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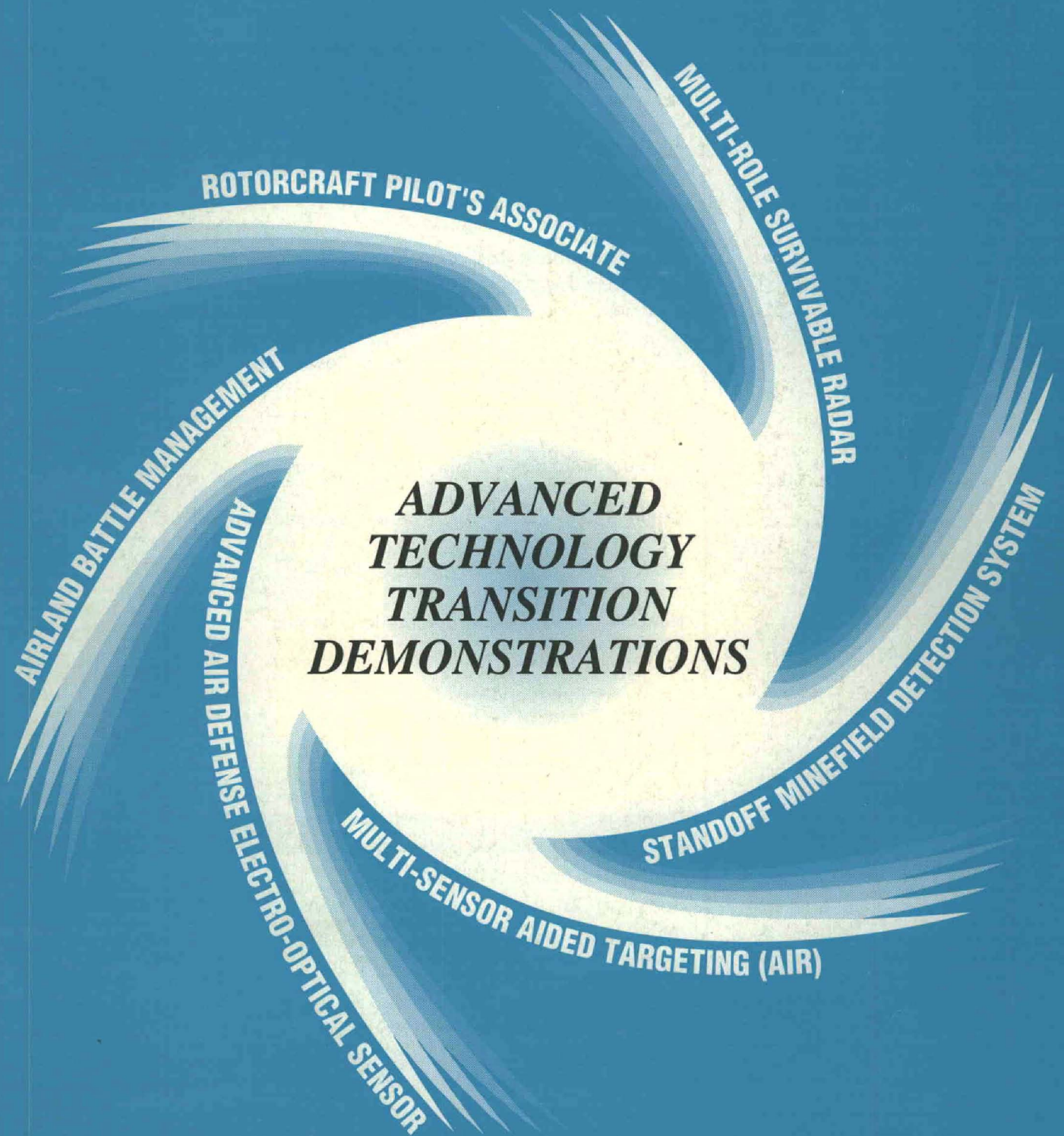

ADVANCED TECHNOLOGY TRANSITION DEMONSTRATIONS

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ARMY Research Development Acquisition RD&A BULLETIN

Professional Bulletin of the RD&A Community

FEATURES

DEPARTMENTS

COVER

Shown on the front cover are some current Advanced Technology Transition Demonstrations. ATTDs provide a means of accelerating the introduction of new technologies into operational systems.

By Dr. Charles H. Church
and Bruce B. Zimmerman

ADVANCED TECHNOLOGY TRANSITION DEMONSTRATIONS

Accelerating the Introduction of New Technologies Into Operational Systems

Introduction

Advanced Technology Transition Demonstrations (ATTDs) serve a critical role in the Army Technology Base Investment Strategy by accelerating the transition of high payoff technology base programs and products into demonstration/validation, full-scale development and/or production.

ATTDs permit exploration of technical options and the elimination of unpromising technologies in the early stages of a program to ensure a higher probability of success in the transition process. ATTDs also allow both the user and materiel developer to work together to experiment with and refine operational concepts, and to develop a more informed requirements document. This will hopefully lead to more technically and fiscally sound acquisition programs and more efficient use of scarce financial resources.

The ATTD approach was promoted by the Defense Science Board and the Army Science Board as a means of accelerating the introduction of new technologies into operational systems. ATTDs are technically sound, attainable, high priority programs offering potentially high payoff technology which the Army hopes to incorporate into existing, next generation or future systems. The criteria for establishing an ATTD are:

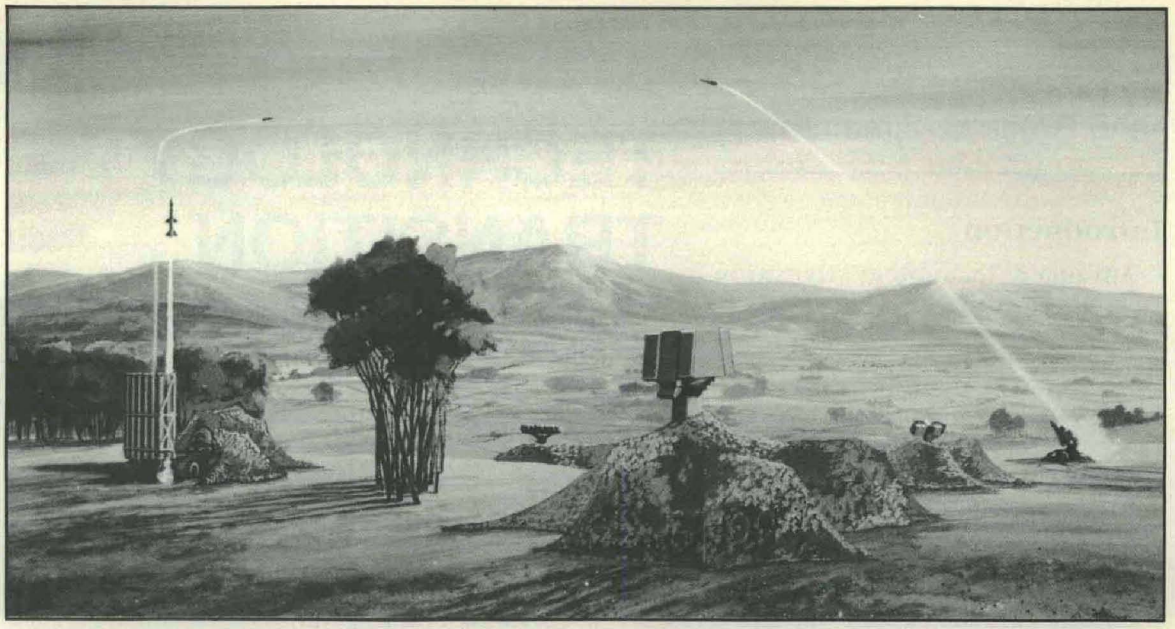
- Risk-reducing proof-of-principle demonstrations to be conducted at the system or major subsystem level in an operational environment rather than the laboratory environment;
- Potential for new or enhanced military operational capability or cost effectiveness;
- Duration of approximately three years;
- Transition plan in place for known applications and/or potential applications;
- Active participation by the user community (proponent); and
- Participation by the developer (project manager).

Each ATTD is baselined with a specific set of objectives, milestones, funding, transition plans and exit criteria in a Technology Development Plan (TDP). This document is designed to serve as a "contract" between HQDA and the materiel developer to conduct the ATTD program and deliver technology products to the Army in a timely and efficient manner. The products of an ATTD will typically transition to more than one system. The transition plans show the path for planned or potential transition to weapon systems development and are aligned with materiel development needs identified in Army modernization plans.

Senior Advisory Group

ATTDs receive special management attention. Review and approval is by an ATTD Senior Advisory Group (SAG) co-chaired by the deputy assistant secretary for research and technology, OASA (RDA), and the assistant deputy chief of staff for operations and plans, force development, HQDA. There is a special subset of the SAG to review and approve Special Access Program ATTDs.

Submissions for new ATTD programs are made to a working group that is co-chaired by the Army Materiel Command (AMC) deputy chief of staff for technology planning and management, and the assistant deputy chief of staff



Multi-Role Survivable Radar will allow air defense systems to engage targets in severe clutter and electronic countermeasures and survive attacks by anti-radiation missiles.

for combat developments, Army Training and Doctrine Command (TRADOC). The working group reviews candidate ATTD proposals and provides recommendations to the SAG for ATTD new start approval. The working group also reviews and assesses the progress of current ATTDs and makes recommendations to the SAG for restructuring of current ATTDs where required.

The first meeting of the SAG occurred in April 1990 and formally approved the following Army ATTDs: Advanced Air Defense Electro-Optical System, Advanced Chemical/Biological Defense, AirLand Battle Management, Common Chassis, Component Advanced Technology Testbed, Composite Hull for Combat Vehicles, Expendable Jammer Enhancement, Multi-Role Survivable Radar, Multi-Sensor Aided Targeting (Air), Radar Deception and Jamming, Rotorcraft Pilot's Associate, Soldier Integrated Protective Ensemble, and Standoff Minefield Detection.

The working group is currently reviewing and assessing candidate ATTD programs for the FY91-93 time frame. The recommended programs will be submitted to the next SAG meeting to seek approval for FY92-93 new start ATTDS. The Army Technology Base Investment Strategy sets an objective of allocating 50 percent of the 6.3A funding for ATTDs. In response to this guidance, a number of candidate ATTDs for FY94 and beyond were programmed in the POM. These candidate ATTDs will be reviewed and submitted for SAG approval at a later date.

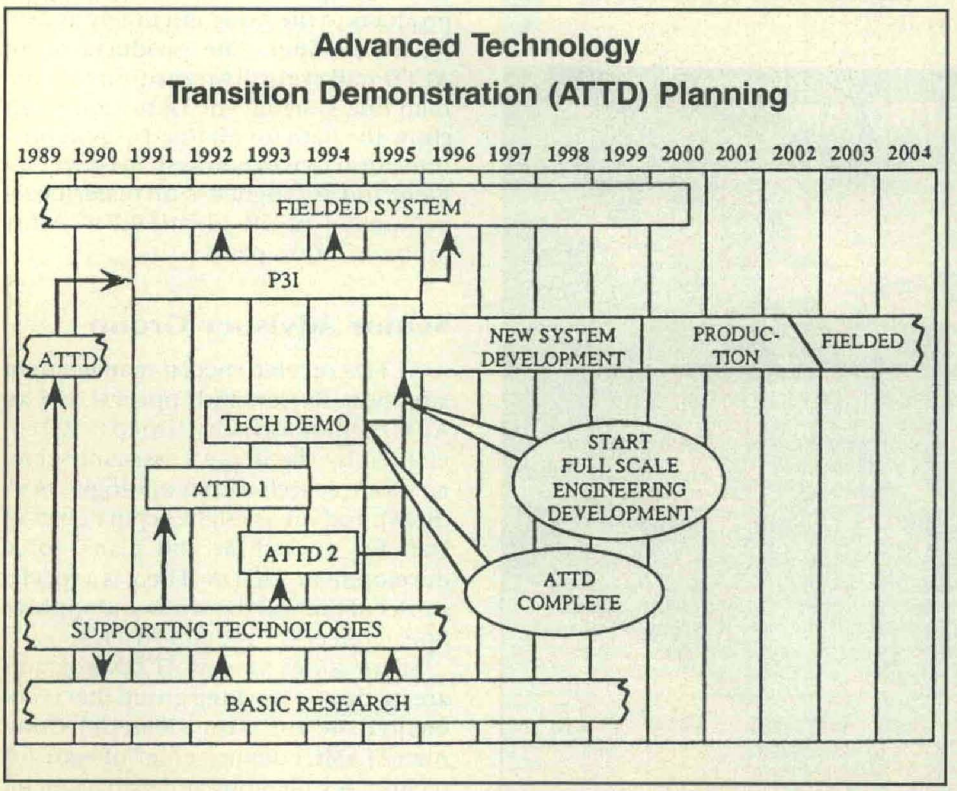


Figure 1.

Characteristics

One of the characteristics of an ATTD is the ability to experiment with several technologies in an attempt to overcome a technical barrier and demonstrate a new operational capability. This allows the Army user and materiel developer to experiment early in the development cycle, before being constrained by system requirements, such that we can afford to fail and try other technical approaches to solving critical Army weapon systems needs.

An ATTD differs from a technology demonstration primarily in that the ATTD is demonstrated by the user in an operational environment whereas a technology demonstration is typically conducted by the materiel developer in either a laboratory or field environment, but not necessarily an

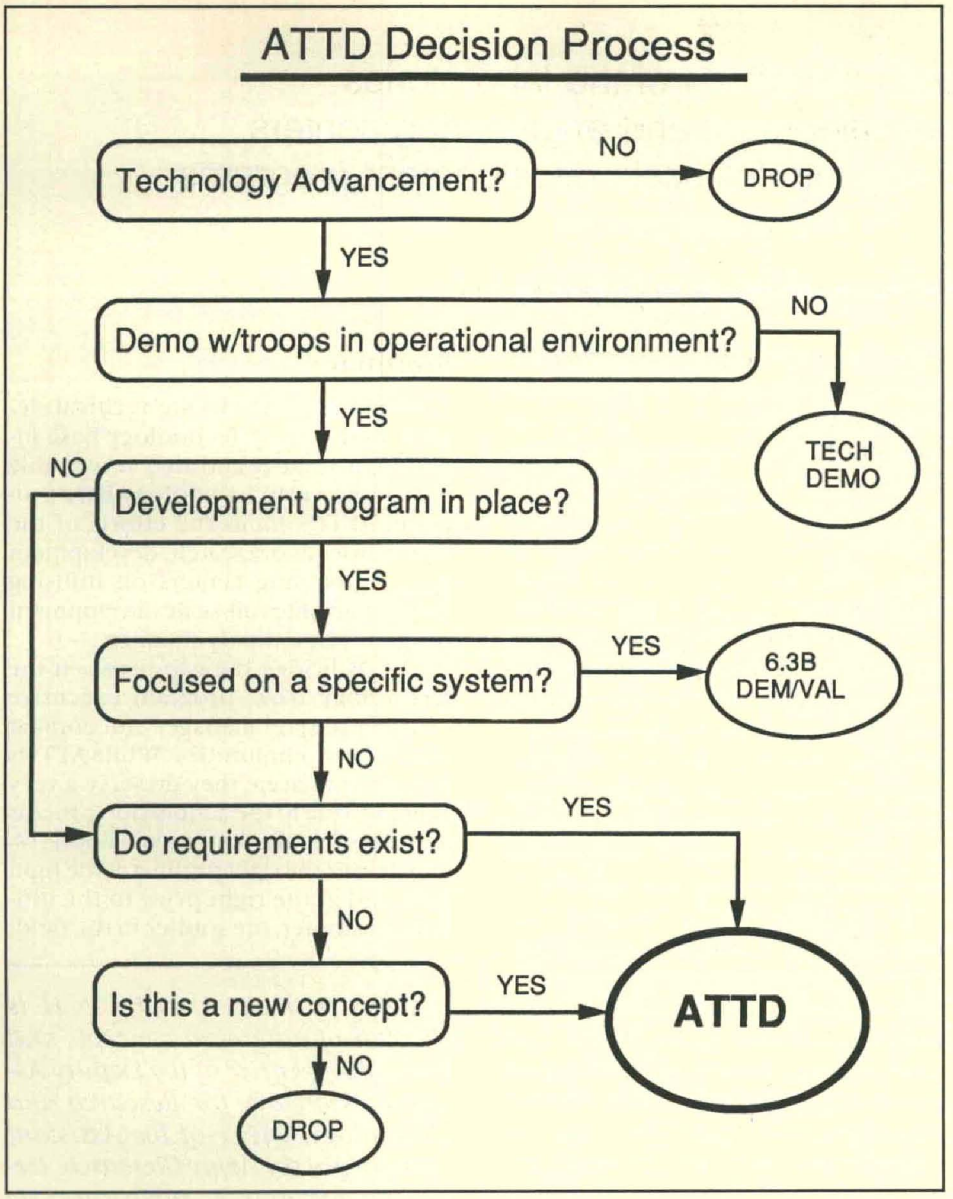


Figure 2.

operational environment. Figure 1 shows the notional program structure for an ATTD and the planned transition points.

Technology demonstrations, which are valuable technology base projects in their own right, can constitute component pieces of an overall ATTD program. ATTDs are typically funded in the 6.3A non-system specific advanced development funding category while technology demonstrations are typically funded in the 6.2 exploratory development funding category. ATTDs differ from technology demonstrations primarily in that the user is involved in conducting the ATTD demonstration and it is conducted in an operational environment.

ATTDs differ from demonstration/validation programs, funded in 6.3B, in that they demonstrate a major system or subsystem level of capability rather than an entire weapon system prototype. In addition, ATTDs typically support several systems applications rather than being focused on a single system as in a demonstration/validation program. In some cases a successful ATTD can bypass the demonstration/validation phase and directly enter full-scale development, but ATTDs are not a replacement for demonstration/validation programs.

Current ATTDs

Figure 2 depicts the decision process for determining whether a program meets the ATTD criteria, and to differentiate ATTDs from technology demonstrations and demonstration/validation programs. To provide an insight into the Army ATTD program, the following descriptions of a selected set of the current ATTDs are provided.

• **Rotorcraft Pilot's Associate (RPA).** The objective of this ATTD is to accelerate the application of cockpit automation and artificial intelligence technologies towards the development of a single pilot operable rotorcraft. This will be achieved through four primary functional areas of pilotage: aviation, navigation, communications and counter air operations.

The RPA ATTD is addressing these functional areas through four primary technology tasks: Day/Night Adverse Weather Pilotage System for aviation; Advanced Pilotage System Program for navigation; Aviation Battle Management Concept/Combined Arms Tactical Command and Control for communications; and Air-to-Air Mission Equipment Package/Weapons Demonstration for counter air.

The RPA ATTD will exploit the technologies of advanced signal processing and computing, artificial intelligence, data fusion, simulation and modeling, passive sensors, displays, automatic target recognition and rotary-wing controls.

The operational effectiveness of the RPA ATTD will be determined through the use of large scale distributed simulation networking involving both the user and developer communities. The RPA ATTD supports the needs of future scout/attack rotorcraft, including preplanned product improvements to the Light Helicopter. In addition, products from the technology tasks are candidates for transition to current aviation assets including the AH-64, OH 58D and Special Operations Aircraft.

• **Advanced Air Defense Electro-Optical Sensor.** This ATTD will demonstrate an infrared search and track sensor to detect and acquire helicopters and fixed wing aircraft with passive rather than active sensors. The proliferation of radar warning receivers on threat close air support helicopters and fixed wing aircraft provides an incentive for incorporating passive acquisition devices on forward area air defense weapons such as the Line of Sight Forward Heavy (LOS-FH).

Anti-radiation missile employment adds another stimulus to the development of passive acquisition capabilities. Variations of this infrared search and

ATTDs focus the efforts of the laboratories and research, development and engineering centers on infusing technology into full-scale development programs in a timely manner.

track approach will be adopted for use on Avenger, as an adjunct to the Forward Area Air Defense (FAAD) ground based sensor, and as a stand-alone sensor for light and special operations forces. Infrared sensors, processors, advanced cooling, optics, and algorithms will be addressed to assure adequate ability to track clutter bound, low signature helicopters to increased ranges.

• **Multi-Role Survivable Radar (MRSR)**. This ATTD will demonstrate a multi-function, track while scan, continuous wave radar capable of operating in the presence of anti-radiation missiles and electronic countermeasures. MRSR will be the departure point for development of a common Corps sensor alternative, envisioned as a mobile sensor capable of supporting both FAAD and Corps echelon weapons and Patriot air defense systems in contingency operations. Technology is focusing on low side lobe antenna designs, very wide bandwidths and noncooperative target recognition techniques. The design employs Very High Speed Integrated Circuit technology.

• **AirLand Battle Management (ALBM)**. The ALBM ATTD will demonstrate a design aid support environment which will provide the corps and division commanders and their staffs with automated reasoning capabilities and knowledge based management tools to cope with the large volume of data which must be analyzed and acted upon to yield decisions required for combat. The integration of artificial intelligence, simulation modeling, soldier-machine interface, and distributed data base technologies are key to the demonstration of a capability to automatically generate operational orders and provide recommended courses of action in a matter of minutes versus the 24 to 48 hours typically required to do this manually.

• **Multi-Sensor Aided Targeting-Air (MSAT (Air))**. This ATTD will demonstrate multiple sensor data collection, feature fusion, and automatic target recognition (ATR) processor modules for Army manned weapons platforms, primarily the main battle tank and attack helicopters. This ATR capability will allow Army systems to acquire and lock-on to threat targets faster than the threat can target U.S. systems. This will enable U.S. weapon systems to get off the first shot, which is critical to battlefield survival. In addition, the advanced MSAT(Air) capabilities offer the potential to acquire threat targets at longer stand-off ranges so that Army systems can engage threat systems at longer, less vulnerable ranges than the threat can engage U.S. systems.

MSAT (Air) will synergistically process target features obtained from multi-spectral sensors (millimeter wave radar, second generation Forward Looking Infrared Radar (FLIR), and laser radars) combined with signal processing and artificial intelligence processing techniques. The results of this effort will provide advanced sensor fusion capabilities to next generation attack helicopters and main battle tanks as well as having the potential for retrofitting to existing systems.

• **Standoff Minefield Detection System (STAMIDS)**. The STAMIDS will test microelectronics and advanced signal processing to detect surface laid mines or minefields from a standoff airborne platform. STAMIDS will be transported by a helicopter in rear areas and by an unmanned aerial vehicle forward of the Forward Line of Troops. The goal is to investigate the feasibility of a wise area image intelligence gathering system and to communicate the mine-field locations to the maneuver commander in real-time. Technologies will include: high/low resolution Infrared sensors, lasers, sensor fusion, and image analysis.

Summary

In summary, ATTDs are a critical element of the Army Technology Base Investment Strategy and are a very visible part of the Army Technology Base program. ATTDs focus the efforts of the laboratories and research, development and engineering centers on infusing technology into full-scale development programs in a timely manner.

ATTDs bridge the gap between the technology base, program executive officer/program manager and combat developer communities. While ATTDs are not a panacea, they do serve a very valuable role in the acquisition process and they help the Army acquisition system deliver the right product at the right time and at the right price to the ultimate customer, the soldier in the field.

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Compared to What?. . .

NEW FINDINGS ON THE HEALTH OF THE FORCE

By Dr. Joseph M. Rothberg
and CPT Paul T. Bartone

Introduction

The Army suicide rate of 13.0 in 1986 turns out to be one third **lower** than the U.S. civilian rate of 12.8. Those aren't typographical errors: each of the numbers has been reviewed and published in reputable scientific journals. The contradiction develops in answering the question "compared to what?" that is asked when looking at the death numbers for the Army. The claim that one number is very much smaller than a number which is obviously **not** smaller but numerically larger is a story worth telling. The tale will unfold as we look at these numbers, how we interpret them, and what we might expect from the future.

