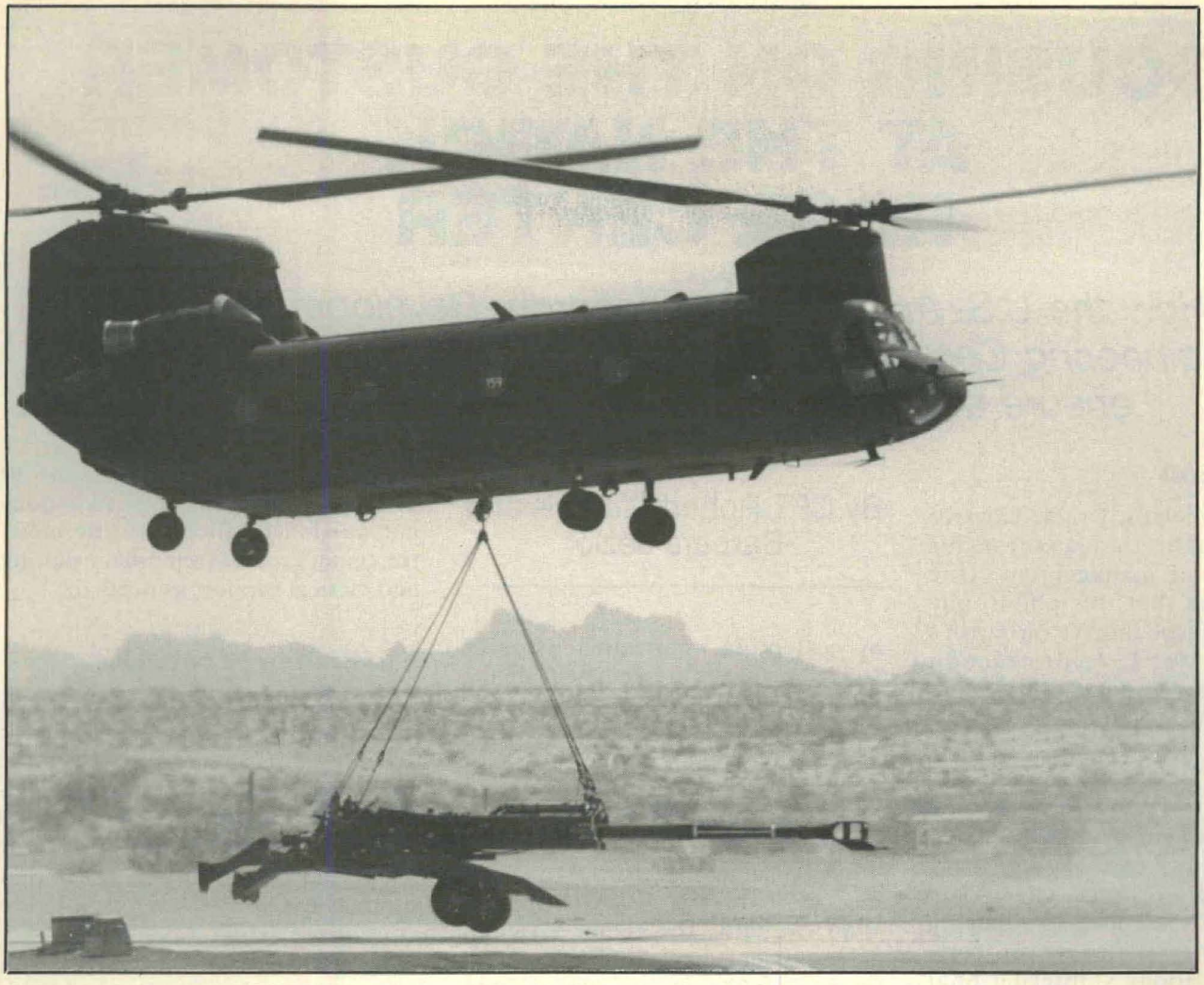
Performance testing is conducted prior to the start of extended desert operations to establish baseline parameters such as acceleration, tractive effort, fuel consumption, and much more. These tests are repeated periodically throughout YPG test cycles to measure deterioration in performance characteristics caused by desert operational wear and tear.

Army vehicles must be capable of successfully operating in a wide range of climatic conditions. YPG evaluates the full load cooling performance of a variety of vehicles each summer to determine how well engines stand up in hot temperatures while operating to their maximum ability. The operating temperatures of engines, transmissions, differentials, and other components are carefully monitored during these tests. Components which fail are upgraded — as many times as necessary — until they meet stringent cooling requirements.

Mobility testing evaluates the ability of vehicles to move and competently perform missions over the variety of surface conditions found in the world's deserts. Test vehicle mobility is evaluated on everything from desert pavement through powdery sand dunes and formidable mountains. The YPG Middle East Cross Country Course is a 22-mile loop through a particularly challenging piece of desert terrain which matches all the primary ground features of the Middle East.

The desert durability phase requires vehicles to operate hundreds — sometimes even thousands — of miles over courses carefully layed out through the sand, gravel and knife-sharp rocks of the desert. Durability test cycles are designed to simulate actual field conditions. A series of missions are performed at an accelerated rate using scenarios which include firing weapons both day and night. This test phase yields important reliability and durability data and provides the time and variety of conditions needed to fully evaluate the man-machine interface (known as MANPRINT) to identify human factors-related problems occurring in desert operations.

The experimental lightweight 155mm Howitzer (on the right) undergoing tests for the Marine Corps alongside the currently fielded M198 155 Howitzer.



All Army air cargo delivery testing takes place at YPG. Here a CH-47 Chinook lifts a sling load of cargo.

YPG test engineer Dave Horn has spent many hours over the past few years thoroughly testing the M-1 Abrams tank — the mainstay of America's modern armored force. Recently, Horn spent 10 days amidst swirling clouds of powdery dust at the proving ground's dust course, testing air filters destined for use on M-ls in the Middle East.

The M-1 tank has a turbine engine, enabling it to maneuver on any battlefield with great agility and at high speeds. The engine requires prodigious quantities of air, however, and without it will slow down and eventually cease operation. The M-1 draws about eight times the air of the diesel-powered M-60 tank it replaces. Because of its voracious appetite for air, the M-1's filters have assumed a position of critical importance. "The filters cost about $200 apiece and each M-1 requires three," said Horn. "Here at YPG we've tested the filters in extreme dust conditions — worse than anything they would probably encounter in the field — to see how they hold up and evaluate methods of cleaning them in the field."

"I think the M-l has proven to be an excellent tank," he stated.

"When taken as an entire system, the M-1 is far superior to anything that could be thrown against it."

YPG Tank-Automotive Division Chief Graham Stullenbarger agrees with Horn and feels the M-1 owes its excellent credentials partly to YPG testing.

"When the M-1 first came out as a prototype vehicle it was very susceptible to the problems of the desert," he mused. "An extensive test effort was mounted since that time and it has paid big dividends. The M-l is now extremely reliable and it operates very successfully in desert environments. It's a great system."

The Army and the other branches of America's military face the challenge of operating in nearly any climate on the face of the globe. For this reason, desert, cold weather and other types of environmental testing are absolutely necessary to ensure equipment reliability. Information gathered from challenging tests ensures the proper design of military hardware and identifies required maintenance procedures incorporated in technical manuals for use by soldiers in the field.

This commitment to rigorous testing, though time consuming and often expensive, certifies America's solemn commitment of military excellence to its soldiers, its citizens, and its friends around the world.

CHUCK WULLENJOHN is chief of the Public Affairs Office, U.S. Army Yuma Proving Ground. An Army public affairs specialist for seven years, he frequently contributes to defense publications.

FOCUSING ON THE CUSTOMER AT THE NATICK RD&E CENTER

How the U.S. Army Natick Research, Development and Engineering Center uses the customer feedback process to ensure a quality product and a satisfied soldier

By CPT Robert D. Davis and Barbara Jezior

Introduction

In the late 1940s, Dr. W. Edwards Deming taught the Japanese his philosophy of management. One might assume that this philosophy had a significant impact on Japan's post-World War II reconstruction and was instrumental in making them the global economic power they are today.

Currently, Dr. Deming and his adherents are trying to effect the same change in the United States by revolutionizing the way American businesses think. His philosophy stresses the importance of adopting total quality management (TQM) to remain competitive in today's international marketplace. A cornerstone of this management philosophy is the total organizational commitment to customer satisfaction, an integral component of which is the customer feedback process.

At the U.S. Army Natick Research, Development and Engineering Center in Natick, MA, the Operational Forces Interface Group (OFIG) ensures that the customer feedback process is integrated into the center's TQM process.

Typically, producers view their processes in three phases: design the product, make the product, and try to sell the product. However, Natick has implemented a different approach, which consists of a four step cycle: design the product; make the product and test it on the production line, in the laboratory, and on a small scale externally; field the product on the market; and test the product in service using market research. The OFIG plays a vital role in Steps 1, 2, and 4, by collecting important customer feedback that is immediately incorporated into product design and product improvement. This ensures that the consumer of the product has input to the center's production process and can influence the design of the item of which he will ultimately be the user.

OFIG, Natick's user product assessment program, was created in October 1985. Initially, the center assigned an equipment specialist and an infantry officer from its operations research staff and a human factors psychologist and two technicians from its behavioral sciences staff to the team. This mix provided a blend of research and product expertise, plus a military member to facilitate access to the military user.

Program personnel also had immediate access to project officers and additional assistance as required from a staff statistician. The number of personnel grew as the program expanded. Currently, the group consists of 10 civilian employees and two non-commissioned officers. Furthermore, the center provides temporary staffing and clerical support as needed.

When a customer has a problem with a product, OFIG can determine if it is just an isolated occurrence.

Facilitating Feedback

OFIG takes four distinct approaches in facilitating the customer feedback process. One effort entails surveys on a fielded product after type classification to determine user satisfaction. These surveys are important when considering the next generation product and how to improve it to the consumer's liking.

Second, OFIG evaluates a new item prior to type classification and fielding. By letting the customer use a prototype, Natick hopes to gather information to refine product design and tailor it to the user's needs prior to the item's formal testing, mass production, and fielding.

The third area is technical briefings and displays at major Army commands and professional conferences. In this arena, OFIG presents products under development to a broad audience of users and non-users to gain feedback on these items and obtain ideas for new items. Finally, OFIG has a 24-hour information hotline that provides users worldwide the opportunity to call the center and ask questions about products or suggest improvements.

Surveys

OFIG surveys soldiers, the principal users of Natick-produced items, worldwide. The surveys, which are developed via a standard system, include

both questionnaires and interviews. Initially, the team selects units that are appropriate for surveying based on the U.S. Army Long Range Training Calendar. This selection occurs one year prior to the training exercise. Once the units have been identified, Natick submits requests to survey the units to the appropriate Army headquarters for approval. If re-selection is not required, the units are notified six months in advance.

Prior to formulating a survey for any particular unit, OFIG determines the type of equipment the unit is using. The respective product directorates are informed of the survey opportunity and are asked what items they would like surveyed and what their areas of interest are for any particular item. OFIG then consults the respective Natick project officers for the items selected for survey, because these individuals are the best source of information concerning the development of the products.

The project officers' input is vital to the formulation of the questions asked, since the user's response must be understandable to the producer for him to properly evaluate and effect the suggested changes to the item. Furthermore, Natick informs other research, development, and engineering centers of the products to be surveyed and solicits questions from their project officers as well. Finally, all of this input is integrated with any other human factors design issues of concern. In short, this survey is the product of a very comprehensive process that OFIG employs as the standard system to formulate questionnaires and interviews.

OFIG schedules five to eight trips a year to units that have just returned from major training exercises in a variety of environments, including the desert, the jungle, or the arctic. The spectrum of units surveyed encompasses a cross section of major Army missions, (eg. light, heavy, airborne), and a variety of commands, (eg. divisions, separate brigades, Ranger battalions), that have used the equipment while deployed to a location that is similar to their operational scenario.

OFIG surveys both combat and combat support units on the performance of Natick products at the National Training Center, Northern Warfare Training Center, Jungle Operations Training Center, and local training areas. Furthermore, surveys are also conducted after joint training exercises such as REFORGER, BRIGHT STAR, BRIMFROST, and TEAM SPIRIT. Between 250 and 400 soldiers are surveyed on each occasion. Since 1985, OFIG has surveyed more than 8,000 soldiers, which has provided Natick with many new ideas, product improvements, and a substantial data base.

In addition to specific product information, systematic surveys provide the center with other benefits. One is a quantified data base that provides a frame of reference for complaints. When a customer has a problem with a product, OFIG can determine if it is just an isolated occurrence. Several complaints can generate the inclusion of the item on a survey to determine the extent and nature of the problem. Systematic surveys also allow OFIG to determine particular problems with a product.

Initially, broad questions concerning the item will be addressed. This permits problem areas to surface, albeit not in detail. On subsequent surveys the questions are then fine-tuned to bring specific issues to the forefront. These issues usually include a variety of suggested field solutions that are evaluated and implemented when appropriate. Finally, OFIG uses the questionnaires and interviews to provide a clearer profile of the user. The surveys address the soldiers' mission requirements, garrison and field life, hygiene, and feeding habits.

A Classic Example

Surveys result in a lot of information being gathered on product performance and user satisfaction. When this information indicates a problem with an item, Natick tries to improve the product. The deficiency that has been identified needs to be corrected to ensure user satisfaction with product performance. A classic example of how this process is accomplished is the entrenching tool.

In 1988, soldiers returning from Honduras were surveyed and the OFIG team discovered that a large number of entrenching tools were broken. This

By identifying a problem early in a prototype's development, the materiel developers can alter the item prior to its operational test. This streamlines the testing and evaluation process in an age of budget constraints.

problem was presented to the project officer responsible for the entrenching tool. He evaluated the information and identified the technical reasons for the problem. The breakage was determined to be an acutual deficiency in the entrenching tool, not the result of misuse. The blade hinge was weak and caused the shovel to break when used in hard, rocky soil. The project officer developed a stronger blade hinge that did not significantly increase the cost of the item and could be applied to existing entrenching tools currently fielded.

Other examples of items that were improved through this process were: the Meal, Ready-to-Eat; the Equipment Belt; the All-Purpose, Lightweight, Individual Carrying Equipment Waist Strap Adjusting Buckle; Camouflage Face Paint; the Personnel Armor System for Ground Troops (PASGT) Helmet; the Hot Weather BattleDress Uniform; and the Arctic Canteen.

In short, OFIG tries to identify all aspects that directly or indirectly influence the user's acceptance of a Natick product. This canvassing is critical in determining improvements to be considered in the design of the next generation of that item and creating the best product possible. Natick's desire to maximize customer satisfaction of a product emphasizes the center's focus on TQM.

Evaluations of New Items

OFIG has conducted user evaluations of more than 40 developmental or modified items since early 1987. These user evaluations differ from the U.S. Army Test and Evaluation Command's operational tests in that they are an informal means for identifying operational problems with a product early on. By identifying a problem early in a prototype's development, the materiel developers can alter the item prior to its operational test. This streamlines the testing and evaluation process in an age of budget constraints.

OFIG employs a variety of evaluation procedures depending on the scope of the field test. The simplest method is to deliver a prototype item to a user for a predetermined time period. Usually there are only a few items available for evaluation. However, at this early stage, the primary goal is to identify gross defects in design or function.

After initial necessary modifications are made, more comprehensive follow-on evaluations are conducted on the improved prototype. This type of evaluation is low cost, since this method of prototype testing is usually "piggybacked" onto an ongoing evaluation or survey effort. It also reduces the amount of money spent on the production of large numbers of a conceptual item for operational testing prior to gaining user input.

Such an evaluation was conducted on a prototype Combat Vehicle Crewman's Equipment Bag. OFIG delivered the one existing bag to members of an armored cavalry unit in the Federal Republic of Germany while on a survey trip and retrieved it 90 days later while on another evaluation. The team interviewed the five personnel that had used the bag on a number of field exercises and sent their comments to the project officer. The soldiers found the bag acceptable for their mission and felt that it created more space by consolidating gear. However, the bag did not have enough compartments. The soldiers required immediate access to some items, and that feature was not included in the prototype's design. This informal evaluation allowed the user's requirements to be incorporated early into the design of a second prototype. Furthermore, this evaluation yielded pertinent information that would not have surfaced in laboratory testing.

Overall, the informal evaluation of new items helps Natick to eliminate user dissatisfaction and ensure product acceptance. This emphasis on a satisfied customer and a quality product supports the Army's initiative on TQM.

The opposite extreme of the informal evaluation spectrum can best be illustrated by a recent glove evaluation in support of the Army's quest for a warm/dry glove for a moderately cold climate. The evaluation was conducted at three installations in the United States and one in the Federal Repulic of Germany. The effort involved a total of 1,400 soldiers.

Initially, the soldiers were divided into control and experimental groups, carefully fitted with the gloves, and instructed on test protocol. After 90 days, data were collected on over 20 variables. Although efforts to determine required improvements for this glove were more costly than for the equipment bag, it was not as costly — in terms of both dollars and time — as submitting an inadequate glove for formal operational testing.

The majority of the field tests fall within the two illustrated extremes of the spectrum. The most common scenario is to have a product evaluated at one site employing 30 to 60 users in both control and experimental groups. Additionally, OFIG tries to save money and manpower by overlapping or "piggybacking" these user evaluations.

By having test efforts coordinated through one office instead of each project officer operating independently, fewer dollars are spent on travel and testing and less manhours are dedicated to coordinating and evaluating. Overall, the informal evaluation of new items helps Natick to eliminate user dissatisfaction and ensure product acceptance. This emphasis on a satisfied customer and a quality product supports the Army's initiative on TQM.

Technical Briefings and Displays

Another Natick endeavor to facilitate the feedback process is to give users a formal, comprehensive briefing and demonstration of the Natick product line. This familiarizes customers with the center's items that are already type classified or currently under development. Additionally, these briefings and demonstrations provide the user access to the developer and allow

for an exchange of information on already fielded products, as well as those not yet in the inventory. These displays are presented to the command and staff of visited installations, military and civilian audiences at professional conferences, and students at numerous military schools and senior leadership courses.

The briefings and demonstrations to the command and staff — inclusive of all levels from company to division — elicit important feedback on the performance of fielded Natick products. The military leadership is extremely interested in soldier support items (Natick's primary product orientation), and is an important source of information and suggestions. Furthermore, their commitment and support facilitate future surveys and evaluations.

OFIG interfaces with military and civilian audiences at professional conferences and trade fairs worldwide. This interface accesses a broad interest and experience base that provides Natick with many suggestions for product improvement and concepts for new product development. The diversity and collective background of the audience provides for many new and innovative ideas and designs. These new approaches complement information gathered from other users and allow for a better overall product development process.

Students at the numerous military schools and senior leadership courses are also primary audiences for the center's product awareness and consumer feedback efforts. OFIG briefs and solicits responses from general and senior field grade officers and command and sergeants major several times annually. This heightens the senior military leadership's awareness of efforts in the soldier support arena and how they can affect changes to the products that are developed. These efforts at increasing product awareness and gathering diversified customer feedback are important in reinforcing the center's focus on TQM. They are both essential for developing quality products and ensuring satisfied customers.

24-Hour Information Hotline

The fourth major initiative that OFIG utilizes to facilitate customer satisfaction and product quality is the Natick User Hotline. This telephone hotline is advertised in OFIG briefings, military publications, and poster displays at installations worldwide. The hotline provides the user an opportunity to access the center at any time with either questions or suggestions on soldier support items. The hotline numbers are DSN: 256-5341 or Commercial: (508) 651-5341.

Materiel developers in today's research and development environment need to focus on the customer. Items developed for a military user need to meet operational requirements and the customer's needs.

On average, five calls per week are fielded by OFIG and forwarded to either the appropriate project officer or answered immediately by the team. This interface is vital, because it facilitates the communication process between the user and the developer when a timely response is critical in ensuring user understanding and satisfaction.

Conclusion

Materiel developers in today's research and development environment need to focus on the customer. Items developed for a military user need to meet operational requirements and the customer's needs. Since the consumer will not use something he is dissatisfied with, it is critical to field products that are also acceptable to the user.

