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ABOUT THE COVER:

Sense and Destroy Armor (SADARM) weapon system seeks out a tank during a recent test firing. The system represents one of a variation of Army's target-seeking unguided munitions. Back cover shows the direct hit on the target tank. Cover photos by Aerojet Electro Systems.

FEATURES

DEPARTMENTS

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Purpose: To improve informal communication among all segments of the Army scientific community and other government R,D&A agencies; to further understanding of Army R,D&A progress, problem areas and program planning, to stimulate more closely integrated and coordinated effort among Army R,D&A activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Sense and Destroy Armor

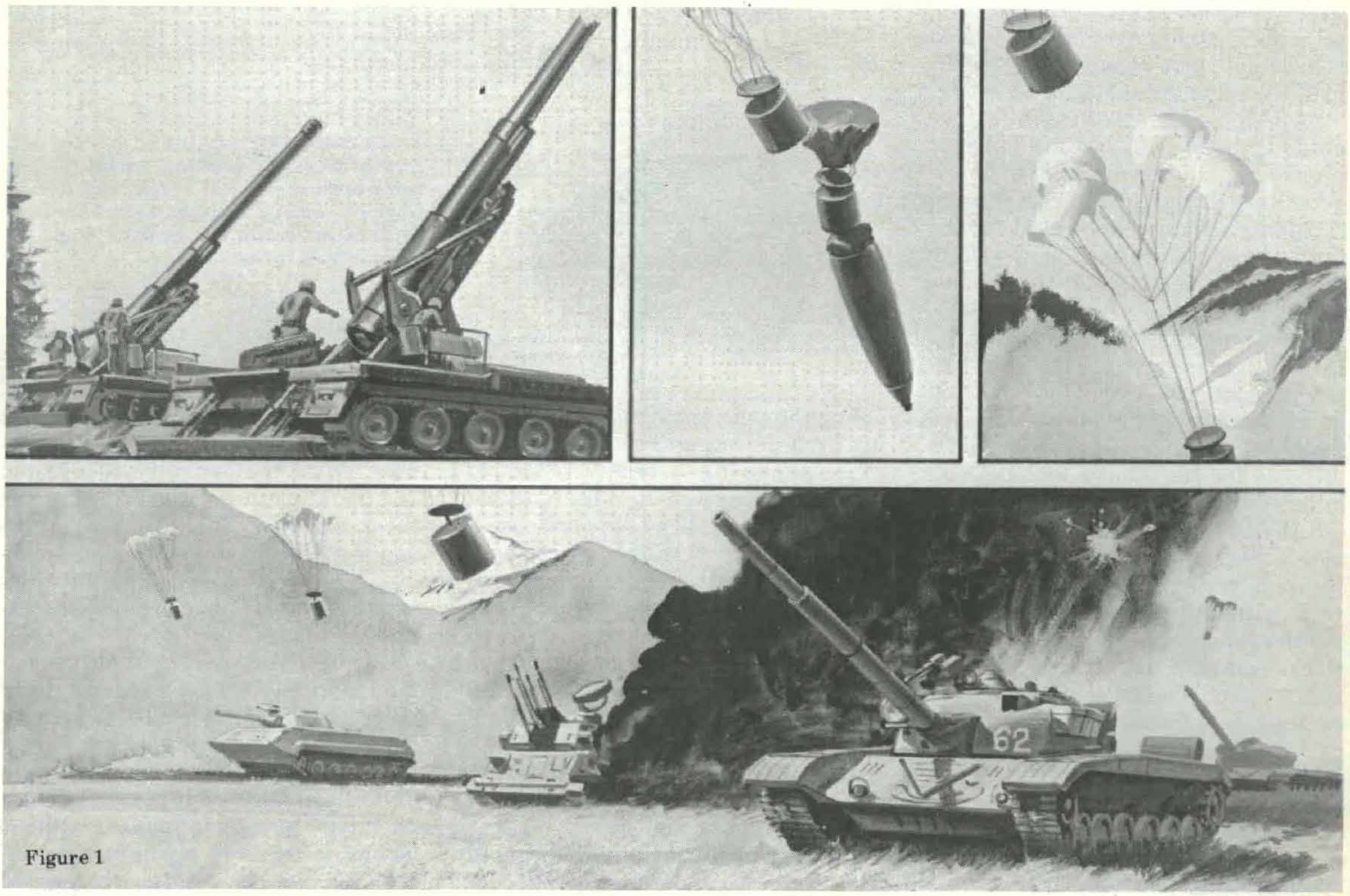


Figure 1

By Theodore J. Malgeri

The four enemy tanks move into a secure position where they are not exposed to fire from antitank weapons. Suddenly there's an explosion in the sky and the tank on the left bursts into flames. Seconds later another explosion occurs and a second tank is destroyed. Why?

The answer to the preceding question may be a development project currently underway at the U.S. Army Armament Research and Development Command (ARRADCOM), headquartered at Dover, NJ. Called the Sense and Destroy Armor (SADARM) program, it is a true "Fire and Forget" antiarmor munition.

Two years ago, when the *Army Research and Development Newsmagazine* (October-November 1977) reported on this program, it was in exploratory development. ARRADCOM has just concluded that phase with a successful "brassboard" firing program. These firings validated the SADARM concept by testing complete submunitions, including vortex ring parachute, sensor and lethal mechanism, in a free fall environment.

The lead laboratory for the SADARM effort is ARRADCOM's Large Caliber Weapon Systems Laboratory (LCWSL). Systems analysis and sensor technology investigations have been ongoing at ARRADCOM's Ballistic Research Laboratory, Aberdeen Proving Ground, to support that development.

The program has also involved other government agencies, including laboratories operated by both the Air Force and the Department of Energy. In addition, to provide hardware, contractor, Aerojet Electro Systems Co., was utilized to integrate the program.

The need for "Fire and Forget" antiarmor munitions is imperative in the context of the threat represented by the massive number of Warsaw Pact armored vehicles arrayed against NATO. These vehicles include tanks, armored personnel carriers, self-propelled artillery and armored air defense guns. The requirement to neutralize armored formations anywhere on the battlefield has become increasingly evident throughout the last decade.

To defeat such a threat, artillery will be required to play an increasing role, out to its maximum range. At the present time, however, artillery does not have the ability to defeat quickly mobile, armored targets beyond forward observer ranges.

In order to neutralize this vast, highly mobile threat, the artillery needs munitions able to kill with only a few volleys per target. This dictates the use of "smart" munitions with the capability to detect and guide an efficient kill mechanism to the target.

SADARM is a simple, low cost munition with these characteristics. It is a target sensing submunition having the capability to detect and defeat armored vehicles. It is presently being developed for use in cargo carrying artillery projectiles; however, other delivery methods (missile, aircraft, other caliber artillery, remotely piloted vehicles, etc.) are potential ways to deliver the submunition to the target.

SADARM's high terminal effectiveness will greatly reduce the number of projectiles required to defeat hard targets. Its self contained target sensing capability eliminates the need for the target acquisition device or system to track individual targets, thus reducing the vulnerability of those assets.

Since multiple submunitions are delivered to the target area by each carrier, the potential exists for attacking many targets simultaneously. Since SADARM attacks from above, it is difficult for the enemy to hide, and hull-defilade tactics are useless.

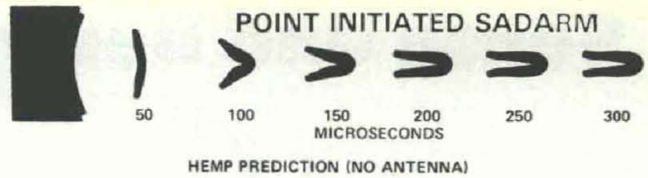
SADARM has the potential to provide a 20-fold increase in our capability to defeat enemy armored vehicles with artillery when compared to dual purpose improved conventional munitions. Analysis indicates a high per volley effectiveness against large concentrations of armor and self propelled artillery batteries.

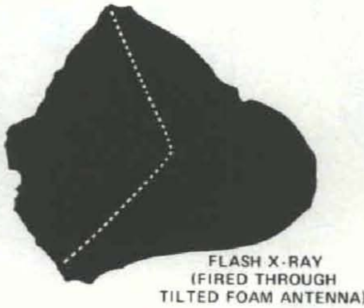
Increased per volley effectiveness means that antiarmor artillery missions can be accomplished with fewer rounds, freeing the artillery unit for other missions. Most importantly, the vastly increased effectiveness makes it possible to inflict the level of damage necessary to neutralize armored formations.

The SADARM system, as initially developed, will use a standard M509 8-inch projectile body to deliver multiple submunitions packaged within the projectile to an area above an armored concentration (Figure 1).

Each submunition contains an autonomous sensor for the detection of armored targets, a lethal mechanism capable of defeating the target at long standoff, and a parachute for stabilizing and imparting a spin to the submunition while controlling the rate of descent of the submunition. This uniform spin and descent rate provides scan capability to the sensor.