Suicide, one of the more common causes of death, has been increasing at an alarming rate in young Americans. According to the 1989 report of the *Secretary's Task Force on Youth Suicide from the Department of Health and Human Services*, suicide deaths in persons aged 15-24 increased over two and a half times from 1960 to 1980 as is shown in Figure 1. The Army recruits a significant portion of its population from that youthful age bracket. Changes in the social forces that have caused an increase in civilian suicide should also be affecting those young adults as soldiers.

Death by suicide has been the subject of papers published every two years in *Military Medicine*, the official journal of the Association of Military Surgeons of the United States. These papers on

Changes in the social forces that have caused an increase in civilian suicide should also be affecting those young adults as soldiers.

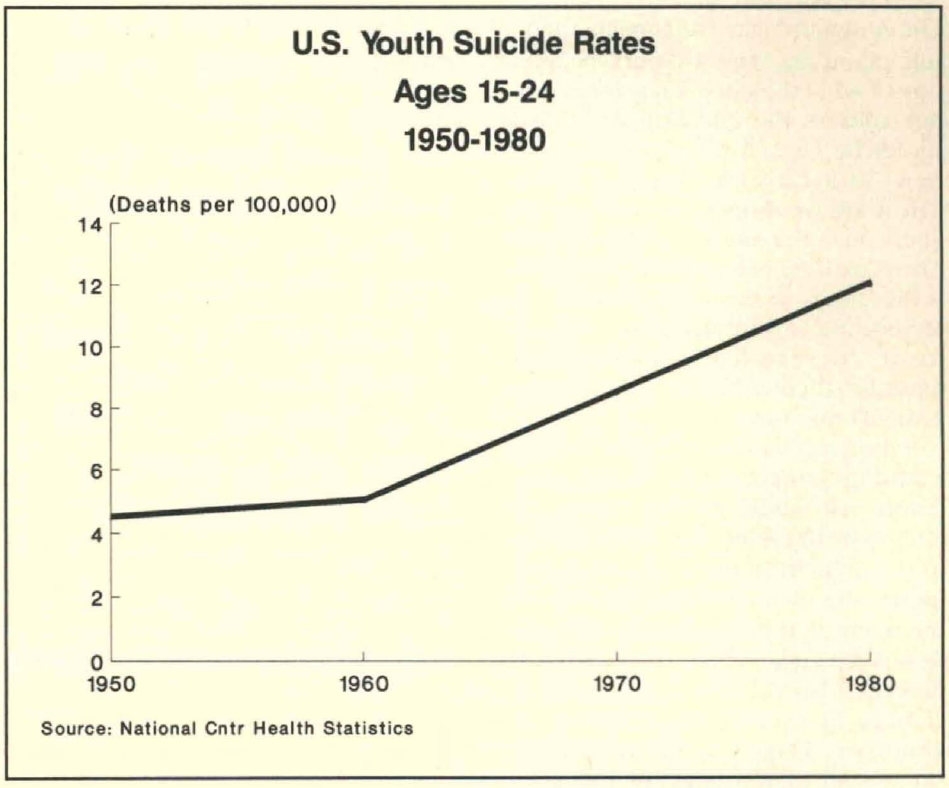

Figure 1.

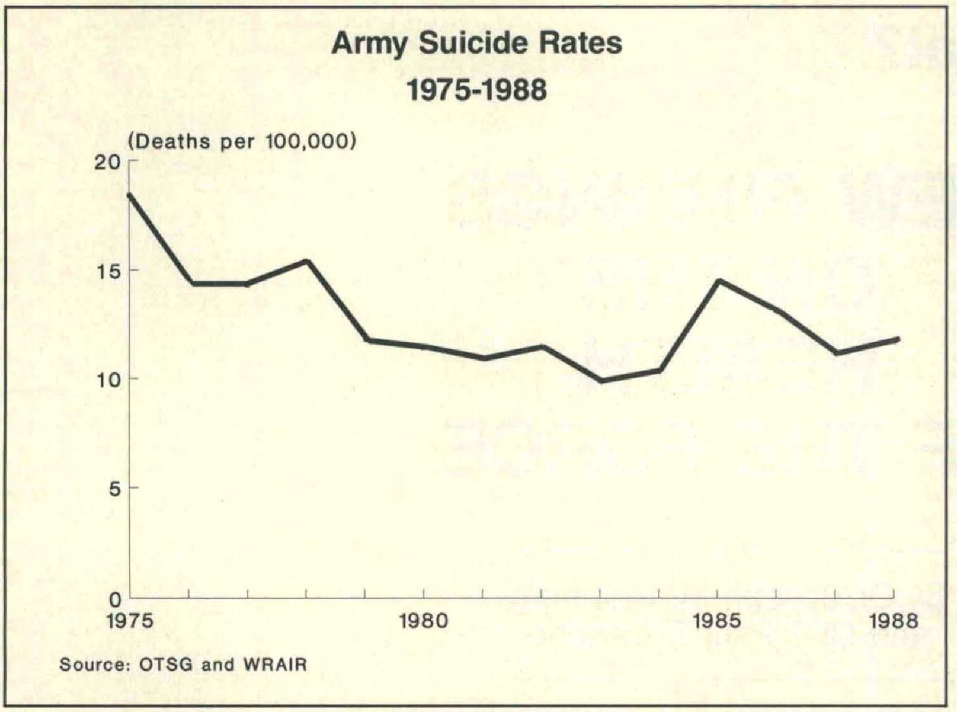

Figure 2.

suicides in the Army have detailed the "who, what, when, where, why, and how" of soldier deaths and death rates over the past decade. The trend has been downward over the 1975 to 1986 period despite fluctuations and even occasional increases, with a range of 10-15 per 100,000, as seen in Figure 2. The epidemiological documentation of suicides in the Army answers the question of what the suicide rate is but does not address the question of what it should be. Or, as former Mayor Koch of New York City was fond of asking, "How are we doing?" Answering this question is the job of the Walter Reed Army Institute of Research (WRAIR). It is the largest of the laboratories of the Medical R&D Command and the motto of "Research for the Soldier" describes their efforts in support of the AMEDD mission.

If the Army had a population that was a random sample of the civilian population, we would expect the suicide rates to be the same. But we know that in the civilian population males have higher suicide rates than females, and the Army's 90 percent male composition is far greater than the civilian 50 percent. Also, the Army has a small percentage of over-50 soldiers, and the group over 50 has a significantly higher suicide rate than younger people in the civilian sector. The absence of anyone under age 17 in the Army works in the opposite direction since civilians in that age group have a lower rate. Thus, to compare the Army suicide rate with that for the total civilian population is inappropriate, since the age, sex, and race compositions of the populations are not the same. The research task is to determine how to make a reasonable comparison between Army and civilian death rates.

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Vital Statistics

The most recent United States vital statistics published by the Department of Health and Human Services are from 1986. These reports tabulate the death rates for males and females and blacks and whites in five-year age intervals for each mode of death. Based on those death rates and the numbers of soldiers in each sex, race, and age-interval, we calculated the number of expected deaths and compared it with the number observed for soldiers for the same cause of death. A scale where 100 means that the number of deaths observed in the Army is exactly equal to the number predicted from the civilian rates is called the standardized mortality ratio. This calculation procedure is known as indirect standardization and the number is our "compared to what" answer to the question of how we are doing. A number over a hundred means that the death rate is higher than the comparable civilian group, and under a hundred indicates a lower death rate.

The answers are very positive for Army service, not only for suicide, but also for other causes of death. Total deaths in the Army occur at **half** the rate expected from comparable civilians. Disease causes a fourth as many deaths, homicides less than a fifth, suicides two-thirds as many, while accidental deaths are about equal. Figure 3 illustrates these relationships. These adjusted comparisons are the correct "compared to what." For suicide, the Army rate of 13.0 shouldn't be compared to the total U.S. rate of 12.8 but to civilians of the same age, race and sex proportion as the Army — a group that has a suicide rate of 18.5.

Implications

The significant public health policy implications of this analysis prompted wide dissemination of the findings and

resulted in this work being published as a featured special communication in the *Journal of the American Medical Association*, one of the world's premier medical publications. In addition to the scientific audience, the results were reported in major national newspapers and on radio and television news segments.

Although we have no data linking specific health promotion or other activities to improved health and increased life-expectance in the Army, identification of the probable causal factors is important. While it remains for future research to pinpoint these relations, we have suggested some promising areas for investigation. Factors that might influence decreased mortality in the Army (beyond the effects of volunteering and passing the enlistment physical) seem to fall into two broad and somewhat overlapping categories, physiological and social.

In the physiological category, we include such Army activities as regular exercise or physical training (PT), weight reduction and control, nutrition, smoking cessation and alcohol reduction programs. Here also, we would consider unimpeded access to an excellent medical treatment system with its associated preventive and educational components. Soldier participation in each of these activities is, to a large extent, involuntary. Organizational policies and controls mandate that soldiers exercise, eat well-balanced meals, maintain a healthy weight, be restricted in opportunities to smoke or drink, and receive routine medical and dental examinations whether they want to or not.

Social Component

But there is also a social component to each of these factors; soldiers in today's Army live and work in an environment that encourages personal commitment to healthy living, through educational programs, training, leadership practices, and peer pressure. Not only are soldiers required to do health-promoting things, their health values are affirmed and strengthened through exposure to a strongly health and fitness-oriented organization.

Another social dimension that merits consideration involves resiliency under stress. A growing scientific literature shows that many physiological changes

Total deaths in the Army occur at half the rate expected from comparable civilians.

and health ailments are directly related to psychosocial stress. Similarly, social support from peers and leaders has emerged as an important modulator in the stress-illness relation. Soldiers who are fortunate enough to belong to units where cohesion levels are high, where fellow soldiers and leaders are perceived as helpful and supportive, may indeed have a significant health advantage as regards stress-related problems. Since the Army provides a work environment in which group tasks and activities are given such heavy emphasis, the beneficial effects of social supports may even be magnified in cohesive military units.

The 10-Component Program

The motto of the Army Medical Department (AMEDD), "To Conserve the Fighting Strength," has made death and life-threatening issues a long-term continuing concern of the surgeon general. The death of a soldier represents the loss of a trained component of a highly interdependent work unit and frequently has widespread negative impact on the unit. The Army's current efforts at maintaining the health of the force have been consolidated into a Health Promotion Program which is described in Army Regulation 600-63, December 1987, which implements the Department of Defense policy (which, in turn, is derived from national goals). The immediate aims of the 10 component program are to maximize readiness, combat efficiency and work performance. The components of the program are:

- **Anti-tobacco**: Work-place smoking is controlled with emphasis on prevention through awareness education and assistance.
- **Physical fitness**: Cardiorespiratory fitness, muscular strength and endurance, flexibility, and body composition are to be established through continuous training.
- **Nutrition**: Existing dietary allowances for feeding healthy soldiers will continue to be implemented with the dissemination of nutrition information, education and counselling programs.
- **Weight control**: All soldiers will be monitored for proper body weight, body composition and personal ap-

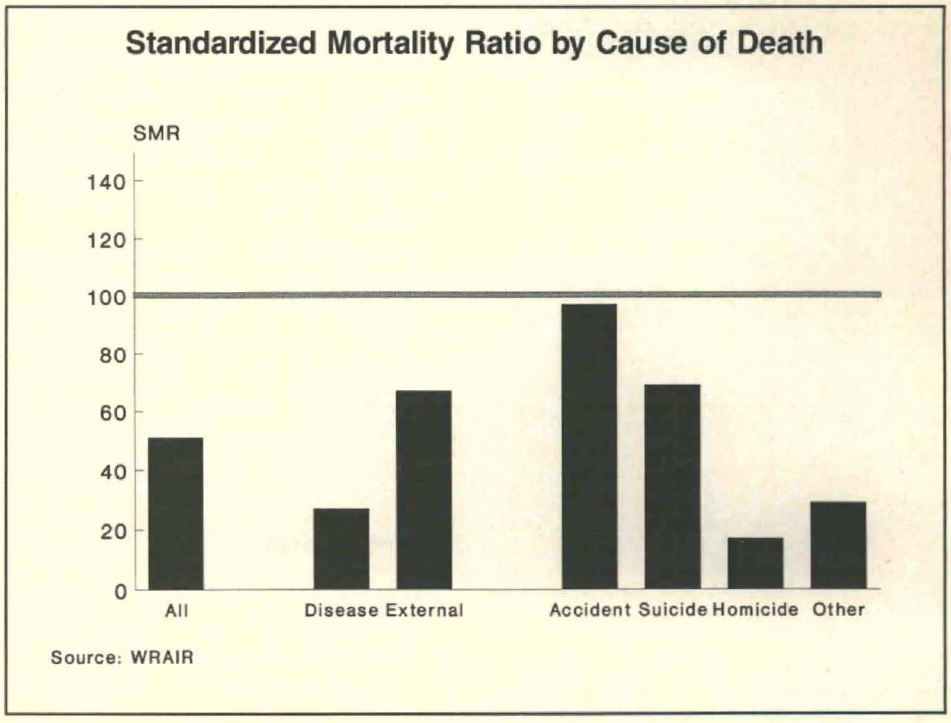

Figure 3.

pearance standards at least semi-annually.

- **Alcohol and Drug Abuse Prevention and Control Program**: Alcohol and drug abuse are incompatible with military service and abusers are to be rehabilitated or separated in accordance with existing programs.
- **Stress management**: The stress of active combat operations often leads to a combat stress reaction called battle fatigue. Unit ministry teams provide preventive, immediate and replenishing spiritual and emotional support and care to soldiers experiencing battle fatigue, while the combat stress trauma teams implement the medical recovery aspects of battle fatigue.
- **Suicide prevention**: A coordinated program for suicide prevention will be established at every Army installation, community, and activity and a psychological autopsy will be done to learn the circumstances of every suicide. Mental health, unit ministry personnel, and Army community services personnel will be involved with the crisis intervention and educational programs.
- **Spiritual fitness**: All soldiers and Army civilians are expected to live by the tenets of the professional Army ethic and those individual values that support and sustain the Army way of life, as described in Field Manual 100-1, "The Army."
- **Hypertension identification**: Routine screening will involve health care providers both in the lifestyle component of hypertension as well as the strictly medical aspects of the condition.
- **Oral health**: The oral health program involves the incorporation of hypertension and tobacco screening into routine dental examinations and the use of a dental fitness classification for each soldier based on the likelihood of having a dental emergency within the next 12 months.

The death of a soldier represents the loss of a trained component of a highly interdependent work unit and frequently has widespread negative impact on the unit.

Conclusions

These 10 components of the regulation consolidate the goals of the Army's on-going philosophy to maintain and increase the health and readiness of the force. Our examination of the mortality data suggests that the Health Promotion Program was initiated from a healthy baseline. Now it is important that additional research is geared to understanding more precisely the contributions made by physiological and psychosocial factors. Policy makers and leaders deserve to be well-informed in their efforts to implement effective programs not only to continue to conserve, but to further enhance, the fighting strength of the Army.

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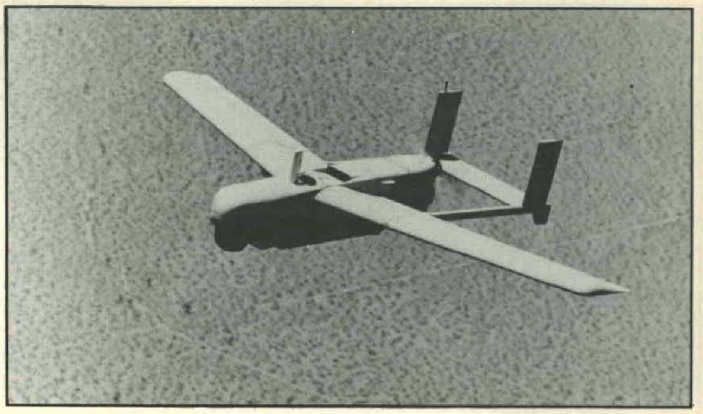
Israeli Aircraft Industries Short-Range UAV



McDonnell Douglas Short-Range UAV

UNMANNED AERIAL VEHICLES

By COL Bradford M. Brown and Robert Glomb

Introduction

Robots on the battlefield fighting side-by-side with soldiers seems to be futuristic science fiction. But for American forces in Operation Desert Shield, the future is now. Two aerial robot systems, called Pointer and Pioneer, are now in the Middle East to assist in reconnaissance and surveillance operations for the Army and the other Services. These systems, known as unmanned aerial vehicles (UAVs), provide inexpensive and effective means to gather information for the battlefield and naval commander without risking the capture or loss of friendly forces. Not only are UAVs versatile systems that can take the man out of battlefield danger, but in this era of declining budgets, they supplement a variety of more expensive manned systems in a cost effective way.

Recognizing the Services' difficulties in fielding and exploiting the capabilities of UAVs, and the distinct lack of common and interoperable UAV systems and subsystems, Congress in 1988 directed the Office of the Secretary of Defense to consolidate the management of DOD non-lethal UAV programs.

Organization and Management

In response to the Congressional direction, the under secretary of defense (acquisition) established a unique joint Service organization for UAV management with the Navy as Executive Service. The organization (see Figure 1) obtains direction from the UAV Executive Committee (EXCOM) which includes representatives from OSD, the Joint Chiefs of Staff, defense agencies, and the Services. The UAV EXCOM is responsible for oversight and overall direction of UAV programs. UAV requirements are established and prioritized by the Joint Requirements Oversight Council (JROC). The UAV Special Studies Group assists the JROC by consolidating and harmonizing individual Service requirements before they are presented to the JROC for approval. The UAV Working Group, composed of UAV EXCOM member organizations along with NSA, DARPA, and designated elements of the OSD and Services staffs, conducts activities required by the UAV EXCOM and serves as a focal point and working level sounding board on UAV matters.

The UAV Joint Project (JP), reporting through the Navy Executive Service chain of command, is the heart of the organization. The UAV JP is chartered to develop, procure, and support an affordable family of interoperable UAV systems that optimize commonality, are acceptable to the Services, and are effectively integrated into the DOD and allied battle force architectures. The precept of "jointness" continues in organizing and staffing the JP itself. Headed by a Navy rear admiral, who is assisted by a civilian SES director and an Army colonel deputy director, the organization is composed of five functional joint directorates: systems engineering and analysis, testing, logistics, projects and demonstrations, and business/financial. The directorates are headed and staffed by a mix of personnel from all four Services. Further supporting a joint environment, program execution is accomplished in three organic UAV program offices, one each from the Army, Navy, and Marine Corps. The organization fosters the spirit of interservice cooperation and coordination that is being sought by DOD.

UAV Requirements

Mission Need Statements for four categories of UAV requirements (close, short, medium and endurance) have been validated by the JROC and approved by the under secretary of defense (acquisition). The categories of requirements, which are generally described by desired UAV system characteristics, are depicted graphically in Figure 2. The figure is a not-to-scale representation of time of flight in hours versus approximate range or radius of action in kilometers. There may be more than one air vehicle in each of the requirements categories.

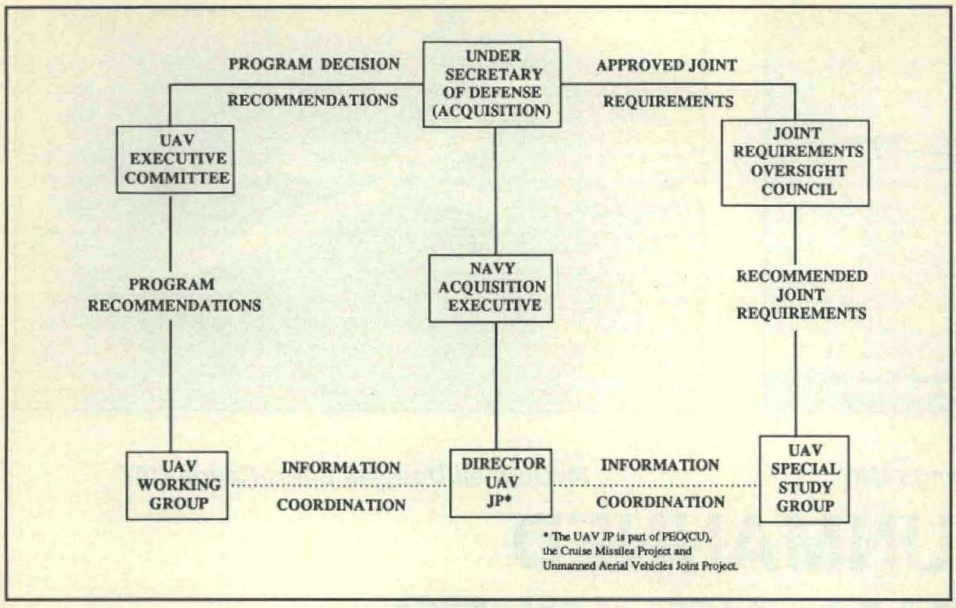


Figure 1.
Management.

Close range requirements address the needs of lower level tactical units such as Army brigades and battalions for a capability to investigate activities within their local area of interest and influence. Systems must be easy to launch, operate and recover; require minimum manpower, training and logistics; and be relatively inexpensive. Short range requirements support division and corps level needs to cover enemy activities out to a range of 150 kilometers or more beyond the FLOT (forward line of own troops) or datum point (in naval operations). These UAV systems are more robust and sophisticated, can carry a wider variety of payloads, can consist of more than one air vehicle, and perform more kinds of missions than close range systems. Medium range requirements address the need to provide pre- and post-strike reconnaissance of heavily defended targets and augment manned reconnaissance platforms by providing high quality, near real time imagery. They differ from other requirements in that the UAV systems are designed to fly at high subsonic speeds and spend relatively small amounts of time over target areas of interest. Endurance requirements respond to a wide variety of mission needs and address the capability to carry many types of payloads. Endurance systems are characterized by times of flight measured in days and very great ranges and altitudes of flight.

UAV Programs

The fielding of a UAV system that meets Army and Marine Corps short range requirements is the center piece of the JP acquisition strategy. This program, managed by an Army UAV program manager (COL Stan Souvenir) at Redstone Arsenal, AL, is presently in competitive production prototyping at McDonnell Douglas and Israeli Aircraft Industries (see page 9). A competitive fly-off between each company's design will be held in 1991 with the winner entering limited production in early 92. Full operational testing will be completed in 1992. Deliveries to the field will begin in mid-1993. The system is the cornerstone for achieving interoperability and commonality with the other categories of systems in the areas of mission planning and control, data links, payloads, and logistics. It will be evaluated for applicability in meeting requirements for a maritime UAV for small naval combatants, Army and Marine Corps requirements for a close range system, and evolving service needs for a UAV with a longer range, compatible with the endurance requirement. Both the maritime and close range UAVs are in the concept definition phase.

The medium range UAV system differs from the others because of its high speed, unique mission and because its inception preceded the establishment of the JP. It stands alone and is not a part of the JP interoperability and commonality objectives. The program is in full scale engineering development at Teledyne-Ryan Aeronautical and satisfies Navy, Marine Corps, and Air Force requirements for unmanned pre- and post- strike reconnaissance and battle damage assessment.