It is too expensive to field an item that meets operational requirements, but that the soldier will not use. By soliciting input from the user early on, this kind of waste can be avoided. This emphasis on product quality and user satisfaction is the heart of TQM and is greatly aided by the use of an effective and efficient customer feedback process.

At the U.S. Army Natick Research, Development and Engineering Center, the Operational Forces Interface Group reinforces the Army's focus on total quality management by ensuring that soldiers worldwide can voice concerns and suggestions about Natick products in a timely, cost-saving manner. This increases customer satisfaction and ensures product quality.

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EXPO SHOWCASES TECHNOLOGY AS DETERRENCE

By Dave Davison

During a time in which the threat to the security of both our nation and the world has shifted but not lessened, and the need for meeting that threat with fewer resources has become a mandate, the development of superior technology on which to build a better, more effective Army has emerged as a major deterrent to that threat.

With this in mind, planners chose "Technology as Deterrence" as the theme for the Army Materiel Command's 1990 Technology Expo held Oct. 1-4 at Aberdeen Proving Ground, MD.

AMC's Office of the Deputy Chief of Staff for Technology Planning and Management, which was responsible for the planning and execution of the exposition, envisioned several purposes for the Technology Expo.

They wanted to promote an understanding of the role and importance of the Army tech base in the defense community; provide a forum to share technical information among groups in the private and public sectors; and provide an opportunity for decision makers and the public to become acquainted with the contributions made by the scientists, engineers and other employees of AMC's laboratories and research, development and engineering (RDE) centers.

Long months of planning and hard work by hundreds of laboratory and RDE center employees were rewarded when, welcomed by nearly perfect weather, more than 2,000 people from all levels of the Army, Department of Defense, Congress, the Army Science Board, industry and the news media passed through the four-day exposition. Visitors to the Expo received a first-hand and first-class look at the technologies being developed for both today's and tomorrow's battlefields.

The Expo offered more than 140 exhibits and demonstrations, manned by scientists and engineers from the labs and RDE centers. Although the exhibits represented only a small part of the research and advanced technology currently being pursued by AMC laboratories and RDE centers, they presented the broadest overview of the Army's technology base program ever mounted.

The scope of the Expo was so large that visitors wishing to see all the exhibits would have had to attend the entire four days.

Exhibits were grouped into 10 functional areas related to satisfying future battlefield needs outlined in Army modernization plans. The functional areas were Command, Control and Communications; Armored Systems; Light Forces; Fire Support; Mine Warfare; Armor/Anti-Armor; Intelligence and Electronic Warfare; Aviation; Soldier Support; and Air Defense. There were additional exhibits to show new developments in the areas of Robotics and Advanced Electronics.

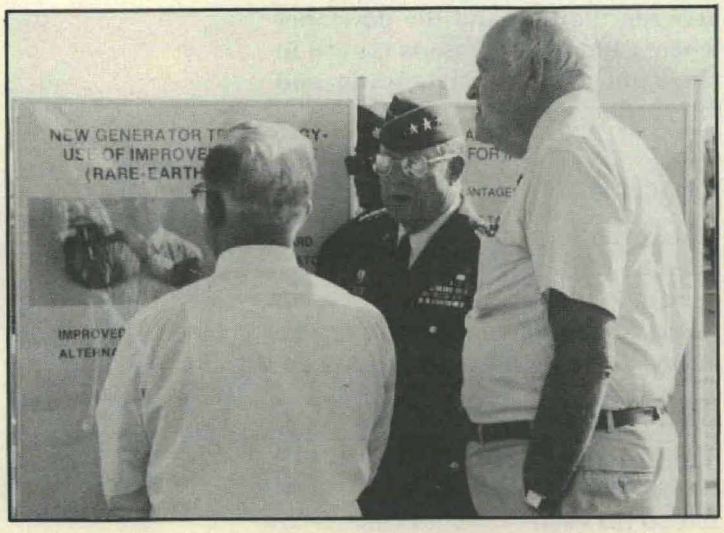
This approach permitted visitors to see exhibits in the functional areas in which they were most interested while drawing attention to the cooperative efforts of labs, RDE centers, industry and academia in individual technology areas.

Exhibits that dealt with a specific technology area were grouped together as a common display. One example was the Component Advanced Technology Test Bed (CATTB), the centerpiece of the Armor exhibit area. Hosted by the U.S. Army Tank-Automotive Command (TACOM), the display combined various aspects of armored vehicle technology being pursued in a cooperative effort by AMC labs, RDE centers, and industry for future heavy armored systems.

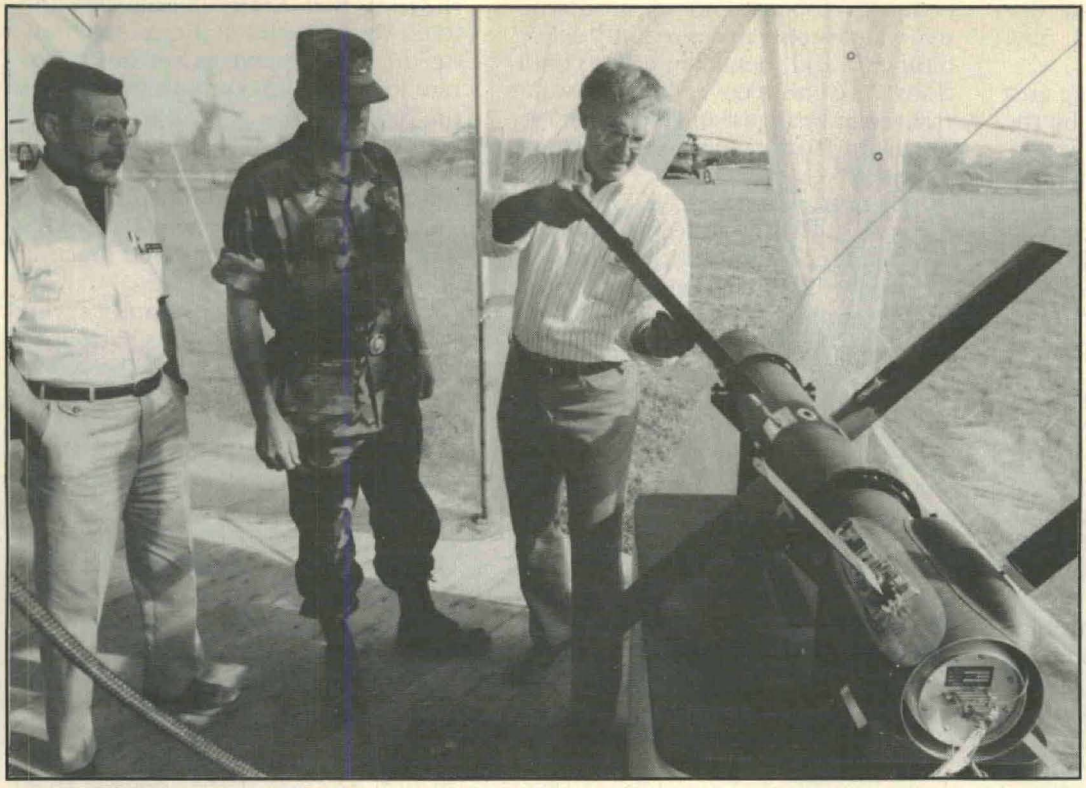
Here, visitors could see new developments in armor, ballistics, propulsion, materials, suspension and other related technologies, all aimed at making the next generation of heavy armored vehicles more lethal, survivable, maintainable and cost-efficient.

A major feature of this display was the Armament RDE Center's Advanced Tank Cannon System. It consists of the XM291 gun, a solid propellant tank cannon with a changeable tube which enables it to fire both 120mm and 140mm ammunition, and its companion, the XM91 Autoloader, which features automatic loading, downloading and rearming functions.

TACOM exhibited models of advanced propulsion systems being considered for development for the next generation main battle tank and other armored vehicles in the 50-70 ton range. One is a 12-cylinder, diesel-powered engine, the other a gas turbine powered system. Both approaches are being pursued by TACOM with goals of attaining significant reductions in size, fuel consumption and life



LTG Billy M. Thomas, deputy CG for RD&A, HQ AMC, discusses one of the exhibits at Tech Expo 90 with exhibitors.



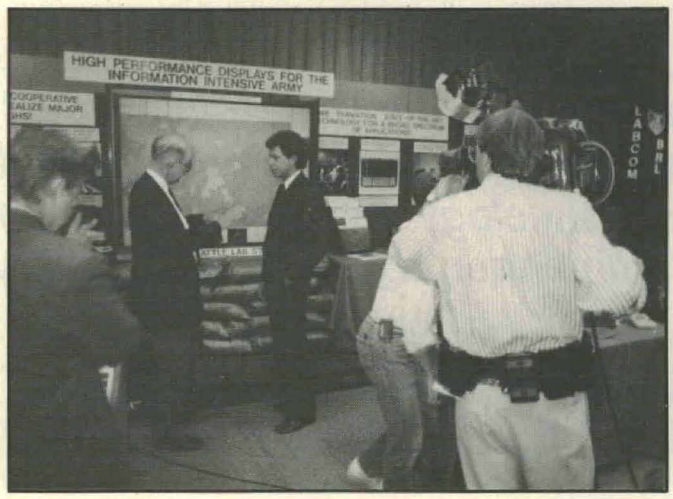
BG Richard W. Wharton, assistant deputy director for tactical warfare programs, DOD (center), and Bruce Fonoroff, director, Technology Planning and Management Directorate, listen to an exhibitor explain the Fiber Optic Guided-Missile.

cycle costs over current propulsionsystems.

The Multi-Sensor Target Acquisition System (MTAS) was exhibited by the Communications-Electronics Command. MTAS is an all-weather, obscurant-proof radar capable of detecting and classifying moving and stationary targets.

At the Robotics area nearby, the Human Engineering Laboratory demonstrated its huge Field Materiel-Handling Robot Technology (FMR-T), integrated with the Palletized Loading System (PLS) logistic vehicle, as it swiftly moved pallets from one truck bed to another. A cooperative effort with industry, the FMR-T is the first robotic device of its kind in the world and represents the application of successful industrial innovations in material handling to the Army field environment.

Other exhibits included the Robotic Drive Control Package, a microprocessor-based system which transforms standard vehicles into robotic vehicles by controlling the steering, throttle, brake, transmission and transfer case; and the Automatic Target Acquisition System, designed for ground-based robotic platforms, as part of an unmanned anti-tank weapon system for use in contaminated, mined or otherwise life-threatening areas.



A crew from the ABC-TV program "Good Morning America" was among news media. Being interviewed (at left) is Dr. C. G. Thornton, director of the ETDL.

One exhibit offered visitors the opportunity to actually drive by remote control HEL's robotic demonstrator vehicle, the "Roadrunner." One of the most popular exhibits was a robotic mannequin named "Manny" provided by the Test and Evaluation Command and designed to test protective clothing that soldiers will wear while in hazardous environments. Equipped with a voice synthesizer, Manny told visitors about his unique capabilities while demonstrating them. Manny's testing capability is a candidate for cooperative research and development efforts with industry involving clothing for use in hazardous environ-

ments ranging from toxic waste disposal to fire-fighting and law enforcement.

New concepts in the emerging area of biotechnology were shown by the Natick RDE Center. One was the cloning of spider silk to provide a natural fiber that may be used to increase the ballistic protection of helmets and vests. Another was camouflage pigments with chameleon-like properties that may be integrated into uniforms to give a soldier the ability to blend into his environment.

A prototype leg brace, stiffer and lighter than steel braces, was exhibited by the Materials Technology Laboratory. Developed with materials technology spun-off from the Strategic Defense Initiative, the brace offers strong potential for applications in civilian medicine.

The Expo also featured examples of technologies under development to meet the unique challenges of operating in harsh conditions such as those encountered in Operation Desert Shield.

The Belvoir RDE Center exhibited the On-Board Water Recovery Unit being developed to provide an alternative water supply in desert and nuclear, biological and chemical warfare conditions. The unit recovers potable water from engine exhaust and is designed for use on the High Mobility Multi-Purpose Wheeled Vehicle.

The center also displayed its Microclimate Cooling System intended to provide cooled air for crew members in armored vehicles when operating in environments where they must wear Mission-Oriented Protective Posture gear.

Ion implantation surface modification, a new protective method to extend the useful service life of tools and components in harsh environments was exhibited by the Materials Technology Laboratory.

Also displayed were the Longbow and the Shoot-Through-Obscuration Multiple Integrated Laser Engagement System. They are new target acquisition systems under development for use in adverse weather and environmental conditions which can "see" through obscurants.

For those who attended, the Tech Expo clearly fulfilled its purpose of showing that Army laboratories and RDE centers are developing the technology needed to serve as a strong deterrent to hostile forces, both now and in the future.

MG Jerry C. Harrison, DCS for Technology Planning and Management, HQ, AMC and LABCOM commander, summed it up succinctly while thanking Expo workers who gathered together at the end of the Expo's final day. He opened his remarks by simply saying "We did it." Organizations participating in the Expo included the Armament, Munitions and Chemical Command, Aviation Systems Command, Communications-Electronics Command, Test and Evaluation Command, Troop Support Command, AMC Field Assistance in Science and Technology Office, Project Manager for Ammunition Logistics and the Medical Research and Development Command.

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Excerpts of Remarks Delivered at AMC 1990 Tech Expo By MG Jerry C. Harrison, AMC Deputy Chief of Staff for Technology Planning and Management and Commander, U.S. Army Laboratory Command

Some of you may wonder about the worth of an exposition such as this, particularly at a time when U.S. forces are deployed overseas and the potential for armed conflict is great. Well, I want you to understand that this event in not merely a celebration of technology. The AMC Tech Expo has very clear purposes and immense benefit to the defense establishment.

- First of all, it provides an opportunity to assemble, in one place, examples of the latest technology being developed within AMC's laboratories and research, development and engineering centers. This is important, not only because it promotes an understanding of the role and importance of the Army tech base within and among the defense community, but also because it allows military users and technologists from all fields to meet in a dynamic atmosphere to discuss and actually visualize how advanced technology could be applied to solving real battlefield problems or creating new battlefield capabilities.
- Second, the Tech Expo is a very effective mechanism for sharing technical information about on-going programs among diverse groups, both in the private and public sectors. You know, technology transfer isn't something that just happens — you have to work at it. If we can avoid overlap or duplication within the science and technology community, if we can exploit and leverage the accomplishments of others, if we can achieve closer coordination or perhaps even create cooperative projects as a result of the Tech Expo — and I believe we can do all three of these things — then the Tech Expo has been an outstanding success.

Finally, let me suggest that during these times of dramatic changes in world events and in the defense establishment itself, it is important for decision makers and the general public to understand the contributions being made every day by government employees, military and civilian, working in government laboratories, performing unique and important government functions. There has been quite a controversy about the health of the government laboratories, and you will undoubtedly be hearing more about possible reorganizations and other cost-saving measures in the days to come. Well, I don't want to leave any doubt in anyone's mind that the AMC laboratories and the research, development and engineering centers are comparable to the finest research and development organizations anywhere in the world and that they have been extraordinarily successful in serving the Army and the Nation.

THE COMPONENT ADVANCED TECHNOLOGY TEST BED

By Gene Baker

Introduction

In FY87, a group of Army Materiel Command (AMC) technologists met to decide how to best develop and demonstrate their components. Technology was emerging, but its growth needed to be coordinated to ensure successful transfer to end-item application.

The user community was also developing its needs and requirements that must be met by hardware. In particular, they were developing requirements for the Heavy Forces Modernization Program (now Armored Systems Modernization [ASM]). The group's solution to the problem came in the form of an integrated test bed that would take the best of government's technology, integrate it into a vehicle system and then demonstrate its performance in a field environment. This test-bed program has been named the Component Advanced Technology Test Bed or CATTB.

The ATTD Process

The CATTB program uses the Advanced Technology Transition Demonstrator (ATTD) process. In this process (Figure 1), industry supplies component ideas to AMC'S labs and centers where further research and development is conducted. If a technology proves promising, it is offered up for a technology demonstration. Other critical input to the demonstrator comes from the user community. They specify requirements or state needs that they would like to see demonstrated. Program management for the demonstrator then tries to match new technology with user requirements to create a productive demonstration.

During the preparation for and at the completion of this demonstration, three critical pieces of information are fed back into the system. First, technology transfer occurs with industry as they receive information about the form, fit, and function of the emerging technology. Second, AMC labs and centers receive performance data on these technologies for the development of specifications and further technical work. Finally, the user receives hardware solutions to some of his operational problems early in the acquisition process.

Since the CATTB program is closely allied with the ASM effort, it has as a second goal the reduction of technical risk for the ASM program.

Goals

As mentioned above, the CATTB is an ATTD. It is one of the first major demonstrator efforts to follow the ATTD philosophy. Specific program goals are as follows:

- The first goal is to accelerate technology transfer to industry. This is being done in CATTB through an "open door" policy where the program management shares lessons learned with industry. Available are drawings, interface control documents, software, simulation data, test performance data and many other items.
- Since the CATTB program is closely allied with the ASM effort, it has as a second goal the reduction of technical risk for the ASM program. This is done by actually demonstrating the hardware in a vehicle environment. This early integration and testing, done as the component matures, will identify any shortcomings and thus smooth the path to full-scale development (FSD).
- A third goal is to develop performance specifications for the components demonstrated and for like components. Some of the items, especially in the countermeasures area, have been field-tested. The CATTB's field demonstration will serve as a "mark on the wall" for the development of FSD specifications in this area.
- The fourth goal is to develop a core of "smart buyers" in government. The CATTB is a government team effort.

The technologies being developed for CATTB are the best the government technology base has to offer. Because the vehicle is a test bed, several variations or manufacturers of components can be evaluated.

There is no prime contractor performing the integration. Therefore, government engineers are more involved than ever in the development of the vehicle and the integration of the components. Many of these same people will be involved in the selection process for the ASM vehicles and their CATTB experience will help them to write better specifications and to do a better job of evaluating proposals. Both will save the Army time and money.

- A final goal is to take part in the development of the government's simulation capability. The CATTB has been designed using a maximum amount of input from simulations. The vehicle will be heavily instrumented during demonstration and the data taken will be used to validate these simulations. It is the goal of this effort to develop the capability to simulate vehicle configurations with a great deal of accuracy, well before a demonstrator or prototype is built. This tool, when developed, will allow selection boards to do a more thorough job in their evaluations, also.

Matrix Concept

The CATTB uses a matrix management concept. It is the combined effort of many of AMC's centers and labs working in concert with industry. The Technology Integration Division at the U.S. Army Tank-Automotive Command serves as the focal point for the matrix. The key players and their component contributions are shown in Figure 2. Each of these agencies is responsible for management of the development of its particular component.