The SADARM approach is considered to be unique because it utilizes a self-contained sensing technique for target detection and does not rely on a guidance and control subsystem to carry the lethal mechanism to the target. The sensor acts as a target activated fuze, evaluating and processing the inherent signature emanating from the target. This sensing technique allows for a relatively simple munition compared to other alternatives and a correspondingly low cost.





Top: COMPUTER PREDICTION of a self-forging fragment warhead, where force is being applied to metal at left, and formed fragment emerges at right. Left: FLASH X-RAY of an actual self-forming fragment being formed in flight.

Figure 2

Likewise, SADARM does not require a man-in-the-loop designation as utilized in semi-active designs. While such a design provides the sensor with a strong return signal for long range homing purposes, the necessity for a designator imposes additional tactical constraints on its employment. Also the active designation exposes the designator to the possibility of detection and suppression.

The argument may be advanced that the active and semi-active modes of operation result in greater probability of target acquisition. However, when operating at relatively short ranges, as in the SADARM concept, the target acquisition capabilities of passive sensors, coupled with micro processing target evaluation schemes, increases to the point where, for SADARM, a system trade-off favors the current approach.

Elimination of a guidance and control subsystem for SADARM is possible due to the combination of the delivery by conventional artillery techniques and the sensor scan and firing of the long standoff kinetic energy kill mechanism.

The deployment of the multiple submunitions and the scan radius of each sensor compensate for the errors of the artillery system (target location error, delivery error). Using a target activated sensor and eliminating a guidance and control system result in significant savings in development, production and maintenance costs.

The lethal mechanism in SADARM is termed a Self Forging Fragment (SFF) warhead. It consists of a dish shaped metal plate backed by explosive. When the explosive is initiated the metal plate is explosively formed into a fragment and projected at thousands of feet per second along a focused path. This fragment provides armor penetration capability at extremely long standoff.

One of the capabilities that has contributed to development of SFF technology has been the ability to analytically predict warhead performance. Using hydrodynamic codes (see Figure 2), designs have been postulated and analyzed for performance without having to resort to expensive fabrication and test. Also the comparison of analytical predictions and test data such as flash X-rays have facilitated in understanding the performance demonstrated in warhead tests.

An important element of the SADARM design approach is that it satisfies the "wooden round" criteria. It requires no new artillery techniques in that it is loaded and fired as any other, dual purpose improved conventional munition round, simply requiring conventional time fuzing. As such, it requires no new or additional user training, while its increased effectiveness will reduce the logistical burden of the number of rounds otherwise required.

In addition, the employment of such a munition provides an operational antiarmor capability in any realistic battlefield scenario.

Acquisition of a target to be attacked by SADARM can be by any of the existing target acquisition methods: direct observation, remotely piloted vehicle, artillery locating radar, moving target indicator radar, etc. Once the call for fire has been made and the rounds have been fired, the observer and the artillery unit have completed their mission because SADARM is a true "fire and forget" munition.

Once over the target area, the submunitions are ejected from the aft end of the carrier projectile and each is stabilized by its parachute. The parachute is rigged to position the cylindrical payload at a fixed angle from the vertical as it imparts a constant spin rate to the payload. It also causes the payload to descend at a constant descent rate. The spin and descent functions combine to provide a scan of a large area in an ever decreasing spiral.

After being ejected, the submunition descends to a predetermined altitude where the sensor is activated and its beam "footprint," driven by the rotating munition, sweeps over the scan area. Any type of armored vehicle within this area will be detected by the sensor which then initiates the warhead. The explosive within the warhead forges the metal plate, forming a slug which is projected at extremely high velocity along the line of sight of the sensor toward the target.

This slug has sufficient energy to perforate the top armor of tanks and other tracked assault vehicles. Since the sequence of events from detection is nearly instantaneous, moving targets are vulnerable to the SADARM munition.

SADARM technology had been developed by early 1978 to a point where independently the components had been proven to operate successfully, and the integration of a complete submunition to demonstrate the total SADARM concept could be undertaken. A year long industry and in-house program was planned to fabricate the test hardware and conduct the required testing.

This test program was designed to focus industry and government expertise on the total SADARM submunition free fall performance. The competent responses of contractors showed the existence of a strong industry base for future efforts. This was reinforced by strong working relationships that developed during the demonstration program.

Testing of the munition was conducted at a unique facility consisting of a long cable, approximately 1,524 meters (5,000 feet) in length, positioned between two towers on either side of a large canyon.

The cable was stretched over the test arena approximately 183 meters (600 feet) above the floor of the canyon. Facilities are available to position a test item at the mid-point of the cable and to remotely drop the test item down into the canyon.

Adapting this facility and developing live fire SADARM testing methodology was one of the most challenging aspects of the effort. Successful accomplishment of the effort is a major milestone for future evaluation of a tactical SADARM.

The scope of problems solved ran the gamut from the safe release of the item from the cable to precision external measurement of spin and descent motion to verify parachute performance. These engineering problems were efficiently solved through interaction of government and industry engineers.

Phase I of the test involved actual free flight drops of inert units to verify sensor and parachute performance in a free flight environment. Test units were "soft" landed in a 75 x 150-foot net stretched beneath the drop point. The net was used to prevent the inert test units from being damaged from repeated drops.

On-board telemetry was used to transmit sensor and parachute performance data to a ground station during the flight. A laser tracker was used to track the unit during descent to obtain data related to spin rate and descent velocity, ground track, parachute stability, drift, etc. The laser tracker also provided the capability to film the test drop.

Phase II of the SADARM concept demonstration program involved the testing of fully operational, explosively loaded SADARM test units. The testing technique was identical to that performed during Phase I with the exception that the telemetry units were replaced with live explosive warheads and the net was removed.

An array of four tanks was strategically located in the test arena to insure that the test unit would overscan a representative target array.

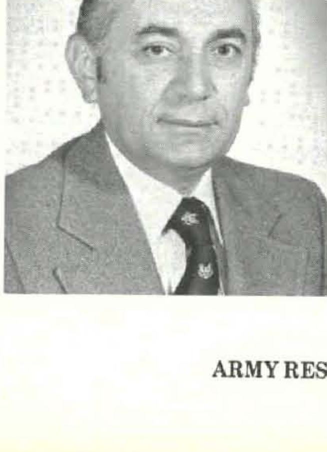
Two successful tests were achieved. Each submunition executed all functions properly, detecting the proper target in the array and firing the warhead at the target. Both hits were located on the turret in the vicinity of the target centroid.

The location of the hits upon the targets clearly substantiated the fact that the sensor tends to respond to the centroid of the target and that it had the capability to initiate the warhead at the precise moment to achieve a strike in this vicinity. The first shot inflicted a possible firepower kill upon the target, and the second shot was assessed to be a "catastrophic" kill.

Films of the tests produced an excellent historical record of the entire operational cycle of the munitions. These will be used to convey the target defeating potential of the SADARM munition.

Successful demonstration of the SADARM concept concluded the Exploratory Development Phase of the program. SADARM is ready to enter advanced development as the 8-inch XM836 Antiarmor Projectile.

The user proponent is the U.S. Army Field Artillery School. DARCOM manager for the SADARM effort will be ARRADCOM's Development Project Office for Selected Ammunition (DPO-SA). Funds to begin advanced development are contained in the DPO-SA FY80 program, however, their release is contingent on approval of the LOA.



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DARCOM D&E Directorate Convenes Budget Update Forum

Because of recent changes in procedures, scheduling, and terminology in the planning, programing and budgeting process materially affecting the Army's RDTE input to the FY82 POM, MG Stan Sheridan, DARCOM D&E Director, and his program and budget chief, Mr. Roy D. Greene, convened a one-day updating session for key budget field representatives.

GEN Sheridan opened the session by telling the group that by such a forum as this, it was possible to talk over changes, clarify, and sort out what it is that HQ DARCOM needs from the field, and what it is that the field needs from headquarters.

He noted that there were several critical areas. First, compliance with incremental funding is not optional; it is required by the Congress. Failure to live by it normally results in downward cost and disbursement trends. Such downward trends provide an apparent signal to higher authorities at DA and OSD, that these are obvious areas for further cuts in the future.

Second, the General continued, the new milestone date of 14 February 1980 for the submission of new MARDIS tapes was critical. The DA had desired an earlier submission, but DARCOM was able to gain acceptance of this date. However, the February deadline was hard and fast.

MG Sheridan concluded by saying that he wanted the group to give him feedback following the session as to whether it had been worthwhile, profitable, substantive, and therefore worthy of continued use. His purpose in conducting this one was to assist the field; was it a help?

A review of the current and revised POM procedures and RDAC terminology was provided by Greene. He described, in a simplified manner, the present PPBS, noting that the new term "consolidated guidance" combines the former financial and technical guidance. For FY81, the process has been completed except that the scheduled decision package sets (DPS) have not yet been completed by OSD, and that the two houses of Congress have not yet resolved all fiscal differences so that the Army was operating on a continuing resolution rather than an approved '80 appropriation.