Additionally, the JP is evaluating Very Low Cost (VLC) UAVs. VLC UAVs, which include Pointer and Exdrone, are discussed later in this article. These systems are characterized as being very light weight and portable, extremely simple to operate, inexpensive to the point of being considered expendable

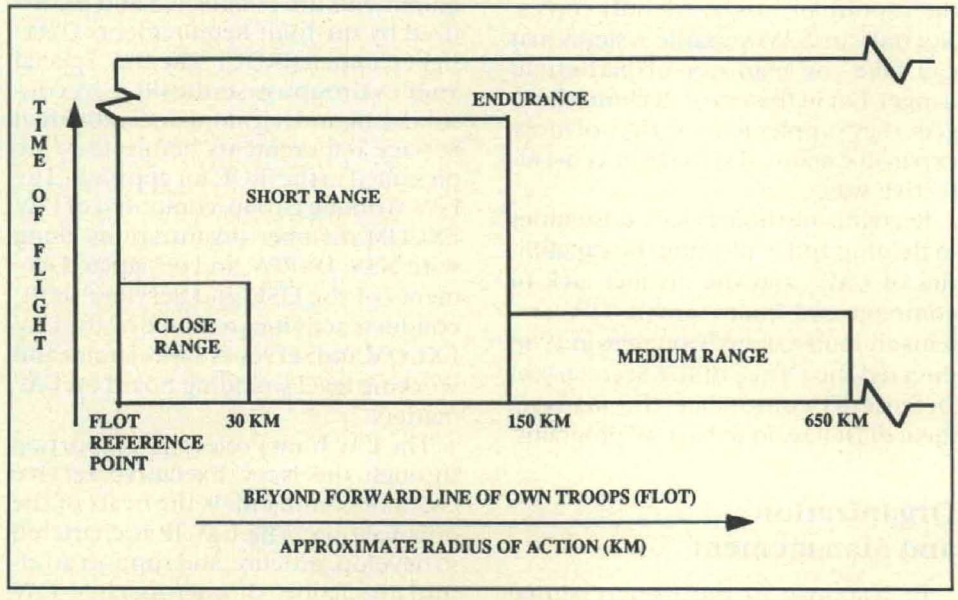


Figure 2.
UAV Requirements.

and requiring very minimal logistics support. VLC UAVs are used at the lowest echelons (company level or even lower) to determine "what's over the next hill." Generally they are non-developmental systems that are procured off-the-shelf for a price of under $10K per air vehicle.

Operational System Fielded

Prior to the inception of the UAV JP, the Pioneer UAV program was initiated on July 8, 1985 and the first system was delivered to the Navy in May 1986. Initial operations aboard the battleship USS Iowa and with Marine Corps RPV companies demonstrated the capability of UAVs to provide organic real-time sensor imagery to fleet users. Subsequently, Pioneer UAV systems were provided to operational forces, fleet units and test and evaluation units of the Army, Navy and Marine Corps. Since 1987, significant combat capabilities have been demonstrated to include: reconnaissance, surveillance, and target acquisition mission support; indirect fire adjustment; and other areas.

Pioneer operator and maintenance training for all Services is conducted at Fort Huachuca, AZ. The Pioneer system has been used in operational exercises in and out of the continental United States since 1987. One three-week operation was flown in support of U.S. counternarcotics efforts along the Texas-Mexico border. Real-time pictures taken by the Pioneer allowed U.S. border agents to seize about 1,000 pounds of smuggled marijuana with an estimated street value of $1 million and to make numerous arrests. Figure 3 shows the Pioneer.

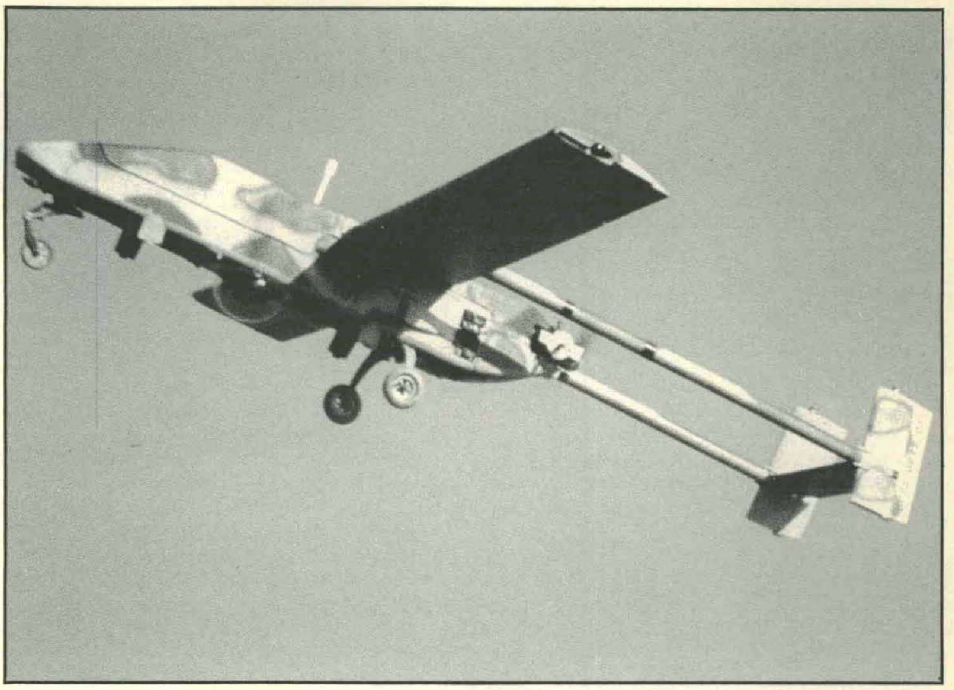


Figure 3.
Pioneer UAV.

Operational Demonstrations

A key tenet of the JPO strategy is to put systems in the hands of soldiers so that follow-on procurement specifications can be developed after the Services have acquired hands-on operational experience. The Pointer, a very low cost close range UAV, passed a proof-of-concept demonstration in June 1988 with the delivery of a "ruggedized" operational system. The air vehicle is constructed of commercially available components and materials. The payload is a fixed day television camera for real-time reconnaissance, surveillance, target acquisition, and battle damage assessment. Pointer is typically operated by infantry companies, artillery forward observers, and special operations personnel. The air vehicle is capable of being hand launched and is transported with its ground control unit in two backpacks of about 40 pounds each. Pointer has a range of three miles and flight duration of one hour using lithium batteries to power a quiet electric motor. In 1990, six Pointer systems were delivered for operational experimentation to the Army and Marine Corps. They have been successfully deployed in Korea, Thailand, Australia, Hawaii, Alaska, Europe, and the United States. Figure 4 shows the Pointer UAV.

The JP intends to acquire about 100 Exdrone UAVs for experimentation in FY91/92 by field users and for testing with an electronic jammer payload. Equipped with a daylight, color television camera, the system is well suited for reconnaissance and surveillance missions close to operating forces. The Exdrone has a range of 25 miles, endurance of two-plus hours, maximum speed of 100 mph, maximum weight of 80 pounds with payload, and can be launched by bungee or rocket assisted takeoff.

The U.S. and Canadian Governments have established a project agreement under the Foreign Comparative Testing program for development, test and evaluation of a maritime vertical takeoff and landing unmanned aerial vehicle system aboard a small naval combatant. The system includes a minimum of four Canadair CL-227 Sentinel vertical takeoff and landing vehicles, four day/night imaging payloads, a launch and recovery subsystem, an integrated mission planning and control station, and full logistics support. The project will include U.S. operator training followed by a six month at sea operational demonstration phase aboard an FFG-7 frigate deployed with NATO forces starting in June 1991. In conjunction with the activities of NATO Project Group 35, the navies of Canada, the United Kingdom, and the Netherlands will take part.

Analysis and Simulation

The exploitation of UAVs for military use needs to have a sound analytical foundation. While it may seem intuitive that unmanned systems offer cost benefits, this assumption must be rigorously verified. This effort, lead by an OSD chaired steering group, and an independent study team, chaired by the Center of Naval Analysis, recently completed its first phase. Results show that the best strategy for DOD is a mix of manned and unmanned systems. A sec-

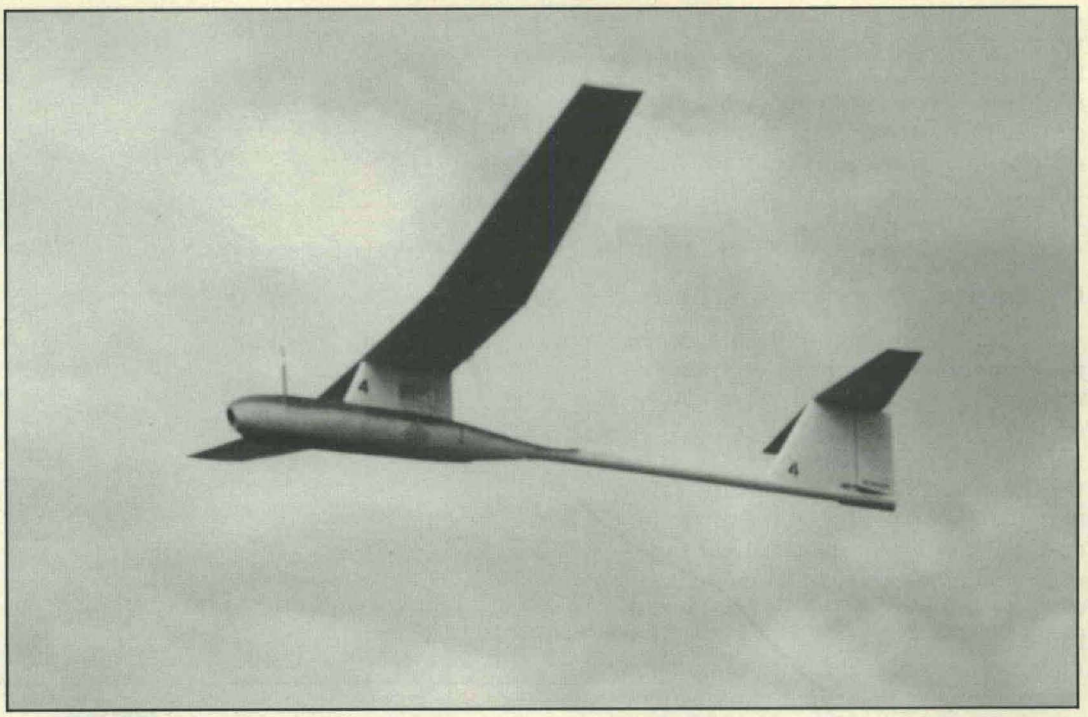


Figure 4.
FQM-151A Pointer UAV.

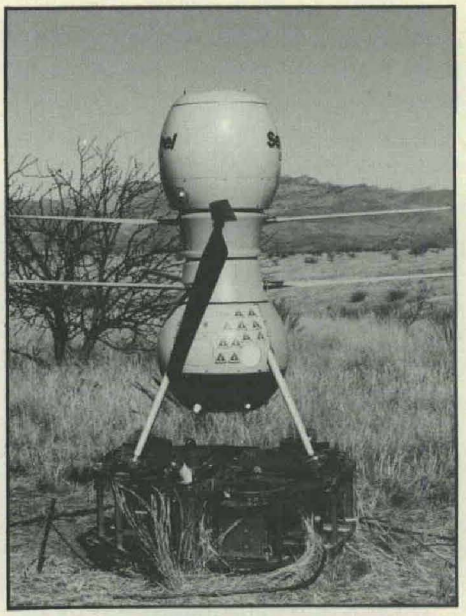
ond phase of the study is now underway to quantify the value of adding UAVs to the force structure and to resolve uncertainties about UAV survivability in high threat environments, determine sustainable sortie rates, and refine life cycle cost estimates.

Interoperability and Commonality

The battlefield continues to grow in complexity. Integration of systems to operate together has become as difficult, if not more so, as the development of the individual systems themselves. Joint exercises and operations are demanding that equipments of one Service perform effectively with that of other Services. This realization has engendered interoperability and commonality as the keystone elements of the UAV JP acquisition strategy. UAV systems and subsystems must be interoperable, that is, they must be able to operate effectively with the myriad of other command, control, communication, and intelligence systems on the battlefield including other UAVs. Commonality dictates that UAV systems have interchangeable repair parts and/or similar and interchangeable characteristics so that personnel training on all systems is minimized. Interoperability can be achieved without commonality, but commonality aids in ensuring that interoperability exists.

Conclusion

From a historical perspective, introduction of UAVs in the military parallels the growing pains experienced with manned aircraft in the 1920s and 30s. While recent successes have shown the military utility of UAVs, skeptics abound, and the constituency, albeit vocal, is small. The JP has made substantial progress, but still has much to do in furthering the development of UAVs.



CL-227 Sentinel Vertical Takeoff and Landing UAV.

COL BRADFORD M. BROWN is the deputy director for the UAV Joint Project. He holds a B.S. degree in management from the University of Tampa, an M.S. degree in systems management and a master of military art and science degree from the U.S. Army Command and General Staff College. He is also a graduate of the Program Management Course at the Defense Systems Management College.

ROBERT GLOMB is director of joint projects and demonstrations for the UAV Joint Project. He has a B.S. degree in electrical engineering and an M.S. degree in industrial engineering from Pennsylvania State University and an M.S. degree in operations research from George Washington University. He is also a graduate of the Program Management Course at the Defense Systems Management College.

ARMY ANNOUNCES R&D ACHIEVEMENT AWARD RECIPIENTS

Twenty-seven Army and two Navy scientists and engineers have been selected to receive Department of the Army R&D Achievement Awards. These awards recognize outstanding achievements in research and development that have improved capabilities of the U.S. Army and contributed to the national welfare during 1990.

The achievement awards, which will be presented this year in the form of a wall plaque, will honor 21 personnel employed at activities of the U.S. Army Materiel Command; three employees of the U.S. Army Corps of Engineers; and five employees of the U.S. Army Medical Research and Development Command.

U.S. Army Materiel Command

• U.S. Army Armament Research, Development and Engineering (RDE) Center

Dr. Frank P. Kuhl will be cited for his research in tracking and lead-angle prediction of maneuvering fixed-wing aircraft and helicopters. His research has led to the discovery of a fundamentally new technique for estimating the acceleration of a maneuvering aircraft using visible, infrared, or laser-radar imagery. This work provides the foundation for future generations of ground-to-air and air-to-air fire control systems.

Richard Fong and William Ng will be recognized for their work in developing a new lightweight, high efficiency, explosively formed penetrator warhead for an infantry anti-armor system. This concept will improve technology in new Army systems that are capable of defeating the future armor threat.

A team comprised of Edward F. Fennell and Floyd Hildebrant of the U.S. Army Armament RDE Center; Dr. Joseph J. Rocchio, Dr. Joseph M. Heimerl, and Kevin P. Resnik of the U.S. Army Ballistic Research Laboratory; and Susan T. Peters and Stephen E. Mitchell from the Naval Ordnance Station, Indian Head, MD, will receive the award for developing and demonstrating the effectiveness of a new technology for high energy low vulnerability propellants. This technology has enabled a new kinetic energy projectile for the Army's 105-mm tank gun fleet to achieve very high performance, significantly extending the useful life of this gun system.

• U.S. Army Aviation Research and Technology Activity

Dr. Roger C. Strawn will be recognized for working with Army and NASA researchers at the Ames Research Center, Mountain View, CA, to develop, demonstrate, and provide to the rotorcraft industry, a reliable computational model for transonic helicopter rotor aerodynamics. This computer code accurately models the transonic aerodynamics and acoustics of advanced high-speed helicopter rotors. Dr. Strawn's work significantly adds to the Army's technical capabilities for evaluating the aerodynamic performance of complex rotor shapes. It also establishes a scientific basis for subsequent improvements in high-speed rotor design.

• U.S. Army Ballistic Research Laboratory

Lee S. Magness Jr. will be honored for conducting research that has resulted in a fundamental understanding of the role of localized shear in the penetration process. His work, which has led to an explanation of the differences in performance between depleted uranium and tungsten alloy kinetic energy penetrators, will provide a rational approach to research aimed at improving the performance of all kinetic energy penetrators.

Dr. Joseph J. Rocchio, Dr. Joseph M. Heimerl, and Kevin P. Resnik of the Ballistic Research Laboratory were members of a team which will be recognized for developing high energy low vulnerability propellant technology. (Previously explained in the ARDEC listing.)

• U.S. Army Chemical Research, Development and Engineering Center

Dr. Susan F. Hallowell will be cited for her research using receptor recognition of drugs and toxins. The presence of drugs or toxins is determined using a colorimeter or spectrophotometer. This newly developed technology can be applied to the development of fieldable kits or assays for the determination of biological threat on the battlefield. Her work in this area will provide innovative solutions to extremely difficult problems encountered in battlefield detection and identification of chemical and biological compounds.

Eugene Jeffers will be honored for his effort in designing and developing the XM135 Binary Chemical Warhead for the Multiple Launch Rocket System (MLRS). The MLRS, with the XM135 Binary Chemical Warhead, will provide the Army with a formidable retaliatory capability. This program was instrumental in advancing the state-of-the-art of chemical warhead design, utilizing the binary concept and viscoelastic thickened binary simulant systems.

Dr. Tu-chen Cheng will be recognized for his contributions in chemical and biological agent detection and decontamination. Using state-of-the-art technology, he was able to successfully purify and clone a catalytic enzyme for chemical agent degradation. His pioneering work in this area will provide innovative solutions to the detection and decontamination of chemical and biological agents.

• U.S. Army Electronics Technology and Devices Laboratory

A team comprised of Dr. Kwong-Kit Choi, Dr. Mitra Dutta, W. David Braddock, and Peter G. Newman will receive the award for the invention of the 10 micron infrared phototransistor and multi-color photo- conductor, which advance the state-of-art in infrared sensing technology. The photo-transistor improves the capability of the present detector, and the multi-color photoconductor enhances the capability and the reliability of the detector for receiving coded signals in remote sensing operations. Its unique feature of wavelength tunability by external bias also adds flexibility to multi-channel optical communications.

• U.S. Army Missile Research, Development, and Engineering Center

Dr. George A. Tanton will be honored for his conception, design, and implementation of a new and revolutionary technique for non- destructive, noninvasive rapid evaluation of bulk, unprocessed semiconductor wafers for fast, sensitive infrared detectors. His work culminated with a prototype demonstration which led to a pilot program for industrial development.

• U.S. Army Natick Research, Development and Engineering Center

Dr. Stephen Lombardi will be recognized for his achievements in successfully cloning spider silk genes and expressing the recombinant product in a bacterial host system. These silk proteins exhibit unusual and potentially useful properties as high performance fibers for ballistic protection and for composite materials. In addition, a family of modified fibers produced from these proteins will result in the ability to study basic mechanisms of ballistic behavior in a detailed and controlled fashion that is not achievable with synthetic fiber approaches.

U.S. Army Corps of Engineers

• U.S. Army Construction Engineering Research Laboratory

Dr. Ashok Kumar will receive his award for the invention and development of a fiber-reinforced ceramic matrix composite for corrosion damage repair of pipes, pumps, and heat exchangers. This new material has four times better cavitation corrosion resistance than the currently used epoxy materials.

• U.S. Army Cold Regions Research and Engineering Laboratory

Austin Kovacs and Rexford M. Morey will be recognized for their work in the development and use of radar and electromagnetic induction systems for the measuring of the thickness of sea ice and fresh water ice, for determining the electromagnetic properties of sea ice and for detecting voids beneath concrete. As a result of their work, it is now possible to rapidly and accurately measure the thickness of large areas of ice. This work will lead to an increase in the effectiveness of military operations in arctic seas and an increased understanding of the rate of global warming.

U.S. Army Medical Research and Development Command

• U.S. Army Medical Research Institute of Infectious Diseases

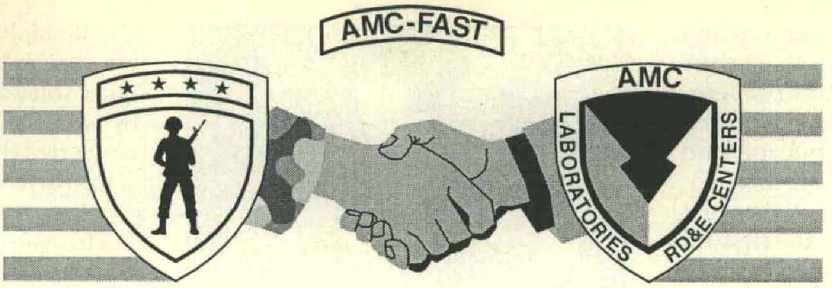
LTC Thomas G. Ksiazek will be recognized for his contribution to improved production of viral antigens for use in diagnostic test development. The procedure is useful for antigen production from virtually all human pathogenic viruses, and has been successfully employed in the development of diagnostic tests for more than 10 different viral diseases of special concern to the Department of Defense.

LTC Kenneth J. Linthicum will be cited for his contribution to predicting outbreaks of vector-borne disease by conceptualizing and developing an ingenious satellite surveillance system. For the first time, a mechanism has been established whereby a disease threat to military troops can be continuously quantified and predicted on a real- time basis.

• Walter Reed Army Institute of Research

Dr. Frank C. Tortella will be honored for his research in elucidating mechanisms of seizure development, propagation and termination, and in developing new drugs for the prevention and treatment of seizures. Because seizures can occur following neural injury or following exposure to chemical or biological weapons, soldiers may suffer temporary or permanent injury as a result of battlefield seizures. These prototype drugs may lead to improved medical care for both soldiers and civilians.

CPT(P) Ruthann M. Smejkal and Dr. Richard K. Gordon will be recognized for the development of second generation antidotes for organophosphate chemical warfare agent poisoning. Using quantitative structure-activity relationships and computer modeling of drug and receptor structures, they systematically and rationally searched for new, more potent, and potentially more useful drugs. The results of this research demonstrates that novel potent antimuscarinics can be synthesized and predicted on the basis of distance geometry.



WHAT AMC-FAST CAN DO FOR YOU

. . . A Win-Win Program

Introduction

The Army Materiel Command-Field Assistance in Science and Technology (AMC- FAST) Program provides a bridge between the Army in the field and AMC laboratories and research, development and engineering centers. Army troop commanders use AMC-FAST to get solutions to their problems. This bridge also provides laboratories and centers with a better understanding of the Army's most urgent needs.

AMC scientists and engineers, selected to serve in the FAST Program as a science adviser or as a FAST junior, are given a splendid opportunity to broaden their horizons from their "work bench" to a view of the field Army and how it operates.

Whether you are in the field, in a lab or center, or just interested in the welfare of the Army, AMC-FAST can benefit you.

A FAST Success Story

On the morning of Feb. 24, 1989, at Headquarters, Combat Equipment Group, Europe, in Mannheim, West Germany, Dr. Raine Gilbert was introduced to the commander. Dr. Gilbert stated that he was the AMC-FAST science adviser, assigned to 21st Theater Army Area Command (TAACOM), and that his mission was to find materiel solutions to problems.

An offer of help from a person with a direct line to all of AMC's laboratories and centers was too good to turn down.

By Richard E. Franseen

The commander immediately told Dr. Gilbert about a problem with exercising tank gun tubes which were in Prepositioned Materiel Configured to Unit Sets (POMCUS) storage. To keep the recoil mechanism combat ready, tank guns must be fired or exercised every six months.

Briefly, the commander explained that the tanks requiring exercise were in warehouse storage packed like the proverbial "sardines in a can." To exercise the tank tubes it was necessary to fuel the tanks, install six heavy batteries, and maneuver the tanks, one by one, out of the warehouse into an open area. There, a five-ton wrecker would be moved into position. The hydraulic crane would then be used to force the gun tube into recoil. Afterwards, the tank would be returned to storage. The commander concluded by saying, "Doctor, why don't you go look for yourself?" That was exactly what Dr. Gilbert wanted to do and with the colonel's invitation, he had an open door.