In some areas, several agencies are involved. They coordinate their input to create one, integrated product. Many of these agencies are developing their components under contract with

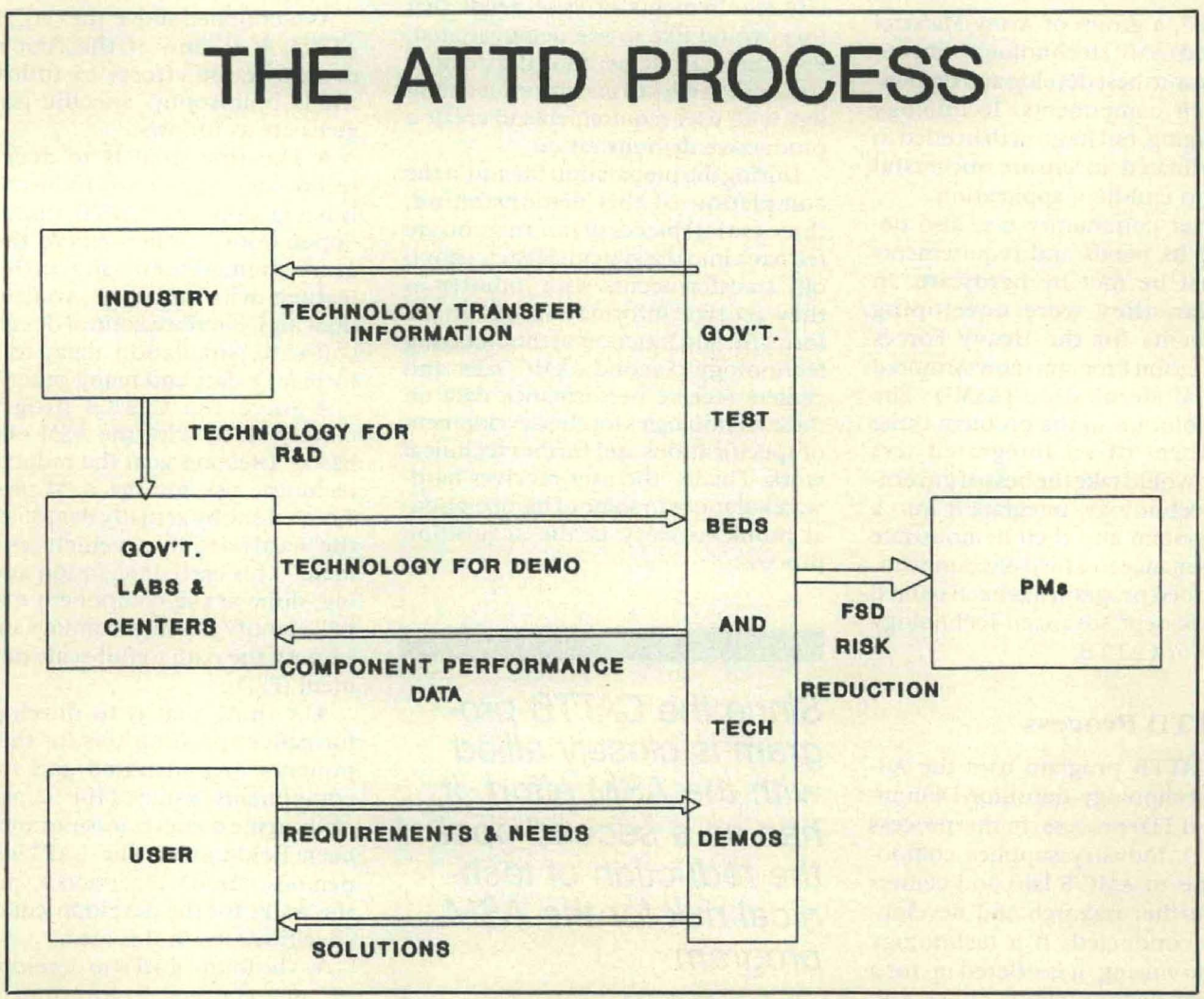


Figure 1.

COMPONENT ADVANCED TECHNOLOGY TEST BED
ARMY TECHNOLOGY BASE PROGRAMS

TECHNOLOGY PROGRAM	AGENCIES
MOBILITY TECHNOLOGIES	
• ADVANCED INTEGRATED PROPULSION SYSTEM (AIPS)	TACOM
• HYDROPNEUMATIC IN-ARM SUSPENSION SYSTEM	TACOM
• ADVANCED TRACK	TACOM
• STANDARD ARMY VETRONICS ARCHITECTURE (SAVA)	TACOM
• EMBEDDED TRAINING	PM-TRADE, TACOM
SURVIVABILITY TECHNOLOGIES	
• MODULAR ARMOR	TACOM, BRL, DARPA
• SPALL LINER	TACOM, BRL
• AMMUNITION COMPARTMENTALIZATION	BRL
• VEHICLE INTEGRATED DEFENSE SYSTEM (VIDS)	TACOM, CRDEC PM-SMOKE
• IR SUPPRESSOR	TACOM
• DE PROTECTION (VISION BLOCKS)	TACOM
• ADVANCED REGENERATIVE NBC FILTRATION SYSTEM	CRDEC, BRDEC
• ADVANCED ENVIRONMENTAL CONTROL SYSTEM	CRDEC, BRDEC
LETHALITY TECHNOLOGIES	
• ADVANCED TANK CANNON SYSTEM (ATACS)	ARDEC
- CANNON/AMMUNITION	OPM-TMAS
- AUTOLOADER	
- M1A1 MOD FIRE CONTROL	
• MULTI-SENSOR TARGET ACQUISITION SYSTEM (MTAS)	CCNVEO
BATTLEFIELD MANAGEMENT SYS TECH'S	
• COMBAT VEHICLE COMMAND AND CONTROL (CVC2)	TACOM, CECOM HEL

Figure 2.

industry. In this manner, industry is also included in the matrix team. Coordination meetings are held to ensure that each separate effort is directed toward the final vehicle goals. These meetings have been highly successful in introducing many of the component developers to one another and in fostering a sense of teamwork.

Technologies

The technologies being developed for CATTB are the best the government technology base has to offer. Because the vehicle is a test bed, several variations or manufacturers of components can be evaluated. This gives program management tremendous flexibility and makes the test bed a valuable tool.

As can be seen from the list in Figure 2, almost every area critical to future combat vehicle development is being demonstrated. Some technologies, such as armor, are unique in that their demonstration will not take place on the vehicle but will be done concurrently. The armor developers are using the CATTB's concepts for modular armor as a baseline for their design and fabrication.

Demonstrations

The schedule for the CATTB is shown in Figure 3. The major events in the program are its field demonstrations and the system integration lab efforts. There are two field demonstrations planned during the course of the program. Both will be conducted at Aberdeen Proving Ground, MD.

The first demonstration will occur in FY91. The CATTB will demonstrate its automotive components, vetronics (vehicle electronics) system, and improvements in signature reduction. Standard automotive tests will make up much of this demonstration. These tests will check the robustness of the new subsystems in a field environment, as they will be subjected to shock, vibration, thermal effects and various other conditions.

As mentioned above, the vehicle will be heavily instrumented, and the data taken will be used to validate simulations and to prepare future performance specifications. This version of the CATTB will have a traditional turreted design which has been specially shaped through simulation to reduce signature. Tests will be done to see how well this vehicle configuration has met signature goals predicted by simulation.

After the FY91 demonstration, the vehicle configuration will be changed to that of an external gun. The turret will be replaced by an Unmanned Weapon Station, and the three-man crew will be moved to the hull. Testing will be conducted in mid-FY93 to demonstrate this vehicle's ability to conduct operational scenarios in this non-traditional configuration. The bulk of the demonstration will be concerned with the lethality subsystems of the vehicle; the Advanced Tank Cannon Gun, the autoloader, fire control and target acquisition. This will be a live firing demonstration.

While the field demonstrations are the ultimate goals of the test bed, the real technical challenge is in electronic integration. The CATTB will have three System Integration Laboratory (SIL) efforts that will prove out the electronics prior to field demonstrations.

The first effort is in preparation for the FY91 demonstration. In this SIL, the automotive electronics will be exercised. The primary effort here is in the verification of transfer of control signals from the driver's controls to the Army's Advanced Integrated Propulsion System (AIPS), now being developed for future heavy combat vehicles. While this is the smallest effort of

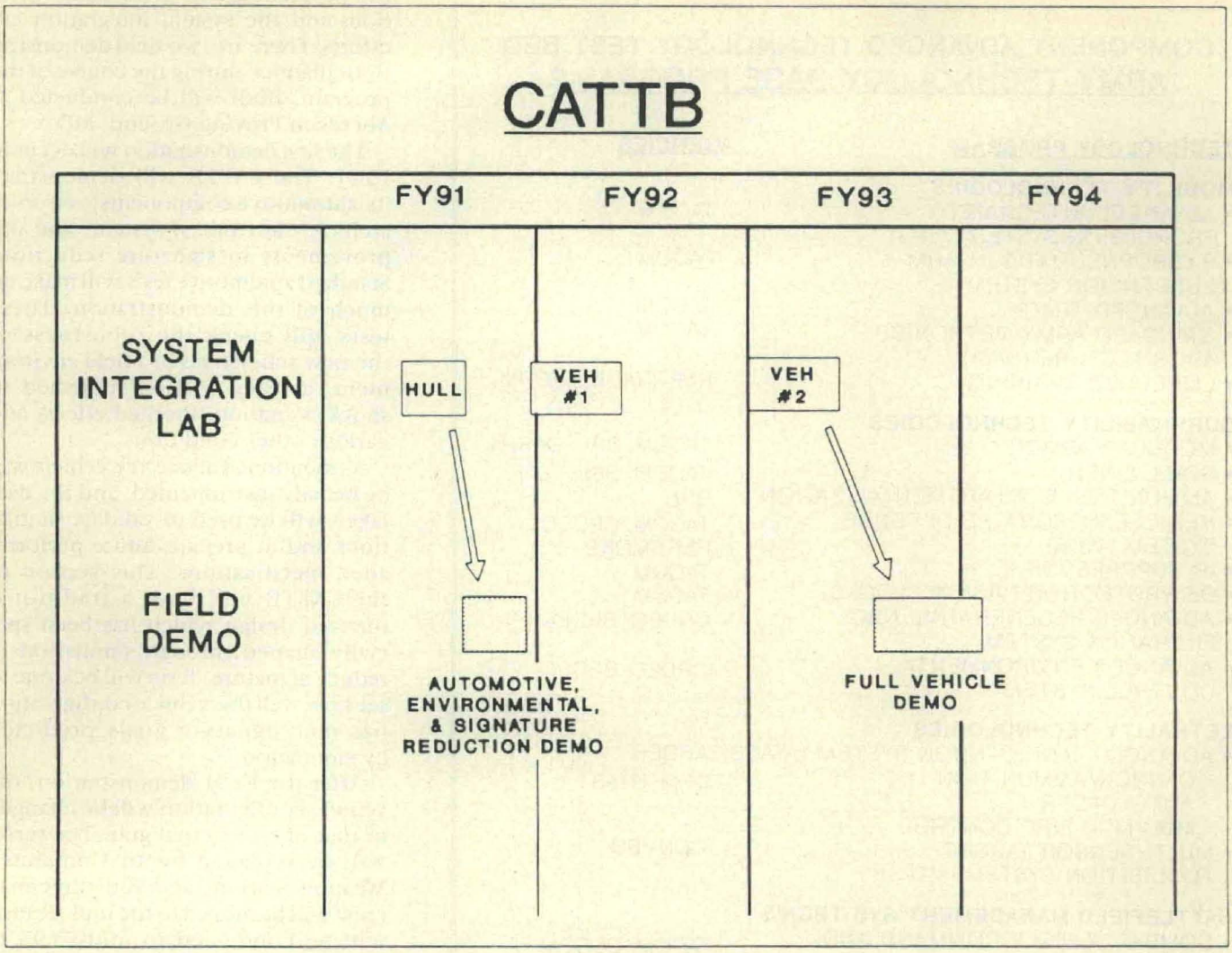


Figure 3.

the three, most of the standard vetronics modules will be used, and therefore, it becomes a good checkout of the Standard Army Vetronics Architecture (SAVA).

Concurrent with the Hull SIL is the development of the full vehicle SIL. This is the baseline for the development of the electronic suite for the FY93 demonstration. In this effort, all of the components that have electrical interface will be integrated and their interface and its associated software validated. The highlight of this SIL will be the accomplishment of several operational scenarios where the entire crew is performing concurrent operations. These advanced tasks will show the robustness of the software to handle all data and power requirements.

Early in the full vehicle SIL, many of the components will utilize their own processing and other capabilities. At the end of our effort, these technologies will be updated to maximize the use of the SAVA. This means that components will share SAVA processing capabilities and will be more of a distributed network than a stand-alone system.

In the full vehicle SIL, an extensive checkout of the software and hardware will be done with emphasis on those tasks that will be demonstrated in the FY93 field demo. This component interface information and the software is available to industry for use in the Common Chassis ATTD Program. We estimate that up to 65 percent of the software will be useable.

Conclusion

The CATTB program is a tremendous asset to all in the development community. Emerging technology will be developed in the correct manner and in concert with requirements for future combat vehicles. This will reduce risk while advancing the technology base. Since it is a combined government/industry effort, much technology transfer will be accomplished. Finally, since it is an operational test bed, the user will be able to use it to determine the answers to some operational problems well before full-scale development.

GENE BAKER is chief of the Technology Integration Division at the U.S. Army Tank-Automotive Command and is program manager for the Component Advanced Technology Test Bed. He is a 1971 graduate of the U.S. Army Military Academy.

THE STRATEGIC LOGISTIC PROGRAM

By Deborah L. Pollard

Introduction

Current trends and influences indicate that over the next 30 years the Army will be required to respond to a broad range of potential scenarios ranging from short contingency operations to high-intensity, large scale wars. The Army force structure will contain a balanced mix of heavy, light, and special operations forces; active and reserve components; and a balanced ratio of combat, combat support, and combat service support units. Continued emphasis will be placed on joint and combined operations. Also, Army doctrine will continue to focus on low intensity conflict, counter-terrorism, and special operations.

Organizational designs for the future force will need to be extremely flexible and adaptable to satisfy a wide range of roles and missions. Emerging organizational design characteristics include modular design, adaptable command and control, sustainment capability/force sufficiency, and commonality of weapon systems. To meet this challenge, the Army must emphasize acquisition of high-technology weapons to achieve qualitative advantage over potential adversaries.

Challenges

To provide effective logistics support to these various levels of combat, the logistics community is faced with several challenges:

- Developing logistics systems designed to sustain combat power and respond to the needs of battlefield commanders.
- Maintaining or increasing levels of logistics support in an environment of declining resources.
- Transforming processes to support emerging AirLand Battle-Future doctrine.
- Reducing the logistics burden on the field to allow more time for training and focusing on combat mission requirements.

Last fall the Department of the Army deputy chief of staff for logistics (DCSLOG) presented an exciting plan to the secretary of the Army to improve logistics integration and modernization, while dramatically reducing operating costs. Exhaustive interviews with military, civilian, and industrial corporate leadership provided a series of excellent ideas and quantitative process changes that were molded into a strategic program. Not only were sound recommendations from previous Army and defense studies utilized in a newly focused methodology, but technological achievements and predictions were also integrated to create an evolutionary glide path for Army logistics to enter the early decades of the 21st century.

Task Forces

Several sequential task forces, employing dozens of logistics experts and logistics strategists, melded a simple, common sense approach for total quality process improvements for Army logistics. The Strategic Logistics Task Force was composed of personnel from various Army agencies. The commanders and deputies of the U.S. Army Combined Arms Support Command (CASCOM) (formerly U.S. Army Logistics Center), Fort Lee, and the U.S. Army Materiel Command (AMC) provided top quality support to the task force. This group:

- Envisioned the environment of 2010 and beyond from DOD and DA long range planning guidance and future warfighting doctrine.
- Derived future logistics opportunities from cogent prior and ongoing studies, insights from interviews with senior Army and industry leaders, and potential applications of technology.
- Evolved foundations for 2010 and beyond by linking the above with logistics imperatives, AirLand Battle tenets, battlefield sustainment functions, and functions of the industrial and sustaining base.
- Developed plans to link validated concepts with the Army force integration process through the Army Long Range Logistics Plan.
- Developed and published a strawman concept for 2010 and beyond. This output, together with parallel efforts by AMC and CASCOM, led the Army to propose a plan that would become a cornerstone in the Department of Defense cost reduction efforts known as the FY90 Defense Management Review Decisions (DMRD).

The Army Secretariat approved the DCSLOG initiative for managing logistics process modernization and several of the formidable DMRD recommendations. The initiative consisted of a program — the Strategic Logistic Program (SLP) — executed by an agency called the Strategic Logistics Agency (SLA) which would report directly to the DCSLOG.

The Strategic Logistics Agency was established in July 1990 to initiate and implement the near, mid, and long-range goals identified for the Strategic Logistic Program to support tomorrow's Army as it performs its evolving missions (Figure 1). These goals focus on improving logistics support to our customers on a global basis. The Strategic Logistic Program mission is to explore new concepts that will support AirLand Battle future doctrine, integrate wholesale and retail logistics systems

into a single integrated network, update technology, and infuse modernized techniques which are applicable in war and peace (Figure 2).

Goals and Objectives

The SLP goals are: develop a single logistics system that improves readiness and ensures sustainability; improve the quality of logistics management and operations; and increase efficiency and effectiveness of logistics operations and training. The SLP enhancements focus on improving logistics processes where the current processes are less than optimal or where the potential exists to streamline overall logistics functions. SLP will use the latest technology such as robotics, open system architecture/interconnectivity environments, electronic data interchange, and artificial intelligence to achieve a "paperless" system.

The objectives of this program are to meld wholesale and retail logistics into one integrated system, and achieve sustainment imperatives for combat logistics. The program will also integrate logistics management with battlefield management, reduce inventories, improve readiness and sustainment, and meet DMRD savings objectives.

SLP is tasked with the responsibility to overcome a $4.2 billion decrement to the Army. Resources for the SLP initiatives are driven by the cost avoidances already decremented from the Army budget.

Methodology

SLP provides the methodology to develop a single Army logistics system. This methodology uses various Total Quality Management (TQM) techniques such as rapid prototyping, quantum process improvements, and continuous process evaluation. SLA is the single integrator for the organizational, doctrinal and functional analyses required to modernize and integrate logistics functions. User participation is deemed essential to achieve SLP objectives throughout the life cycle; from conceptual stages, during functional requirements development, and on through operating capability. The resulting process improvements will be incrementally implemented. More than 21 individual logistics design characteristics have been identified for proof-of-principle testing during the FY90-95 timeframe.

A host of Army core logistics functions fall under SLP's "umbrella" These include requirements determination, supply, maintenance, materiel acquisition (of spares and repair parts), distribution and transportation, and soldier services. The SLP directs development of major systemic improvements of these logistics functions from an integration standpoint (Figure 3).

Today's environment is commodity oriented and uses technologically aging systems. Decision-making is hampered by incomplete and suspect item management information. The decision-making process is also hampered by limited asset visibility. This results in weapon system availability being adversely impacted by imbalances in resources and inventory.

The vision for future core logistics functions is a standard system based on weapon system management. It will be scenario flexible, mission-oriented, fast, interactive, and will provide accurate, comprehensive and readily available data. The Army will then have the visibility and information to make cost-effective stock allocation decisions that maximize weapon system operational availability.

Near-Term Initiatives

The cornerstone of near-term (through FY95) SLP initiatives is transforming the present separate wholesale and retail systems into a single, integrated system that effectively spans the continuum from "the foxhole to the factory." When this initiative is completed, the distinctions between wholesale and retail, as we know them today, will disappear. This integration will enhance supply, maintenance, transportation, and distribution management programs by reducing order-ship time, improving the materiel returns process, basing provisioning on real-time data base input, eliminating excess stock, and reducing stockages of certain repair parts.

Work is underway to reduce the order-ship time used in computing stockage levels. SLA envisions that elements of a new requisitioning system will be introduced in Operation Desert Shield and in Europe and the continental United States during fiscal year 1991. These enhancements to current standard information systems will allow near real-time to less than one day.

We anticipate using satellite communications technology to supplement telephone modems as a means to further enhance speed of operations. A shorter pipeline translates into lower

Figure 1.

Figure 2.

stockage levels throughout the Army. This is the beginning of savings the Army will realize from a shorter pipeline. By the end of FY94, it may be possible to reduce the entire pipeline for repair parts by 20 days in addition to reducing the stockage levels by approximately 50 percent.

Another near-term effort includes executing short-range efficiency enhancements mandated by the recent DMRD process. A major DMRD short-term initiative under the SLP umbrella is converting depot level repairables from procurement funding to stock funding. The Army is implementing this initiative in phases. Starting in October 1990, the Army Materiel Command began procuring these repairables through the stock fund. In July 1991, depot level maintenance of repairables will be paid for through the stock fund.

In January 1992, all "customers" will be required to use the stock fund to pay for their repairables, with no more "free issue." To develop confidence in this method of doing business, the Army leadership approved a division level test beginning in January 1991. This will provide the opportunity to ensure the implementation plan and supporting systems have been evaluated, analyzed, and properly designed prior to mandatory implementation in January 1992. SLA anticipates that a net reduction in operations costs of 10 percent will result.