For FY82, said Greene, the cycle is just starting, though the consolidated guidance had not yet been received. However, to get the system going, planning was underway utilizing a draft guidance document, albeit that document was not oriented toward RDTE.

Next, Greene outlined the organizational OSD/DA framework for planning, programing, and budgeting, pointing out the role of the research, development, and acquisition committee (RDAC) as a screening mechanism, along with the committees of the major commands and for Army-wide construction. With the FY81 POM, he explained, there had been the addition at the OSD level of a review by the Defense Resources Board—whose function was to prioritize defense requirements DOD-wide. This injection, in concert with certain other changes, stressed Greene, means that the POM as submitted in the future, must at the start be the Army's "best shot"; there will be little opportunity to make significant changes during FY82 budget reviews.

Greene turned then to a description of the revised structuring of the FY82 program for RDAC review. In reality, the revised system is one that prioritizes, starting with specified, basic, essential needs—such as those entailed in the cost of doing business, just to open the doors for business, so to say. These essentials have been grouped together under the term "Foundation"—resembling what used to be called "Core" elements, and consisting of seven general categories (Fig. 1).

The inclusion in this Foundation group, Greene noted, of the management and support costs as well as those for testing, is new. The technical base funding of a 7 percent increase for 6.1 and a 3 percent increase for 6.2 includes *a part* of the OSD guidance of a yearly growth of 10 percent for 6.1 and 5 percent for 6.2 (the remainders are included in another area covered below).

The key criteria for development systems to be included in one of the Foundation categories is whether there is a validated requirement, and whether money has actually been expended on the development. A program which has been approved and budgeted for, but has not incurred actual payments, is not qualified for inclusion in the Foundation.

The Foundation identification stresses completion of ongoing programs before undertaking new starts. This part of the RDTE program, said Greene, will not be subject to much discussion.

The second part of the total RDTE figure will be a grouping called "Increments" (Fig. 2). This is a highly competitive category, wherein new starts, new product improvement or modification program, etc., must compete with other tradeoffable items for inclusion in the request.

It is here however, under the technical base growth portion, that the remaining 3 percent for 6.1 and 2 percent for 6.2 are carried in order to provide the OSD directed "real growth" in the technological base.

Admittedly, Greene said, there are a few problems of definition which he and his staff were trying to resolve quickly in order to provide definitive guidance to the field.

Other more specific and detailed briefings on inflation/cost growth, incremental funding, MARDIS, FY81, DPS, guidance for technical programs review 7-11 January 1980, and new dollar FY82-86, followed.

As requested by GEN Sheridan at the outset, the attendees provided feedback at the day's end that was highly favorable and complimentary in terms of assisting the field in doing their jobs.

FOUNDATION

Complete oth. Adv. Dev. commitments	Completes Ongoing 6.3 Projs. per FYDP Profile.
Complete oth. Engr. Dev. commitments	Completes Ongoing 6.4 Projs. per FYDP Profile.
BMD	Continue effort per OSD CG.
Major Systems	Continue Major Systems Development per Current FYDP Profile.
Tech. Base	7% 6.1 and 3% 6.2 Real Growth per OSD CG.
Testing	Maintain Current Program with Minimum Essential I&M BEMAR.
Management & Support	Maintain Current Staff and Minimum Essential Equip. Replacement.

Figure 1

INCREMENTS

Enhancements	One or more PDIPS Describing Those Items Not Fundable Below.
Improved Mgt. & Facilities	Increase Manning; Accelerate BMAR; Initiate Other New Requirement.
Force Modernization	Initiate a New System Development at 6.3A or Initiate 6.4 Development of a Project Being Completed in 6.3 Below.
Improve Current Sys. Capabilities	Initiate New PIPS/Major Modifications or Block Design.
Tech. Base Growth	3% 6.1 and 2% 6.2 Real Growth per OSD CG.
Near-term Readiness	Accelerations, Expanded Work Scopes or New Tech. Demos. Representing an Addition to an Approved Proj. FYDP Profile Funded Below.

Figure 2

RDA: Where We've Been; Where We're Going

Interview With
LTG Donald R. Keith
Deputy Chief of Staff
for
Research, Development
and Acquisition

Q. You have been in the R&D business a long time, having begun as an action officer, then, as the executive to the CRD, and as a director. You are now the Army's top uniformed expert. What is the most significant change in the roles of an R&D officer, and secondly, the position you now hold?

A. The major change is the way we now manage our total acquisition business. As you well know, beginning in 1974, we aggregated our procurement and R&D functions at all levels of management. It is now research, development, and acquisition in every sense of the word and it is a bigger responsibility. As a matter of fact, at this time, as we are crossing the R&D-procurement boundary with so many of our new systems that are a part of the modernization of the Army, I am spending more time on procurement issues and less on R&D.

I think that will fluctuate with the times, because it will depend upon the period that we are in. We just happen to be in a period when we are programing for and justifying a large amount of procurement dollars to fund a number of programs that are successfully emerging from the R&D process.

I think that has been a healthy change. I think that the discipline that is now imposed on the R&D manager, who must see the system across the procurement boundary, has made a significant impact on the way we do our business. I think it is good that everyone in the acquisition business has to, from the very inception, consider how to successfully bring the item out of R&D into production, be concerned about supporting it logistically, and be concerned about the training of the force in order that they will be able to successfully accept this equipment. That has caused us to think very deeply about the things that a traditional R&D officer in the past was not forced to do, simply because it was not part of his role.

Q. With so much of the Army's materiel acquisition dollars going to the procurement of recently developed or soon to be completed systems such as the XM1, do you feel there has, of necessity, been some lessening of the technology base growth?

A. No, quite the contrary. There is even more emphasis during this time period placed on the tech base. In fact, we have, over the period of time that I have been the DCSRDA, come very close every year to making the real growth goal of 10 percent in 6.1 and 5 percent in 6.2. The area that has suffered relatively, as we have done this, has been the 6.3 area. I for one would like to change that, and I believe we can. The 6.3A category has been the one that has suffered most. Those systems that have been through 6.3B to 6.4, have been because we had already committed ourselves to an end item. As 6.4 demands diminish, we should be able to apply more resources to 6.3A.

Q. The Army, as well as its sister services, is frequently criticized for making its new systems too complicated, too complex, and therefore too expensive and too difficult to maintain and operate. It is not true that much of this complexity is derived from the need to make weapon systems do the job in place of manpower. Are we not in a sort of "Catch 22" situation that will not allow much simplification?

A. Well, it is difficult, but I think there is a solution. Our approach to this problem is to harness technology to make things easier to operate and maintain. In all of the R&D programs that are now coming to fruition we have spent a great deal of money in the R&D phase to get high performance systems, but also systems that are easier to operate and to maintain. We have used technological advances in such things as built-in test equipment, easier access to components through human engineering, automatic test equipment, and not the least, good manuals to help the maintenance man and the soldier do his job. Black Hawk is an excellent example of where we have a sophisticated machine that gives us much higher performance, but the maintenance manhours per flying hour are considerably lower than the Huey it is replacing. There are many other examples if we inventory the new equipment coming on.

Q. There have been some rumblings reaching the magazine, that the Army has retreated from its previous position of utmost cooperation with industry in the provision of advanced planning information. Would you comment on this?

A. I have not seen any retreat from our previous position of desiring to cooperate with industry. As a matter of fact, no one from industry has made that complaint to me. If they had, I would have been trying to find out how much there was to that kind of allegation. I believe very strongly that we are partners with industry and that we must have a free flow of information in order for them to understand our needs and for them to better us, as we are able to afford new programs.

However, conceptual information may be a problem. As you know, DARCOM's commands and the various industrial associations have sponsored advanced planning meetings with industry, wherein they are invited to hear our longer range thinking. It may be that industry has felt that we were not projecting ourselves far enough. If that is the criticism, I would have to say there is some truth to that.

We have been so concerned, in the post-Vietnam era, with our short range problems of reorganizating and reequipping our Army that our long range planning has suffered somewhat. I'm happy to report to you that we recognize this, and we have a concerted effort underway now, at all levels, from the Army staff through DARCOM and

TRADOC, that should help us communicate better.

What do I mean by that? On the TRADOC side, all of the centers are involved in the so-called mission area analyses. One example is fire support. The Combat Developers project themselves into the future and try to determine whether each functional component is structured correctly, has the right doctrine and tactics, and most importantly to us in the hardware business, whether there are deficiencies in equipment. At the same time, there is a disciplined interaction with the science and technology assessments going on in the laboratories to support these mission area analyses. The labs will also provide technological opportunities that may even drive the requirements process. Once we have brought all of these mission areas together—and there are 11 of them, we must then convert them into the long range plan that will provide direction to our R&D activities. We intend to stay on-line and use this process for programs and budgeting, because long range planning without applying the resources to progress is pretty hollow.