Dr. Gilbert found out that the situation was even more exasperating than the colonel had described. It took a six man crew one work week (240 man hours) to exercise the tubes of one battalion. During the exercising, it was necessary to be extremely careful with the alignment to avoid damaging the tanks' gun system. Despite careful attention, damage sometimes occurred.

The ball was now in AMC-FAST's court. Dr. Gilbert first determined that some local employees had already addressed the problem by wrapping a chain around the barrel and pulling the tube into recoil using a hydraulic piston. While this did the job, it was dangerous to operators and materiel. However, it did provide a starting point for a solution.

Dr. Gilbert got in touch with the Ballistic Research Laboratory and the Human Engineering Laboratory to work jointly on a solution. They brought in Benet Laboratories at Watervliet Arsenal. Within four months, a prototype of a safe hydraulic gun tube exerciser was successfully demonstrated in Europe.

Improvements were made and a second prototype was evaluated in December 1989. This evaluation proved that the gun tube exerciser reduced the manpower requirements to exercise 54 tanks from 240 to only 12 hours.

In the course of these developments, Dr. Gilbert discovered that active tank battalions also required a better means of exercising their tank recoil systems. At the request of field commanders, the scope of the project was broadened to include deployed tanks. The finished prototypes were demonstrated throughout U.S. Army Europe (USAREUR) to audiences including local labor employees, soldiers, commanders and their staffs from company level up, and the commander in chief, USAREUR.

As a result of the demonstrations and evaluation and Training and Doctrine Command (TRADOC) endorsement, project manager (PM) Abrams accepted the mission of funding, acquiring, and fielding the gun tube exerciser throughout the Army. As of Nov. 1, Watervliet Arsenal had manufactured the first 12. Safety certification is underway and fielding should take place in early 1991.

In less than two years, a problem was identified, a solution developed, manufacturing started and fielding plans put in place. Future costs savings from the use of 60 exercisers could amount to more than $1,000,000 per year.

Other Success Stories

Examples of other AMC-FAST success stories include: the Sleep Restraint, which permits tank crew members to obtain some rest during long button-up periods; the Auxiliary Power Unit for the Abrams Tank, which offers improved readiness and savings of over $30,000 per year per tank; the Multi Integrated Laser Equipment System (MILES) Hand Grenade, which increases the realism of training; and "Big Bob," an engine diagnostic kit, which reduces the frequency of tank engine changes. All of these products have been developed to help operational units. They have demonstrated the capability to generate significant Operations and Support (O&S) cost savings and to improve readiness, safety and training.

Currently, FAST is working on more than 100 separate projects. Although each project has its own peculiarities, the process for handling projects follows the general procedures used in the Gun Tube Exerciser. The procedures are: problem definition, solution identification, development and demonstration of prototype(s), assisting the requirement process and fielding the product. FAST projects have had a highly visible impact; however, projects represent only one of several benefits provided by FAST.

The presence of science advisers on the staffs of field Army commanders has been a valuable resource to both the field commands and to AMC. During the five years of AMC-FAST's existence, its advisers have performed studies on single fuels and their effect on operations, security of storage sites, potential

Dr. Raine Gilbert demonstrates the Gun Tube Exerciser.

explosive hazards, fuel contamination, hazardous waste disposal, satellite communications, milk reconstitution facilities, and scoring of gunnery teams.

These reports have served as the basis for operational, administrative, and training decisions. In the transfer of information, advisers have been used extensively by both the field commands and AMC to ask questions and to get answers.

The term "get answers" is used deliberately. Despite the high qualifications of FAST science advisers, it would be unreasonable to expect any one person to be an expert on the entire range of activities with which they deal. Essential to the success of the science adviser is his knowledge of AMC and its resources.

Science advisers have performed valuable services in arranging visits for members of their commands and for AMC personnel. When the Southern European Task Force (SETAF) needed to learn first-hand about weapons trainers, Russell Phelps, SETAF science adviser, made the arrangements. When Natick RD&E Center needed to show its latest products to the field, FAST advisers arranged the visits and prepared reports.

One of the more unusual FAST adviser services was performed by the science adviser then located at the 7th Army Training Center. On receiving word of a visit by a Russian general, the command was faced with the problem of preparing briefing material in the Cyrillic alphabet. Not knowing Russian, but through his knowledge of a computer software program, and supported by a Russian linguist, the science adviser converted the prepared briefing material into briefing charts written with the Cyrillic alphabet.

The variety of opportunities presented to science advisers to use their imagination, knowledge of AMC, education and experience has been truly exceptional and the advisers have enthusiastically met these challenges.

The AMC-FAST Team

The FAST Program successes have been accomplished by a relatively small team made up of a four-person headquarters, 17 science advisers in the field and 28 points of contact located at AMC laboratories and centers. The FAST Headquarters element provides program direction and also selects, assigns, trains and supports the science advisers. The director, assisted by a deputy and a resource manager, reviews prioritized project requests, allocates funds, and monitors field activities.

Science advisers are AMC scientists and engineers from AMC laboratories and centers who are assigned to field Army commanders and serve as staff members. During their two-year assignment, they provide technical advice and carry out projects in the manner previously described. At the completion of their tours, the advisers return to their home organizations with a more realistic understanding of what the Army needs.

The lab and center points of contact provide information and technical contacts to the science advisers and a ready access to the FAST Program for members of their lab or center.

Expanding the FAST Mission

AMC established the FAST Program to fill an Office of the Secretary of Defense (OSD) stated need of providing a direct link between the military laboratories and centers and the service personnel in the field. FAST has demonstrated its capability to fill that need. In the past year, the staffs of both the Department of the Army and AMC have discovered in FAST an additional capability to improve the process of rapidly fielding new equipment.

FAST Points of Contact

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USARPAC	FT. SHAFTER	MR. LOUIS E. JAKUB	AV 315-438-1480
USARAL	FT. WAINWRIGHT	TBD	
EUSA	YONGSAN	MR. JAMES F. GIBSON	AV 315-723-5127
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FORSCOM	FT. MCPHERSON	DR. DONALD E. SNIDER	AV 367-5435
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III CORPS	FT. HOOD	DR. PATRICK J. EASTON	AV 737-7145
XVIII CORPS	FT. BRAGG	MR. CLIVE L. NICKERSON	AV 236-4506
NTC	FT. IRWIN	MR. DONALD GROSS	AV 470-5004
SOUTHCOM	ROSSLYN, VA	MR. ROBERT T. KOHOUT	CM 703-522-6942

In response, FAST has focused on the fielding problem and has helped to establish the Army Commanders Initiative Program (ARCIP). ARCIP is headed by a board of directors composed of the vice chief of staff of the Army, the military deputy to the assistant secretary of the Army for research, development and acquisition and senior staff members from the Offices of the Deputy Chief of Staff for Operations and Plans (ODCSOPS), Deputy Chief of Staff for Logistics (ODCSLOG), Deputy Chief of Staff for Personnel (ODCSPER), TRADOC and AMC.

The purpose of the board is to consider nominations from commanders for the fielding of FAST project equipment. The ARCIP Board held its first meeting on Nov. 1, 1990 and considered requests for the fielding of the Quick Erect Antenna Mast (funded by USAREUR), Gun Tube Exerciser (funded by PM Abrams) and the Auxiliary Power Unit for the Abrams tank.

Although ARCIP is new and FAST has only recently focused on fielding equipment, it appears that FAST can provide a valuable service in the fielding of special items. In the short interval since the beginning of Desert Shield, FAST teams have conducted several monthly visits to the Middle East which provided a number of items of special equipment. FAST teams are currently working on other requests from Desert Sheild units for special materiel.

AMC-FAST has been directed to increase emphasis on an important training experience for younger engineers and scientists. The director of Harry Diamond Laboratories (HDL), supported by FAST, initiated a FAST Junior program in 1988. This program usually assigns GS 9, 11 or 12 engineers and scientists to work directly with FAST science advisers on specific problems.

Initial successes by HDL personnel working on a variety of projects including the tank engine analyzer (''Big Bob''), investigation of electrical failures, and production of highly mobile gun racks, led to the expansion of the FAST Junior program to include all AMC labs and centers. The current goal is to assign two or three FAST Junior personnel per year from each AMC lab and center. This will increase the potential to solve problems in the field and will increase field experience for laboratory and center personnel.

How You Can Use FAST

AMC-FAST, the bridge that AMC built between AMC laboratories and centers and the Army in the field, has been in use for five years. It has had considerable success, and with continued support and use this success can continue. If you have any questions about how FAST can help you, or questions about the program, please contact your science adviser or FAST Headquarters. The FAST Headquarters phone numbers are DSN: 354-5482 or commercial (703) 664-5482).

Finally, if you are a highly motivated AMC scientist or engineer and would like to have a chance to participate in this challenging, rewarding program by becoming a science adviser or FAST Junior, the FAST Office would like to hear from you.

RICHARD E. FRANSEEN is director of the U.S. Army Materiel Command's Field Assistance In Science and Technology Program. He has served as a research and development engineer with the Army Materiel Command for 26 years. He holds a 1963 B.S. degree in mechanical engineering from Rice University and performed post-graduate study in electro-physics at George Washington University. He graduated from the Defense Systems Management College Program Managers Course in 1985.

The Army Research Office. . .

SHAPING THE FUTURE THROUGH BASIC RESEARCH

By Dr. Gerald J. Iafrate
and Dr. Robert W. Shaw

History

This year the Army Research Office (ARO) celebrates its 40th anniversary. This article briefly describes the history of ARO and outlines some examples of present and projected activities. During coming months, a series of articles describing current and future thrusts at ARO will be published in *Army RD&A Bulletin*.

For more than four decades, in response to Army-wide requirements, ARO has performed its mission of developing, managing and coordinating basic research in the physical and engineering sciences, materials science, geosciences, biology and mathematics. This basic research has provided the fundamental base for important advances in military technology.

The importance of technology to support the soldier in combat has been appreciated through centuries of warfare. Stories go back at least as far as the third century B.C. when Archimedes is said to have developed great solar mirrors to set fire to the Persian fleet. Considerably later, around 1800, Count Rumford established a basic principle of Thermodynamics — the relation between work and heat — from his observations of the heat generated during the boring of cannon. The most stiking modern example is the rapid application of fundamental discoveries to develop nuclear weapons.

GEN Eisenhower, as chief of staff wrote, "Scientists . . . must be given the greatest possible freedom to carry out their research." Soon after the end of World War II, in a report to the president titled "Science and Public Policy," John R. Steelman wrote "In war the laboratory became the first line of defense." Because of the demonstrated importance of basic research to national defense, the federal government began to plan for greatly increased funding and the Army decided to establish a program of research in the Ordnance Corps. The Corps had performed basic research at its research and development installations and through contractors for many years, so the program was built on an already strong commitment to research. The new program was intended to support a new initiative for research at universities and non-profit research institutions.

These plans were implemented quickly and the Office of Ordnance Research (OOR) was established at Duke University in June, 1951. Duke had carried out significant ordnance research for the Corps during the war and, with the University of North Carolina at Chapel Hill and North Carolina State University in Raleigh, the area had a high concentration of top faculty and students in science and engineering. The Corps had also decided that, at a university, there would be little tendency to divert research activities from basic to applied problems.

The OOR mission was: to formulate and implement the research program of the Ordnance Corps; to assure the prompt recognition, evaluation and dissemination of research results from all sources which show promise of Ordnance application; and to promote and support basic research. The Ordnance Corps had already identified fields of research with relevance to the Army. Examples are shown in Table 1.

Initially, the OOR was staffed by university faculty. However, within a year, permanent administrative and scientific staff were hired. During that first summer of existence, the OOR worked out detailed procedures for attracting, processing and reviewing scientific proposals and set those procedures in motion.

To attract proposals, letters were sent to universities believed to have research potential in areas of Corps interest. OOR staff also spoke with scientists at scientific meetings and on visits to their laboratories. To handle the evaluation of proposals, OOR staff established a system of reviews to ensure: cost-effective use of funds, scientific freedom for the investigator, and relevance of the research to the long or short-term needs of the Ordnance Corps.

After initial scientific screening reviews by the OOR staff, proposals were sent to scientific experts outside the Army for peer review and to scientists at Ordnance installations for indications of interest. The OOR staff also checked the proposals for duplication with programs supported elsewhere. The proposals rated highest received support. The basic design of this review system is still used today at ARO.

In the early 1960s the Ordnance Corps and other Army groups responsible for materiel were reorganized into the Army Materiel Command and the OOR was renamed the Army Research Office.

ARO Today

The high quality of planning and implementation by the architects of the

OOR are evident today in the operation of ARO. A principal mission of ARO is to serve as a window for the Army for basic research at universities and other civilian institutions. That window looks both ways. We encourage top scientists outside the Army to perform research relevant to Army needs; and, we seek to understand the implications for the Army of basic research performed elsewhere and to communicate important relevant developments to Army scientists.

The current structure of ARO is similar to the OOR structure but has evolved as science and engineering have evolved during the past 40 years. Table 1 lists the ARO divisions and gives a few examples of their current interests.

By comparing the OOR and ARO programs, we can see both continuity and evolution. For example, the enormous growth of electronics and the importance of electronic devices is now recognized by a separate division (the largest at ARO) devoted to it. Similarly, biological sciences was not originally part of OOR. Today, basic research programs in biotechnology and neurosciences are crucial to Army preparedness to meet future threats.

TABLE 1: ARO RESEARCH PROGRAM OF 40 YEARS AGO AND TODAY

DIVISIONS	*EXAMPLES OF RESEARCH INTERESTS*
Office of Ordnance Research - 1951	
Physics	Solid State, Surfaces, Liquids, Optics
Chemistry	Molecular Structure/Function
Mathematics	Statistics of Observations
Engineering Sciences	Supersonic and Diabatic Flow, Servo-mechanisms
Army Research Office - 1991	
Physics	Electron Transport in Solids, Optics
Chemistry and Biological Sciences	Polymers, Combustion Kinetics, Biodegradation, Biotechnology
Mathematics	Control Theory, Statistics, High Performance Computing
Materials Science	Materials Processing and Behavior, Smart Materials
Engineering Sciences	Fluid Dynamics, Structural Mechanics
Geosciences	Electromagnetic Propagation, Hydrology
Electronics	Microelectronics, Communications

ARO's 40th Anniversary

In June, 1991 the Army Research Office will celebrate 40 years of service to the Army. Some of ARO's creators will attend the ceremonies and symposium on "Basic Research — Shaping the Future of the U.S. Army." Distinguished research workers, including four Nobel prize winners supported by the ARO during the past 40 years, also will attend. In honoring the founders and architects of ARO, we honor their achievement and their foresight in establishing a clear mission for the office and providing it a structure that has enabled it to perform this mission over the four decades of its existence.

The Future

The Army Research Office looks forward to the future by supporting basic research for the purpose of deterring war and protecting the American soldier. Those goals have not changed during the past decades, nor will they change in the future. The means to achieve them, however, must evolve to meet new and more complex threats.

The Army has been planning for future conflicts involving quick, deep strikes by mobile, self-contained units. Arming and protecting our soldiers effectively will require better communications, more sensitive detectors and political imagers, and faster information processing for target acquisition. These improvements require fundamental developments in electronics, solid state physics and mathematics.

Chemical and biological threats will require research in chemistry, biology, and materials science for improved detectors, decontaminants and materials to protect the soldier. Light, powerful, efficient, well-armored vehicles will require research in engineering and materials sciences. Prediction of consequences of weather and the terrain will require research in geosciences.

All these and other requirements to arm and protect the soldier are made more difficult by the need to decrease the logistics burden for quick, deep penetrating and self-contained units. In a rapidly changing world, we must plan to meet changing adversaries and threats. We must support basic research to provide the fundamental understanding required for a flexible defensive technology to evolve and overcome those threats.

In addition to its responsibility for combat preparation, the Army has accepted a new challenge — to clean-up and preserve the environment from the consequences of military activity. This will be a difficult job and one requiring basic research to provide the needed technology. The ARO is now planning for new initiatives in chemical reactor and catalyst research, biodegradation, combustion engineering and monitoring, and transport and fate (ultimate destination) of pollutants in ground water and atmospheric plumes.

During the past 40 years, ARO has been an active partner with scientists in and outside the Army. We look forward to new achievements, supporting and protecting the soldier, fostered by that partnership.

DR. GERALD J. IAFRATE, director of the Army Research Office, has a Ph.D. in physics from the Polytechnic Institute of Brooklyn.

DR. ROBERT W. SHAW, associate director of the Division of Chemical and Biological Sciences at the U.S. Army Research Office, has a Ph.D. in physical chemistry from the University of Washington.

THE THREE GRACES OF FORCE MODERNIZATION

Who is in Charge? Where Are We Going? How Are We Going to Get There?

By LTC Kenneth H. Rose

There are several ways in which we may perceive and approach force modernization. One popular way is to view it as a materiel application process — the so-called "eaches" approach. This includes three sequential steps. First, we embrace a particular materiel item. Next, we seek a concept that will justify and govern its employment. Finally, we select a proponent to prepare the concept, support acquisition, and manage implementation. The problem with this is that by the time the proponent gets organized, the materiel characteristics have changed and it is time to start over.

A more basic problem is identified by Martin Van Creveld in *Command In War*: "In an age when new electronic marvels are being introduced almost daily . . . it is easy to forget . . . that command, rather than simply being an assortment of technological marvels around which organizations and procedures are built, consists of a series of processes . . . by which the technological means at hand are pressed into service." Replace the word "command" with any combat capability — armor/antiarmor, close fire support, countermobility, whatever — and you have a succinct statement of the dilemma facing those who must modernize the military forces.

However, restating the steps of the "eaches" approach in reverse order provides the focus that Creveld suggests. It also generates three fundamental questions that may serve as a universal management model. Hence, the Three Graces of Force Modernization: Who is in charge? Where are we going? How are we going to get there?

The answer to, "Who is in charge?" has two components, perhaps best described as strategic and operational. The strategic component addresses the principal drivers of the modernization process. For example, we must first decide whether we want a requirements-based acquisition system (buy what we

need) or a materiel-based application system (use what we buy). Like most things in life, this is not a one-or-the-other matter. The answer is a mixture of both. But, it is not a 50/50 mix. One approach must prevail or we condemn ourselves to the same fate as the apartment superintendent who can never get the grass between the buildings cut: everybody's property is nobody's responsibility.

The operational component identifies the players in the game — all the players, not just the top executive or the bottom action officer. Leaders without followers lack relevance and followers without leaders lack coherence. The mixture of the two is not a simple hierarchy. Rather, leaders and followers interact in complex matrices of interwoven formal and informal command and technical associations. The people must be identified and their responsibilities and interrelationships must be defined.

The next question, "Where are we going." sets the major directions of development. The answer to this should be a series of flexible vectors, but not predetermined paths. It should be based in part on the threat that we must counter, but can not be only response-driven; there must be an active role for initiative and original thought. The answer can not be so creative that it wholly ignores the constraints of the real world, and can not be so focused that it skips directly to the next question.

The second question is perhaps the most difficult to answer because it is necessarily laced with uncertainty and prediction — not the strong suits of military organizations with long histories in the rational tradition. To model something that has yet to be invented is not just hard, it is impossible. Yet, such is the stuff of which this answer is made. The absence of a good answer yields to the undirected, often useless floundering that is characteristic of the "eaches" approach. Adequately answered, this question sets the stage for deliberate advances in military operational art.

This is also the point where the role of industry becomes important. As stated earlier, development vectors are determined not only by the threat, but also by opportunity. Industry can and must assist the military laboratories, materiel developers, and concept developers in identifying where we can or may be able to go. However, again, this must not become so materiel-specific that it ignores the question at hand and skips to the next. For organizations that exist to sell their products, this may be a difficult task indeed.

"How are we going to get there?" This is everybody's favorite question. Now we can talk specifics in terms of "what" and "when" — and that makes everyone a lot more comfortable. But, this is not just a matter of "pick your favorite item." Just as the development vectors had to be carefully interleaved in the previous question, materiel systems and families of systems must be integrated in a way that produces a coherent whole within and between the vectors. We also get very serious about budgets as well as less exciting things (at least to some), such as logistics, organizations, and training. Now the role of industry becomes critical. No more promises here. The military decision-makers require sound engineering advice and commitments. What was earlier a loose collection of free thinkers must now become a very cold and dedicated team of doers.

Force modernization is a congress of complexity. Goals, issues, and procedures combine to create an environment that stymies the best of intentions. We can not make this go away, but we can deal with it. We can master the complex environment by establishing as beacons along the way three simple, yet powerful questions: Who is in charge? Where are we going? How are we going to get there?

Force modernization is a Congress of complexity. Goals, issues, and procedures combine to create an environment that stymies the best of intentions.

LTC KENNETH H. ROSE is deputy commander of the Belvoir Research, Development Engineering Center.

PM-LH

MG Ronald K. Andreson holds a B.S. degree from the U.S. Military Academy at West Point, NY, and an M.S. degree from Georgia Institute of Technology in Atlanta, GA. His military education includes completion of initial branch, airborne and aviation training, the Associate Transportation Corps Advanced Course, the U.S. Army Command and General Staff College and the Army War College. His most notable assignments have included: commander, 13th Aviation Battalion (combat), Fort Hood, TX; deputy brigade commander (logistics), 6th Cavalry Brigade (air combat); deputy commanding general for research and development, Army Aviation Systems Command; and project manager, Black Hawk.

MG Ronald K. Andreson

Program Missions

The light helicopter program will develop and produce a lightweight, low cost, advanced technology helicopter to replace the tactically obsolete AH-1, OH-6 and OH-58A/C fleets, and to complement the AH-64 Apache fleet.

The primary mission of the new helicopter will be that of attack and armed reconnaissance with air combat capability embedded in each of these missions.

The LH aircraft will be a leap ahead in worldwide combat effectiveness and will be designed for battlefield survivability and reduced maintenance burden. Safety is being designed into the aircraft. The copter will modernize the Army's corps and division light attack/scout assets.

The LH will correct major light fleet deficiencies such as marginal night and adverse weather capability; location and navigation accuracy; inability to self-deploy to overseas theaters of operations; inadequate reliability, performance and survivability; and high cost of ownership compared to existing aircraft.

The LH system's mission equipment and electronics architecture will provide the potential for future upgrade to the AH-64 aircraft.

The LH's system improvements will include lightweight composite airframe structures; protected anti-torque systems; low vibration, high reliability rotor systems; second generation target acquisition and night vision sensors; a tri-service electronics architecture that is compatible with the Air Force Advanced Tactical Fighter System, that can incorporate Integrated Communication, Navigation, and Identification Avionics and Integrated Electronic Warfare Systems modules; and built-in diagnostics and prognostics.

After five years of work on the project, the demonstration and validation development of the new helicopter has been successfully concluded by each of the two teams — McDonnell Douglas and Bell Helicopter Textron's "Superteam" and Boeing-Sikorsky's "First Team." A source selection and evaluation board has convened to evaluate the proposals. The winning team will then conduct the demonstration and validation prototype phase and build and test several prototype aircraft. According to the present schedule, fielding is projected for February 1998.

Total LH procurement could range up to 1,681 aircraft, depending upon the precise mix of heavy mechanized and light units to be procured within the realities of force structure and budget constraints.

"The Army will receive the best 7,500 pound empty-weight fighter that will meet the user requirements, perform its required mission, defeat the projected threat and survive on the future battlefield," says Andreson. "Very capable people and organizations from both the government and industry are working on the LH each day. They will ensure that this vital program remains a success story."