The concept of weapon system management is central to the SLP. Weapon system management serves as the "trunk" of the logistic functions tree. SLA will integrate logistics support requirements for this concept. Weapon system managers will make repair, distribution, redistribution and procurement decisions using input from combat commanders' requirements, thus enhancing weapon system availability where it is needed most.

By the end of 1994, stockage policies will be determined using weapon system availability models. These availability models (sometimes called sparing to availability) will also determine optimal maintenance repair policies for depots, the field, and contractor repair facilities. Also, these models will be used to develop replenishment and war reserve requirements from refined training and field usage data. Total asset visibility, to include assets in transit, will allow system managers to make effective and efficient redistribution decisions in lieu of or before pursuing other alternatives.

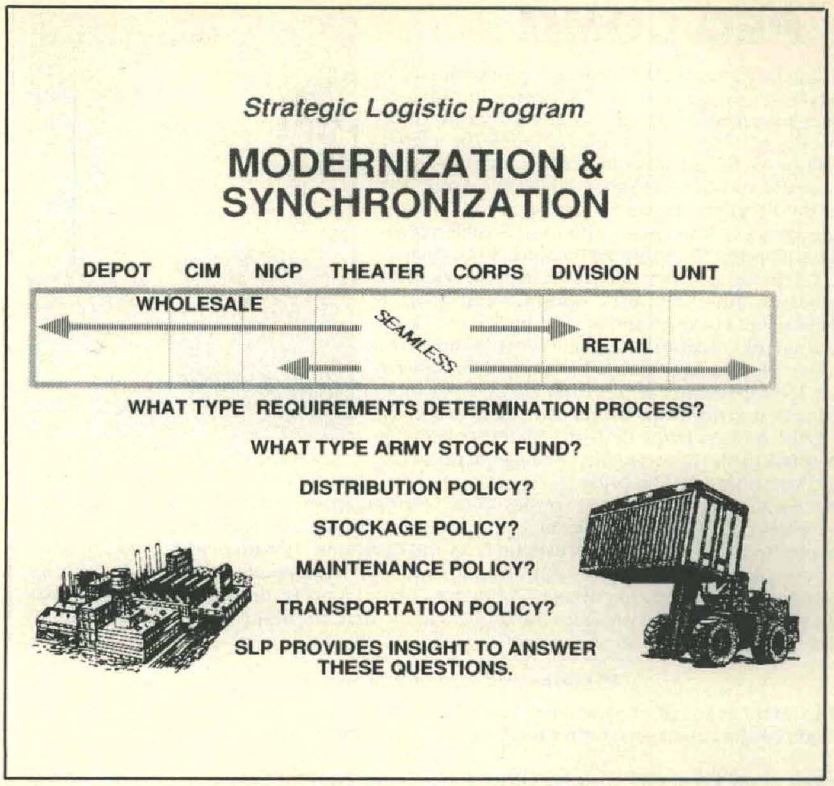


Figure 3.

Mid-Term and Long-Term Initiatives

SLP mid-term initiatives include developing logistics decision support applications, implementing a single stock fund to account for fiscal data, providing concepts for enhancements to support the Tactical Combat Service Support Control System, and focusing on logistics doctrine and systems changes required by the Office of the Secretary of Defense Corporate Information Management (CIM) initiative.

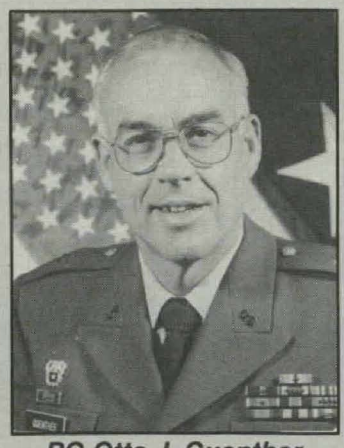
For the long-term initiatives, SLA will conduct a broad, comprehensive analysis of logistics requirements for the period 2000 and beyond. The SLA will develop functional statements of requirements for the future logistics system to foster logical development of the next generation of logistics management information systems. These systems will be an integral part of the emerging Department of Defense consolidation of logistics functions at the national level.

Conclusions

As the Army progresses into the 90s, SLP will design logistics modernization and integration to keep pace with force requirements effectively and efficiently. Readers should agree that this program is a major change in the traditional approach to logistics planning. SLA will take an active role in carrying out the vision of the DCSLOG while focusing on efficient, responsive, and effective methodologies.

DEBORAH L. POLLARD is a quality assurance specialist detailed to the Strategic Logistics Agency, Fort Belvoir, VA, from the U.S. Army Depot System Command, Chambersburg, PA. She is a graduate of the Army Materiel Command Quality and Reliability Assurance Intern Program and holds a bachelor's degree from Indiana University of Pennsylvania.

PEO COMM



BG Otto J. Guenther

BG Otto J. Guenther holds a B.A. degree in economics from Western Maryland College, and an M.S. degree in procurement/contract management from the Florida Institute of Technology. His military education includes the Signal Officer Basic Course, the Infantry Officer Associate Advanced Course, Command and General Staff College, the Army War College and the Program Manager's Course at the Defense Systems Management College. Among his most notable assignments are: commander, 102nd Signal Battalion in Germany; commander, Defense Contract Administration Services in the San Francisco and New York regions; and project manager for Position Location and Reporting System/Tactical Information and Distribution System, Fort Monmouth, NJ. BG Guenther's leadership philosophy emphasizes support to the soldier. His top priority is found in PEO COMM's motto "Provide the Best to the Best." In other words, field quality equipment to the soldiers in the field. BG Guenther believes the implementation of Total Quality Management is the means to accomplishing his top priority. He strives to bring out the best in every member of the PEO COMM team and has implemented a professional development program that has created project management teams of technically proficient, highly motivated individuals. He stresses a no-nonsense approach to problem solving which focuses on facts and decisions. "I want people who can solve problems not just identify them." He believes in giving people the responsibility and authority to get the job done and in holding them accountable. Through his leadership, BG Guenther has created a PEO COMM team that provides the soldiers in the field the best communications equipment at the lowest possible cost.

Missions and Organization

The PEO COMM has a staff of 31 at Fort Monmouth, NJ, as well as a PEO Liaison Office at the Pentagon. Eight project managers, with a total military and civilian staff of 477, report directly to the PEO.

The missions of the Program Executive Office for Communications Systems are: to perform as the Army centralized manager for assigned executive programs reporting directly to the Army Acquisition Executive; to provide overall direction and guidance for the development, acquisition, testing, product improvements, and fielding of assigned programs; to coordinate, integrate, insure interoperability, lead and directly control the program and project managers within the assigned mission area; and to place primary management emphasis on cost estimating, planning, programming, budgeting, program integration, interoperability, and oversight. PEO COMM controls an annual budget of approximately $1.6 billion.

Seven of the PEO COMM programs are located at Fort Monmouth, NJ, along with the PEO Headquarters. PM Global Positioning System is located at the Los Angeles Air Force Base, Los Angeles, CA, with field offices at Fort Monmouth, NJ, and Warner Robbins Air Force Base, GA. Other field office locations include Arizona, Hawaii, Indiana, Massachusetts, Florida, California, Europe and Korea.

PEO COMM

PEO	BG Otto J. Guenther DSN 995-2153 Comm. (908)544-2153	Fort Monmouth, NJ
Deputy PEO	Neal W. Atkinson DSN 995-4148 Comm. (908)544-4148	Fort Monmouth, NJ
PEO Liaison	LTC Robert Raiford LTC Michael Barclay DSN 224-8406 Comm. (703)614-8406	Washington, DC

PROJECT MANAGERS

PM Mobile Subscriber Equipment	COL David Gust DSN 995-2523 Comm. (908)544-2523	Fort Monmouth, NJ
PM Army Data Distribution System	COL Leland Hewitt DSN 992-4251 Comm. (908)532-4251	Fort Monmouth, NJ
PM Multi-Service Communications Systems	COL Carl Drewes DSN 992-4740 Comm. (908)532-4740	Fort Monmouth, NJ
PM Single Channel Ground and Airborne Radio Systems	COL Domenic Basile DSN 995-3063 Comm. (908)544-3063	Fort Monmouth, NJ
PM Regency Net	COL James Fields DSN 995-4011 Comm. (908)544-4011	Fort Monmouth, NJ
PM Satellite Communications	COL Thomas Stauffacher DSN 992-5305 Comm. (908)532-5305	Fort Monmouth, NJ
PM Single Channel Objective Tactical Terminal	COL Leroy Paul DSN 992-1014 Comm. (908)532-1014	Fort Monmouth, NJ
PM Global Positioning System	COL Bruce Sweeny DSN 833-1513 Comm. (213)363-1513	Los Angeles, CA

PROGRAM E
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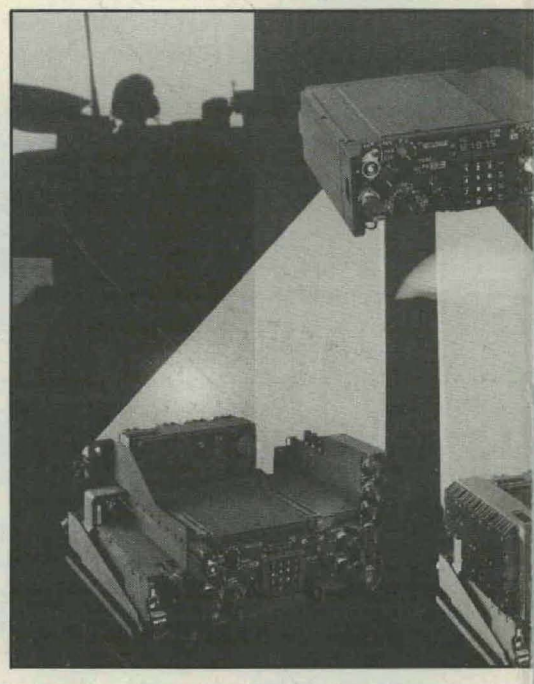
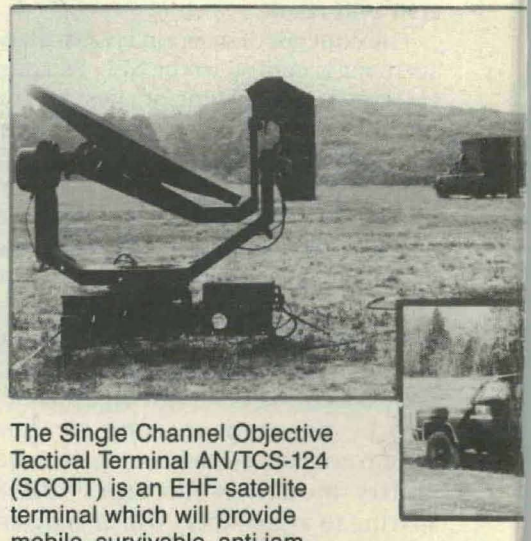
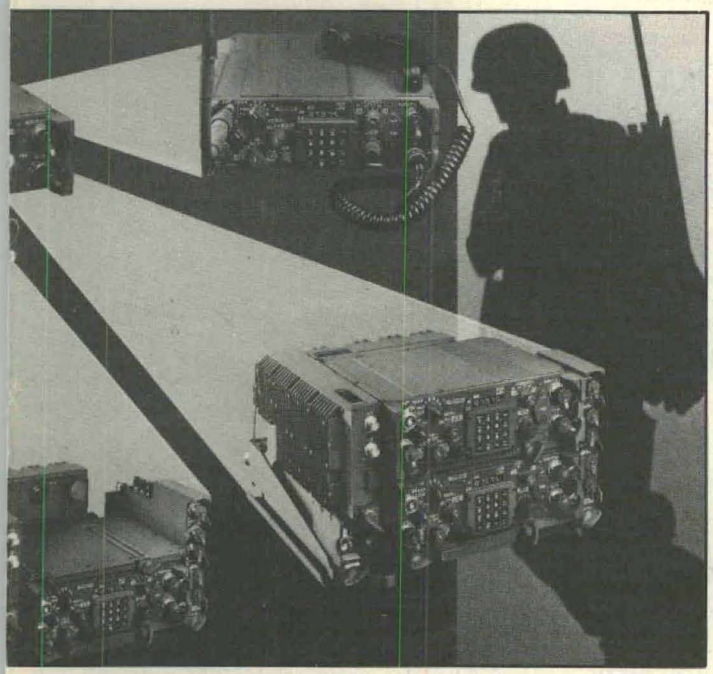


Single Channel Ground and Airborne Radio Sys
combat net radios which provides the primary m
The SINCGARS family of radios has the capabili
sages and is consistent with NATO interoperabili
with one prime contractor and a second source t
to U.S. forces in Korea. The next scheduled majo



The Single Channel Objective Tactical Terminal AN/TCS-124 (SCOTT) is an EHF satellite terminal which will provide mobile, survivable, anti-jam and low probability of intercept communications installed in an S-250 shelter mounted on a truck SCOTT is the ground segment of the MILSTAR will provide data or secure voice communicatio for up to four users. The user can be up to 2,50 in full scale engineering development with oper production contract will be awarded in FY 93.

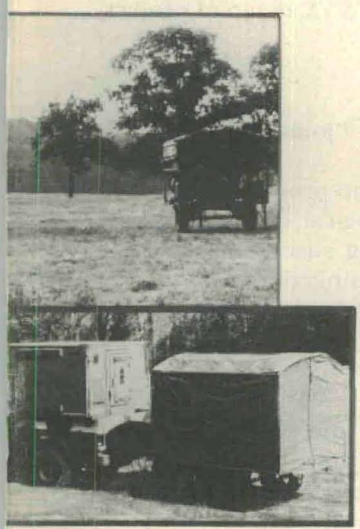
XECUTIVE OFFICE
ATIONS SYSTEMS



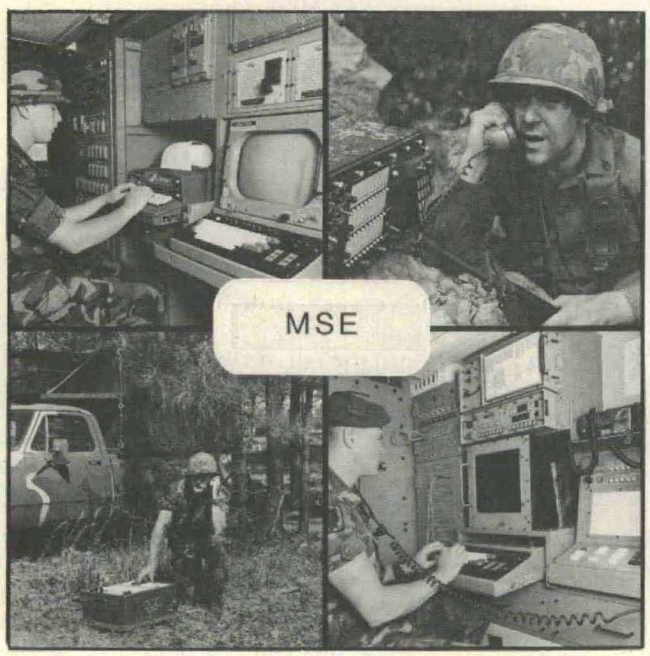
ems (SINCGARS) is a new family of secure, jam-resistant VHF-FM eans of command and control for infantry, armor and artillery units. ty to transmit and receive voice, tactical data and record traffic mes- y requirements. SINCGARS is presently in its fourth production year beginning production. Approximately 5,000 radios have been fielded r fielding is to WESTCOM in 1991.

Shown at left, the Global Positioning System (GPS) is a space-based radio positioning and navigation system that will provide extremely accurate, three dimensional position, velocity and time of day information to users anywhere on or near the earth. USAF is executive service with Army (and other services) providing the Joint Program Office/Army to manage Army requirements and funding. GPS is currently in Low Rate Initial Production.

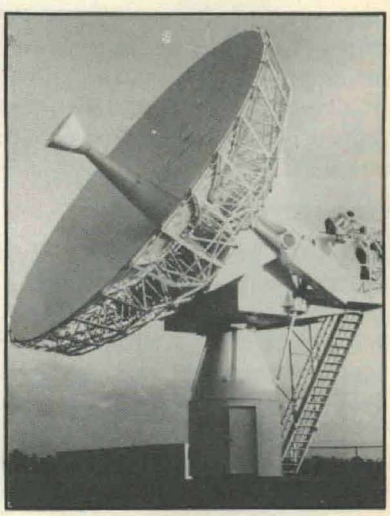
The AN/TRC-170 Troposcatter Radio System is a digital, air and ground transportable microwave radio terminal system capable of communicating over a distance of 100 miles in the (V)3 configuration and 150 miles in the (V)2 configuration. Managed by PM for Multi-Service Communications Systems, this radio system provides the primary long-distance link in the Echelon Above Corps communication system.



The SCOTT terminal is with a trailer and generator. system assigned to the Army. It s at 75-2,400 bits per second) feet away. Currently, SCOTT is ational test scheduled this FY. A



The Mobile Subscriber Equipment (MSE) system is based on a system architecture which ensures that both mobile and static users in combat, combat support and combat service support units in the corps area of operation are provided secure, automatic, real time access to strategic and tactical voice/data networks. Fielding of MSE began in February 1988 to III Corps and is also underway in V Corps.



PM Satellite Communications (SATCOM) is responsible for the research, development, acquisition and life cycle support of satellite communications ground equipment for all DOD activities in accordance with the Army MILSATCOM Architecture.

ELECTRONIC WARFARE VULNERABILITY ASSESSMENT PROGRAM

By Darrell R. Pace

Introduction

For many years the U.S. military has recognized the need to insure that our electronic systems, so important in battle, are capable of operating in a highly stressed environment. As a result, a new program named Electronic Warfare Vulnerability Assessment (EWVA) has been established within the DOD. This article describes the background and nature of the program and discusses the methodology and mechanism proposed to implement the process within the services. EWVA can potentially have a major impact on development, acquisition, and testing of all electromagnetic dependent systems used by the military services.

Background

In 1978, the Office of the Secretary of Defense (OSD) established the Data Link Vulnerability Analysis (DVAL) Joint Test Force (JTF), at Kirtland AFB, NM. That organization was charged with developing and validating a methodology to test and evaluate the anti-jam performance and effectiveness of data links operating in a hostile electromagnetic environment.

The DVAL JTF completed its task in 1983 with the development of a four-module approach to vulnerability assessment (susceptibility, interceptability, accessibility and feasibility). In a June 1983 letter, the principal deputy under secretary of defense for research and engineering directed the service secretaries to implement the DVAL methodology. The problem, however, extends far beyond just data links; all electromagnetic dependent systems must be considered. Of course, traditional electronic counter-countermeasures (ECCM) is embraced by the program, but EWVA goes even further.

Hopefully, EWVA will evolve into an orderly program that assists in the development of all major systems expected to operate in a hostile electronic environment. Such systems must also operate effectively in the same environment with friendly, allied, and adversary non-hostile electronic systems.

From 1983 until the fall of 1988, the vulnerability assessment problem floundered around within the DOD and within the services with a great deal of lip service, but very little action. It seems that everyone was aware the problem existed, but the fixes have always seemed to be "too expensive" to fully implement.

Many efforts to address this problem were made within the services, but it was not until the fall of 1988 and spring of 1989 that some serious action began to take place. During that time the DOD Test and Evaluation Committee (TEC) determined that EWVA could be a candidate for the Central Test and Evaluation Investment Program. In this program, OSD would provide money for several years to get EWVA started and then funding responsibilities would transfer to the services. The chairman of the TEC issued this guidance in an April 1989 memorandum and assigned the secretary of the Air Force for acquisition (SAF/AQ) as the executive agent. The SAF/AQ then tasked the Air Force Electronic Warfare Center, Kelly AFB, TX, to prepare a Program Management Plan (PMP) (still in draft) and take necessary actions to implement EWVA as a joint project.

Overview

The EWVA is a joint service project to:

- Develop and provide to the military services a logical, coherent process for determining susceptibilities and assessing the vulnerability of electromagnetic dependent systems to intentional and unintentional electronic threats in operational scenarios;
- Identify and develop the data bases, facilities and supporting capabilities required to efficiently and effectively implement the EWVA process within each service; and
- Demonstrate the process prior to implementation by the services.