At the same time we'll have, as a result of these analyses, and the interaction between the labs and the combat developer, a far better capability to deal with industry.

I don't believe there is any lack of desire to deal with industry. It may be that our product hasn't been as good as they would have liked.

Additionally, GEN Meyer, our new Chief of Staff, at the up-coming Commander's Conference, intends to develop a direction for the future by projecting, as best we can, the

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most probable national strategy and the Army's perceived role in the implementation of that strategy. We will then look at the Army to see if we are structuring and equipping ourselves properly for the late 80s and beyond. The paper that results from this key session will provide long range guidance for all elements and activities of the Army.

Q. Do you believe that the experience factor, the maturity of the materiel acquisition system has reached the level where the Army can prevent the industry practice of "buying in" on a program?

A. I suppose that we will never be perfect in that regard, but we have made giant strides in the time that I have been in this business. Most of the progress has been made in the institutionalization of the cost analysis community, at every level, from OSD through the Department of the Army, to DARCOM, and each of its subordinate commands. Each has a costing community that is well trained and expert in the cost analysis business.

We have cost analysis people involved in every source selection, and one of the very important elements in the source selection process is called cost realism. By this process we assess the scope of work being proposed by the contractor, and through our independent analysis determine whether or not we have a realistic proposal.

In addition, at every milestone in the acquisition process we have both a baseline cost estimate and an independent parametric cost estimate, updated and validated at the development command, at DARCOM, at the Department of the Army, and at OSD. So we have built in, I believe, all of the safeguards that one can reasonably expect to attain.

The problems we are having today, I feel, have to do largely with the nature of the economy, and secondarily, with the unique period that we are in where we are making the transition from R&D to procurement in so many programs. That has turned out to be the toughest part of the job.

Q. Over the past 20 years, the testing aspect of the R&D process has gone through several versions, with various theories being expounded, i.e., sequential versus concurrent, toe-to-heel, etc. A few years back the services were required to revise their testing procedures and schedules. In the view of some, this meant a slow-down in the fielding of some systems. Are you satisfied that we have not reached a good compromise between the need to test and the need to field?

A. From a policy point of view, I would say yes. In the execution of that policy, your description of the many variations, I think accurately describes the swing of the pendulum due to emphasis that has been placed by the people in positions of authority at various times. At the end of the spectrum there are the advocates of taking risks to field rapidly, while at the other there are those conservatives who would go largely heel-to-toe, thus minimizing the risk.

We have under our policy guidelines the latitude to lay out our testing strategy on a case by case basis. We encourage innovation and we design our tests, we believe, for maximum efficiency. But in the real world there are constraints and there are parochial interests that must be overcome. We are short of people and facilities and there is little motivation for the testing community to share the risks and the credit from shortening the test period.

That leaves the Department of the Army and ultimately OSD in a referee position. I don't think that that's a very good position for either DA or OSD to be in so we will just have to keep working on this problem.

As you know the Army Science Board Summer Study gave us some recommendations and we are obviously going to include them in our deliberations for improvement. Ultimately, I think we will stick to our policy of case-by-case flexibility because there are no two programs that you can exactly mirror-image.

Q. Has there been much of an impact on testing of military systems from the new environmental and safety laws? And have these laws ever forced a decrease in the operational effectiveness of a proposed system?

. . ."procurement in the past, by the way the Army divided its functions, has been a sub-specialty of logistics. Procurement jobs were largely constrained to actual contracting. The procurement specialist then, was a business-oriented person or even a lawyer, who knew how to put together a request for proposal, how to put together a contract, and how to negotiate a contract. All of those are very important functions. But as R&D became RDA, with responsibility for total acquisition, the procurement function is now far broader."

A. There have been some, but it really hasn't been terribly significant. I am sure the testers would say that it forces them to do things that they may believe, based on their experience, are unnecessary. But I think, on balance, that most of the things that are being demanded of us have not been unreasonable and have not really hindered our ability to field new equipment.

We do have to do an environmental impact assessment before we start testing. Our equipment design has to take into consideration both environmental and safety laws. But we are relieved in combat equipment from meeting certain environmental standards. That is, tanks do not have to have catalytic converters and guns can exceed noise levels that normally one would not have to live with.

We do have to be concerned about our test and training sites and spilling pollutants or noise into the surrounding community.

As far as safety goes, we have always been concerned and have had to safety-certify our items before beginning testing, so there is really no change there. One area that has gotten more emphasis lately is closer scrutiny of the total impact on human beings in various test environments that could prove hazardous, either in the short or more particularly in the long term. We have done an awful lot to constrain activities where there is any doubt whatsoever. On balance though, safety and environmental laws have not yet caused us unsurmountable problems.

Q. The RSI theme and goal has received much publicity over the past year. Do you feel that in the interest of increased *military* operational capability among NATO armies, that the more readily attainable and more realistic method is to concentrate, as some say, on the "consumables"—interoperability of ammunition, spare parts, fuel rations, etc., rather than on total systems as Roland? A case in point perhaps is the recent agreement on 155mm ammunition. What are your views here?

A. I agree with you, and I have to say that that is generally recognized by everybody in the business. I have heard Dr. Perry say this on numerous occasions, and those involved with RSI in the Pentagon and in the Congress agree, that our absolute first priority is to be interoperable with high volume consumables.

There is a second priority that is also very important and we are working very hard on it. That is command, control and communications. We can hardly fight side-by-side if we are unable to communicate with each other adequately. So we are spending a great deal of time, effort and dollars to be sure that we can do that. As we automate command and control functions, this becomes even more important because we are entering a digital world that also must be interoperable. And that presents us quite a challenge.

I think I should also comment on the other part of RSI, which in your line of questioning tends to sound a bit negative. We went after Roland for instance, not because someone thought that it was a great political idea at the outset. We had an urgent requirement, stated by the air defense user, for a short-range, all-weather air defense system, primarily for the rear area, to protect high value assets like air fields, POL sites and ammunition dumps. Before we set out on a traditional development program of our own, we decided to look at what our allies had to offer. There were three European systems, all of which met or nearly met the requirements as it had been stated by our user. We finally decided to go with Roland because it best satisfied our requirement and we could get it about three years earlier than developing one ourselves. In addition, we could save a rather significant amount of money on the development side.

I won't go into the history and problems of Roland, but it turned out that we bit off more than we anticipated. We have made it through the technology transfer phase and are about to produce an excellent weapon system for the Army. In the process we have learned some lessons that we can apply as we consider similar actions in the future.

Our ability to upgrade the NATO alliance may indeed hinge upon our willingness to accept some European things, where they make sense and meet our requirements, because Europe has already, and intends in the future to accept many of ours. The Europeans have a national pride and they are also concerned about maintaining a high level of technology in their industries. There is an unquantified payback for developing and building high technology military weaponry to their whole industrial base. They are concerned about, and I think we must recognize the need for, reasonable economic balance, as well. Jobs mean votes for politicians. So, we are trying to find things that make military and economic sense, to accomplish our end goal of enhancing the alliance as a whole.

Q. What broad technology areas do you see at this time as offering the greatest future military potentials? Do you see a number of smaller advances, in such areas say as sensor technology, improved communications, better armor, terminal homing weapons for the individual soldier, etc.? Or do you see major breakthroughs looming in the future—exotic laser weapons.

A. Well, there are a lot of exciting things going on today that are difficult to prioritize, but I guess our ability to acquire and attack targets in depth is the generic area that I believe will have the greatest impact on warfare. We are now able to look well beyond the FEBA and in real time get that target intelligence processed in order to deliver accurate terminally guided munitions to the target. We've been dreaming of such a capability for many years; it is now becoming a reality. As we field this capability, and as we learn to use it, there is bound to be a change in the way we fight our own force. And it will also change the way the enemy fights us. I think it will cause one of the greatest revolutions in warfare that we have seen in many decades.

You mentioned the possibility of terminal homing weapons for the individual soldier. The technology is here that would allow that today. There are a number of different approaches that we are investigating right now; and in fact, in the course of the execution of FY80 RDTE program, we will be doing concept formulation on several of these technologies in order to choose a direction to pursue for the next generation man-portable antitank weapon.

Q. The past career success rate of the former R&D program members has been outstanding. While that program per se, no longer exists, do you see an equally profitable success rate for today's officers who follow the SSI indicator of 51, either as a primary or as secondary speciality?

A. The batting average of the R&D career speciality has been and continues to be very good, by whatever measure you would like to apply—selection for promotion, selection

"We [NATO Forces] can hardly fight side-by-side if we are unable to communicate with each other adequately. So we are spending a great deal of time and effort, and dollars I might add, in being sure that we can do that."

for command, or selection for schooling. I see no diminishing of this trend.