PM-LH HEADQUARTERS GROUP

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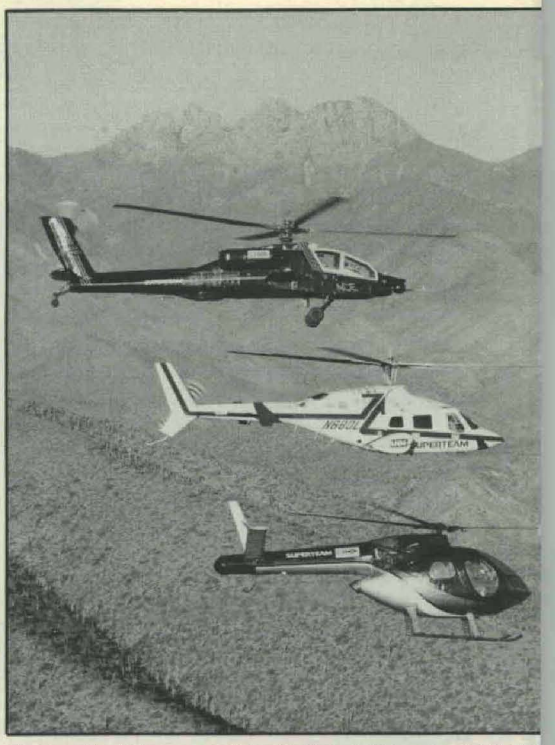
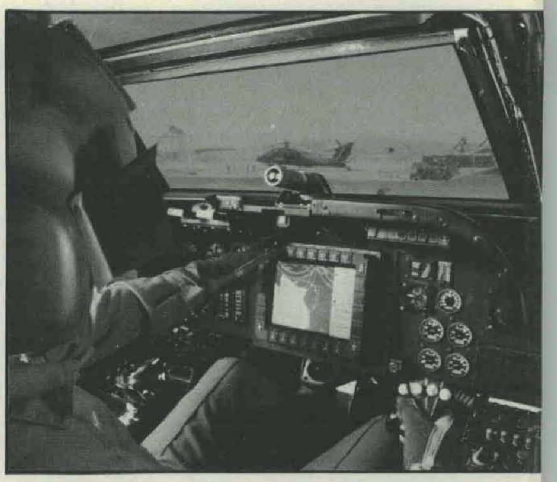


Three critical elements of the McDonnell Douglas/Bell Heli ter Textron entry in the U.S. Army's LH competition are (to bottom) the McDonnell Douglas AH-64 Apache advanced co evaluation helicopter, the Bell 222 with a high agility 680 system and the McDonnell Douglas NOTAR no tail rotor sy for anti-torque and directional control demonstrated on a m fied U.S. Army OH-6 aircraft.



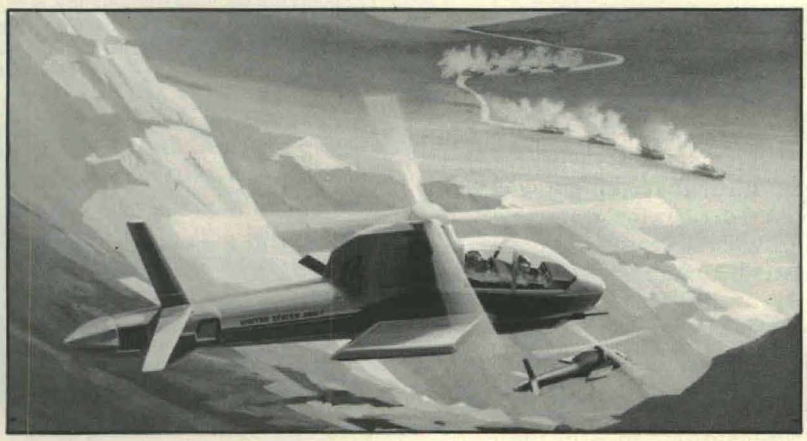
Selected components of the McDonnell Douglas/Bell Hel ter Textron SuperTeam LH mission equipment package have installed in a prototype Apache helicopter for flight evalua The liquid crystal flat panel display is shown in digital configuration.

Shown right, the Boeing Sikorsky First Team's Light Helico offers the U.S. Army exceptional capability for armed recon sance, light attack, and air combat missions. The LH's ma verability is greatly enhanced by its powerful FANTAIL antito system. FANTAIL permits sideward flight at speeds three t faster than possible with today's light helicopters. FANTAIL' noise level also contributes to LH survivability.

PROGRAM MANAGER LIGHT HELICOPTER PROGRAM

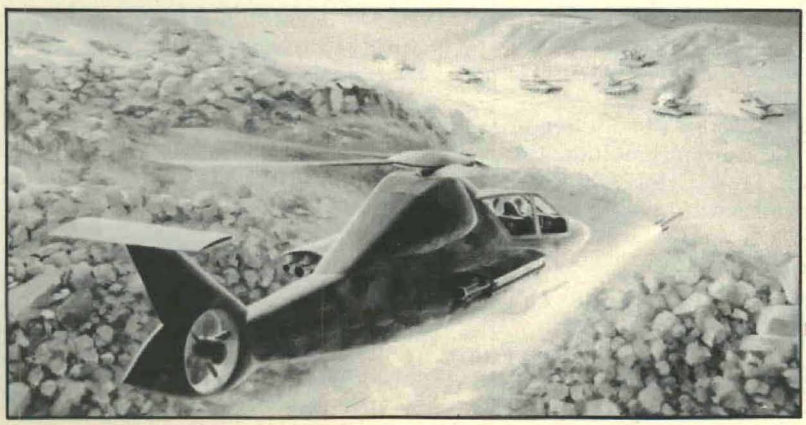
A Continuing Series to Introduce Our Readers to the Army PEO Structure.

Boeing Sikorsky Light Helicopter First Team FANTAIL demonstrator aircraft is shown during flight testing at Sikorsky's facility at West Palm Beach, FL. Aircraft is a Sikorsky H-76 modified with a FANTAIL antitorque system similar to the one designed for the First Team's Light Helicopter.



The McDonnell Douglas/Bell Helicopter Textron SuperTeam's LH rotorcraft is taking shape for tomorrow's battlefields as a technologically advanced armed reconnaissance attack helicopter.

Head-on view of Boeing Sikorsky Light Helicopter First Team's full-scale mockup shows Aided Target Detection/Acquisition pod on nose, 20-mm Gatling gun cannon, retractable missile bays, five-bladed rotor.



COMMANDING GENERAL AVSCOM

MG Donald R. Williamson

MG Donald R. Williamson earned his bachelor's degree at the University of Montana, where he was named the Distinguished Military Graduate. His military education includes: the Infantry Officer's Leadership Course, the Airborne and Ranger Schools, the Army Command and General Staff College, and the Army War College. Listed among his previous key assignments are: project manager for the Cobra Attack Helicopter; executive assistant to the deputy chief of staff for logistics; battalion commander for the 70th Transportation Aircraft Intermediate Maintenance Battalion; and deputy commanding general, U.S. Army Aviation Systems Command (AVSCOM).

According to Williamson, "AVSCOM, like the rest of DOD, is facing a period of uncertainty regarding its future structure and missions and considerable change is inevitable. The command must act now to determine how it will do business in this new environment."

"Total Quality Management, with its emphasis on leadership, team building and fact-based problem solving and decision making, is the guiding philosophy we use to promote meaningful changes and improve support to our customer," Williamson says.

Williamson views Total Quality Management as a business strategy. He has taken initial steps to increase awareness that, over time, inefficiencies have been institutionalized in processes at all levels. "The challenge," he says, "is to reverse this trend and facilitate continuous improvements, such as using a common-sense approach to problem solving and making meaningful change when change is needed." Williamson emphasizes a strong, and direct leadership with open and clear communications, recognizing that "our people are our most valued resource."

Missions and Organization

AVSCOM is headquartered in St. Louis, MO, but its influence stretches worldwide — wherever the Army has its aircraft. Outlying subordinate activities are: U.S. Army Avionics Research and Development Activity, Fort Monmouth, NJ; NASA Ames Research Center, Moffett Field, CA; NASA Langley Research Center, Langley Air Force Base, VA; Aviation Applied Technology Directorate, Fort Eustis, VA; and NASA Lewis Research Center, Cleveland, OH.

AVSCOM provides matrix support to the light helicopter (LH) program, lending the experience of AVSCOM personnel and the resources of the command to the development of the newest of Army aviation systems.

Working closely with AVSCOM's Directorate for Engineering, Legal Office and Directorate for Procurement and Production, the LH program is in the demonstration and validation stage. The production date for the LH is projected for October 1996, with first delivery of the LH tentatively set for February 1998.

After the new system is fielded, all of AVSCOM will become involved in supporting the aircraft. AVSCOM will assure that spare parts are readily available through its National Inventory Control Point which currently tracks more than 55,000 items. AVSCOM training teams will travel worldwide to provide on-site training on the new equipment to users in the field. The command also determines storage and disposal plans for Army aircraft, once obsolete.

Nearly 9,000 aircraft, and their support systems, fall under the shelter of AVSCOM's aviation life-cycle management umbrella. These aircraft include: the AH-64 Apache, UH-1 Cobra, AH-1 Iroquois, UH60L Black Hawk, CH-47 Chinook, OH-58A/C Kiowa, and OH-58D Kiowa Warrior, light observation helicopters, and fixed wing airplanes.

AVSCOM COMMAND GROUP

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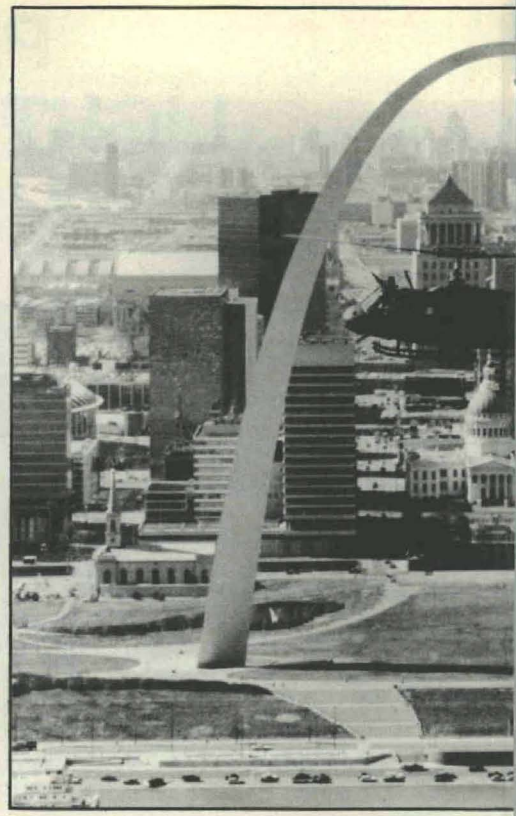
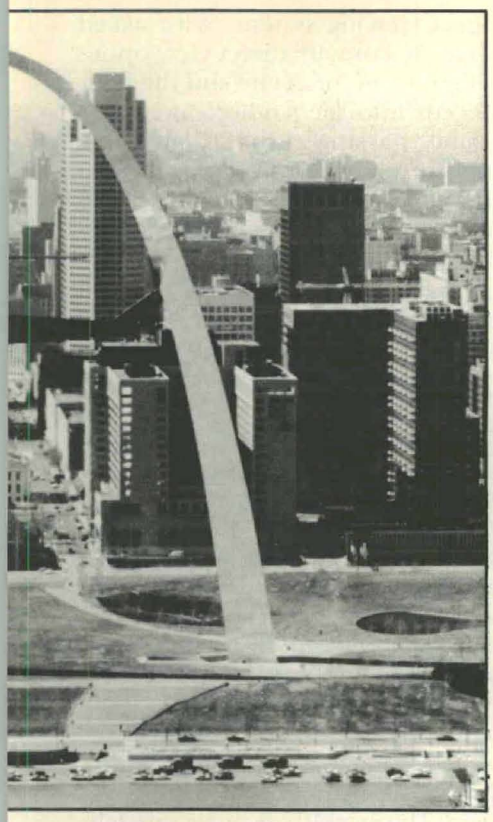


The UH-1 Iroquois, better known as the Huey, is as much a symbol of Army helicopters as the Gateway Arch is of St. Louis. The Huey made its debut in 1959 and has evolved through 13 distinct models. This senior mem-

(Shown at Right) The OV-1D Surveillance/RV-1D electronic Intelligence Mohawks are the Army's only tactical fixed wing aircraft providing the corps commander with a multisensor, side-looking airborne radar (SLAR), infrared, ELINT and photo, standoff surveillance and target acquisition capability.

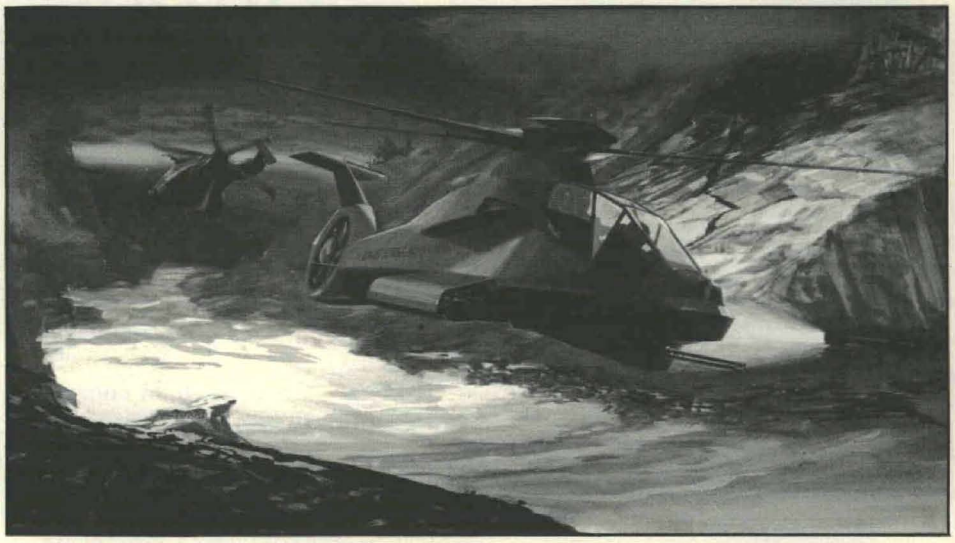
Coupled with an extremely accurate inertial navigation system, the digital Automatic Target Handover System of the Kiowa Warrior OH-58D (shown at right), enables the engagement of six conventional artillery targets in the same amount of time it takes to accomplish one artillery mission using other engagement means. Delivery is scheduled to begin in May for the OH-58Ds, with provisions to accept Air-to-Air Stinger missiles and combinations of 70-mm Hydra Rockets, 50-caliber machine guns and Hellfire missiles.



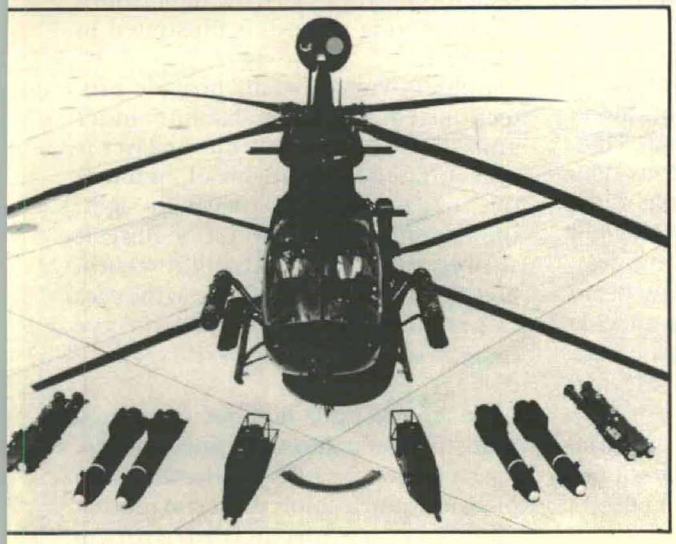
er of the utility/assault helicopter fleet currently in the rmy inventory, showed how versatile it was during the ietnam war and still performs a huge variety of rear chelon chores.

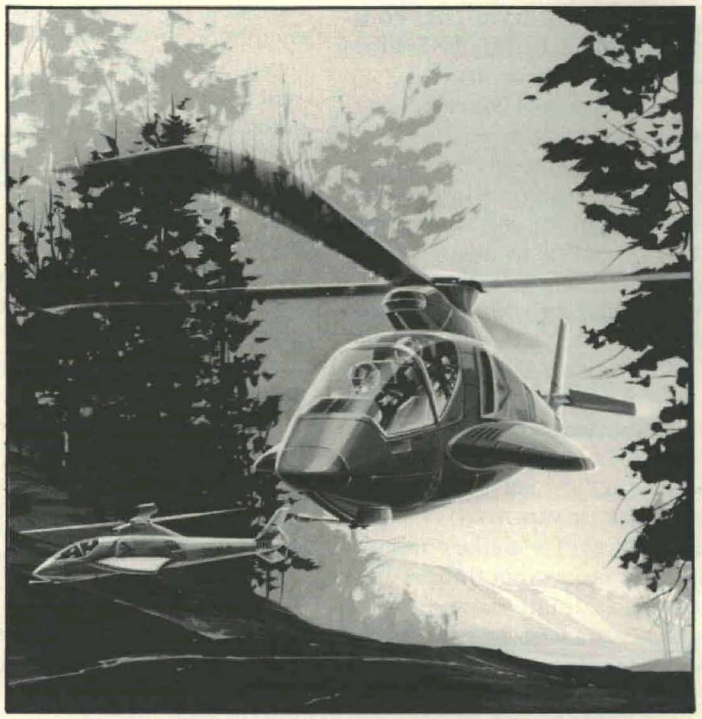
U.S. ARMY AVIATION SYSTEMS COMMAND

A Continuing Series to Familiarize Our Readers with Key Army RD&A Organizations and Leaders



Boeing Sikorsky Light Helicopter.





McDonnell Douglas/Bell Helicopter Textron SuperTeam's Light Helicopter

LASER PROTECTION OF TELESCOPIC OPTICS

By John Brand, David Sliney, Louis Herczeg, Robert Volz, and LTC Tony Dedmond

Priorities in Protection

The Army's number one priority in laser protection is the soldier's eye. As discussed in a previous article in the September-October 1989 issue of *Army RD&A Bulletin*, the explosion of laser applications in civil and industrial life has been mirrored in the military. Laser devices are now no longer the province of national level effort. Small countries or even modest sized industrial concerns can now build or buy lasers for industrial or military purposes.

Military applications of lasers include: rangefinders, as target designators, and combat training simulators. The requirement to range or designate targets for missile seekers or for aircraft pilots demands short pulses to insure range accuracy and high powers to sense reflected light through kilometers of murky atmosphere.

These requirements — a short pulse (which also means that light energy transformed to heat inside the eye can't dissipate harmlessly), and high power levels (which make heat build up to values that cook or vaporize sensitive tissue inside the eye) — make contemporary military laser rangefinders and designators exceedingly dangerous.

When does a laser engagement occur? Most of the world's first line attack helicopters and modern tanks are equipped with laser rangefinders or target designators. Individual soldiers may also carry hand held laser rangefinders or operate target designators. Whenever a target is illuminated to obtain range or to designate for missile or bomb attack a laser engagement occurs.

The danger which such an engagement poses to the eye depends partly on two geometric factors. One is line of sight. Damage will occur only if light has an unobstructed path. Another factor is co-field of view. A laser beam lighting up the side of a turret poses no danger to the crew inside unless a crew member is looking through a periscope or vision block and has the laser somewhere in the visual field. One need not actually visually detect the laser or even see the laser light to be hurt (most lasers use invisible infrared light). The laser light must simply enter the eye. If the light does not enter the eye, no damage occurs because today's fire control lasers are harmless. They lack the power even to burn skin.

How much danger do lasers pose to eyes? This depends on the laser and how far away it is. Two rules of thumb on ranking this danger are useful: First, a visible laser is more dangerous than a near-infrared laser (it can take as much as a factor of 80 times less visible light energy to do the same damage!). Secondly, a laser with a narrow beam is more dangerous than one with a wide beam (provided the narrow beam with its small spot actually hits the target optics).

Another important factor is how the soldier is viewing the laser. A soldier can view a laser with the naked eye, with direct view optics, or with an indirect viewing system. With naked eye viewing or with direct view optics the light from the scene and the laser proceeds into the soldier's eye, after possibly passing through lenses or windows or bouncing off mirrors, and without being converted to electrical energy on the way. An indirect or electronic viewing system (TV, thermal night sight, or shrouded image intensifier night vision goggles), at some point in the path of the light converts the light to an electrical signal and back again to light.

The laser hazard to the unprotected eye is serious. However, for most military lasers only the laser light entering the eye's pupil is harmful. In daylight conditions that's normally a very small amount, compared to the number one danger, viewing with telescopic optics.

Direct view optics include non-magnifying windows, non-magnifying periscopes and telescopic optics. Non-magnifying optics are like the naked eye. Telescopic optics gather light like a funnel. Both present a serious eye hazard. The magnifying power of a telescope allows it to gather more light, proportional to the square of the magnifying power (less transmission losses in the telescope). For example, a 13-power (13X) telescope gathers 169 times the light that an unaided eye gathers. If the glass lenses absorb or reflect half the light, a soldier behind 13X optics still receives about 85 times more laser light into the eye than a counterpart without optics receives. This profoundly affects susceptibility to laser effects ranging from transient visual upset ("flashblinding") to serious eye damage. The effect of telescopic (magnifying) optics on the light from a laser entering the eye is illustrated in Figure 1.

Indirect-view systems provide protection that is almost absolute under any circumstances. Even if the laser is a far-infrared laser capable of "whiting out" or damaging a thermal night sight, the operator's eyes cannot be hurt. It should be noted that night vision goggles without a shroud about the eyes can allow laser light to enter the eye from the side, and possibly cause damage or dazzling.

Flashblinding is familiar to anyone who has been photographed with a flash camera. It causes momentary loss of vision, and a colored afterimage that fades over a short period with no

permanent damage. Although the tactical effect of flashblinding can be serious, no permanent vision loss occurs. Other forms of eye damage can occur, however, which are permanent. What does eye damage mean and how does it occur?

Eye Injury

The human eye is particularly vulnerable to injury from visible and near-infrared lasers because the eye focuses the light from these types of lasers on the retina. The focussed light from a distant laser can be concentrated to a spot smaller than a human hair. Such concentrated energy can burn, coagulate, and even rupture this critically important eye tissue. If sufficient laser energy enters the eye, a small hole can be created in the retina. In some cases, blood can pass through this small hole and enter the clear interior of the eye and block vision (a viteous hemorrhage). Fortunately, the eye has a remarkable ability to repair some types of injury. For example, blood in a vitreous hemorrhage will normally clear in time. However, the person receiving such an injury will initially sustain a very serious visual loss.

Because of the great biological complexity of the retina, it is impossible to predict after each accident case how significant and permanent a visual loss will result. The size of the damaged retinal area depends upon how much heat transfer and mechanical disruption has affected adjacent, unexposed parts of the retina. Vision loss can vary from a mild, small blind spot (termed a "scotoma") to almost complete loss of vision, depending upon energy levels and whether the laser light strikes the critical area of central vision known as the fovea.

At first thought, it seems hard to imagine how a small area of damage extending across only 0.1 millimeter to one millimeter can cause a very severe loss of vision. However, there is only one small region of the retina which is responsible for our high visual acuity (resolution, or fine vision) that we require for reading, target detection, and aiming. This central area, known as the fovea, is less than one millimeter in diameter, and it must scan back and forth across each line of print as we read. Damage to this small area — which is far less than one percent of our total retinal area — can be visually debilitating. This suggests that severe vision loss will only occur from lasers which are viewed directly (there is one unlikely exception, involving severe damage to the point where the optic nerve attaches to the retina). If the laser beam enters the eye obliquely, retinal damage may occur, but it may not result in a significant or even noticeable loss of vision.