The EWVA project will incorporate past and ongoing vulnerability assessment capabilities within the services and OSD, and will establish appropriate interfaces with ongoing efforts in

establishment of system performance requirements, definition of operational environments, system hardening, threat simulator and emulator developments, and electromagnetic environment effects programs.

An ad hoc tri-service Joint Project Office has been established to provide overall program direction, management, planning, coordination and execution, and to facilitate the institutionalization of the EWVA process within each service. Oversight is accomplished by a tri-service steering group and the OSD deputy director, defense research and engineering (test and evaluation).

A Fundamental Consideration

The assessment of the vulnerability of electromagnetic dependent systems to electronic warfare threats is a fundamental consideration in the acquisition and testing process, operational analyses and operational planning efforts. The criticallity of these efforts, and rapid advances in technology, demand a viable and sustained organic capability to provide timely, independent, consistent and well-founded vulnerability assessments.

Figure 1 shows the steps required to conduct a vulnerability assessment. Note the various inputs required to conduct each phase of the process. Currently, the electronic vulnerability assessment process differs among and within the services. Assessment efforts are often fragmented with limited sharing of information, data bases and facilities.

There is no forum, other than the EWVA project, to facilitate cooperation among the services, and no correlatable data bases on military system performance. There is also a potential for unnecessary duplication of facilities and capabilities in performing assessments within each service. Even terminology associated with the assessment of the vulnerability of systems varies among the three services.

Responsibilities

Within the Army, the U.S. Army Materiel Command is the major command responsible for vulnerability assessments. The U.S. Army Vulnerability Assessment Lab (VAL) at White

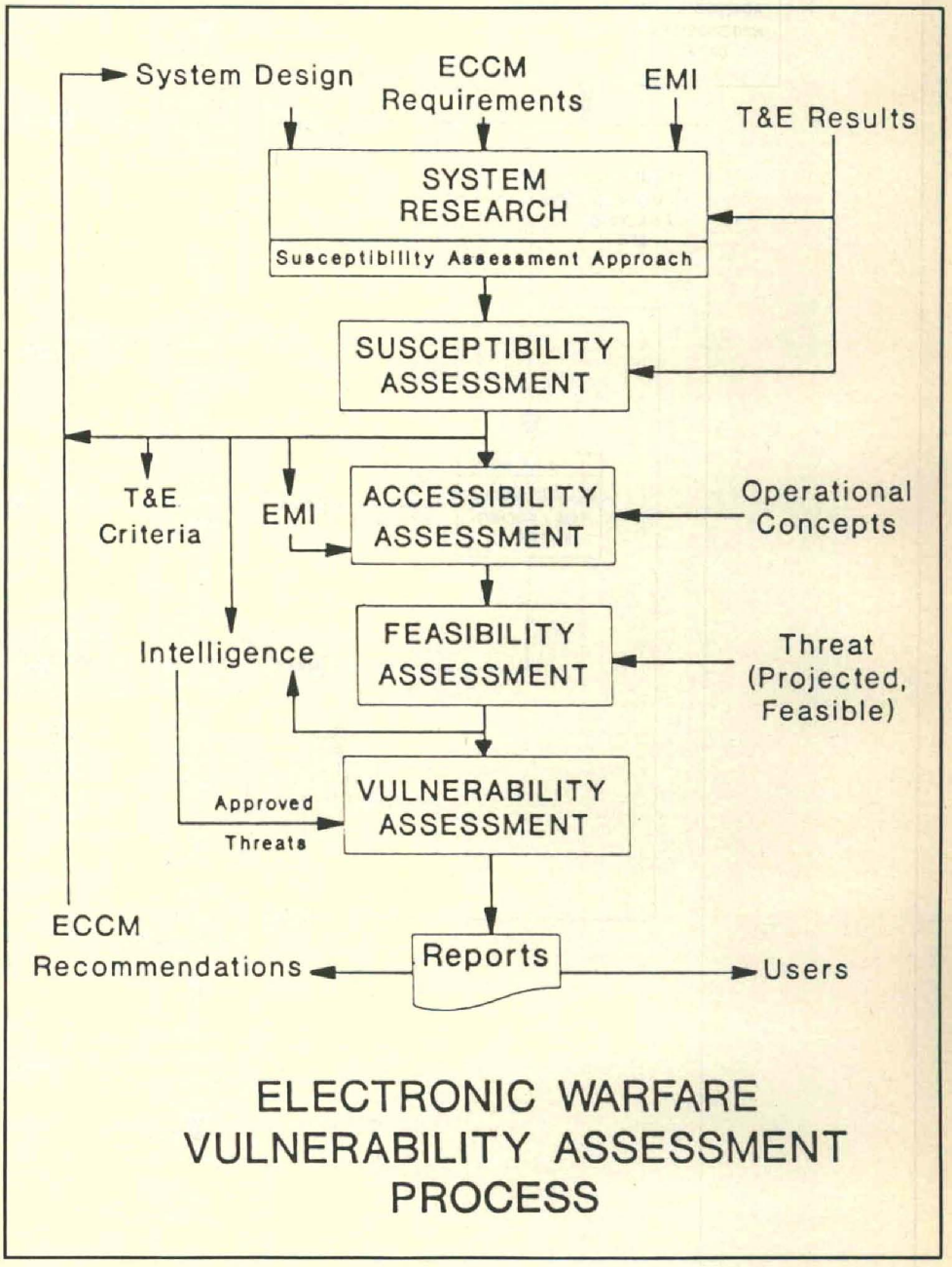
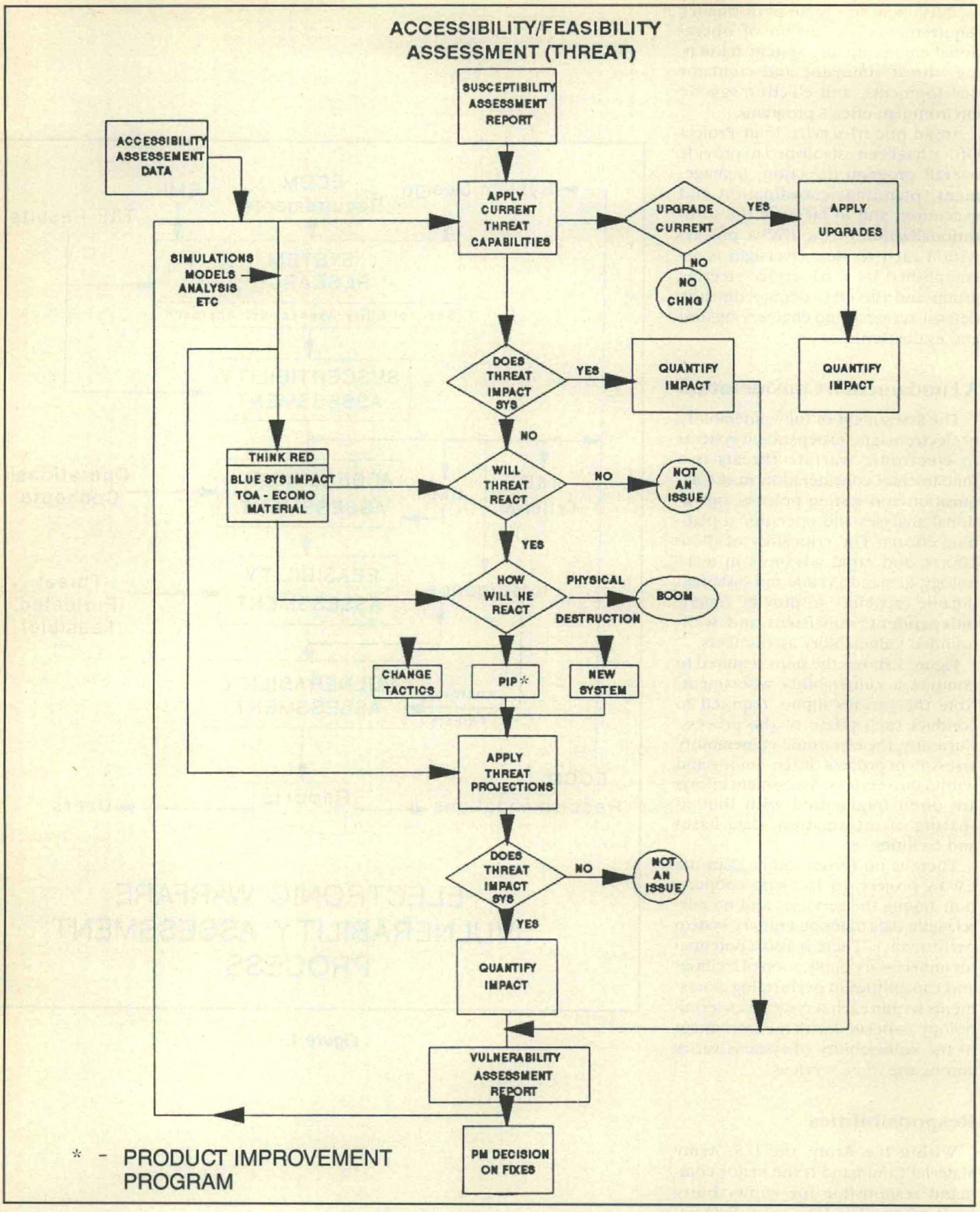


Figure 1.


ACCESSIBILITY/FEASIBILITY ASSESSMENT (THREAT)
SUSCEPTIBILITY ASSESSMENT REPORT
ACCESSIBILITY ASSESSEMENT DATA
APPLY CURRENT THREAT CAPABILITIES
UPGRADE CURRENT
YES
APPLY UPGRADES
NO
NO CHNG
SIMULATIONS MODELS ANALYSIS ETC
DOES THREAT IMPACT SYS
YES
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NO
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WILL THREAT REACT
NO
NOT AN ISSUE
YES
HOW WILL HE REACT
PHYSICAL DESTRUCTION
BOOM
CHANGE TACTICS
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NEW SYSTEM
APPLY THREAT PROJECTIONS
DOES THREAT IMPACT SYS
NO
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QUANTIFY IMPACT
VULNERABILITY ASSESSMENT REPORT
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* - PRODUCT IMPROVEMENT PROGRAM

Figure 2.

The EWVA process will establish the mechanisms for insuring the integration of the susceptibility data into the intelligence community so that realistic vulnerability assessments can be performed.

Sands Missile Range, NM is responsible for conducting vulnerability assessments on all non-communications electromagnetic systems. A division of VAL, "VAL CECOM," at Fort Monmouth NJ, is responsible for conducting vulnerability assessments on U.S. Army communication systems. To date, the Army is the only one of the three services that has consolidated the responsibility for conducting vulnerability assessments at a single location.

An Umbrella Program

EWVA will be the "umbrella" program, identifying in a single process, the functional areas or "tools," supporting data bases, and capabilities essential for vulnerability assessments. In essence it must:

- Provide a well-founded, trackable and consistent vulnerability process;
- Ensure the process is timely and provides useful products to the decision maker, developer, tester, user, and system maintainer;
- Establish the EWVA process as an integral part of a system's life cycle and promote its application within each service;
- Develop a set of correlatable data bases that ensure consistency in assessments among the services and across the individual systems within each service;
- Recommend DOD and service policy guidance on the need for, and the conduct of, electronic vulnerability assessments;
- Recommend the acquisition, sharing and efficient use of vulnerability assessment capabilities, data bases and assets within and among the services; and
- Establish a joint service mechanism for coordinating, implementing and sustaining these initiatives.

Threat and Susceptibility Data

One of the most important factors in any vulnerability assessment is the integration of the threat data and the susceptibility data. This cross feed of information is a must if meaningful vulnerability assessments are to be accomplished.

The EWVA process will establish the mechanisms for insuring the integration of the susceptibility data into the intelligence community so that realistic vulnerability assessments can be performed. Access to this information will also enable preparers of System Threat Assessment Reports to more accurately project the "Reactive Threat" (what will the enemies' reaction be to the fielding of a system).

Figure 2 shows the process that applies the susceptibility data to the approved threat data, and thus indicates possible system vulnerabilities. It should be noted that this is a continuous process throughout the life cycle of a system.

To provide an idea of the scope of this program, the Air Force has already compiled a list of more than 100 systems believed to be candidates for EWVA. The Army and Navy will also compile similar lists of candidate systems. These systems range from complete platforms to individual subsystems. Obviously all of these systems cannot be accomodated in a timely manner, but it does give some insight as to the potential size of the program. The OSD Test Package Directive indicates all electromagnetic systems should be considered for EWVA.

Summary

The EWVA project has a rigorous schedule to achieve OSD goals.

Teeth for this program have already been provided by DOD Directive 4600.3 which requires all major and non-major system acquisitions to have vulnerability assessments performed before they can pass to the next acquisition milestone.

DOD Directive 5000.1 and associated instructions and manuals are being modified to include the requirement for vulnerability assessments throughout a system's life cycle. Funding for these assessments is the program managers' responsibility. The program is being designed to aid the acquisition community during the concept through design and development phases. This is expected to save the dollars frequently wasted when systems are built that have to be modified immediately to be effective in their intended environment.

DARRELL R. PACE is the senior threat analyst assigned to the Office of the Deputy Chief of Staff for Intelligence, HQ AMC. He has played a key roll in the formulation of current policy and guidance relative to intelligence support to the Army's RDT&E community. A major in the U.S. Air Force Reserve, he has attended New Mexico State University and has completed many continuing education courses, specializing in electronic warfare and communications.

ARMY'S AIM EFFORT HELPS STREAMLINE ACQUISITION

A Significant Step in the Army Acquisition Community's Transition to an Open Systems Environment

By Larry J. Thompson

In order to improve the materiel acquisition process, the Office for Acquisition Information Management (AIM) will provide an automated information system to the Army's program executive officers (PEOs) and their project managers (PMs). Testing of AIM system hardware and software will begin in FY 91. Fielding of the operational system will commence in the second quarter of FY 92.

The importance of AIM and its support of the Army acquisition executive (AAE) became obvious from the recommendations of the Grace and Packard Commissions, and the Goldwater-Nichols DOD Reorganization Act. Additional emphasis on the need for AIM resulted from the 1989 Defense Management Review and Report.

By AAE direction, AIM is a design-to-cost program. The Defense acquisition executive (DAE) and the AAE select specific Army PMs to report on "major" or "special-interest" systems. AIM will provide sufficient automation to the DAE/AAE-designated PMs and their PEOs so they can effectively monitor and report management data to the AAE. This means AIM will equip primarily those personnel within the PEOs and selected PMOs who are directly responsible for preparing and transmitting the following: reports to the AAE; the PEO and PM budget with documentation to defend it; schedule information; and responses to HQDA, DOD and congressional inquiries.

In order to adequately serve the needs of the AAE in this regard, it is incumbent that part of the automation effort be directed to the preparatory environment within PEOs and PMOs. This means both classified and unclassified processing and telecommunications must be made available, reliable, fast and easy to use. To meet the on-site processing needs, the AIM Office will acquire and field the AIM Program Management Information System (PMIS).

The AIM non-developmental item acquisition strategy will preclude users from having to contend with more than one workstation, since the hardware used for PMIS will be the same as that contracted to accommodate the mainstream of other known or expected Army workstation tasks. In one sense, AIM hardware for PMIS may be viewed as the preferred replacement (technological refreshment) of the existing PC/AT-class workstation environment.

Hardware for PMIS will consist of mini- and micro-computers and peripherals from DOD requirements-type

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As significant elements of AIM are made ready, they will be fielded and transitioned to their appropriate local functional or Information Systems Command "gaining" organizations for operation and maintenance.

contracts, such as the Standard Multiuser Small Computer Requirements Contract and Desktop III contracts awarded by the Air Force. MS/PC-DOS and POSIX-compliant (portable operating system for computer environment standard) operating system and executive software will also be provided via such contracts. Since these contracts have pre-award validation of conformance to the DOD/Army information architecture (D/AIA), AIM hardware and software from them will therefore conform to the D/AIA. Maximum use will also be made of GSA Schedules for other items conforming to the D/AIA.

AIM PMIS applications software will consist of the Defense Systems Management College Program Manager's Support System (DSMC PMSS) integrated with other DSMC modules and Army-selected software. PMIS will provide menu access to other software modules such as: the Army Acquisition Management System; the Defense Acquisition Executive Summary; the Consolidated Acquisition Reporting System; Personal Computer Software for Generating DOD Procurement Forms; the Multi- channel Memo Distribution Facility Electronic Mail System or a compatible electronic mail module; a public-domain, Army, DOD or other government-wide-licensed communications program with ASCII text/programer's editor; and, for user-selectable word processors, spreadsheets and data base management systems.

The integration of PMIS with related acquisition information systems will be a key feature of AIM. Integration will assure maximum adaptability and "coexistence" with systems already fielded. Integration will also provide a basic, uniform capability that can be immediately deployed and made fully operable to support newly-formed or automation-poor PM offices.

AIM will be a gradual but highly significant step in the Army acquisition community's transition to an open systems environment, a movement in Army and industry toward adaptability and uniformity.

AIM automation "blueprints" and necessary data will be provided to the PEOs and PMs. With this information, they can obtain additional components and sets, like those provided by AIM, through their own normal office automation procurements.

Network integration of the PMIS and AIM telecommunications network (AIMNET) will comply with DOD, Army and National standards for automation and telecommunications. This includes POSIX and the Government Open Systems Interconnect Profile, X.25 (the telecommunications standard used for the Defense Data Network (DDN)), and the use of the DDN, and the Multi-channel Memo Distribution Facility Electronic Mail System.

Near-term and back-up secure telecommunications will be provided via secure telephone units. The objective AIM system will use KG or National Security Agency-approved commercial encryption unit telecommunications encoding devices and the Defense Secure Network to protect processing and transport of acquisition-sensitive and classified technological and project information. AIMNET will provide access to acquisition information residing on existing and planned Army-wide mainframe, mini- and micro-computers and their databases.

One very desirable aggregate effect of AIM's acquisition and integration strategies is that their implementation will inherently discipline the entire process sufficiently to ensure that AIM cannot become a "stovepipe" system.

As significant elements of AIM are made ready, they will be fielded and transitioned to their appropriate local functional or Information Systems Command "gaining" organizations for operation and maintenance (O&M). Through fielding agreements or Memorandums of Agreement, warranties or O&M funds will be provided for up to two years or one budget cycle (whichever is earlier). This will occur after initial operational capability (IOC) for those organizations unable to absorb the initial O&M burden.

For additional information contact LTC Wayne T. Bailey, commercial phone (703) 355-7225, DSN 345-7225, Fort Belvoir, VA. LTC Bailey is currently in charge of the AIM project.

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ADHESIVE BONDING WORKSHOPS

Improving Communications Through the Exchange of Technical Knowledge

By Robert B. Bonk and Anthony T. Desmond

Introduction

The Army Materiel Command's (AMC) Adhesive Bonding Improvement Initiative (ABII), discussed in the March-April 1989 issue of *Army RD&A Bulletin*, is a comprehensive program initiated by the commander, AMC in 1986. The goal is to improve the design and especially the production technology used to fabricate Army hardware items which use structural adhesive bonding.

As a result of an investigation committee report on several aviation-related bonding problems in the mid-1980s, the ABII is targeted at problems in Army hardware items that are largely the result of the failure to effectively apply existing technology to process knowledge, process control, and joint design, including consideration of the end-use environment.

A major part of the ABII program plan to attack these problems is built around improving the knowledge base of bonding technology and communicating that knowledge throughout the Army community. To achieve this, the U.S. Army Armament Research, Development and Engineering Center (ARDEC) Adhesives Section has been tasked by AMC's deputy chief of staff for production, to conduct a series of informal training workshops on production-related adhesive bonding. The workshops will be conducted at AMC major subordinate commands, depots and ammunition loading plants.