I also have recently been given staff responsibility for the 97 speciality—procurement. The procurement specialist has not done as well and I would like to comment about that. First of all, procurement has in the past been a subspeciality of logistics. Procurement jobs were in the main constrained to contracting. The procurement specialist then, was a business oriented person or even a lawyer, who knew how to put together a request for proposal, how to put together a contract, and how to negotiate a contract. All of those are very important functions. But as R&D became RDA, with the responsibility for total acquisition, the procurement part of that function takes on far broader meaning.

We are short of expertise, both officer and civilian, in the critical area of transitioning from R&D to production. So, I would like to broaden the procurement speciality. It may even get renamed before we finish but I won't predict that now.

The program manager of the future is going to have to be an acquirer, not just an R&Der or procurer.

I would like to tell you what I mean by that. We are suffering today because we did not do good procurement planning early enough on some of the systems that are now coming out of R&D. R&D managers focused their concern on the problems of R&D—getting the performance, staying on schedule and staying within cost estimates. Obviously, we have to continue to do that. But there is much in the way of production planning, early in the R&D cycle that may have considerable influence on how successful we are at making a smooth efficient transition to production. We haven't been doing as good a job here as we are capable of doing. So, what I want to do is to take a look at all of the RDA jobs in DARCOM and the DA staff to determine what the officer corps' true needs are for acquisition specialists. It is obviously some mix of engineering and business talent that we must develop and train to manage the total spectrum of RDA activities.

I don't mean to imply that we have done a bad job, but we have never taken on a peacetime modernization like this before. The last time we did anything of this magnitude was in World War II where all of the emphasis was on producing equipment in volume during a period of total mobilization. So, we have in the decade of the 70s, plowed virgin soil, and if we don't absorb all the lessons we have learned and get re-geared for the next cycle, we'll be missing a bet.

Q. How about the civilian side? Are we able to keep a sufficient inflow of new young engineeers and scientists in the light of personnel cutbacks and ceilings?

A. There's an absolute parallel. I am equally concerned about the civilian side, and indeed both the DA staff and DARCOM are looking at civilian career fields as well. We have always enjoyed a good structure on the R&D side. That is, the Army recognized that it needed to go out and hire good scientists and engineers to be able to do what needed to be done, and our grade structure reflects this recognition. Consequently, we have done quite well in this area. The demand for good engineers is tightening, however.

The procurement function, by contrast, has been looked upon as less demanding and has not, in my opinion, been properly grade structured. Therefore we do not have enough of the kind of people attracted to this very important career area. I am not sure how we are going to go about correcting this, but I am sure that we will tackle the problem.

I would like to add one other point. I am doing exactly the same thing on the Reserve Component side. This is an area that I think that we have not exploited adequately. If there is any mobilization source of highly qualified people, available on a relatively short notice and able to hit the ground running, it is from industry where people have been involved in the R&D and acquisition business on a daily basis. So, I'm looking to strengthen the Mobilization Designee program with that in mind. Looking at the entire structure, from DARCOM all the way up through DA, I'd like to see the Army have an avenue of experience, training, and promotion for high quality Reservists that could provide us a wealth of talent on mobilization. This is an ongoing effort that I have to say is moving faster and better than the Active side, because we started a little sooner. I'm proud of where we are on that.

Overall, I'd say we are getting our road map well drawn.

EXPERIMENTING for

Tomorrow's Combat Vehicles

By COL Lawrence B. Fitzmorris

The Armored Combat Vehicle Technology (ACVT) Program is designed to use the results of testing with experimental test beds to determine requirements for new weapon systems. Objectives are to determine appropriate Army and Marine Corps actions regarding the development of lightweight combat vehicles and medium caliber antiarmor automatic cannon. TRADOC, DARCOM, and the Marine Corps are partners in this most important endeavor.

The program philosophy is to allow requirements for future weapons systems to be derived from judgments, based on hands-on experience with new technology, rather than from "pie-in-the-sky" user "wish lists" or highly optimistic industry "promises."

The progam has pushed the state-of-the-art in weapons system technology and vehicle technology in the form of experimental test beds, in instrumentation to measure the performance of these test beds, and in engineering and combat models to portray the characteristics of future weapons systems. The program is having success in all these areas, as well as problems.

So far, no problem has been insurmountable. However, as experienced hands know, pushing the state-of-the-art often results in slippages, and the ACVT program is no exception. Here it has pushed back a schedule that originally called for much of the program to be nearing completion at this time, rather than requiring nearly two more years of testing and analysis.

The ACVT program has undertaken a series of tests designed to address the technology issues involved in its objectives. Each of these tests will be discussed.

In the HIMAG (High Mobility-Agility) IIA test conducted at Hunter-Ligget in 1977, the program first measured the effects of high mobility and agility of a target on a tank gun firer's hit performances. This test was conducted with M60 tanks and ground mounted TOW, tracking and dry firing at a highly evasive target maneuvering on a runway. Results indicated a definite and significant payoff for agility against tank gun systems.

In a seating position test, the program examined a supine or reclining position versus a prone posture for armored vehicle crewmen in an attempt to find a good way to lower vehicle silhouette. The prone position was medically and physically unsatisfactory, but the supine or reclining was determined to be effective.

The HIMAG chassis test was conducted principally to gather engineering data on high performance tracked vehicles. The HIMAG chassis was the program's first experience with a highly instrumented test bed, and there were some severe dependability problems, in both the automotive and instrumentation areas, that plagued the test schedule and events.

More than three-fourths of the available test days were involved in some form of repair activities. However, all required tests were completed successfully, except soft soil testing, for which the test program lost the weather window at Fort Knox. That hole was recently closed with some soft soil tests with surrogates at Waterways Experiment Station (WES).

The HIMAG chassis and other vehicles were also used to conduct an operational 20 KM traverse test to determine the extent to which the vehicle speed would be limited by the driver or by the vehicle.

Chassis testing results show that considerable improvement can be achieved in tracked vehicle cross-country ride characteristics by improvements in suspension systems. Such improvements are well within the state-of-the-art.

It was also learned that, even at high performance levels, drivers will use most or all of a vehicle's mobility capabilities. For example, a professional civilian driver who knew every turn and hill in the course, the equivalent of a Parnelli Jones, ran the 20 KM cross-country course in the HIMAG in 30 minutes.

Everyone thought the GI drivers would take longer. Not so! In fact, one soldier, relatively new to the Army and having never seen the course before, ran the course in the HIMAG in 23 minutes!

In examining the HIMAG IIA results, analysts realized that gunners might not be as able to track and hit targets in real terrain as well as they did on the airstrip at Hunter-Ligett.