Tactical Laser Protection

The first U.S. fielded laser rangefinders included eye protection against fratricide by similar systems. The crew of the M60A3 tank, with a ruby laser rangefinder, was provided with a clip-on laser protection filter kit. The kit contained ruby laser eye safety colored filters that could be attached to the crew's optical fire control systems. These colored glass filters function by absorption. The colored filter absorbs very strongly in the red and near infrared region of the spectrum and transmits a limited amount of green and blue light.

The scene color, when viewed through the filter, is blue-green and therefore the filters were not well received by the soldier. However, M60A3 tanks could train together and accidentally lase each other with some degree of protection provided the not too popular laser filters were attached to the sights and no one looked out the vision blocks. This worked quite well until the proliferation of different types of lasers in a unit or until the crew discovered that the laser safety clip-on kit box, when empty, made a convenient ashtray.

The vulnerability of U.S. soldiers to laser eye damage from an engagement with enemy forces liberally equipped with different kinds of lasers led to the consideration of the risks of many one or two sided laser engagements. This was a far more serious problem than the training fratricide problem.

The issue surfaced several years ago and was briefed to the highest levels of Army management. The result was the Optical Improvement Program (OIP) and, later, the Advanced Laser Protection Program (ALPP). The Optical Improvement Program is concerned with protection of the presently fielded optical systems from current and mid-term threats. The Advanced Laser Protection Program deals with protection of all Army systems, including the unaided eye, from future more capable lasers with characteristics presently found only in laboratories.

The protection of the unaided eye against current and mid-term threats is not part of the OIP, being accomplished by interlocking programs under the control of various Army agencies in collaboration with other services and the Defense Advanced Research Projects Agency. An important point is that the various services have differing requirements for protection. The Army infantryman does not face a laser powered by the electrical resources of a nuclear battle cruiser!

Present Protection Systems

Optical thin film dielectric interference coating technology is the basic method currently employed by the Army to provide laser eye protection for users of magnifying optical sighting

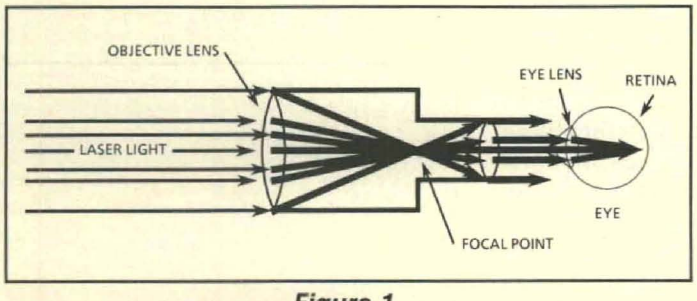


Figure 1.
The effect of magnifying optics on laser damage to the eye.

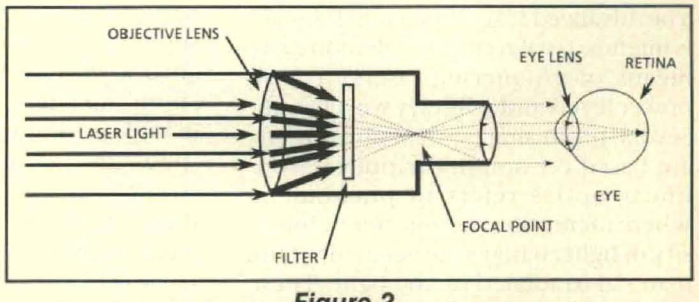


Figure 2.
A telescope protected by a conventional laser filter.

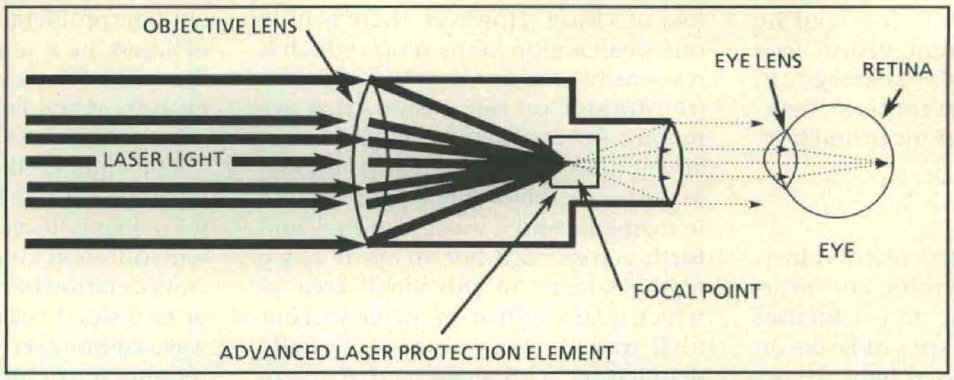


Figure 3.
A telescope protected against laser light by an advanced laser protection device.

systems. The filters work by using light interference to reject by reflection or to transmit desired regions of the spectrum. The optical interference coatings can be combined with clear infrared heat absorbing glass to reject or block energy from all known laser rangefinders, designators, and training simulators, while maintaining sufficient light transmission for target detection, recognition, and tracking.

The Army's high volume demand for high quality optical coatings for laser eye protection (over 200 layers thick) has, over the past five years, significantly advanced the optical coating industry in the United States.

When placed inside an optical sight, the filter must be located in a position where rays of light from the laser do not strike the filter at angles beyond the design angle of the filter and laser irradiance levels do not exceed the filter's design damage threshold. This ideal position usually occurs at a location either directly behind or in front of the objective lens. An example is shown in Figure 2.

Future Protection Systems

Any laser protection presently in use can be overpowered or be "sidestepped" by a laser having a wavelength the filter was not designed to protect against. The Advanced Laser Protection Program is intended to develop and demonstrate means of countering lasers of high power levels and arbitrary wavelength. Several promising types of phenomena are based on non-linear optics. Nonlinear optics refers to phenomena where increasing the amount or intensity of light changes the behavior of the material irradiated by the light. These phenomena are ideal for building switches and limiters.

An optical switch is a component that becomes essentially non-transmissive when the light incident on it exceeds a certain threshold; a limiter allows only so much light to pass through, and additional light is all or mostly deflected, reflected, or scattered harmlessly.

The nonlinear processes require the greatest light intensity possible to function. A nonlinear device will thus be located at a focal plane, toward the front of the telescope, if possible, to protect any fragile components. A nonlinear device is shown in an idealized telescope (Figure 3). Such technology, requiring as it does an intermediate focal plane, can be difficult to retrofit to existing equipment.

Extra focal planes usually require forethought and a very good reason for the extra cost, complexity, and light loss. New systems, however, should be designed with easy access to intermediate, or "countermeasure" focal planes to provide growth potential and allow relatively inexpensive modification to meet the laser threat, which can only become more severe as time passes.

Summary

There has been concern in the military community about the potential for harm to troops since the laser began showing up in military applications. As anyone who attends an industrial exposition can attest, there are many lasers in wide use industrially. Whether these show up in battle depends on how strongly an opponent wishes to use them. A prudent person prepares for what is known, and also prepares for what is likely to come to pass. That is the philosophy of protection of soldiers using telescopic optics.

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LOUIS HERCZEG is employed at the Armament Research, Development and Engineering Center at Picatinny Arsenal.

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Editor's Note: Due to a technical problem, the following article was unfortunately published with several errors in the January-February 1991 issue of Army RD&A Bulletin. A corrected version is published here. We appologize for any inconvenience caused to the author or our readers.

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.

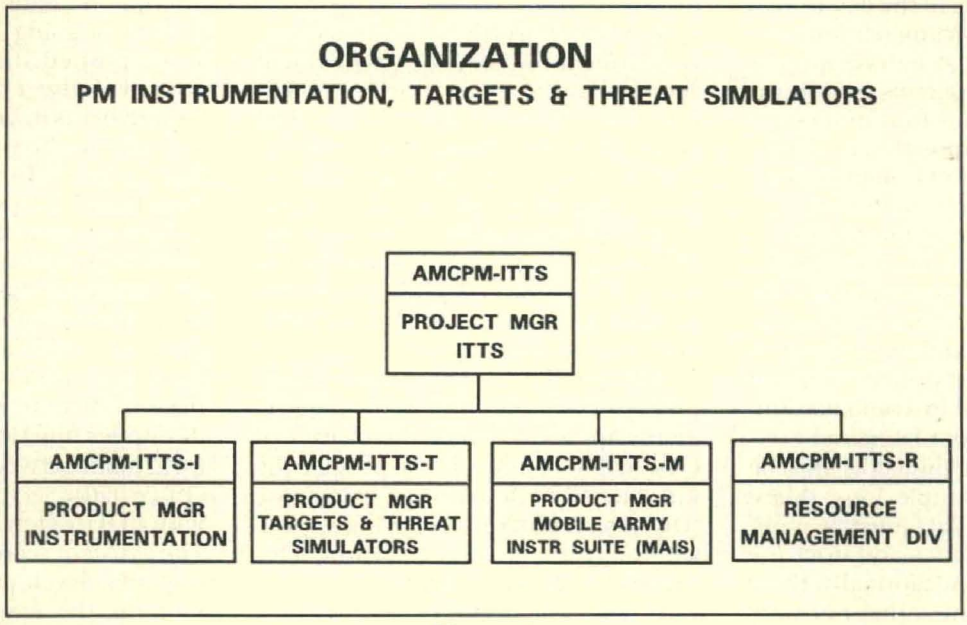


Figure 1

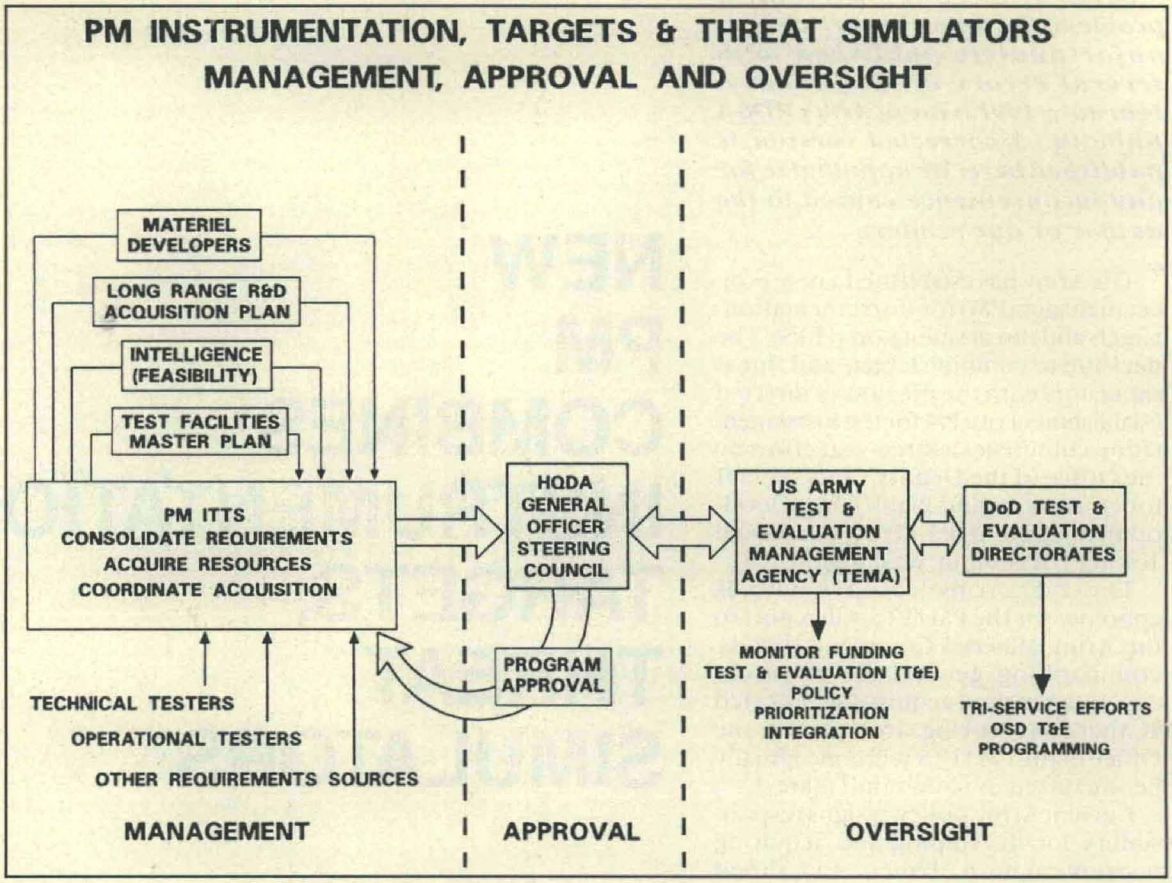


Figure 2.

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 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 test and evaluation issues 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 test and evaluation issues. The assistant secretary of the Army for research, development and acquisition remains the Army's appropriations director for RD&A issues.

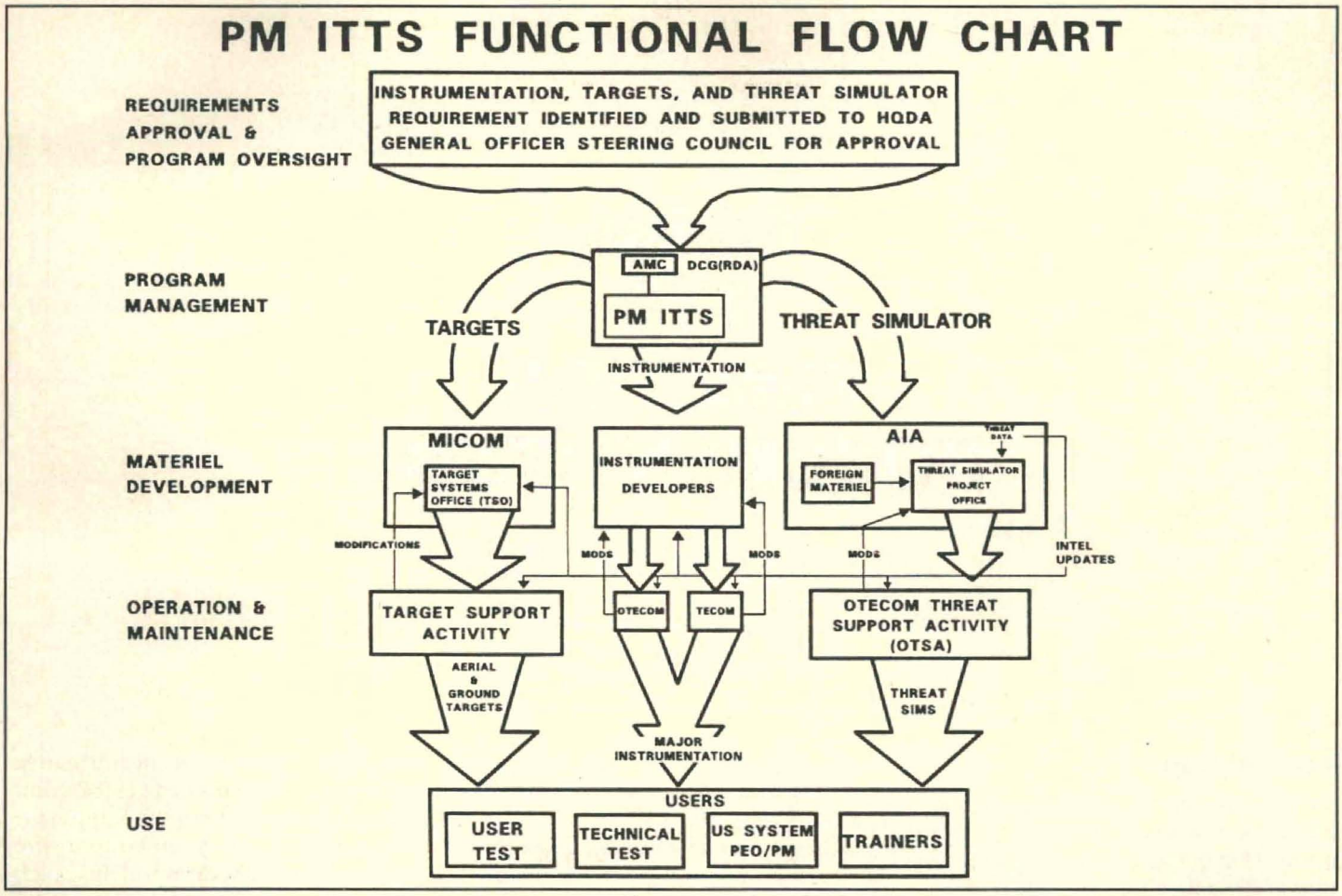


Figure 3.

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 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 (AIA), 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 Threat Simulator Program. It has provided a single point of contact for requirements approval, established a project manager for the management and execution of development programs and provided HQDA oversight and advocacy. During these years of austere funding, the above actions will provide an efficient and cost effective method to develop and acquire the instrumentation, targets, and threat simulators necessary to support the Army testing community.

MAJ FRANK G. ATKINS is assigned to the Operational Testing Division, Office of the Deputy Chief of Staff for Operations and Plans-Force Development, HQ, Department of the Army. He is a graduate of the Command and General Staff College and holds an M.B.A. from Florida Institute of Technology with a concentration in logistics.

FORM, FIT, FUNCTION DOCUMENTATION...

The Future of Tech Data?

By Thomas J. Nycz

Introduction

Where do we go with engineering drawings and specifications in the future? That question raises other questions and issues which are causing a lot of discussion within DOD and industry alike. Basic issues, such as how the Army acquires drawings, the level of detail we ask for, what media is preferred to accept data for future acquisitions and logistics support, are significant to the Army's mission in the years ahead.

Level III Only?

During the last two decades, The U.S. Army Communications-Electronics Command (CECOM) has emphasized the acquisition of full disclosure Level III production drawings and created detailed contractual requirements to obtain documentation to support competitive acquisitions. These drawings are defined as Level III per DOD-D-1000 and DOD-STD-100. The thrust of this type of documentation has always been to capture design definition and construction details, including parts, materials, unique processes and assembly instructions, on government formats with unlimited rights to their use.

Typically, we stressed that these documents maintain an industrial base with many contractors. We also found that these documents saved us money through competition.

Well, to quote a well known singer of quite a few years ago, "The Times are A-Changing." We are having a number of problems getting both large and small manufacturers to bid on contracts where components are no longer available from the manufacturers. Devices like integrated circuits (ICs) are no longer available because technology and manufacturing processes have advanced significantly and producing old or obsolete technologies is not economically worthwhile.

The manufacturers cannot get the specified parts or interchangeable replacements so they refuse to bid, or they get an award and are unable to produce the equipment or spares for us without major design efforts.

Form, Fit, Function

One possible answer is the Form, Fit, Function (F3) design and documentation approach. The creation and use of drawings which describe the functional interchangeability of equipments and spares could provide an answer to the problem of technology passing us by.

Defining F3 requirements is not a trivial task. The parameters which define the size, weight, performance and test requirements of a device, component, module, assembly, equipment or system must be specified to insure interchangeability. Components, such as transformers, can be defined by parameters such as voltage, size, weight, power consumption and heat dissipation.

We typically do not attempt to define the detailed construction and manufacturing processes of a transformer; we leave that up to industry. Specifying design parameters on more complex modules may involve timing diagrams, waveforms, logic patterns and matrices. The parameters must be developed carefully with the proper tolerances.

Former CECOM Commanding General LTG Billy M. Thomas strongly urged us toward F3. He understands too well the problem of diminishing manufacturing sources and the difficulty in not being able to find vendors to make components using older technology. Our problem is compounded by having to support many older equipments and buying small quantities of end items and spare parts.

A Culture Change

The consideration of F3 drawings represents a radical change in our

New designs must be fully qualified through performance and environmental tests, meet electromagnetic interference and electromagnetic compatibility requirements and pass some form of reliability test.

philosophy, almost a culture change. Our goal is to increase design flexibility and make the maximum use of the latest available technology.

F3 could also offer increased reliability and would require less overall documentation for us to review and manage. There could also be significant savings through competition and technology advances. This point is realistic if we look at what has happened to computer memory devices over the last 10 years. Capabilities have dramatically increased while the costs have gone down for better and more powerful devises. A recent CECOM success using F3 is the second source SINGARS program where a complete radio was designed and produced to look and act like the initial radio but which is, in reality, a completely different design internally.

Challenges

We must also keep in mind that F3 is not a panacea for use in all situations. Many valid concerns face us in the acquisition and use of F3 drawings. Some of the more significant risks involve assuring that all technical characteristics are specified and toleranced properly and that logistical interchanageability is maintained. Sufficient quantities must be acquired to entice vendors and manufacturers to enter the bidding process.

New designs must be fully qualified through performance and environmental tests, meet electromagnetic interference and electromagnetic compatibility requirements and pass some form of reliability test. Validation of the F3 drawings and specified requirements is difficult and may require the use of "hot mock-up" equipment scenarios to demonstrate acceptability.

The use of F3 documentation is not necessarily a solution to our diminishing source problems. It is not intended as a "cure-all" but may present us with some recourse. To paraphrase a local New Jersey consultant, "The only thing worse than a single source is no source."

Our challenge at CECOM is to come up with a plan to test the F3 approach on some selected acquisitions. The plan must represent a combined effort with our Product Assurance and Test folks and the Integrated Logistics Support Office since testing and logistics impacts are significant in future acquisitions.

Our director of production and manufacturing technology, C.F. MacDonnel Jr., has asked the Technical Programs Division to generate the appropriate guidance on the use of F3 and include a decision tree to help our people make a sound decision based on technical, logistical and economical factors. Our people must be able to determine the best approach on the type and detail of the documentation needed for future acquisition and logistics support.

The first step in our evaluation process was to get industry feedback on the change in philosophy. We prepared an announcement for the Commerce Business Daily (CBD), a publication used to advertise acquisitions by the government. In that announcement, published April 17, 1990, we told industry about the possibility of using F3 for end items and spares to overcome the technology issues. In that announcement we also added the possibility of releasing a solicitation for spares by providing the existing Level III drawings as information only and permitting alternative designs and bids based on functional interchangeability with the existing design. We asked for industry comments by May 15, 1990 with feedback on successes and potential pitfalls to help prepare substantive guidance.

Feedback from industry has largely been very positive especially from the large businesses with a depth of engineering talent to draw upon. There are some concerns from small businesses and the Competition Management Office about reduced competition and restricted business in the future for spares and end items.

Our plan during the next few months is to issue internal guidance to our people, including a decision tree, and select some test acquisitions. We see this approach as a significant challenge and we welcome comments and lessons learned from both industry and government readers. Comments can be sent to the U.S. Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ED-T, Fort Monmouth, NJ 07703-5000.

Individuals working this project are Richard Scarinzi, Richard Uldrich or myself. We are part of the CECOM Production and Manufacturing Technology Directorate and can be reached at (201) 532- 4524 or AUTOVON 992-4524.

THOMAS J. NYCZ is chief of the Technical Programs Division, Production and Manufacturing Technology Directorate, U.S. Army Communications-Electronics Command, Fort Monmouth, NJ.