Workshops

The purpose of the adhesive bonding workshops is to educate design engineers, production engineers, quality assurance representatives and production line personnel in the fundamentals of adhesive bonding, sealing and coating as related to the fabrication of military hardware. Particular emphasis is placed on the use of adhesives, sealants, and composites in production assemblies, including basic design considerations, proper adhesive selection, surface preparation, processing parameters, component fabrication, and the establishment of proper quality assurance parameters.

The actual workshop segments include an introduction to adhesive bonding technology, theories of adhesion, adhesive types, properties and applications, the proper design, selection, and application of adhesives for use in Army hardware items, an introduction to composites and composite repair, non-destructive inspection methods, and information about several adhesive bonding databases developed by ARDEC. In addition, several technical representatives from private industry give technical presentations on areas in which they have a particular expertise, such as the use of cyanoacrylate adhesives (Super-Glue), anaerobic adhesives, sealants, materials durability and processing techniques.

Classroom instruction is typically followed by an open discussion period where ARDEC adhesive experts address mission-specific bonding problems. In addition, the use of case studies taken from Army experiences in adhesive bonding are used extensively to relate the classroom material to real-life situations. These workshops typically last from one to three days,

depending on the mission interests and the number of attendees at the installation. Workshops are funded by the AMC Directorate for Production, and are presented free to the installation.

Initial Efforts

The first workshop was conducted at the Communications-Electronics Command (CECOM) during September 1988. This one-day seminar was given to 40 engineers and scientists and covered several areas of organic materials. The feedback from this trial effort was extremely positive and led to a second workshop in April, 1989 at Letterkenny Army Depot. This workshop was given to approximately 40 production line and quality assurance personnel over two days. This workshop was also the first in which an open forum was held on the shop floors with the attendees to discuss and try to solve various adhesive bonding problems at Letterkenny. These problems included the surface preparation and bonding of neoprene and silicone rubber seals and gaskets on electronic panels and radar or communications shelters, as well as the repair of composite panels for Hawk radar antennae. Many of these specific problems were then transferred back to the laboratory environment for future study.

Fiscal 90 Workshops

During fiscal 1990, workshops similar to those at CECOM and Letterkenny were given to approximately 250 Army technical personnel at six AMC sites. These included: the Army Missile Command and Anniston Army Depot, October 1989; Tobyhanna Army Depot, May 1990; Army Aviation Systems Command (AVSCOM) and the Corpus Christi Army Depot (CCAD) June-July 1990; and the Lake City Army Ammunition Plant, August, 1990.

The training agenda for each workshop was specifically tailored to the particular mission interest of the site. Among the speciality items discussed in the presentations and open sessions were general ways to improve adhesive bond durability, the surface preparation and bonding of neoprene and silicone rubber, proper use of anaerobic adhesives on specific armament items, composite repair, and problems surrounding the chemical processing of aluminum and titanium for bonding. Feedback from each of these workshops has been exceedingly positive. In fact, at least two sites (AVSCOM and CCAD) will be revisited due to the demand for the course.

Pending future funding, six additional workshops are tentatively scheduled for fiscal 1991. Planned workshops include additional sessions at AVSCOM and the Corpus Christi Army Depot, Natick RD&E Center, Tooele Army Depot, New Cumberland Army Depot, and an additional site yet to be determined.

Conclusion

The adhesive bonding workshops have been very helpful in improving communications between the laboratory and the field through the exchange of technical knowledge. As a result, laboratory personnel can gain a better appreciation of the problems faced on the production line, while the production and quality assurance personnel can communicate their technical problems to those with the knowledge and resources to solve problems. Agencies interested in having a workshop conducted at their site should contact Robert Bonk on DSN 880-3187 or commercial (201) 724-3187.

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ANTHONY T. DESMOND is a materials engineer in the ARDEC Adhesives Section, specializing in the production and repair of Army aviation systems and in information management systems relating to materials technology. He received his B.S. in chemical and biomedical engineering from Carnegie-Mellon University and is completing an M.S. in systems management from the Florida Institute of Technology.

NEW PM COMBINES INSTRUMENTATION, TARGETS, THREAT SIMULATORS

By MAJ Frank G. Atkins

The Army has established a new project manager (PM) for instrumentation, targets and threat simulators (ITTS). The decision to combine targets and threat simulators with the previously directed establishment of a PM for test instrumentation culminates a three-year effort by the Office of the Deputy Chief of Staff for Operations and Plans-Force Development (ODCSOPS-FD), Operational Testing Division in Washington, DC.

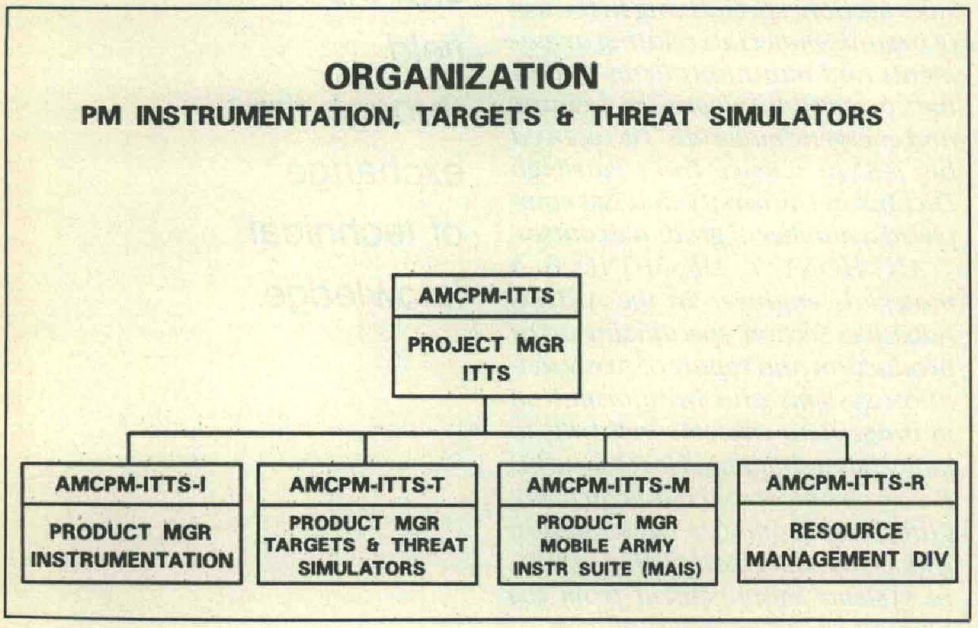
The U.S. Army colonel who is appointed as the PM ITTS will report to the Army Materiel Command deputy commanding general for research, development and acquisition. Located at Aberdeen Proving Ground, MD, the Office of the PM ITTS will conceptually be organized as shown in Figure 1.

Current Army policy assigns responsibility for developing and acquiring instrumentation, targets and threat simulators to numerous commands and organizations, including Army laboratories and research centers, program executive officers (PEOs), intelligence agencies, training activities, and user and technical testers. Establishment of a project manager for ITTS creates a single point of contact for these activities and fixes responsibility in a central command.

Having all requirements flow through PM ITTS enhances the Army's continuing efforts to eliminate redundancy and unnecessary duplication and will provide a more efficient and responsive program. Although the above mentioned organizations will continue to be actively involved, the PM ITTS will play a major role in the day-to-day management of instrumentation, target, and threat simulator development programs. These programs are critical to the materiel acquisition process.

Because Army acquisition decision-makers and members of Congress are all demanding more and better testing, there is a resurgence of interest in the "fly before buy" concept. For example, live fire testing has been mandated by Congress, and prototype evaluation versus analysis of contractor plans is now the norm. These policies demand highly sophisticated instrumentation, targets and threat simulators.

Targets and threat simulators must be much more than simple look-alikes. Complex signature data must be replicated and threat tactics and



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Targets and threat simulators must be much more than simple look-alikes. Complex signature data must be replicated and threat tactics and doctrine must be employed. Additionally, there is a growing awareness that not only must testers be capable of portraying the Soviet threat, but also third world systems and weapons of allied nations.

Accurately portraying the threat in a realistic battlefield environment is a major effort for weapons systems testers. PM ITTS will be an integral part of the solution to that challenge.

The program architecture is comprised of three parts: management, approval and oversight. Headquarters, Department of the Army (HQDA) will accomplish the approval and oversight functions. Two activities — the Test and Evaluation Management Agency (TEMA), which reports to the chief of staff of the Army, and the Operational Testing Division in ODCSOPS — are the HQDA action agencies. As stated above, PM ITTS will accomplish day-to-day program management. AMC will provide matrix support.

TEMA will oversee policy and funding for PM ITTS while requirements approval will be the charter of ODCSOPS. TEMA will also provide the interface with Department of Defense (DOD) level staff offices having responsibilities for test and evaluation. This process is shown in Figure 2.

As requirements for target and threat simulators are received from users, PM ITTS will consolidate them and have the Army Intelligence Agency (AIA) do an "intelligence feasibility" study to determine if sufficient threat data is available to proceed with development.

To prevent unnecessary duplication, a check will be run against the DOD Test Facilities Master Plan (TFMP) to ensure multiple or redundant developments are not ongoing. Once this has been accomplished, the PM will forward for approval the consolidated list of requirements in a recommended priority order to the General Officer Steering Council for Instrumentation, Targets and Threat Simulators.

Upon program approval, PM ITTS will enter the Army Planning, Programming and Budgeting System and compete for development funds. Once funding is secured, PM ITTS will coordinate program execution with matrix organizations to them to perform the materiel developer function. TEMA will be the focal point between the Army Staff and Office of the Secretary of the Army and with DOD for policy and funding issues.

The functional flow of activities for the PM is indicated at Figure 3. As the executive agent, the PM ITTS executes the program as approved by the General Officer Steering Council. The first action that must occur is a cross-check with the Foreign Materiel Program (FMP). This ensures that the

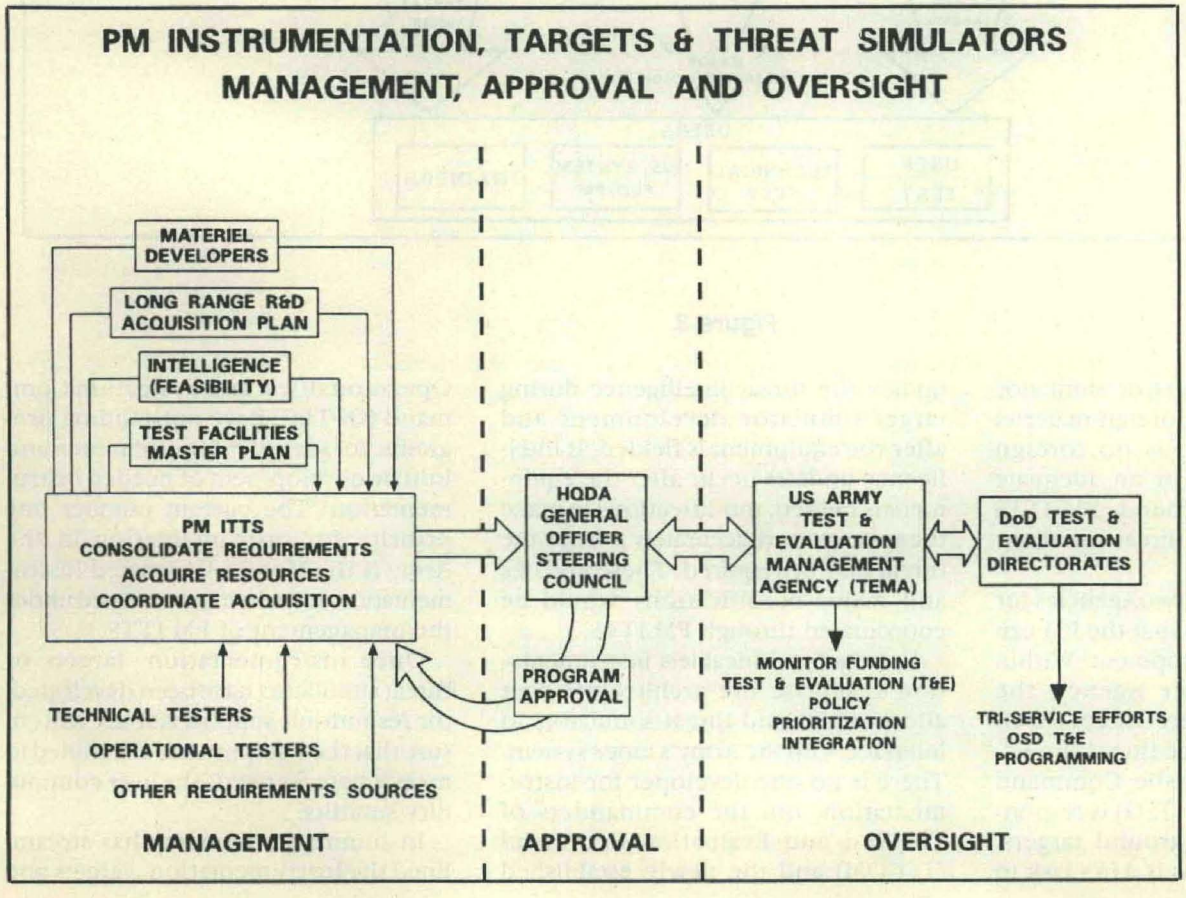


Figure 2.

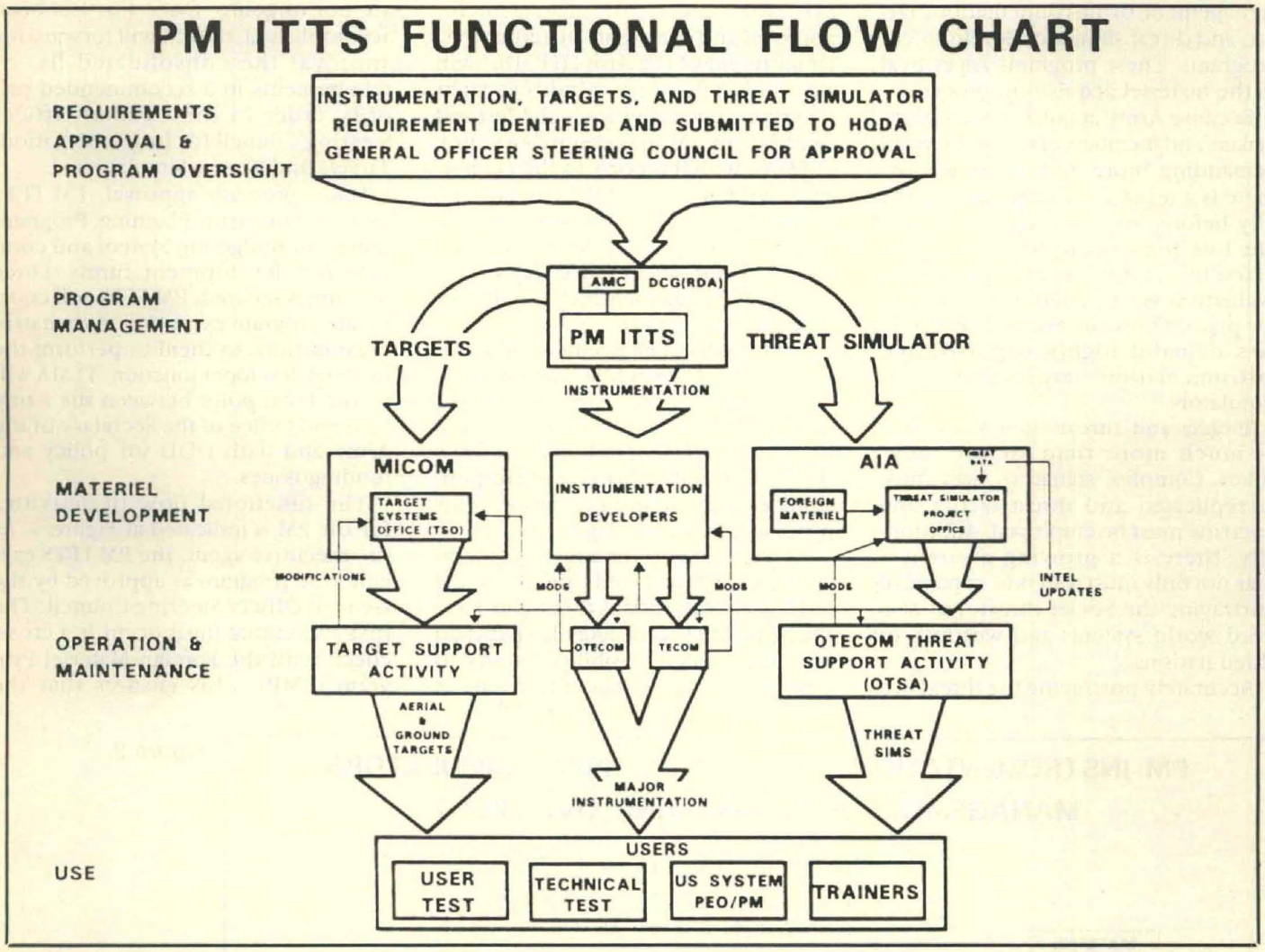


Figure 3.

requirement for a target or simulator cannot be filled by a foreign materiel acquisition. If there is no foreign equipment available, or an adequate surrogate cannot be found, PM ITTS will initiate target or threat simulator development.

Currently, there are two agencies for targets and simulators that the PM can direct to execute development. Within the Army Intelligence Agency, the Threat Simulator Project Office (TSPO) is chartered to produce threat simulators; and, AMC's Missile Command Target Systems Office (TSO) is responsible for aerial and ground targets. Integral to this process is AIA's task to update the threat intelligence during target/simulator development and after the equipment is fielded. If intelligence updates occur after the equipment is fielded, modifications to make the systems more accurately portray the threat may be required. These updates and major modifications would be coordinated through PM ITTS.

User and technical test instrumentation comprise the architecture that allow targets and threat simulators to interface with the Army's range system. There is no one developer for instrumentation, but the commanders of The Test and Evaluation Command (TECOM) and the newly established Operational Test and Evaluation Command (OPTEC) have outstanding programs to identify requirements and initiate development of needed instrumentation. The current number one priority for instrumentation in the Army is the Mobile Automated Instrumentation Suite, being developed under the management of PM ITTS.

Once instrumentation, targets or threat simulators have been developed, the responsible support activity will ensure that the equipment is scheduled to meet whatever needs the user community submits.

In summary, the Army has streamlined the Instrumentation, Targets and

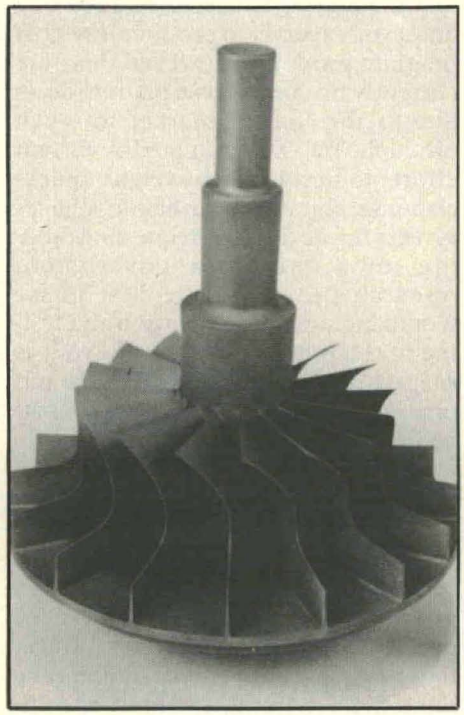
TITANIUM MAY HOLD KEY TO LIGHTER COMBAT VEHICLES

By George Taylor

Titanium may someday play a major role in helping the Army to dramatically reduce the weight of its combat vehicles without sacrificing ballistic protection. That is the opinion of metallurgists at the U.S. Army Tank-Automotive Command's (TACOM) RD&E Center, who are seeking Congressional approval of funds to begin a long-term program aimed at determining the feasibility of manufacturing armor, track and other vehicle components out of titanium.

Titanium offers several advantages over other metals. It weighs about 40 percent less than steel. But despite its light weight, it offers strength properties like those of steel. It also can withstand high temperatures, does not fracture easily and offers outstanding corrosion resistance.