RESULTS OF 75MM LETHALITY TESTS

TANK TARGETS

- 75MM KE PERFORMANCE - XM774 105 MM

LIGHTLY ARMORED VEHICLE TARGETS

- 75MM KE NOT VERY EFFECTIVE IN TERMS OF DAMAGE (PRESSURE AND TEMPERATURE EFFECTS MINIMAL)
- 75MM HE EFFECTIVE

OTHER TARGETS

- 75MM HE INEFFECTIVE AGAINST BUNKERS
- 75MM HE MODERATELY EFFECTIVE AGAINST BUILDINGS

Figure 1

Fig. 2. HIMAG Full-Up System

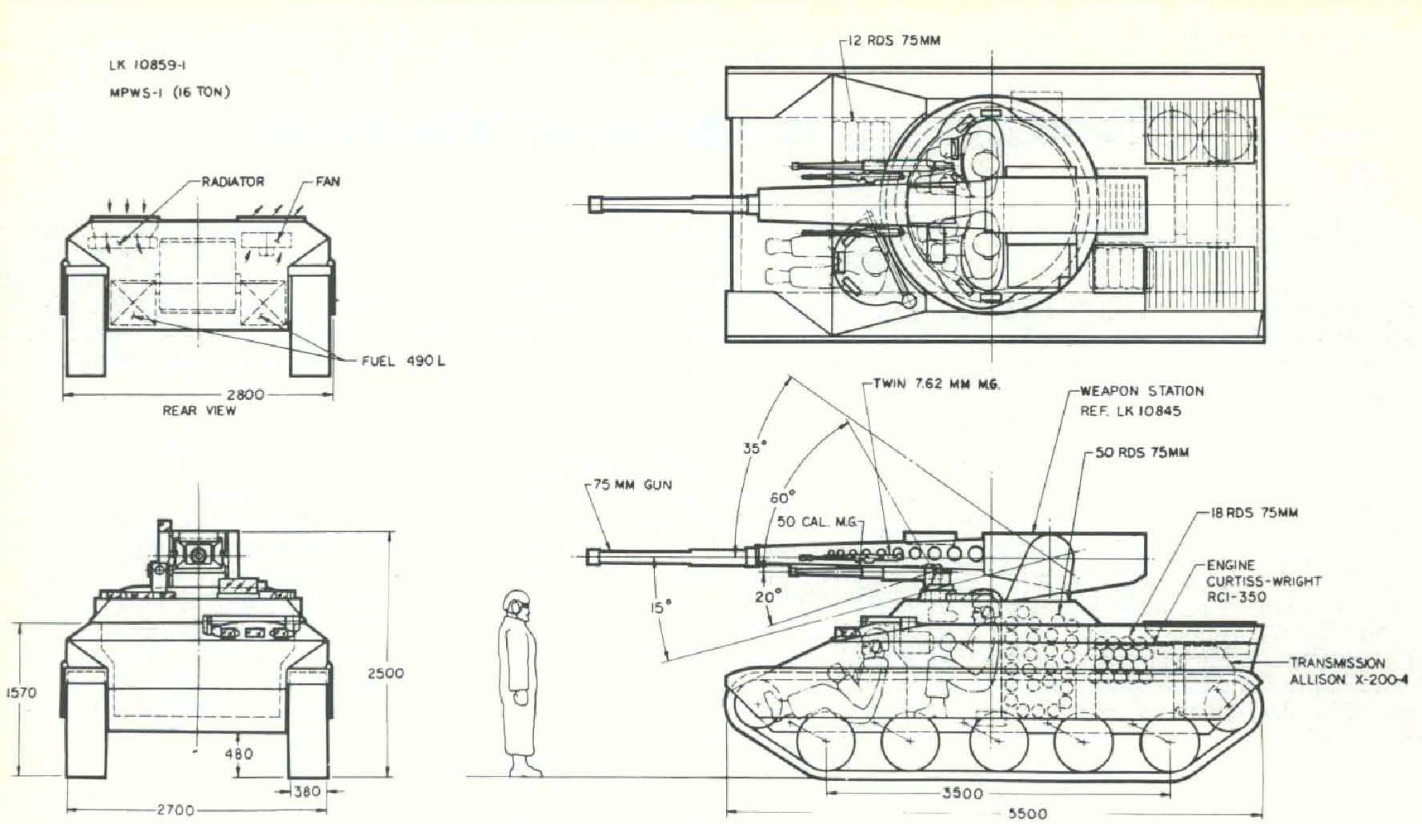


Fig. 3. TARADCOM Concept Drawing

Therefore, it was decided to conduct the same type test in more realistic terrain that included breaks in visibility between the gunner and his target.

A course was constructed which had line of sight barriers specifically selected to be assured that the test could get different intervisibility segment lengths desired in the course.

Many different target vehicle paths were used and gunners conducted engagements at different times. Target tracking systems included M60A1 tanks, tracking both with and without lead (simulating a perfect linear lead computer), the GM candidate for the XM1, a Soviet-type tank, and an advanced missile system representing future antitank missile system capabilities.

Target vehicles were an M60A1 tank, moving at speeds up to 20-25 mph, and a hot rod M113, built by WES. This vehicle recently completed a tracked vehicle speed record of 77 mph. In this particular test its average speeds were between 40 and 50 mph.

Each gunner was told to fire whenever he felt he had a proper sight picture. A device was added to each tracking system which covered the gunner's sights momentarily after trigger pull to obscure his vision, such as would happen from the smoke, dust and flash of firing his own main gun.

Gunners got off a great many more shots against the M60A1 tank than they did against the hot rod M113. Gunners also had much more difficulty tracking and engaging the more agile, elusive vehicle. How often would they have hit the targets? One can make a guess, but the data are not yet available.

In this test an unpleasant after effect of highly instrumented testing was realized. The test was run in the fall of 1978, and we are just now completing the reduction of data, which includes reducing 1 3/4 million frames of film. Preliminary indications are that individual hit probabilities in the hit avoidance test will be somewhat lower than HIMAG IIA.

If one thinks about conducting a 2,000 meter attack with a highly agile vehicle, versus a slower tank, it is easy to foresee the likelihood that defending antitank guns will get off fewer shots, with reduced hit probability, contributing to a significant payoff in battlefield survivability. The numbers associated with that payoff, unfortunately, must await the data reduction and analysis.

However, survivability is only part of the equation. To be successful in battle, it is also necessary for combat vehicles to deliver knockout punches.

Last summer at Soccorro, NM, BRL accomplished, under the auspices of this program, one of the most extensive shooting programs against real tanks and APCs that has been conducted since the 1950s. 75MM lethality numbers are classified, but figure 1 generally portrays what was learned at Soccorro.

In late 1978, the test of the 44.5-ton HIMAG, with 75MM automatic cannon, was scheduled to start in February 1979. It is now officially scheduled to commence in late 1979. This delay reflects the kind of hardware problems with experimental guns, ammunition, and gun control systems that one might expect.

Coincidentally, the instrumentation that will be used to measure test parameters has also experienced design and engineering problems, and will not be ready much before testing is to start, even though it, too, was to be on board and operational last February.

In the HIMAG Full-Up System Test (FUST), we will contribute to a data base for analytic models. This will be done by characterizing the performance of the automatic cannon on the HIMAG, examining high technology fire control payoffs to see if a burst fire cannon permits a combat vehicle to have a simpler and cheaper fire control.

We will also test several levels of fire control sophistication and suspension performance in shoot-on-the-move situations. We also plan to demonstrate the capability of burst fire cannon and high technology fire control to hit low and medium performance aircraft.

Human engineering labs and TARADCOM are planning to conduct an experiment, on the TARADCOM ride simulator, that will optimize visionics and gunner station hardware for shoot-on-the-move engagements at high mobility levels. This experiment will commence in late January 1980 and run through summer 1980.

Besides HIMAG, the ACVT program's other principal test bed is the high survivability test vehicle lightweight. With HSTV-L, the program will examine high mobility/agility and the automatic cannon in a more operationally configured vehicle.

HSTV-L is also a test bed, but it more closely resembles, from the crew's point of view, a lightweight armored combat vehicle of the type that might be fielded by the Army or Marine Corps.

HSTV-L testing will be more operational than engineering. It will test the ability of two and three man crews to perform their tests in a variety of environments, examine the contribution to target servicing of a hunter-killer fire control system, and gather engineering data peculiar to a lighter weight vehicle (16-20 tons) than HIMAG.

HSTV-L has also experienced delays in development, though not so severe as HIMAG. We expect to commence engineering tests at Aberdeen in March 1980 and to move to Fort Knox in July for operational testing.

Delays in hardware and instrumentation availability mentioned have not been unexpected. Uncertainties and risks are associated with any high technology endeavor. The challenge is to accept them early enough to be able to deal with them. This is better than pursuing a "success only" philosophy that ultimately results in a succession of "fire brigade" actions and a magnified effect on schedules and resources.

This problem highlights the need for early candid sincerity on the part of all participants, government and contractor alike, rather than merely assuring results and pronouncing forecasts derived through rose-colored glasses.

The Advanced Antiarmor Vehicle Evaluation Test (ARMVAL) is being conducted by a Joint Test Directorate, rather than by the Combat Vehicle Technology Directorate at Fort Knox. However, it is a part of the ACVT program.

ARMVAL is a series of force-on-force experiments in which the Marine Corps, through the use of surrogate lightweight armored combat vehicles and CDEC's real time casualty assessment instrumentation, hopes to sort out doctrinal, tactical, and organizational issues.

The Army's principal interest in ARMVAL is the command and control implications for units equipped with highly mobile vehicles that use evasive tactics to degrade threat kill performance.

For the Army, there are also many other implications which bear on our examination of the utility of lightweight armored combat vehicles in a variety of roles, such as:

- Light tank in light divisions (includes replacement of M551 Sheridans in 82d Airborne Division).
- USMC mobile protected weapons system.
- Follow-on to Improved TOW Vehicle (ITV) in infantry units.
- Replacement for main battle tank in cavalry units.
- Cavalry vehicle (follow-on to Cavalry Fighting Vehicle, CFV).
- Infantry carrier (follow-on to Infantry Fighting Vehicle, IFV).

The ACVT program study effort is based principally on extrapolation of HIMAG and HSTV-L data, through the medium of engineering models, to estimate the performance of vehicle concepts we might want to field in the late 1980s.

An example of such a concept is at figure 2. We have experienced some difficulty in getting the necessary engineering characterization from our test bed contractors, because of the nature of the contracts that were let with them several years ago. Some of the information needed by the modelers is deemed proprietary by the contractors, and we are having to work out that problem.

Once the HIMAG and HSTV-L tests commence, the enormous amounts of data generated by these highly instrumented tests will be reduced and manipulated to provide, as quickly as possible, insights into test results and data for the engineering and combat models.

Data reduction and first level analysis is being done by contractor support, because of the limited government expertise available to the Combat Vehicle Technology Directorate in this area.

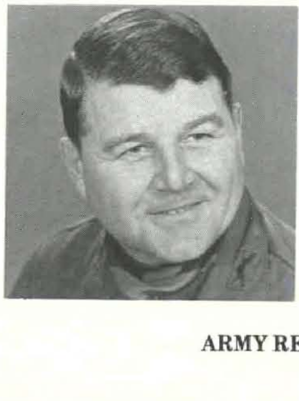
Lining up computer support and software development, when the test schedule is a moving target, are not simple tasks. Great reliance is being placed on contractor support to accomplish this job.