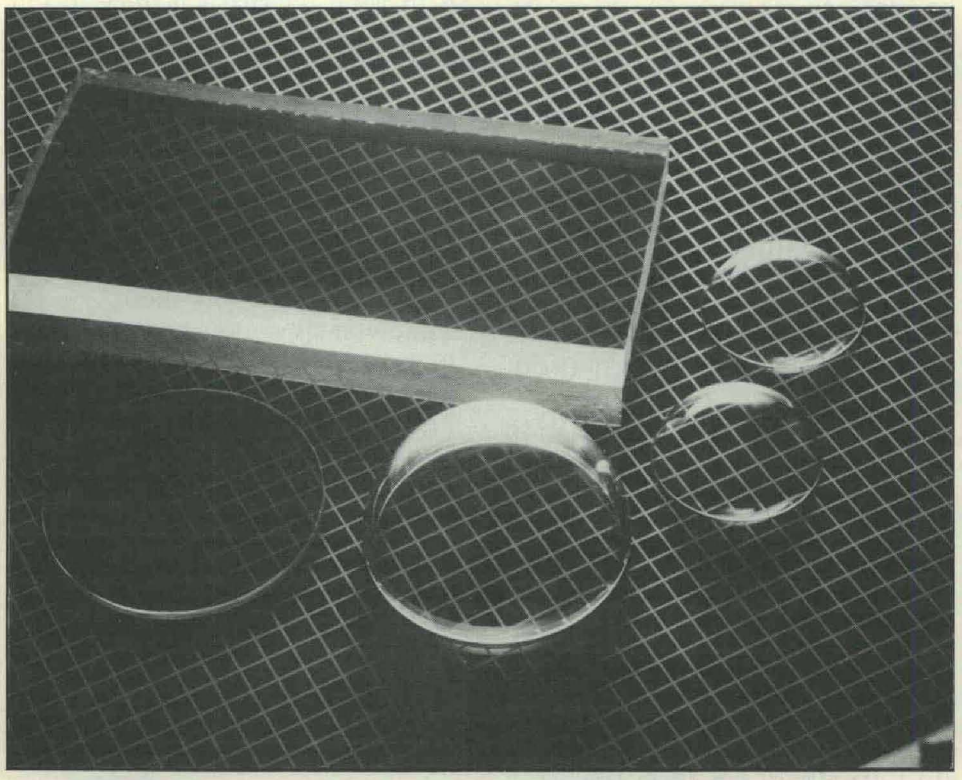
ALON MATERIAL SLATED FOR MISSILE USE

By Eric Hurwitz

ALON infrared (IR) dome materials date back to 1976 and, like many good products, took years to perfect before going commercial.

Short for aluminum oxynitride, ALON is a ceramic as transparent as glass and the IR dome is a dome-shaped device used to house an IR detector, that locates a missile's target and guides the missile to it.

The material is transparent to electromagnetic waves over a wide range of wavelengths, ideal for sensor windows and transparent armor. Patented in 1980 by the U.S. Army Materials Technology Laboratory (MTL) in Watertown, MA., the materials went through years of research, with transfer of the technology to Raytheon in 1984. The big mission: To enhance the capabilities of any missiles manufactured by Raytheon for the Army. The result: overwhelming success. The broad transmission range and strengths are higher than those of alternative materials, making ALON a prime candidate for use in the IR domes of surface-to-air missiles under the most severe combat conditions, according to Rick Gentilman, a former manager of the Raytheon Materials Group at Raytheon in Waltham, MA.



ALON Plate with the IR Domes.

ALON is a prime example of the military working with private industry to create a successful transfer of technology.

"The product is a good one," says Gentilman. "There are no particular deficiencies. It took the last 10 years to get all the bugs out, and now I think we're pretty much satisfied with what we've got."

Dr. Robert Katz, chief technologist and former chief of MTL's Ceramic Research Branch, says that accomplishing these results in 10 years was remarkable — usually the technology transfer process produces results within 15 to 25 years.

"MTL management championed ALON, and that is a reason why things went along very smoothly," says Katz. The result is a product that costs at least 15 percent less than competing materials, such as calcium aluminate glass or germanate glass. Its high strength and erosion resistance is also superior to other materials. This is vital because it is used in a surface-to-air missile that must be transported and launched under combat conditions.

It all began at MTL (then the Army Materials and Mechanics Research Center) in 1976 when Dr. James McCauley and Normand Corbin tried to make a transparent form of aluminum oxide by incorporating a small amount of nitrogen. There was a time when everything did not run smoothly. Some rather humorous situations arose.

"We did struggle for about a year-and-a-half," says McCauley who recently departed as MTL Materials Science Branch chief to become dean of the Alfred College of Ceramics in Alfred, NY. "We just couldn't get anything to come out right. One day I worked on a

predicted proper chemical structure, plugged in numbers, and by a small miracle, it worked. I shouted to Norm, where are the samples we worked on? We got them, cut them up to see if they were transparent, and they were! I said Holy God, we made these things already (and didn't know it)! The patent came soon afterwards.

"This (ALON) is a tremendous case study," says McCauley. "It is a great example of directed fundamental research. We had ideas on what we wanted to do. Raytheon heard my talks (on ALON), became interested, used our technology, we published a joint paper, they came up with three or four more patents, and got to the pilot plant stage.

"We got the (initial) patent and that's it. We never got royalties but that doesn't bother me. It is just tremendous to see the items used. We had luck at the technical meetings when Raytheon took interest and said, this looks good, this looks good! I'm glad to see the way things have turned out."

Dennis Montanari, manager of Raytheon's IR Materials Group, who has worked on the project the past year and a half, looks back with pride on the accomplishments of this program, and hopes that future success in enhancing systems performance justifies all the work that was put into the project.

ALON was named by MTL Director Dr. Edward Wright as one of the most important MTL technologies. Dr. Dennis Viechnicki, chief of the Ceramics Research Branch at MTL, agrees that ALON is a high quality product. Viechnicki feels that the accomplishments made over the past few years at MTL cannot be underestimated. "ALON has its niche," says Viechnicki. "It is cheaper to make than other similar materials and it has (needed mechanical) strength."

While Viechnicki applauds the breakthrough with ALON, he feels it is not the cure-all. There is ongoing work at MTL on sapphire that is an alternative to ALON. Viechnicki says that sapphire is definitely stronger than ALON. The only problem is that sapphire is more expensive to produce, so the good strength and low cost of ALON make it a more attractive package. In addition, although ALON and sapphire windows use essentially the same processing procedures, ALON takes less time and the final finishing operation requires less effort and skilled labor to create a similar quality window. Grinding and polishing take less time and the final finishing operation require less intervention by opticians, according to Gentilman and Montanari.

However, as remarkable as ALON seems, there's still a ways to go. Viechnicki says that no product is perfect, and ALON is no exception. ALON cannot be applied to everything under the sun; it remains to be seen how many applications will occur over the next few years.

"Scientists would rather use something that is on the shelf than come up with something new, so maybe new uses will arise in the future," says Viechnicki.

Gentilman also acknowledges that ALON is not perfect, his theory being that there are certain materials that work better under certain conditions. "No one material is perfect," says Gentilman. "Yttrium oxide is made by a similar process and has better infrared optical properties. However, it just isn't as strong as ALON. No one material meets all requirements."

Along with automation, Montanari believes the ALON program will be extremely efficient.

That efficiency makes an originator like McCauley proud. The idea that he worked on years ago has now become a commercial product that will serve as an important materiel for our national defense. McCauley says he plans to lecture his students at Alfred on ALON IR dome materials and the years it took to see the dream come true. He may be in the education field now, but he may never leave ALON IR dome materials behind.

ERIC HURWITZ is a public affairs specialist at the U.S. Army Materials Technology Laboratory in Watertown, MA. He attended the Boston University School of Public Communication, and holds a B.A. in journalism from Suffolk University. He is currently studying education at Salem State College in Salem, MA.

THE ARMY ACQUISITION CORPS CIVILIAN COMPONENT

Introduction

The U.S. Total Army Personnel Command (PERSCOM) recently opened the civilian component of the Army Acquisition Corps (AAC) by issuing a candidate development pool announcement, sending letters of invitation to incumbents of critical acquisition positions, and by issuing personnel policy for management of the AAC. Although the initial candidate pool announcement closed on Feb. 11, 1991, another announcement is expected to open this summer.

Army Acquisition Corps civilians receive professional development throughout their careers. Mobility, which is a condition of employment with the AAC, may be across geographical, organizational, or functional lines. Once accessed into the AAC, members receive continuous career management through centralized training and developmental assignment support, to include advanced leadership training. The program will build a world class acquisition work force. It concentrates on the development of AAC members to fill approximately 1,500 General Schedule (GS) and Merit Pay (GM-14 and 15) civilian positions which are coded critical. These are positions which require a specific level of acquisition education, training, and experience outlined in public laws and DOD directives.

To date, the Army acquisition executive has approved the designation of 682 General Schedule and Merit Pay 14 and 15 positions as "critical." Approximately 800 more positions are under review for designation as critical.

The AAC implementation plan supports all Army equal opportunity objectives for women, minorities, and disabled employees.

The following information is extracted from recently announced AAC civilian personnel management policy and highlights key elements of the AAC civilian program:

Incumbents

Following the designation of positions as AAC critical positions, incumbents are sent individual letters explaining the program and advising them of their options. For incumbents, membership in the Army Acquisition Corps is voluntary. If the incumbent chooses not to join, he or she will be allowed to continue in their current position. Only incumbents who choose to join the AAC will be considered for vacant critical acquisition positions.

Joining the AAC

For those who apply and are accepted into the AAC, the corps exchanges obligation for obligation. Membership in the AAC development program offers enhanced opportunities for leader development training, challenging work experience, and promotion in exchange for a commitment to professional development and flexibility in accepting a variety of assignments. AAC incumbent member requests for time waivers or grandfathering will be handled individually.

Non-AAC Members

Current incumbents of critical positions who do not become AAC members will continue under local or career program training, development and advancement provisions. Each individual may be granted waivers (grandfathered) for the encumbered position only. The provisions of DOD Directive 1400.24, *Civilian Mobility Program*, apply.

Current incumbents of positions identified as critical will not be removed from their positions for failure to execute a mobility agreement. They will not qualify for any AAC positions, local or otherwise, because of the requirement of AAC membership. When they leave their AAC critical position, they have no further AAC ties or entitlements.

Becoming a Member of the AAC

PERSCOM Acquisition Accession Boards (PAAB) will formally review civilian and military applicants for induction into the AAC. PAAB members are drawn from the branches and career programs, functional areas, PERSCOM, and the AAE staff. The PAAB selects the requisite quantity of applicants to become AAC members sufficient to meet critical position and candidate pool needs.

Incumbent applications will be acted upon by the first available PAAB. Multiple PAABs will be scheduled to act upon all incumbent applications and to evaluate non-incumbent applications for the candidate pools.

Interim Procedures for Critical Positions

Vacant non-SES AAC critical positions can be filled only through the Army Acquisition Corps Management Office (AACMO). Once a position is designated as an AAC critical position, recruitment actions must be handled in accordance with AACMO instructions. Pending initiation of central referral from the AACMO, servicing civilian personnel offices will continue current systems with the following modifications:

- Where local announcements are used rather than career program referral systems, announcements are Department of Defense wide, with a minimum 30 day open period.
- The requirements for membership in the AAC and execution of the AAC mobility agreement must be clearly explained (documented) to all applicants under both local and career program procedures.
- Selective placement factors must be approved by the AACMO.
- Selections are confirmed only with a current active AAC mobility agreement and written confirmation of accession into the AAC.

The Candidate Development Pool

The focus of the AAC is on the development of acquisition managers. Critical position losses will be filled from the AAC ranks including both those in the candidate development pool and available incumbents. The pool will consist

of GM/GS 13 through SES AAC members competitively selected from the DOD civil service work force.

The first group of candidates will be selected from applicants who apply under the development pool announcement which opened in October 1990. Membership in an Army career program is not required for acceptance into the AAC.

Merit Promotion and Placement

The candidate pool and AAC members in critical positions will be the sole recruitment source for AAC critical positions. Advancement potential is therefore significant. AAC members will have a current file maintained in the AACMO. File information will consist of SF 171, Performance Appraisals (five years), AAC status, mobility agreement and geographical preference record, and related documentation as developed.

Where possible, pre-vacancy rating and ranking of registrants by series, grade and managerial skills will shorten the time required to apply specific selective placement factors. Referral to management of the best qualified will occur under a three tier system:

Tier 1 Best Qualified Members Interested in the Geographical Location. If there are not at least three volunteers among the best qualified, and management declines to select, selecting officials will go to the next level.

Tier 2, Send Best Qualified but not Geographically Available Members a Notice of Opportunity. Affirmative respondents will be added to the Tier 1 list. If there are not at least three volunteers among the best qualified, and management declines to select, selecting officials will go to the next level.

Tier 3, Refer all Best Qualified Candidates Regardless of Geographical Preference.

Filling the Candidate Pool

Periodically, the AACMO will open the candidate development pool and release a recruitment announcement. Applicants will be screened and qualified nominees will be referred to the next PAAB for consideration. Applicants will be evaluated under a competitive rating and ranking system in accordance with Federal Personnel Manual requirements.

Recruitment will focus on accessing those considered most likely to develop into future acquisition managers. PAABs will be convened at least once per year, usually in October, to select new members for the AAC. In addition, periodically, PAABs may be established to evaluate applicant groups needed to address pool imbalances and to consider applications from incumbents of newly added AAC critical positions.

The PAAB is limited to recommending applicants for the candidate pool in the series and grade ratios needed to meet future critical position needs. Equal employment opportunity and affirmative action will be addressed.

Career Development

Almost every acquisition occupation and technical skill is developed in one or more of the civilian career programs. Reliance is placed on career programs to provide AAC development tracts to do much of the technical and some of the leader development that leads to the GS/GM-13 grade level. Therefore, it is unnecessary to access civilians into the AAC early in their careers.

The steady state inventory for certified and non-certified acquisition specialists will be approximately one third larger than the number of civilian critical positions. Instead of a 10-year development pipeline, which is typical of the military component of the AAC, civilians will have no more than a four year pipeline. Army career programs with positions and tracks providing AAC required training and experience include: CP-11 (Comptroller), CP-13 (Supply), CP-14 (Procurement), CP-15 (Q&RA), CP-16 and CP-18 (Engineers and Scientists), CP-17 (Materiel Maintenance Management), CP-23 (ADP), CP-24 (Transportation), CP-25 (Communications), and CP-33 (Ammunition Management).

Upon accession into the AAC, civilians will be awarded an acquisition candidate identifier of 4M. The member will attend schooling and be encouraged to obtain additional acquisition experience in order to meet AAC certification requirements and award of skill identifier 4Z.

Career Path

The "30 year" career pattern for civilians would move between the career programs and the AAC. Whether a civilian enters the Army work force at the intern or a higher level, he or she would generally have acquired most or all of the required years of acquisition experience (and perhaps procurement command and DSMC requirements) prior to competing for entry into the candidate program.

Although the program will target candidates for entry at grade GS/GM-13, lateral entry is possible at all grades, GS/GM-13 through SES. Once candidates are accepted for the program, their development would be rounded out to include all remaining certification requirements. Where appropriate, the candidate will attend the Material Acquisition Management Course at ALMC (unless he or she already possesses comparable development) and the Program Management Course at DSMC. On a competitive basis, they may also attend an operational overview (greening course), intermediate service school (Army Management Staff College) and senior service college.

Career Program Membership

Members of the AAC retain the right to be registered in and to participate in the Army Career Programs. While a member occupies a non-AAC position, he or she continues membership in the candidate pool.

Removal from the AAC

When a member fails to abide by the requirements of the AAC, including the mobility agreement provisions, they are subject to removal from the AAC with prejudice. Such removal is accomplished in accordance with governing civilian personnel regulations.

Additional Information

Additional information on the civilian component of the Army Acquisition Corps is available from: U.S. Total Army Personnel Command, Civilian Acquisition Management Branch, ATTN: TAPC-OPB-B, 200 Stovall Street, Alexandria, VA 22332-0411, DSN 221-3094 or commercial phone (703) 325-3094.

1990 Colonel QVC Board Results

A PERSCOM Qualification, Validation and Certification (QVC) Board met on Nov. 26-28, 1990 to review records of all Army Acquisition Corps (AAC) officers eligible for certification at the rank of colonel. The following officers were selected for full certification and award of AAC Skill 4Z. Names are listed alphabetically by basic branch. Officers holding Skill 4Z are eligible to fill all AAC critical positions to include DA selection as project manager. The officers certified by this board bring the total of certified colonels and promotable lieutenant colonels in the AAC to 112.

NAME	RANK	BRANCH
Belch, Peter Paul	COL	AD
Bond, William Leroy	LTC	AD
Ellis, Claude Jr.	COL	AD
Gustine, James Edward	LTC	AD
Huston, Robert Eugene	COL	AD
Patterson, James Anthony	LTC	AD
Souvenir, Stanley James	COL	AD
Stieglitz, Gilbert Jon	COL	AD
Stolt, Gregory August	LTC	AD
Taylor, David Robert	COL	AD
Barbara, James Cornelius	COL	AR
Derrah, Donald William	COL	AR
Jackson, Michael Dean	COL	AR
Knox, Richard Leo	LTC	AR
Koropey, Oleh Borys	COL	AR
Michlik, Martin John	COL	AR
Uliano, Gary Lee	COL	AR
Abbott, Danny Lee	COL	AV
Almojuela, Thomas Nahanee	COL	AV
Bennett, James Henry Jr.	LTC	AV
Benson, John Oscar	COL	AV
Brown, Bradford Michael	COL	AV
Deloach, Samuel Juther	LTC	AV
Downs, Gary Thomas	COL	AV
Forville, David Roy	COL	AV
Green, Gerald Charles	COL	AV
Holder, James Ray	COL	AV
Huey, James Thomas	COL	AV
Kronenberger, Louis Jr.	COL	AV
Lowman, Raymond Paul II	LTC	AV
Reinkober, Thomas Earl	COL	AV
Spring, Sherwood Clark	COL	AV
Sullivan, David Earl	COL	AV
Vollrath, Thomas Lee	COL	AV
Williams, Ronald Neil	COL	AV
Evans, Ronald Lee	COL	CM
Goss, Joseph Bernard Jr.	COL	CM
Phillip, Joseph Peter	COL	CM
Lee, Edward Morris Jr.	COL	EN
Levine, Barry Warren	COL	EN
Lunsford, Richard Jackson Jr.	COL	EN
Phelps, Glenn Smith	COL	EN
Caldwell, John Edward	COL	FA
Finley, Earl Walter	COL	FA
Harnisch, John Martin	COL	FA
Hecker, William Frederick Jr.	COL	FA
Hmara, Jeffrey Leo	COL	FA
James, Gerard Glynn	COL	FA
Kriebel, James	COL	FA
Meier, Arthur Charles II	COL	FA
Rinehart, Stephen Charles	COL	FA
Simonich, Michael Louis	LTC	FA
Stryjewski, Robert Henry	COL	FA
Theimer, David Bernard	LTC	FA
White, Aubrey	COL	FA
Byrd, Wayne Wilson	COL	IN
Deming, Dennis Charles	LTC	IN
Jones, David Trevor	COL	IN
Ryan, William Wood Jr.	LTC	IN
Williams, Richard Charles	COL	IN
Ganino, Joseph	COL	MI
Baker, Douglas Ray	COL	OD
Bald, James Francis Jr.	LTC	OD
Becker, Lawrence Joe II	LTC	OD
Boudreau, Michael William	COL	OD
Bramblett, John Russell Jr.	COL	OD
Bramlette, Larry James	COL	OD
Bregard, Richard William	COL	OD
Conway, Jack Donald	COL	OD
Devanney, Thomas Michael	COL	OD
Engel, Richard Allen	LTC	OD
Ervin, William Jackson III	COL	OD
Fang, Donald Reed	COL	OD
Fousek, Richard Joseph	COL	OD
Frazier, Willie Jr.	COL	OD
Gamino, John Michael	COL	OD
George, Donnie Lynn	LTC	OD
Greer, Charles Willis	LTC	OD
Manula, Thomas Dale	COL	OD
Matthews, David Fort	COL	OD
Mayton, Joseph Herbert Jr.	COL	OD
Nance, Willie B. Jr.	LTC	OD
Neuman, Michael Joseph	COL	OD
Paul, Jack Madison	LTC	OD
Roddy, Michael Abel III	COL	OD
Short, Augden Walden Jr.	LTC	OD
Smith, James Bernard	COL	OD
Smith, Marvin Scott	LTC	OD
Stoddart, William John	COL	OD
Szydlo, Robert Bernard	COL	OD
Worthy, Horace	COL	OD
Britt, Thomas Watson	COL	QM
Hodder, Clinton Alexander	COL	QM
Peterson, Blair Arnold	LTC	QM
Rodgers, Archie David III	COL	QM
Steverson, James Richard	COL	QM
Basile, Domenic Frank	COL	SC
Bellamy, Lonnie Jerome	COL	SC
Doyle, James Thomas	COL	SC
Drewes, Carl Erwin Jr.	COL	SC
Fields, James Edward	COL	SC
Giasson, Charles Bernard	LTC	SC
Gust, David Richard	COL	SC
Jensen, Bruce Anton	COL	SC
Olson, Walter Lloyd	LTC	SC
Paulson, Peter Grant	LTC	SC
Power, John Richard Jr.	COL	SC
Sheil, Timothy John	COL	SC
Stauffacher, Thomas Joseph	COL	SC
Styer, Norman Warren Jr.	COL	SC
Sweeny, Bruce Dixon	LTC	SC

SPEAKING OUT...

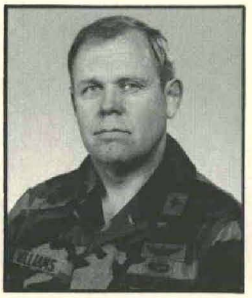
How Do You View the Army's PM Selection Process and What Suggestions Do You Have for Improving It?

EDITORS NOTE: With this issue of* Army RD&A Bulletin, *a new department titled "Speaking Out" is introduced to our readers. The intent is to provide an opportunity for individuals in the RD&A community to express their views on a host of acquisition-related topics. We welcome your comments and suggestions.

Some people contend that the Army's PM selection process is flawed because it places too much emphasis on certain criteria while not stressing other factors which may be of equal or greater importance. The debate on this issue has existed for years. How do some of the Army's current PMs view the selection process and what suggestions do they have for improving it? That question was posed to a number of PMs selected by the *Army RD&A Bulletin* staff.

COL Martin J. Michlik
Project Manager
Night Vision Electro-Optics

The PM selection process is an excellent way for the Army to choose qualified, experienced officers to manage its research, development and acquisition programs. I believe military PMs are extremely beneficial because of their understanding of the needs of the field Army. I am concerned, however, with the future because of the limited numbers of junior officers who are getting the chance to work in PM office assignments. In my view, the best preparation to be a PM is experience helping to manage some portion of the effort in a PM organization. Relatively few officers now get this opportunity. We should make a special effort, as the Army Acquisition Corps matures, to assign more junior officers to PM organizations.



COL Ronald L. Williams
Project Manager
CH-47

Naturally, I believe the process selects the best people for PMs. It appears that PM boards are placing greater value on PM office experience. While this is good, I am concerned that the Acquisition Corps will result in an officer track that has very low credibility with the rest of the officer corps. The "regreening" assignment will not be hard troop time. It is especially important for aviation PMs to have recent cockpit experience in TOE assignments, since officers are operators. I would like to see the opportunity for assignment at brigade level for LTCs in the Acquisition Corps.