Though these benefits make titanium suitable for many military and commercial applications, its high cost is a major drawback. In its pure form, titanium plate — suitable for armor — costs about $10 a pound. This compares with about $.75 per pound for armor steel and about $2.00 to $2.50 for a pound of armor aluminum. Thus, titanium's use has been mainly limited to jet-engine components and other specialized aerospace applications where it is virtually the only suitable material.



As-HIP niobium modifies Ti3A1 centrifugal compressor rotor.

But there are applications for which a less pure — and less expensive —form of titanium would be suitable. For example, titanium has been used successfully in race-car engine parts such as valves, connecting rods and crankshafts. These applications, however, do not require the high temperature and durability characteristics essential for aerospace components. At TACOM, engineers want to find out if a lower grade of titanium could provide lightweight, high-strength combat-vehicle components at a cost low enough to make its use economically practical.

"A rotating part in a turbine engine in a high-temperature environment needs a very high grade of titanium, but that is something we don't need in, say, a track shoe or a piece of armor," said

TYPICAL CHARACTERISTICS OF THE LIGHT METALS

	Al	Mg	Ti	Steel
Melting Point (°F)	1220	1210	3060	2800
Density (lbs/c.ins)	0.10	0.06	0.16	0.28
Ultimate Tensile Strength (ksi)	55	35	140	140
Crustal Abundance (%)	8.0	2.8	0.9	5.8

metallurgist James Ogilvy. "So we should be able to reduce the specification requirements somewhat and get a lower cost — maybe less than $7 a pound."

Another drawback to titanium is that its hardness makes it a difficult material to machine. However, engineers hope to look at alternative manufacturing methods which, if proven feasible, would significantly reduce machining requirements and thus keep production costs down. Casting is one good alternative approach. But another method that looks particularly promising is an advanced technique in powder metallurgy that may permit the manufacture of a variety of combat-vehicle components from powdered titanium.

In powder metallurgy, pressure and heat are used to form parts from one or more metals that are available in powder form. The process involves first compacting the powder using a combination of high pressure and elevated temperature in a die of the desired shape.

The big advantage to using powdered metal is that parts are close to final dimensions when they leave the dies and thus need little machining or cutting to obtain the correct shape and size. This means manufacturers can cut costs significantly through reduced production time and elimination of the scrap material that machining produces.

In this procedure, referred to as pressing and sintering, powdered metal, however, has only about 85 percent of the density it has in its raw state, and therefore lacks the strength needed to withstand high stress. However, with other processes such as hot-forging powdered metal or hot isostatic pressing (HIP), it is possible to increase the density to near its original level.

In hot-forging, the powder is first preformed into a shape having the general features of the part but lacking fine details. A preformed gear, for example, would have the desired round shape but have no teeth. Then, following sintering, the piece is placed in a forging die, heated to about 1,800 F and pressed into a finished part. The HIP process involves placing parts in a special chamber highly pressurized with argon, nitrogen or other inert gas, and heating them to a very high temperature.

There are no technological barriers that would prevent establishment of a domestic capacity to produce low-cost titanium products. However, there are currently no commercial plans to do so due to the limited market for such products. TACOM, prompted by current efforts to develop lightweight, quick-response, highly maneuverable vehicles to meet future needs, is requesting funding for a two-phase government research program. The first phase would include the fabrication and testing of titanium armor plate, as well as shaped parts such as track shoes and pins, torsion bars and other combat-vehicle components and the development of material specifications based on the test results.

The second phase would include the preparation and submission to industry of a Request for Proposal (RFP) to produce armor plate, powdered metal or casting components that would meet the specifications. The RFP would be limited to defining material specifications, and would not dictate the manufacturing methods to be used to meet them.

Funds for the program are being applied for under a special category established by Congress during the 1950s, known as Title III. To qualify for funding under Title III, a proposed program is required to meet several criteria. First, it must be initiated by a DOD agency. It must also involve research into any area of technology having potential military application but for which domestic industry has not invested capital needed to make it readily available because of a lack of a current market. Additionally, the requesting agency must indicate how its proposed research would benefit the national defense.

TACOM RD&E Center metallurgist Ogilvy said if Congress approves funds for the titanium research program, the Army would not be the only beneficiary. "By developing low-cost titanium products," Ogilvy asserted, "it would make widespread application economically practical in the other services and in the commercial area. Then, as the market for these products expands, the domestic manufacturing capacity to produce them, which is currently quite small, would likely expand to meet the increased demand. This, in turn, could bring the price down even lower and encourage a further growth in demand."

GEORGE TAYLOR is a technical writer-editor for the U.S. Army Tank-Automotive Command. He has a bachelor's degree in journalism and a master's degree in communications from Michigan State University.

General Officer Promotions

Four members of the Army Acquisition Corps were recently selected by a Department of the Army board for promotion to brigadier general: COL Jan A. Van Prooyen, chief, Nuclear and Chemical Division, Office of the Deputy Chief of Staff, Operations and Plans, U.S. Army Europe and Seventh Army; COL Anthony C. Trifiletti, assistant commandant, U.S. Army Armor School, Fort Knox, KY; COL John E. Longhouser, executive officer to the under secretary of defense for acquisition, Office of the Under Secretary of Defense for Acquisition, Washington, DC; and COL Orlin L. Mullen, executive officer to the assistant secretary of the Army for research, development and acquisition, Washington, DC.

Colonel Promotions

The recently announced FY 90 Army Selection List for promotion to colonel, competitive category, shows 39 Army Acquisition Corps officers were recommended by the selection board for promotion. Three of the 39 officers were selected from Below the Zone and one from Above the Zone. Nine of the selected officers are serving product managers. Of the 16 serving or previously serving battalion commanders selected, three are serving or previously serving product managers. A breakout of selections by Functional Area (FA) and Skill Identifier (SI) are shown in Figure 1.

FA/SI	Above the Zone			First time Considered			Below the Zone		
	Considered	Selected	% Selected	Considered	Selected	% Selected	Considered	Selected	% Selected
51	**80**	**2**	**2.5**	**112**	**45**	**40.1**	**268**	**2**	**.7**
514M	2	1	50.0	11	7	63.6	19	0	.0
514Z	25	0	.0	48	19	39.5	132	1	.7
514M/4Z	**27**	**1**	**3.7**	**51**	**26**	**50.9**	**141**	**1**	**.7**
52	**11**	**0**	**.0**	**17**	**5**	**29.4**	**35**	**0**	**.0**
524M	0	0	.0	2	1	50.0	3	0	.0
524Z	1	0	.0	1	0	.0	4	0	.0
524M/4Z	**1**	**0**	**.0**	**3**	**1**	**33.3**	**7**	**0**	**.0**
53	**47**	**1**	**2.1**	**64**	**16**	**25.0**	**150**	**1**	**.6**
534M	0	0	.0	0	0	.0	6	0	.0
534Z	2	0	.0	5	2	40.0	20	0	.0
534M/4Z	**2**	**0**	**.0**	**5**	**2**	**40.0**	**26**	**0**	**.0**
97	**35**	**0**	**.0**	**27**	**8**	**29.6**	**99**	**3**	**3.0**
974M	1	0	.0	0	0	.0	7	0	.0
974Z	5	0	.0	13	6	46.1	48	2	4.1
974M/4Z	**6**	**0**	**.0**	**13**	**6**	**46.1**	**55**	**2**	**3.6**
15/35	**33**	**1**	**3.0**	**19**	**7**	**36.8**	**78**	**2**	**2.5**
15/354M	0	0	.0	0	0	.0	0	0	.0
15/354Z	2	0	.0	0	0	.0	2	0	.0
15/354M/4Z	**2**	**0**	**.0**	**0**	**0**	**.0**	**2**	**0**	**.0**
BOARD TOTAL	**1,385**	**35**	**2.5**	**1,397**	**520**	**37.2**	**3,090**	**61**	**1.9**
Total 4M	3	0	.0	13	8	61.5	35	0	.0
Total 4Z	35	1	2.8	59	27	45.7	206	3	1.4
Total 4M/4Z	**38**	**1**	**2.6**	**72**	**35**	**48.6**	**241**	**3**	**1.2**

Figure 1.

FA/SI	Above the Zone			First time Considered			Below the Zone		
	Considered	Selected	% Selected	Considered	Selected	% Selected	Considered	Selected	% Selected
FA 51	**127**	**7**	**5.5**	**127**	**81**	**63.7**	**148**	**10**	**6.7**
514M	17	3	17.6	48	42	87.5	65	2	3.0
514Z	4	1	25.0	12	8	66.6	17	3	17.6
514M/4Z	**21**	**4**	**19.0**	**60**	**50**	**83.3**	**82**	**5**	**6.0**
FA 52	**18**	**1**	**5.5**	**18**	**12**	**66.6**	**11**	**2**	**18.1**
524M	1	0	.0	6	3	50.0	2	0	.0
524Z	0	0	.0	1	1	100.0	0	0	.0
524M/4Z	**1**	**0**	**.0**	**7**	**4**	**57.1**	**2**	**0**	**.0**
FA 53	**95**	**3**	**3.1**	**91**	**47**	**51.6**	**106**	**3**	**2.8**
534M	1	0	.0	16	10	62.5	15	0	.0
534Z	0	0	.0	5	3	60.0	1	0	.0
534M/4Z	**1**	**0**	**.0**	**21**	**13**	**61.9**	**16**	**0**	**.0**
FA 97	**71**	**0**	**.0**	**62**	**35**	**56.4**	**58**	**3**	**5.1**
974M	5	0	.0	13	8	61.5	17	0	.0
974Z	1	0	.0	10	4	40.0	3	0	.0
974M/4Z	**6**	**0**	**.0**	**26**	**12**	**46.1**	**20**	**0**	**.0**
CMF15/35	**39**	**0**	**.0**	**37**	**22**	**59.4**	**36**	**2**	**5.5**
15/354M	0	0	.0	3	2	66.6	0	0	.0
15/354Z	0	0	.0	0	0	.0	0	0	.0
15/354M/4Z	**0**	**0**	**.0**	**3**	**2**	**66.6**	**0**	**0**	**.0**
BOARD TOTAL	**1,444**	**41**	**2.8**	**1,636**	**991**	**60.5**	**1,733**	**114**	**6.5**
Total 4M	24	3	12.5	86	65	75.5	99	2	2.0
Total 4Z	5	1	20.0	28	16	57.1	21	3	14.2
Total 4M/4Z	**29**	**4**	**13.7**	**114**	**81**	**71.0**	**120**	**5**	**4.1**

Figure 2.

Lieutenant Colonel Promotions

The FY 90 Selection Board results for promotion to lieutenant colonel were released in October 1990. The results show a total of 90 Army Acquisition Corps majors were recommended by the board for promotion. A breakout of the lieutenant colonel promotion board results are shown in Figure 2.

Command and Staff College Selections

The results of the FY 90 Command and Staff College Selection Board were released in September 1990. The results show that the Army selected 1,023 officers from a pool of 6,779 eligible officers, a select rate of 15 percent. Sixty-seven officers from the Army Acquisition Corps (AAC) were selected by the board to attend the resident course. Altogether, 323 AAC officers were considered by the board, resulting in a 20 percent selection rate.

Defense Systems Management College 1991 Courses

The following is a partial listing of courses offered by the Defense Systems Management College during 1991. Courses will be given at the main campus at Fort Belvoir, VA, unless otherwise stated. For information about courses, call the registrar's office on DSN 354-2152 or Commercial (703) 664-2152.

ACQUISITION BASICS COURSE

COURSE NO.	BEGINS ENDS	LOCATION
91-1	22 Feb - 22 Mar 91	
91-2R	22 Apr - 17 May 91	St. Louis
91-3R	03 Jun - 28 Jun 91	Los Angeles
91-4R	09 Sep - 04 Oct 91	Huntsville

ADVANCED INTERNATIONAL MANAGEMENT WORKSHOP

91-2	10 - 14 Jun 91	
91-3	09 - 13 Sep 91	

CONTRACT FINANCE FOR PROGRAM MANAGERS COURSE

91-2R	11 - 15 Mar 91	Huntsville
91-3	22 - 26 Apr 91	
91-4R	17 - 21 Jun 91	St. Louis
91-5R	22 - 26 Jul 91	Boston
91-6R	09 - 13 Sep 91	Los Angeles

CONTRACT MANAGEMENT FOR PROGRAM MANAGERS COURSE

91-2R	07 - 11 Jan 91	Los Angeles
91-3R	18 - 22 Mar 91	Huntsville
91-4	24 - 28 Jun 91	
91-5R	22 - 26 Jul 91	St. Louis
91-6R	26 - 30 Aug 91	Boston
91-7	23 - 27 Sep 91	

CONTRACTOR PERFORMANCE MEASUREMENT COURSE

91-2R	14 - 18 Jan 91	
91-3	04 - 08 Feb 91	
91-4R	25 Feb - 01 Mar 91	Orlando
91-5R	15 - 19 Apr 91	Huntsville
91-6R	20 - 24 May 91	WPAFB
91-7	03 - 07 Jun 91	
91-8R	08 - 12 Jul 91	Boston
91-9	22 - 26 Jul 91	
91-10R	12 - 16 Aug 91	St. Louis

DEFENSE MANUFACTURING MANAGEMENT COURSE

91-2	18 - 22 Mar 91
91-3	17 - 21 Jun 91
91-4	23 - 27 Sep 91

EXECUTIVE MANAGEMENT COURSE

91-1	15 Apr - 03 May 91
91-2	16 Sep - 04 Oct 91

EXECUTIVE REFRESHER COURSE

91-2	04 - 15 Mar 91
91-3	15 - 26 Jul 91

FUNDAMENTALS OF SYSTEMS ACQUISITION MANAGEMENT COURSE

91-4R	04 - 08 Mar 91	Boston
91-5R	18 - 22 Mar 91	St. Louis
91-6R	13 - 17 May 91	Huntsville
91-7R	03 - 07 Jun 91	St. Louis
91-8	24 - 28 Jun 91	
91-9R	15 - 19 Jul 91	Los Angeles
91-10R	16 - 20 Sep 91	Boston

INTRODUCTION TO SOFTWARE MANAGEMENT ACQUISITION COURSE

91-3	28 - 29 Jan 91	
91-4R	01 - 02 Apr 91	Boston
91-5R	03 - 04 Apr 91	Boston
91-6	15 - 16 Apr 91	
91-7R	06 - 07 May 91	Huntsville
91-8R	08 - 09 May 91	Huntsville
91-9	17 - 18 Jun 91	
91-10R	15 - 16 Jul 91	St. Louis
91-11R	17 - 18 Jul 91	St. Louis
91-12	03 - 04 Sep 91	

MANAGEMENT OF ACQUISITION LOGISTICS COURSE

91-3R	04 - 08 Mar 91	St. Louis
91-4R	29 Apr - 03 May 91	Los Angeles
91-5R	24 - 28 Jun 91	Huntsville
91-6	29 Jul - 02 Aug 91	

MANAGEMENT OF SOFTWARE ACQUISITION COURSE

91-2	04 - 08 Feb 91
91-3	03 - 07 Jun 91
91-4	30 Sep - 04 Oct 91

MULTINATIONAL PROGRAM MANAGEMENT COURSE

91-2	28 Jan - 01 Feb 91	
91-3R	04 - 08 Mar 91	Huntsville
91-4R	08 - 12 Apr 91	Boston
91-5	13 - 17 May 91	
91-6R	15 - 19 Jul 91	Paris

PROGRAM MANAGEMENT COURSE

91-1	28 Jan - 14 Jun 91
91-2	29 Jul - 13 Dec 91

SELECTED ACQUISITION REPORT COURSE

91-8	24 - 28 Jun 91	
91-9	26 - 30 Aug 91	
91-10R	09 - 13 Sep 91	Boston
91-11	23 - 27 Sep 91	

SYSTEMS ACQUISITION FOR CONTRACTING PERSONNEL COURSE

91-2	28 Jan - 08 Feb 91
91-3	15 - 26 Apr 91
91-4	15 - 26 Jul 91

SYSTEMS ACQUISITION FUNDS MANAGEMENT COURSE

91-3	14 - 18 Jan 91
91-4	28 Jan - 01 Feb 91
91-5	13 - 17 May 91

CAREER DEVELOPMENT UPDATE

DSMC (continued)

SYSTEMS ACQUISITION FUNDS MANAGEMENT COURSE (continued)

91-6R	03 - 07 Jun 91	Huntsville
91-7	24 - 28 Jun 91	
91-8R	15 - 19 Jul 91	Boston

SYSTEMS ACQUISITION MANAGEMENT FOR GENERAL/FLAG OFFICERS

91-2	19 - 23 Aug 91	

SYSTEMS ENGINEERING MANAGEMENT COURSE

91-4R	14 - 18 Jan 91	Huntsville
91-5R	25 - 29 Mar 91	Los Angeles
91-6R	08 - 12 Apr 91	St. Louis
91-7R	29 Apr - 03 May 91	Boston
91-8	20 - 24 May 91	
91-9R	22 - 26 Jul 91	Huntsville
91-10R	16 - 20 Sep 91	Los Angeles

TECHNICAL MANAGERS ADVANCED WORKSHOP

91-2	17 - 21 Jun 91	

TEST AND EVALUATION MANAGEMENT COURSE

91-3	28 Jan - 01 Feb 91	
91-4R	25 - 29 Mar 91	St. Louis
91-5R	03 - 07 Jun 91	Boston
91-6	05 - 09 Aug 91	

TOTAL QUALITY MANAGEMENT COURSE

91-2	28 Jan - 01 Feb 91	
91-3R	11 - 15 Feb 91	Los Angeles
91-4R	06 - 10 May 91	Boston
91-5R	12 - 16 Aug 91	Huntsville
91-6	26 - 30 Aug 91	
91-7R	23 - 27 Sep 91	St. Louis

TOTAL QUALITY MANAGEMENT WORKSHOP

91-4	15 - 16 Jan 9 1	TBD
91-5	12 - 13 Feb 91	TBD
91-6	19 - 20 Mar 91	TBD
91-7	16 - 17 Apr 91	TBD
91-8	14 - 15 May 91	TBD
91-9	11 - 12 Jun 91	TBD
91-10	16 - 17 Jul 91	TBD
91-11	20 - 21 Aug 91	TBD
91-12	17 - 18 Sep 91	TBD

MANPRINT Senior Training Course

(Length: 5 Days, Course Administration Number: ALMC-MT)

Class Number	Class Dates	Applications Due to ALMC	Location
91-003	4-8 Mar 91	17 Jan 91	CECOM, Ft. Monmouth, NJ
91-502	11-15 Mar 91	1 Feb 91	Ft. Belvoir, VA
91-007	1-5 Apr 91	15 Feb 91	AVSCOM, St. Louis, MO
91-008	6-10 May 91	22 Mar 91	Ft. Rucker, AL
91-501	22-26 Jul 91	7 Jun 91	PM TRADE, Orlando, FL
91-009	29 Jul-2 Aug 91	14 Jun 91	TACOM, Warren, MI
91-010	12-16 Aug 91	28 Jun 91	Ft. Knox, KY

MANPRINT Staff Officers Course

(Length: 2 Weeks, Course Administration Number: ALMC-MS)

Class Number	Class Dates	Applications Due at ALMC	Location
91-004	18-29 Mar 91	1 Feb 91	Ft. Lee, VA
91-003	15-26 Apr 91	1 Mar 91	Ft. Lee, VA
91-006	13-24 May 91	27 Mar 91	Ft. Lee, VA
91-007	3-14 Jun 91	19 Apr 91	Ft. Lee, VA
91-008	17-28 Jun 91	3 May 91	Ft. Lee, VA
91-005	8-19 Jul 91	24 May 91	Ft. Lee, VA
91-009	19-30 Aug 91	5 Jul 91	Ft. Lee, VA
91-010	9-20 Sep 91	26 Jul 91	Ft. Lee, VA

MANPRINT Training

The Army Logistics Management College (ALMC) will be conducting all MANPRINT Senior Training and Staff Officers Courses during 1991. The following is a partial listing of these courses and course dates. For additional information, call Norman J. Walsh Jr., MANPRINT course director, at DSN 687-2156/3250 or Commercial (804) 734-2156/3250.