Several of the Army's combat analysis models, such as the AMSAA Duels and TRASANA's Carmonette, are being modified to portray technological characteristics peculiar to lightweight armored combat vehicles and a burst fire cannon, such as the effects of target agility on a firer's hit performance.

These combat models are only part of our effort to evaluate the worth of lightweight armored combat vehicles and the automatic cannon. The program also is assessing benefits and burdens of these kinds of weapons systems in all areas germane to procurement decision by comparing our concepts to other existing or projected weapons systems.

The synthesis of testing and analysis that is unique to this program should enable the Army and the Marine Corps, better than ever before, to determine what should be done about technology for lightweight armored combat vehicles and medium caliber automatic cannons. It will also provide insights as to the value of experimental test beds as tools for determination of requirements.

Success in this program depends heavily on the ability of our industry partners to share the load. I believe that when the ACVT effort is complete, the military community and industry will together have accomplished a complex set of tasks in an efficient manner with high quality products.



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The OH-58 Helicopter Modernization Program

By Marcus A. Bayliss

Army aircraft modernization programs have received much publicity of late—both pro and con. It is not my intent to take either side in this debate, but to present the rationale leading to a modernization program, specifically the OH-58 (Kiowa).

In 1976 the Army began a program to upgrade the OH-58A (Kiowa) helicopter to provide a more suitable day scout capable machine. The focus of this paper deals with that program.

The OH-58A entered Army service as a result of competition initiated by a RFQ (Request for Quote) issued by the Army in January 1968. This request called for a helicopter meeting the requirement stated for a light observation helicopter (LOH).

Initially, the Army had held a full competition for the LOH in the 1960s which has been won by Hughes Helicopters OH-6A (Cayuse). Fourteen hundred OH-6As were delivered and served in Vietnam as scout helicopters.

A second competition was held between Bell Helicopter's OH-58A and the Hughes OH-6A. The OH-58A was selected as the "new" LOH aircraft. A contract to produce 2,200 aircraft was issued to Bell Helicopter Co. in March 1968.

Fourteen months later, May 1969, saw delivery of the first aircraft, followed by deployment to Vietnam in August of 1969 and Europe in October of that year. Bell completed delivery of the OH-58A in 1973. This relatively short time from competition to contract fulfillment needs some explanation.

The OH-58A is a derivative of the OH-4, Bell's entry into the original LOH competition. After the OH-6A was selected, Bell developed the 206 series for the commercial market. This has led to several models, including the Kiowa.

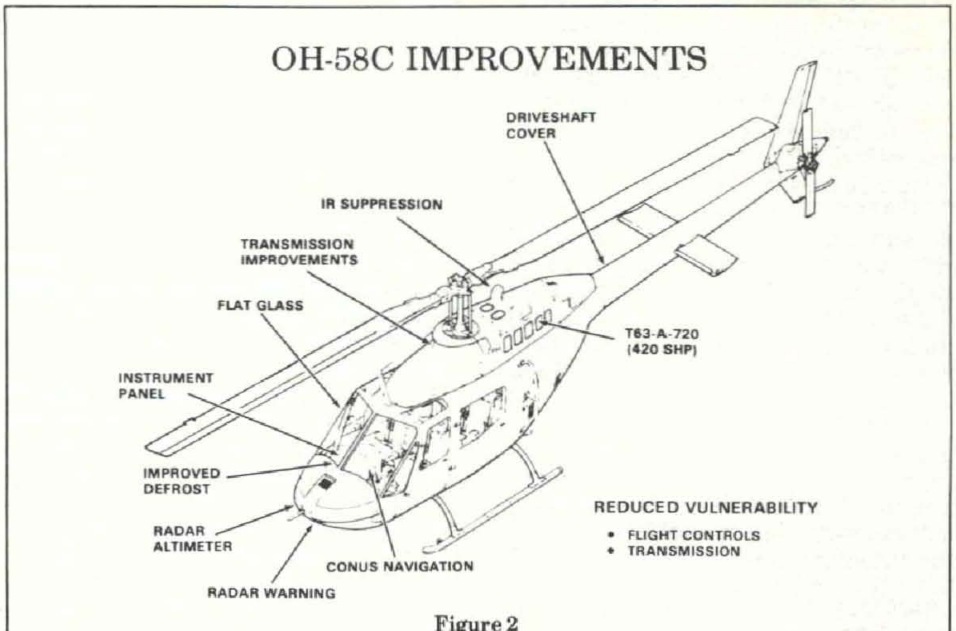


Figure 2

More than 2,600 of this type helicopter have been delivered to commercial customers. This large commercial fleet represents a definite advantage to the Army, since many flight hours of experience are available from which to make improvements.

Nine years have elapsed since the OH-58A first entered the Army inventory. Those nine years have seen it and its civilian counterpart pass a thorough operational analysis and evaluation of its role as a light observation helicopter.

With the Kiowa's entry into Vietnam, it was immediately thrust into a demanding aero-scout role for which it was not designed, but which it could fill in the low intensity warfare environment of Vietnam. Since Vietnam, the OH-58A has continued in both the aero-scout and LOH role and has participated in many tests which validated the aero-scout concept.

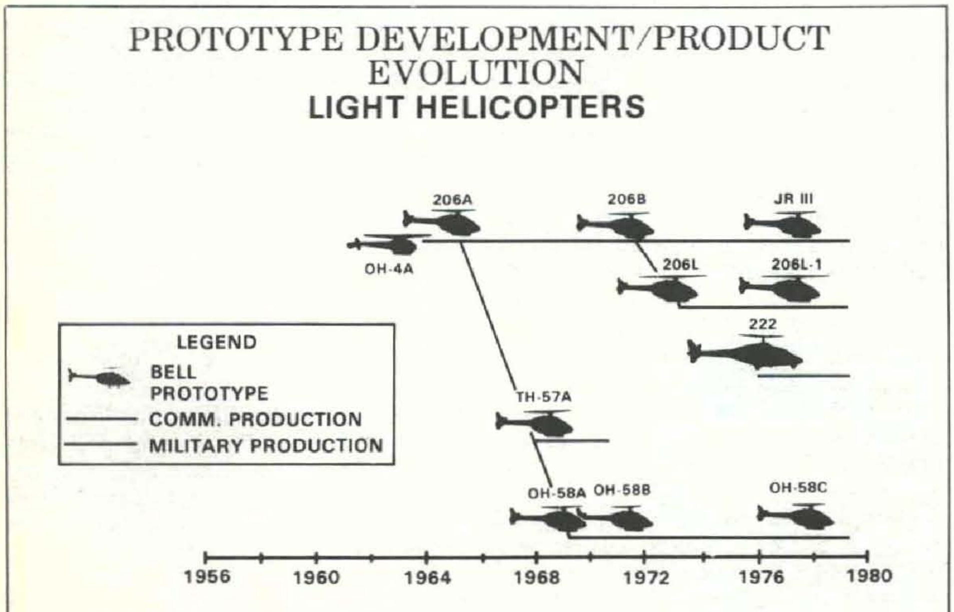


Figure 1

In 1974, the Army formed the Advanced Scout Helicopter Task Force (ASH-TF) to define the aero-scout role on the *mid-intensity* battlefield and to develop requirements for a scout helicopter.

In its final report, this organization stated that a requirement existed for an advanced scout helicopter (ASH) but that the OH-58 could be modified (improved) to serve an interim role. The task forces final report and recommendations began the process leading to an interim scout helicopter, the OH-58C.

Meanwhile, like all aircraft, the Kiowa had its share of growing pains. Some of the more severe pains were caused by aero-scout pilot reports of insufficient engine power, especially on a hot day. This same complaint was voiced to Bell by commercial 206 operators.

Bell responded by qualifying a larger engine for the civil fleet. Why didn't the Army immediately follow suit? At that time, no formal requirement had been written for the more stringent aero-scout role.

In most other areas of interest to the Army, the Kiowa was outstanding—low maintenance manhours per flight hours, low attrition rate, high availability. With this past record, why was it necessary to modernize the OH-58A?

First, since its introduction, one of its primary missions has changed dramatically. There was a shift in emphasis of the aero scout role from the "brush fire" unsophisticated battlefield to the "first battle of the next war" which will probably be fought on a highly sophisticated electronic battlefield.

Second, the Kiowa fleet has now accumulated over 2,411,000 flight hours. This high experience level has identified some potential areas for improvement which will have large life cycle benefits. Additionally, the millions of flight hours flown by the Kiowa's civilian counterpart have led to advancements in components.

Early in 1976, the Army and Bell Helicopter Textron entered into a contract to design, develop and procure some 12 Modification Work Orders (MWOs) to be applied on the OH-58 scout fleet. These MWOs were to be provided as separate kits which could be installed by depot level maintenance.