LTC Gary J. Hagan
Product Manager
Hypervelocity Launcher

Obviously, Congress was upset enough about the process to pass legislation detailing requirements for PM selection. These requirements will force a relatively standard career progression path leading ultimately to PM selection. That's good, but I feel the Army is still too hung up on injecting "user experience" into the Acquisition Corps (AC). For example, I understand the current career template requires AC majors to go back to field units after CGSC. I believe those three to four years would be better spent by AC personnel practicing their craft at one or more facets of the acquisition business. Thus, to further upgrade the PM selection process, I suggest the Army adopt a radical concept — full comparability for PM management with command. After the seven to eight year mark, keep AC personnel in acquisition assignments exclusively — if practice doesn't make perfect, it certainly makes it better.

COL Stanley J. Souvenir
Project Manager
Unmanned Aerial Vehicle

The PM board selection process is an excellent process and is the best way I know of for PM selection. The biggest concern among the officers in this project is the tough career decisions that take you to command or project management. The best suggestion for improving the selection process is to get consistency and a clearly defined acquisition management career field for the officer just starting to make these tough choices.

(continued on page 40)

SPEAKING OUT...

(PMs — continued from page 39)

COL Gary M. Stewart
Project Manager
Airborne Surveillance Testbed

It is a fair process which seeks to get the best qualified officer for the job and seems to work fairly well. I would offer three suggestions to help make the process better. First, let's be more aggressive in making the board selection process more open and visible to our officer corps. It should not be perceived as mystery. Second, I believe we should spend more time ensuring we get the best possible matches between specific project needs and officer qualifications. It is important to stay within branch needs as we make the matches. There are a lot of qualified colonels competing for a few PM jobs. Let's be sure we really slate the best one tailored to meet the unique requirements of each job. Third, I think the PM selection process would become more meaningful if the Army's uniformed senior leaders emphasized more the importance of project management and its role in keeping the Army strong.

COL Ronald L. Evans
Project Manager
NBC Defense Systems

Having participated in a recent product manager selection board, I believe the current selection process is both fair and equitable. Further, the current selection process will be further improved as the Army Acquisition Corps program becomes implemented and inculcated in the field. One of the more difficult aspects of the PM selection process is evaluating officers who held jobs in quasi acquisition related fields, e.g. testing (TECOM, OPTEC, TEXCOM), procurement (non-acquisition contracts management), Strategic Defense Initiative related positions, etc. Clear guidelines need to be established and promulgated to assist selection boards and also provide information to assist junior officers in planning their careers. I also have a concern that many branches will find it very difficult to provide PM (product/project) opportunities unless the Army is willing to certify an acquisition officer then select him for PM positions other than in his basic branch.

RD&A NEWS BRIEFS

U.S., Soviets Sign Vaccine Study Agreement

The commander of the U.S. Army Medical Research and Development Command (USAMRDC) and the director of the Soviet Union's Institute of Poliomyelitis and Viral Encephalitides recently signed a memorandum of agreement under which they will eventually conduct a cooperative vaccine trial in the Soviet Union. A vaccine to protect against hemorrhagic fever with renal syndrome (HFRS) will be provided to Soviet medical authorities and administered in areas of the Soviet Union where the disease is a major public health problem. The vaccine will be developed at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), a laboratory of the USAMRDC at Fort Detrick, Frederick, MD.

Scientists from the USAMRIID and researchers from the Soviet Union's Institute of Poliomyelitis and Viral Encephaltides in the Academy of Medical Sciences will collaborate for several years to complete development of the vaccine. The USAMRIID researchers have already completed basic research and have started preliminary testing of the genetically engineered vaccine candidate. The vaccine, still in very early experimental stages, is a recombinant of non-infectious genetic material from the virus causing HFRS and the vaccinia virus, which is used to immunize humans against smallpox.

Safety and immunogenicity testing of the vaccine in humans will be done at the USAMRIID, and is projected to be completed within the next several years. It is only after successful completion of these initial vaccine trials that the larger-scale trials in endemic areas of the Soviet Union will begin. U.S. Army medical researchers have already studied HFRS in China and Korea, where they have conducted efficacy trials of an antiviral drug for treatment of HFRS.

The World Health Organization estimates that 100,000 to 500,000 cases of HFRS occur annually. The disease is most prevalent in Asia and in the Soviet Union east of the Ural Mountains. It also occurs sporadically in Eastern Europe.

The disease course begins with a flu-like, febrile stage, followed by a period of low blood pressure, then decreasing kidney function, which may be followed by excessive urinary output. Hemorrhage may occur throughout the body during and after the low blood pressure phase, with the most serious damage caused by bleeding in the brain, lungs and gastrointestinal tract.

During the Korean War, hundreds of U.S. soldiers developed the disease, then called Korean hemorrhagic fever. It is still a threat to U.S. soldiers stationed in Korea, although the rate of incidence is low. In 1987, 18 U.S. Marines became ill with HFRS, and two of them died. Approximately 100-200 Korean military personnel experience the disease each year.

The United States and the Soviet Union will share both the costs and benefits of the vaccine. Potential benefits to the Soviets include protection of a large segment of their population from a potentially fatal endemic illness. The United States stands to gain protection of military personnel deployed in endemic regions, and increased clinical data about this illness. An effective vaccine will be shared with all nations in which HFRS is a public health problem.

Solar Power Brings Hope for Improved Vehicle Readiness

The Army could significantly improve vehicle readiness by using solar-powered battery chargers to maintain batteries in vehicles which sit idle for long periods. That is the conclusion of a recently completed two-year test program conducted by the U.S. Army Tank-Automotive Command's (TACOM) RDE Center to determine the feasibility of using vehicle-mounted solar panels in a battery-charging role.

Each day that a lead-acid storage battery is idle, it loses seven-tenths percent of its charge. And, if not charged by a generator or battery charger, it eventually loses most of its power. This frequently proves to be a problem for some Army vehicles, particularly those in National Guard units, where it is not uncommon for a vehicle to go unused for several months at a time. That is long enough for a battery's state of charge to drop below the level needed to start an engine.

At TACOM, RDE Center engineers evaluated solar panels to see if they could maintain batteries by providing a trickle charge to offset the discharge during idle periods. The project was part of the Army's Military Adaptation of Commercial Items (MACI) program.

The objective of the MACI program is to determine those instances when the Army could use standard or modified commercial equipment and eliminate the time and cost required to develop special-purpose hardware. The approach involves first testing existing commercial equipment in a specific military application. Engineers then prepare a performance specification based on the test results, and industry is asked to provide either existing or modified commercial hardware that will meet that specification.

The solar-panel project included two phases of testing. In the first phase, panels made by three different companies were mounted on 10 five-ton trucks at a National Guard unit in Ypsilanti, MI, to determine if they could maintain a charge on batteries in vehicles not in use during the winter months. According to the RDE Center's Martin Snyder, engineer in charge of the project, the tests were highly successful. "This phase of the testing verified that commercially produced panels will indeed maintain a charge on a pair of 6TL batteries under diverse climatic conditions," Snyder said. (The 6TL battery is the 12-volt battery used in most combat and tactical vehicles. In military-designed Army vehicles, batteries are installed in sets of two, which are connected together to produce 24 volts, the standard voltage for these vehicles. Some vehicles use as many as five battery sets.)

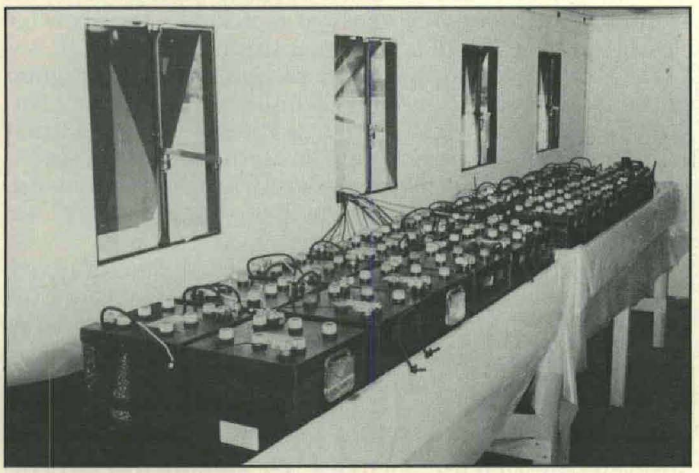
Phase 2 involved more extensive tests conducted in three different locations — Yuma Proving Ground, AZ, Fort Lewis, WA, and TACOM — to evaluate solar-panel performance in a wide variety of climates. At each site, 12 battery sets were placed in an outdoor shelter to keep them dry, and each was connected to a solar panel made by one of three firms. The batteries' state of charge was checked weekly for one year. "The three test sites all yielded about the same results," Snyder said. "The solar panels each maintained a charge on a pair of batteries throughout the one-year test period.

At TACOM, the snow and ice accumulation didn't bother the panels because it would melt off. The desert condition at Yuma gave a surprise that was totally unanticipated. Fine dust coated the panels to the point where they were almost unrecognizable, but, nevertheless, they still kept a charge on the batteries. And at Fort Lewis, where the sky is predominantly overcast, the panels were also able to maintain a charge.

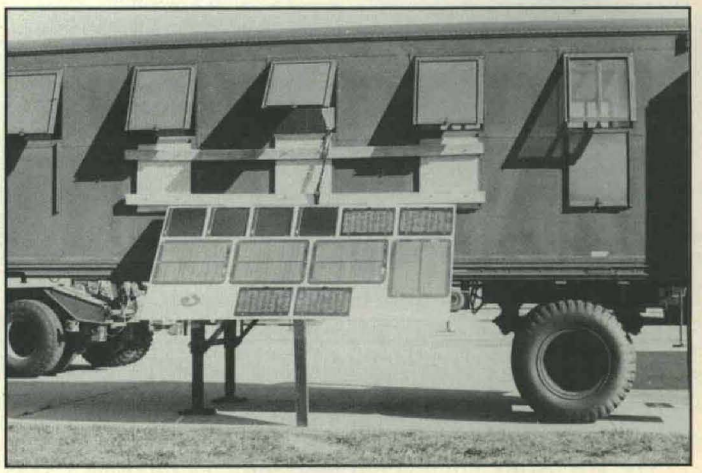
The cost to the Army for a panel and associated bracket needed for mounting it to a vehicle would be about $110. However, maintaining a battery's state of charge during idleness would greatly extend its service life, resulting in replacement cost savings that would offset the cost of a panel.

"The economics are there," Snyder asserted. "But economics should not be the real reason for doing this. It is a question of readiness. What happens now when you need a vehicle that has sat idle for a long period is that it is necessary to recharge or replace the batteries, which is a time consideration. But with the solar panel, the vehicle would be kept in a readiness state."

If the Army decides to adopt the solar panel for use in a battery-charging role, the next step is to develop a kit that would include mounting brackets to accommodate the various vehicles in the fleet. The kits would be issued to field



Twelve sets of military batteries being trickle-charged by solar panel.



Solar Panel-Trailer Installation.

Solar Power (continued)

units as retrofit kits, which troops would then install on vehicles during extended idle periods and remove prior to a resumption of service.

The preceding article was written by George Taylor, a technical writer-editor for the U.S. Army Tank-Automotive Command.

Newest Howitzer Slated for Fielding in 1992

The Army's newest self-propelled howitzer, the M109A6, will join the ranks of combat units sometime in 1992, according to the program's Deputy Project Manager Walt Ryba. Nicknamed "Paladin" by the Army after medieval knights who roamed Charlemagne's empire in defense of noble causes, the M109A6 was type-classified in February 1990 and approved for production by the Army in September 1990.

Funding for Paladin's first full year of production has been approved by Congress. Ryba notes that Paladin is a significant improvement over the current Army self-propelled howitzer, the M109A2. The M109 system was fielded in the early 1960s when it quickly became the Army's field artillery workhorse. It has supported the Army's heavy maneuver brigades ever since.

During past years, improvements have increased the M109's firing range, but the weapon system's operational capabilities have remained unchanged. Ryba describes Paladin as a self-propelled howitzer that fires 155mm shells to a distance of 30 kilometers. "That's 25 percent farther than the M109A2," says Ryba.

Paladin 155mm Self-Propelled Howitzer (M109A6)

Terrain Information Extraction System Update

The U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, has completed the initial development of the Terrain Information Extraction System (TIES). This state-of-the-art research and development test bed is one of the first low-cost, multisource digital terrain data base generation systems in the federal government.

TIES allows users to compile data from maps, aerial photography and satellite imagery. Digital outputs from the system will include the following:

- Feature data in vector form (where the outlines of features are traced) or raster form (where feature data are stored in grid cells);
- Elevation data in contour, triangular irregular network (a system of triangular facets) or matrix form;
- Orthophotos (aerial photographs or images corrected for distortions in order to register a map);
- Computer image generation inputs (wireframe models of structures and texture maps).

The three major components of TIES are the Digital Stereo Photogrammetric Work Station, the Image Digitizing System and a Geographic Information System.

The Digital Stereo Photogrammetric Work Station is an advanced soft-copy photogrammetric work station. It accepts digital or digitized imagery in a variety of formats, and produces feature data, elevation matrices and orthophotos. Wireframe models and texture map generation capabilities will be added in the near future.

The Image Digitizing System is a photogrammetric quality scanning device, capable of digitizing black and white or color transparencies at resolutions to 7.5 microns. It provides a capability to digitize imagery where no digital imagery is available.

The Geographic Information System supports map digitization, as well as storage, maintenance, analysis and display capabilities.

Efforts during 1991 will include testing of the baseline capabilities and integration of the system with other research efforts at the laboratory. TIES will serve as a test bed for transferring technology to other Department of Defense users, as well as a resource for research on computer-assisted and automated feature extraction.

Milton Chosen as Technology Director

Dr. A. Fenner Milton has been promoted to the Senior Executive Service and selected as the Army's director for technology, Office of the Assistant Secretary of the Army for Research, Development and Acquisition.

Dr. Milton oversees the Army technology base program and budget as well as the Army Technology Base Master Plan. He provides technical guidance to the Army's $580M Exploratory Development Program performed by the Army's program executive officers, the Army Materiel Command, the Medical R&D Command, the Corps of Engineers, and the Army Research Institute.

Dr. Milton served previously with General Electric's Aerospace Group in Syracuse, NY, where he was manager of the Electro-Optics Laboratory, developing advanced semiconductor components for military systems. His career in defense technology includes 12 years with the Optical Sciences Division of the Naval Research Laboratory and three years with the Science and Technology Division of the Institute for Defense Analyses. Dr. Milton received his doctorate in applied physics from Harvard University, and is also the co-author of *Making Space Defense Work*.

RD&A NEWS BRIEFS

Kamely Directs Research and Lab Management

Dr. Daphne Kamely has been promoted to the Senior Executive Service and chosen as director for research and laboratory management in the Office of the Assistant Secretary of the Army for Research, Development and Acquisition.

Previously, Dr. Kamely was scientific advisor for biotechnology at the U.S. Army Chemical Research, Development and Engineering Center. She came to the Army from the Environmental Protection Agency where she served as senior scientist and manager of bioenvironmental programs.

In her new position, Dr. Kamely formulates policy and sets priorities for the Army's $200M basic research programs. She also oversees and formulates policy for the Army's 42 laboratories and research, development and engineering centers. She sponsors and has the Army lead for various panels of the Army Science Board and the National Academy of Sciences.

In addition, as an adjunct associate professor of biochemistry at the John Hopkins School of Hygiene and Public Health in Baltimore, MD, she teaches a graduate course on cancer and the environment.

Dr. Kamely received her undergraduate degree in physics and mathematics from Goethe University in Frankfurt, Germany and earned a doctorate degree in biophysics and molecular genetics from Harvard University.

The Missing Step in Total Quality Management

One of the keys to the success of Total Quality Management (TQM) is the process action team (PAT). Most PATs are composed of a good sample, across grade and skills, of people who are involved in a selected process. Most teams go through the following steps:

- Train the PAT in TQM.
- Characterize the present process (fully understand it including a detailed flow chart of the process).
- Determine measures of customer satisfaction and establish a baseline (not measure of activity, but customer satisfaction and output — recall each person is a customer and supplier to others within the process in addition to external or end product customers).
- Improve the process and monitor the change (improvement in customer satisfaction or output).

Often the PAT disbands after a briefing or report of the results of their suggested or documented process improvements. Occasionally, the PAT stays together and repeats the process, implementing additional improvements. Sometimes a new PAT is created at a later time to restudy the process and suggest additional improvements.

This is not TQM. There is a crucial missing step. TQM must include all the people involved in the process and be continuous forever! Recall in a production line how each employee and station has a graph measuring their part of the process. Likewise in an office, each employee must understand the whole process and how their part fits in. It is in that way that they can contribute to continually improving the process and monitoring their results. The missing step is to implement or institutionalize TQM to all people involved in the process.

Unless TQM becomes a way of doing business for everyone involved in the process, the PAT is no different than a study team which comes in, suggests improvements and goes away, hoping people will accept and carry out their suggestions.

The PAT should not disband until it institutionalizes TQM. Each person must know what their products are, who their customers are, what their measure of performance, output, or customer satisfaction is and how this fits within the whole process. Each person must chart and measure their results and continuously strive to improve their output and the process. Only after completing this missing step can the process team disband.

The preceding article was written by Dr. Kenneth Oscar, deputy commander for procurement and readiness, U.S. Army Tank-Automotive Command.

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.

Army Acquisition Executive Support Agency
ATTN: SFAE
(Army RD&A Bulletin)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

Phone: (703)274-8977/8
DSN 284-8977

LETTERS

Dear Sir:

We at the U.S. Army Combined Arms Support Command (CASCOM), formerly the U.S. Army Logistics Center, Fort Lee, Virginia, couldn't help but notice that your November-December issue did not list CASCOM as a possible assignment location for members of the Army Acquisition Corps and RD&A related functional area officers. The purpose of this letter is to tell you that we have a number of critical and challenging FA 51 positions that should be considered by our officers and would appreciate your help in publicizing these to the RD&A community.

As the TRADOC combat service support (CSS) integrating command representing the user, CASCOM monitors and actively develops systems, concepts and doctrine, and force structure for our total Army CSS force. This calls for officers with broad based and hands-on knowledge to shape the Army of tomorrow. Attached is a listing of the kinds of positions available. I encourage your use of this information. We in CASCOM appreciate your publication and wish you continued success as you support our efforts to sustain our quality force.

Sincerely,

Werner G. Schmidt, Jr.
Colonel, Ordnance Corps
Chief of Staff

FA 51 Positions
FA 51/02A FA 51/03A FA 51/12 FA 51/13
FA 51/25 FA 51/74 FA 51/88 FA 51/91 FA 51/92

Army RD&A Bulletin Responds:

The bulletin staff regrets excluding the assignment locations at CASCOM in our Career Development Update. In future issues, we will be certain to include CASCOM's positions in any listings of potential assignment locations for members of the Army Acquisition Corps and officers in FA51. Thank you for pointing out this obvious oversight.

BOOK REVIEWS

The Masks of War

By Carl H. Builder
A Rand Corporation Research Study
The Johns Hopkins University Press

Reviewed by CPT T. W. Koufas, Army Acquisition Executive Support Agency

In today's America, we face significant technological, economic, political, and social challenges in the national security environment. Changes to our traditional thought process require careful thought.

The basis of this book revolves around the understanding of the institution. The institution is described as the all powerful Army, Navy, and Air Force. These institutions are the true force in our structure that rarely change. While composed of many ever-changing individuals, they have distinct and enduring personalities of their own that govern much of their behavior. The personality of each service institution effects their approach to military strategy, planning, and analysis.

Each service institution is motivated by its own individual needs in developing their goals and objectives. The Army, with its pride in its ties to the citizenry of this country and the ability to soldier, likes to be the constant in our military structure.

The Navy, which holds on to its strong traditional ties, likes to be the more independant of the three services. The platforms used to perform their missions provide the Navy with a certain amount of autonomy.

The Air Force, which prides itself in having the latest in technology, likes to believe in its ability to wage air warfare as a means to autonomy. Of the three services, the Army and Air Force are closer in their intraservice distinctions.

The author's analogy of the service institutions and the way they plan their strategies, do war planning, and analyze situations is clear in its intent. All too often the true intentions are masked behind somewhat selfish and parochial reasoning. He is concerned however, that future changes in the way the service institutions conduct themselves, especially in the area of nuclear capablities, could be detrimental to this nation. If we treat the institutions as if they were more perfect, more noble than the people who compose them is to court deception on both sides of the relationship. The masks of war that the services hold up before their faces to explain or justify their deeper self-interests is one side of a deception. The other side is treating the services as more than human.

FROM THE ARMY ACQUISITION EXECUTIVE...

I am currently seeking advice from the acquisition community on better ways to obtain the products the Army needs within planned cost and schedule while creating incentives to obtain more realistic proposals from our defense industry partners. One of the persistent contracting problems we have faced in our research and development (R&D) programs is that the government's tendency toward lowest price has motivated contractors, at times, to underestimate the actual cost of accomplishing the work. While our acquisition and contracting strategies have become more sophisticated over the years, the desired result is still beyond our reach. The time has come to make another advance in our approach to R&D contracting.

My staff and I have prepared and circulated a paper that proposes a strategy to establish a more realistic incentive structure for R&D contracts. Let me provide some background to our proposal.

During the last five years, the Department of Defense (DOD) has turned increasingly to fixed-price contracts for the development of new systems. This approach had the advantage of limiting government liability, but not without some attendant problems. It tended to both encourage and penalize "over-optimism" for the contractor and the government. Over-optimistic projections induced contractors to submit low offers for the R&D effort and win an award without fully recognizing the likelihood and potential consequences of an overrun, thereby placing themselves in a position of excessive financial exposure.

Recognizing this, DOD has re-emphasized the use of cost-type R&D contracts, wherein the government assumes most financial risks of cost overruns. This, however, has created a new set of problems. First, contractors perceive that low offers win, so they "buy in" to win the award. Second, when such a contract is awarded there is usually no effective incentive for avoiding overruns because, in the final analysis, the government must pay for essentially all the work performed under the cost-type contract. Finally, there is no penalty to the contractors if they overrun the contract.

Simply put, fixed-price and cost-type R&D contracts both suffer from similar problems: unrealistically low offers and cost overruns. They differ only in terms of who bears the ultimate financial liability.

The priority concern in development contracting should not be to apportion responsibility for overruns between the government and the defense industry, but to avoid overruns. How? We avoid overruns by funding adequately, pricing realistically, and executing professionally. In pursuit of this objective, I have requested the acquisition community to comment on adoption of the following principles for R&D contracting:

- Fully-fund R&D efforts (rather than expect the contractors to help fund these efforts)
- Eliminate the practice of "getting well" in procurement
- Incentivize contractors to submit realistic offers (rather than "buying in" at unexecutably low levels)
- Balance risk appropriately between contractor and government
- Select contractors on the basis of best value (rather than low price alone)

We have further suggested consideration of the following general approach for development contracts:

- We need a realistic cost estimate at the beginning of the R&D effort in order to have a good yardstick for measuring both our budgeting needs and the reasonableness of subsequent contractor proposals.
- We should avoid the temptation to skimp on our R&D program funding. If we are "penny wise and pound foolish," we will ultimately suffer the consequences in an overrun, program restructure, and/or termination.
- We must encourage contractors to submit realistic proposals by establishing a contract incentive mechanism to reward underruns generously and penalize overruns significantly. I have recommended that we incorporate the most attractive features of the fixed-price and the cost-plus based contracts into a package that is tailored to the development of specific programs.
- We must review the contractors' progress in executing R&D contracts by establishing intermediate milestones and aggressively manage contractor cost, schedule, and technical performance against those milestones.

At this time of declining defense spending, we must find innovative ways to mitigate financial risk to DOD and our defense industry partners. I want the Army at the forefront of this effort. Our legacy will be programs that meet the needs of our soldiers at a fair price and in a reasonable period of time.

Stephen K. Conver

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