Software System May Aid in Meeting OSHA Standards

The Hazardous Communications (HAZCOM) Standards mandated by the Federal Occupational Safety and Health Administration (OSHA) could bring a substantial cost to the construction industry for training and reporting. To lower the cost of compliance, the U.S. Army Construction Engineering Research Laboratory (CERL) in Champaign, IL, has joined with three organizations in the private sector to develop a software system that will both train employees and generate reports automatically.

The joint partnership for this study was made possible under the Construction Productivity Advancement Research (CPAR) program. The project began earlier this year with the signing of a Cooperative Research and Development Agreement (CRDA) between the partners. Joining CERL in this work are Northeast Louisiana University, Associated General Contractors, and Associated Builders and Contractors of Louisiana.

HAZCOM went into effect March 17, 1989, and requires contractors to provide scheduled training for employees to inform them of potential hazards on the job. Compliance with this requirement must be documented through reports to OSHA. This training and reporting incur a high cost to contractors, who often are forced to hire extra manpower to handle this workload or face expensive fines from OSHA.

"Ninety percent of the construction industry consists of companies employing 20 or fewer people," said Hollis Bray, instructor in the School of Construction of Northeast Louisiana University. "These are the people especially affected by HAZCOM, because everybody has to comply, no matter how small." Bray noted that, since March 1989, 18,000 citations have been issued for violations at a cost of over $1 million in fines, "and that was just for the big contractors who were inspected." He projected that an additional $10 million in penalties could be levied if inspectors were available to check the smaller contractors, with the minimum fine for a violation being $1,000 per day.

The personal computer (PC) based system to be developed in this CPAR project will avoid many of the additional labor costs by automating compliance. While early work is focusing on employee recordkeeping, the system will eventually offer employees self-paced training sessions. When these are completed, the program will automatically generate reports for OSHA in the required format. The software will be designed to be compatible with common PCs already used widely within the industry. "Today even the smallest companies often have a PC," Bray said.

CERL's involvement in this CPAR study reflects the Army's need to ensure compliance with the OSHA standards. The lab's parent organization, the Army Corps of Engineers, manages a multi-billion dollar annual military construction program. Although most of the actual work is done by private contractors responsible for their own employees, the software program will benefit the Army. First, by cutting the contractor's overhead cost for training and reporting, less cost will be passed on to the government. Second, in cases where the Army uses its own personnel for potentially hazardous jobs, the standards apply just as they do in private industry; these personnel must be trained and reports filed with OSHA.

"Another possible use for the software will be to automate Material Safety Data Sheets," Bray said. "The law requires all contractors to keep — literally — a file cabinet on the jobsite that contains a Material Safety Data Sheet on every chemical found there — sawdust, paint, roofing tar, everything. This is especially a burden for contractors who have several jobs going at different sites because of the duplication that's needed. The PC program will make it easy to maintain, update, and generate these records." The program is being designed as an add-on to existing computer hardware and will be marketed to private firms at production cost. The target date for completion is early 1991.

Microclimate Cooling

Army scientists have studied the effect of heat and humidity on soldiers in "buttoned-up" combat vehicles and aircraft, and have found that extremely hot, humid interior conditions cause high body temperatures and fatigue. This can result in casualties.

Simply cooling a vehicle's interior is not effective in cooling the soldier while dressed in standard chemical protective clothing.

To overcome this problem and the decline in performance which accompanies it, researchers at the U.S. Army Natick Research, Development, and Engineering Center are developing microclimate cooling systems. Both air and liquid cooling systems are being developed to prevent foot soldiers and vehicle crewmen from succumbing to the effects of heat stress. The air-cooled system is now standard issue with the M1A1 Tank.

The tank system uses a specially constructed lightweight vest that is connected by a hollow umbilical cord to a source of cooled, conditioned air from the turbine engines of the M1A1. The vest is worn over underclothing but under all outer garments and equipment. The cool air flows around the soldier's torso, removes excess body heat and sweat and keeps his body temperature within acceptable limits.

Currently under test is an improved version of the air vest that can be used in other Army vehicles and aircraft. To achieve compatibility with aircraft, the umbilical cord has been shifted from the front to the side.

Soldiers, wearing the vests, can endure higher temperatures with higher heat and can work longer without performance degradation. Maintenance of a lower body temperature also reduces sweating and minimizes dangerous and sometimes deadly dehydration.

Microclimate cooling systems are true force multipliers. They permit soldiers to perform missions under conditions that a similarly unequipped enemy would find completely intolerable.

Belvoir Employees Get Materiel Acquisition Awards

Five members of the Belvoir Research, Development and Engineering Center's Battlefield Deception Team have received the Secretary of the Army's Award for Outstanding Achievement in Materiel Acquisition. Jeffrey A. Smith, Harold H. Henegar, Jr., Franklin G. McGlaughlin, Robin-Lynn McClean, and Scott W. Kohnke were honored for their "dedication, professionalism and teamwork . . . [which] resulted in the extraordinarily rapid production and fielding of combat deception systems, significantly contributing to our combat force's readiness on the battlefield."

The award, called the Knox Medal, was presented to the team by MG William B. McGrath, chief of staff of the Army Materiel Command (AMC) in a ceremony held at the center. The Knox Medal is named after the first U.S. Secretary of War, Henry Knox, and is given for outstanding individual or team contributions, by military or civilian personnel, to the timely, efficient, and economical acquisition of quality supplies and services. It recognizes high-level achievement in project, materiel and special management activities, procurement and production efforts, and management of R&D.

In recognizing the team's efforts, Belvoir RD&E Center Commander COL Peter J. Cahill said, "Their success is an example of how much some acquisitions can be streamlined if people are creative and willing to take risks."

(From the left) Scott W. Kohnke, Franklin G. McGlaughlin, Harold H. Henegar Jr., Jeffrey A. Smith and Robin-Lynn McClean display their award certificates after receiving the Army's Award for Outstanding Achievement in Materiel Acquisition.

Army Tests Smoke Effects on Vegetation

Scientists at the U.S. Army Chemical Research, Development and Engineering Center (CRDEC) have expanded the use of a new technology which will improve the Army's ability to protect the environment at its testing and training areas.

Through the use of open-top chamber testing technology, the center is studying the impact of chemical agent simulants and smoke to determine levels of exposure where no negative effects will be observed on vegetation.

"Using these chambers, we conduct experiments with up to eight species of tree seedlings to determine at what concentration a simulant or obscurant could be applied without harmful effects to the plants," said Dr. Randall Wentsel of the Environmental Toxicology Branch. "With this information, we can recommend the concentration ranges of these chemicals that could be released in order to safeguard Army testing and training areas and their surroundings."

Open-top chambers are double-walled, clear plastic cylinders, 10 feet in diameter and 8 feet high with the top open to weather from above. Air is drawn into the chamber through the side by a fan and is passed through a purification filter. The filter removes all ambient pollutants, which allows the scientists to conduct their studies in a controlled environment. A typical test utilizes 16 chambers, each containing 32 trees.

"We filter the air inside some of the chambers but we also do comparative studies using unfiltered air and on trees outside of a chamber," said Maria Sadusky, a soil chemist at the Toxicology Branch. "These tests enable us to isolate the effects of the (chemicals) and test them for their no-effect level." The chambers are usually used for the study of the effects of ozone and other air pollutants on plant life. Through the assistance of Dr. John Skelly, professor of plant pathology at Pennsylvania State University, the Army has been able to adapt this technology for its use. Skelly, who is an expert in environmental assessment, pioneered this type of research to assess damage to forests from air pollution.

"CRDEC has expanded the use of open-top chamber research, a new technology which has played a major role in the vegetational assessment of plant injuries due to ozone. Open top chamber research is now used to study the environmental impact of chemicals used by the military such as smoke and obscurants," Skelly said.

"This is a good example of cooperation between government laboratories, universities, and the local community," said Dr. Harry Salem, chief of the Toxicology Division. "It takes advantage of the expertise needed to demonstrate the commitment of the Army to protect the environment."

Distinguished Mathematician Marks 39th Year with Army

In September, Professor Francis G. Dressel marked his 86th birthday and 39 years of service to the Army. An expert in the theory of partial differential and integral equations, Dressel began his career as an instructor of mathematics at Duke University in 1929 and retired from Duke as professor of mathematics in 1974. His teaching excellence is legendary among his many students.

In 1951 he became senior scientific advisor to the Division of Mathematics of the Army Research Office (ARO), and in 1974 became a full time member of the ARO

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scientific staff. He is the only employee whose tenure spans the entire lifetime of ARO, where he manages research, monitors conferences, symposia and workshops, and edits Army-wide conferences in mathematics.

Dressel is a member of Phi Beta Kappa and has received the Army's Outstanding Civilian Service Medal.

Foreign Vehicle Center Adds Resources

On April 4, 1988 the Foreign Vehicle Resource Center (FVRC) was established at the U.S. Army Tank-Automotive Command (TACOM) in Warren, MI. The purpose of the center is to maintain a collection of foreign (Free World) wheeled and tracked vehicles which will support a variety of current and projected R&D programs throughout the Army Materiel Command community.

The FVRC is the only centralized state-of-the-art foreign technology center of its kind. Currently, this center has an inventory of five vehicles which are periodically loaned to various agencies for testing or selective R&D investigations. During the past fiscal year, the FVRC loaned equipment for tests to three separate R&D agencies.

In FY91, the FVRC will be complemented by an extensive inventory of over 500 16mm movie films and video tapes documenting numerous tracked and wheeled vehicle test programs over the past 40 years. These films are expected to be categorized and indexed by early 1991. A list of this material will be available upon written request to the U.S. Army Tank-Automotive Command, Foreign Intelligence Office, ATTN: AMSTA-SF, Warren, MI 48397-5000. Arrangements are currently being made to support the loan of films and video tapes to DOD agencies.

Questions or comments relative to the Foreign Vehicle Resource Center should be directed to Chuck Henderson or Bob Kaczmarek on DSN: 786-7029/5604 or Commercial: (313) 574-7029/5604.

Belvoir PACK Sets Heavy Lift Record

The Belvoir RD&E Center has set a U.S. military record and what is also believed to be a U.S. commercial record for the heaviest payload carried by an air cushion vehicle (ACV). On Sept. 26, 1990, Belvoir's Pontoon Air Cushion Kit (PACK) technology demonstrator successfully lifted and transported from Fort Story, VA, to Norfolk, VA, an Army 250-ton capacity truck-mounted container handling crane. The weight was 130 tons.

Belvoir's newest technology demonstrator, the PACK, is a lightweight, flexible skirt system with autonomous air supply units that can be installed on Army modular barges for conversion to air cushion supported platforms.

The old record for the heaviest payload carried by a military ACV was set by the U.S. Navy's Jeff-A amphibious assault craft in 1984. That lift was 123 tons. The new record-setting overwater trip to Norfolk lasted six hours and was accomplished using the Army's Landing Craft Utility (LCU-2000) as the tug.

Belvoir project engineer Brian David predicts that with some minor skirt design enhancements, the PACK will be capable of carrying 140 tons over water in waves up to five feet.

BOOK REVIEWS

Juran on Leadership for Quality: An Executive Handbook

By J.M. Juran

Published by The Free Press 1989

Reviewed by T. Siciliano, HQ, U.S. Army Materiel Command

The decade of the 1980s was filled with the sounds of deregulation, competitiveness and productivity. The 1990s may well resound to the tunes of quality and participation.

Operating from the premise that all managers want their organizations to produce high-quality goods or services, Juran has written a handbook for managers seeking a comprehensive plan for attaining top quality of their products as well as their processes.

Juran's oft-cited trilogy — that in order to achieve top quality, an organization must have quality planning, quality control and quality improvement (and that the impetus for quality must come from the top), is the central framework of this book. Each of these aspects is described and analyzed in the book.

The Juran theory is based on his system for strategic quality management (SQM). He warns the reader that "establishing company wide quality management involves profound changes, some of which may be unwelcomed."

He goes on to state that in SQM, quality goals become part of the business plan, and, because of this, priorities require modification. Managers employing SQM need extensive and continuing training and the entire organizational culture will need to be changed to one which is driven by quality.

SQM is constantly measured against goals. Feedback on performance is continuous throughout the organization and immediate action is taken to correct variances. While this approach requires many resources, it is critical to the success of the business plan and ultimately, the organization.

Juran concludes his work by advising that management make no trivial quality plans. Our nation is facing an economic crisis, he says, and our response to it should be nothing less than a revolution in quality.

As advertised, this is a handbook (or almost textbook, if you prefer). It requires a significant amount of concentration on the part of the reader to assimilate its content. It is filled with lists, graphs, charts and tables. The reader is cautioned that it is not a "cover-to-cover" or "over-the-weekend" light reading drill, but rather a serious treatment of the philosophy and implementation of SQM. It can well prepare management for the long and difficult road ahead.

WRITER'S GUIDELINES

ABOUT THE BULLETIN: Army RD&A Bulletin is a bimonthly professional development bulletin published by the Army Acquisition Executive Support Agency, an element of the Office of the Assistant Secretary of the Army (Research, Development and Acquisition). The bulletin's editorial office is located at Headquarters, U.S. Army Materiel Command, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001. Phone numbers are Commercial (703)274-8977/8 or DSN 284-8977.

PURPOSE: To instruct members of the RD&A community relative to RD&A processes, procedures, techniques and management philosophy and to disseminate other information pertinent to the professional development of the RD&A community.

SUBJECT MATTER: Subjects of articles may include, but may not be necessarily limited to, policy guidance, program accomplishments, state-of-the-art technology/systems developments, career management information, and management philosophy/techniques. Acronyms should be kept to an absolute minimum and when used, must be written out and explained.

LENGTH OF ARTICLES: Articles should be approximately 1,500 to 1,800 words in length. This equates to 8-9 double-spaced typed pages, using a 20-line page.

PHOTOS: Include any photographs or illustrations which complement the article. Black and white or color are acceptable. We cannot promise to use all photos or illustrations and they are normally not returned unless requested.

BIOGRAPHICAL SKETCH: Include a short biographical sketch of the author/s. This should include the author's educational background and current position.

CLEARANCE: All articles must be cleared by the author's security/OPSEC office and public affairs office prior to submission. The cover letter accompanying the article must state that these clearances have been obtained and that the article has command approval for open publication.

Authors should include their address and office phone number (DSN/autovon and commercial) when articles are submitted.

In addition to printed copy, authors should submit articles on a 5 1/4-inch floppy disk in ASCII format.

SUBMISSIONS TO THE ARMY RD&A BULLETIN

ARTICLES: *Army RD&A Bulletin* is continuously seeking articles of interest to the RD&A community. Articles for future publication may be mailed to the address below. Questions concerning submissions should be directed to the editorial staff at the phone number listed below.

LETTERS TO THE EDITOR: The editorial staff welcomes readers'comments on any articles published in the bulletin, or other topics of interest to members of the RD&A community. Letters to the editor should be limited to two typed, double-spaced pages, and should include your name, address, and commercial and DSN phone numbers. If you wish to write anonymously, please let us know, but enclose this information regardless, so that we can contact you, if necessary. Correspondence should be submitted to the address below.

BOOK REVIEWS: If you have read a book which you feel may be of special interest to the RD&A community, please contact us. The editorial staff welcomes your literary recommendations. Book reviews should be no longer than two double-spaced typed pages. In addition, please note the complete title of the book, the author's name, and your name, address, and commercial and DSN phone numbers. Submit book reviews to the address below.

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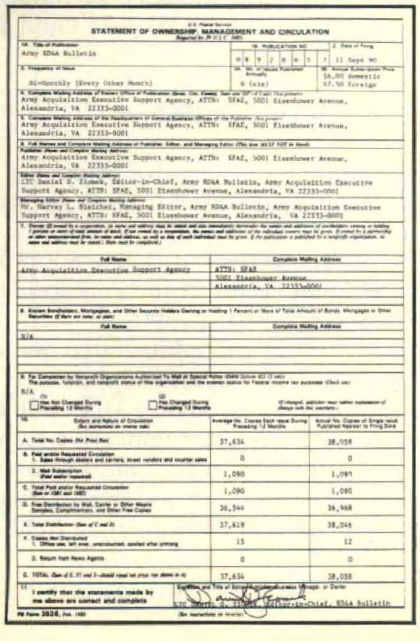

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PS Form 3526, Feb. 1988 (See instructions on reverse)

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FROM THE ARMY ACQUISITION EXECUTIVE...

As we continue to work to improve the acquisition process, it is clear to me that setting realistic and achievable performance standards remains one of our major challenges.

As I have participated in Defense Acquisition Board (DAB) meetings, Army Systems Acquisition Review Council (ASARC) meetings, and Defense Acquisition Executive Summary (DAES) reviews, I have seen numerous examples of Army programs that were falling short of standards of performance that we, in the Army, had established. In some cases, the standards seemed reasonable, and we simply had a problem that needed to be solved before we could achieve the desired level of performance. In more instances, however, it appeared to me that we may have set unrealistically ambitious standards. We seem particularly optimistic when it comes to projecting the system reliability of many of our programs, as measured by "Mission Capable Rate" and "Mean Time Between Failure." We seldom see an analytical underpinning to support these projections.

Setting our weapon system performance standards too high is a tempting practice, and may seem innocuous. But, in the long run, this overoptimism harms our programs. It damages perception of our acquisition practices, and, ultimately, our ability to put modern equipment in the hands of the soldier.

At the beginning of a program, it certainly is tempting to incorporate the very best technology and performance into the new system. We want nothing but the best for our soldiers. Also, we may believe that getting the new program approved and funded may depend upon our ability to demonstrate that the new system represents a substantial improvement over the previous system. These concerns are valid, but they must be tempered by a realistic view of what we will be able to deliver.

A number of negative consequences may be the unintended results of this "overpromising." If we require more capability than technology can deliver, we may have to wait an inordinately long time for the technology to catch up with our requirement. In the meantime, we may miss the opportunity for a useful interim system or modification. Our longstanding search for a "single man-portable anti-tank weapon" to replace the Dragon may be an example of this phenomenon. Likewise, if a system is burdened with too many stringent requirements or expectations, our failure to delivery may cause the program to be canceled. The Aquila is probably an example of this problem. The more common effect of overpromising is that we have difficulty moving the system through the development process and we fall into the mode of (1) failure to meet the requirements; (2) special Army or Office of the Secretary of Defense (OSD) review to address the problem; and (3) relaxation of the requirement and/or addition of dollars and time to meet the original requirement.

All these outcomes cast our Army acquisition system in the worst possible light, erode our credibility with OSD and the Congress, and, most importantly, keep useful capabilities out of the hands of the soldier.

How should we avoid the trap of setting standards that are unreasonably high and difficult to attain? I suggest the following:

1. **Negotiate requirements.**The users and developers must negotiate performance standards for new systems. The system should not proceed until both the user and developer are satisfied that it will meet the users' needs, can be executed successfully by the acquisition community. If one of the parties in the negotiation forces the other into accepting an unsatisfactory solution, an unsuccessful program surely will be the result.

2. **Conduct systematic requirements trade-offs.** Negotiations between the users and developers must be based on sound, quantifiable data, such as: what does the user need, what can the technology deliver, and what will the proposed solution cost in both dollars and time?

3. **Specify both ceilings and floors on performance.** Avoid the trap of requiring a new system to meet an ideal, maximum level of performance. It is fine to specify a desired level of capability, but also specify the minimum level of performance below which we would be unwilling to accept the new system. Without the latter, the higher standards will be applied to our system as "exit criteria."

4. **Establish intermediate milestones.** We need to know early if we are going to have difficulty meeting the reasonable system requirements. The best way to do this is to establish interim goals that we can use to measure progress. If we are not going to make it, let's find out early so that we can take appropriate corrective action.

5. **Don't create unnecessary problems.** We owe our soldiers quality systems that are fielded when they need them. It is difficult enough to get programs through the gauntlet of budget cuts, ASARC and DAB meetings, Congressional mark-ups, and other perils. Let's not make that task more difficult than necessary by setting unachievable standards. It is far easier to field a program containing modest improvements than one that fails to meet unrealistically high requirements.

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