Each kit would be independent, i.e., each kit could be installed on its own without relying on parts or fittings from any other kit. Some would be designed and built under Army contract by Bell while others were to be provided by the government (GFE).

Contract orders for initial kits were issued in March 1976 with delivery planned in 1977. A contract to conduct qualification of the OH-58C (as the OH-58A is known with the uprated engine installed) was signed with Bell Helicopter Textron in July 1976. Army plans now specify 585 OH-58As which are to receive all kits and be redesignated the OH-58C.

Transmission improvements were called for both in a product maturity category as well as survivability. The MWO kit incorporates a new mast bearing which will increase reliability at higher power ratings, as well as increased survivability.

Included in the "C" modification, is a new four pinion upper planetary gear stage in the transmission. This new design allows the transmission to "fly dry." In the event of combat damage, which causes loss of all transmission oil, the aircraft can return to home base. In the test cell with simulated loads, the transmission has operated for up to three hours after loss of oil.

Another major improvement is the redundant tail rotor control system. It allows the pilot to switch to an alternate control linkage should the primary system be damaged or jammed. The tail rotor control was selected for redundancy because of its criticality at NOE altitudes and low airspeed.

One of the major areas of concern to OH-58A pilots was the difficulty of operating within engine temperature limits. The T-63-A-720 engine provides a 33 percent increase in installed power (up to 420 SHP from 317 SHP) and a subsequent increase in performance. The power margin provides high/hot hover performance without approaching engine temperature limits.

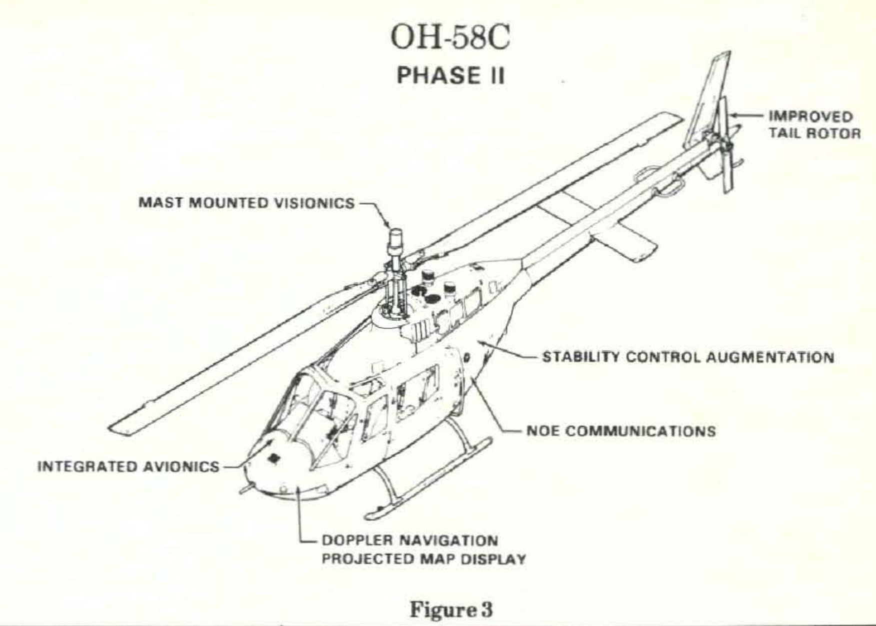


Figure 3

Cockpit and instrument panel changes include several items of survivability and mission equipment. In the mission equipment category is a radar altimeter to facilitate NOE flight at night and enhance safety in the event of inadvertent instrument flight.

CONUS navigation adds the AN/ARC-123 radio. This allows the OH-58C to operate on the civil airways system within the United States and provide an instrument landing system (ILS) for precision approaches during training.

Increased survivability is provided by the AN/APR-39 radar warning receiver. This item displays to the pilot when the Kiowa is being "painted" (detected) by enemy radar and when action must be taken to avoid ground-to-air missiles.

After training, the pilot can interpret the display well enough to allow an approximation of the enemy radar's position. Advanced versions of the APR-39 may be incorporated later which will allow precise enemy location.

The first improved Kiowa was delivered to the Army for pilot training on 10 March 1978. The initial contract for 275 calls for delivery at the rate of approximately 35 per month. A follow-on contract for 310 aircraft is intended for worldwide competitive award late in FY80.

While the OH-58C can perform its intended interim role, the Army has not solved one of the major areas of complaint from the scout users of the Kiowa. It still does not possess a target acquisition system comparable to the AH-1; the scout relies on his own, often unaugmented eye, to provide target detection, recognition and identification.

The Army is under contract to conduct a demonstrated program on the OH-58C with a mast mounted television sensor plus a laser rangefinder designator. This installation will permit target observation without exposing the helicopter to enemy observation and fires. Other state-of-the-art improvements are being considered.

Until formal designation of the "improved" OH-58C, it is being called OH-58C Phase II. All these modifications are pointed toward one goal— provide the aero-scout of Attack Helicopter and Air Cavalry units with an adequate interim capability which allows him to fulfill his role in the first battle of the next war.

Because of the planning and effort which has gone into development of the total OH-58C program, it will result in the most cost effective solution to the interim scout requirement.

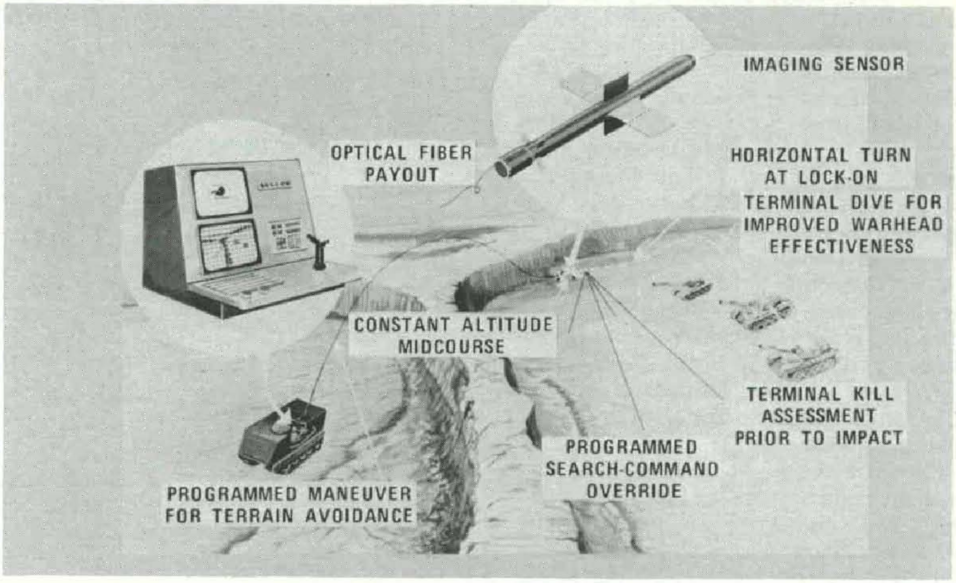
MARCUS A. BAYLISS holds a bachelor of science degree in mechanical engineering and a master of science in engineering management from the University of Missouri, Rolla. He has been associated with the OH-58 program since 1970 when he was made OH-58 project engineer in the LOH Project Managers Office. Deprojectization of the project manager in 1973 resulted in a move to the Iranian PM until 1974 when the Directorate for Weapons System Management came into existence, which included the LOH Readiness Project Office. Mr. Bayliss was transferred to that office and has worked on the OH-58 program since.

Missile Concepts for Tomorrow

By COL Kenneth L. Chesak

New weapon systems are many years in the making, they simply do not progress from someone's idea or concept into a solid operationally-ready system in much under 6-8 years. Between those two points there is a tremendous amount of proving out of theory, of components, of reliability, of maintainability, etc. But it all has to start with an idea, and this article describes four ongoing tasks and the objectives and concepts for four new tasks at HQ U.S. Army Missile Command, that might well lead to future Army operational systems.

The U.S. Army is presently deficient in weapons suitable for high payoff fighting in urbanized localities as well as those needed to carry out assaults against bunkers. With the passing of the 3.5-inch rocket and the 90mm recoilless rifle from the soldiers' arsenal, the infantryman currently will have to use the same tools his father used in WWII—hand grenade, satchel charge, and rifle fire. But the Missile Command is looking to change that dramatically.



System Concept-Optical Guided Missile

Two approaches are being looked at. The first is to modify the Viper by providing a second warhead that functions as a hand grenade. This weapon is currently being called SHAWL, for Special Hard-Target Assault Weapon LAW.

The second approach is to develop a flat trajectory, rocket propelled grenade that can be launched from the standard infantry rifle. RAW, for Rifleman's Assault Weapon, is the current name.

The first of these, the SHAWL, is designed to defeat masonry and lightly armored targets. It functions in the following manner. As the rocket impacts the target face, the front warhead detonates making a hole large enough for the second, an antipersonnel warhead, to follow through the hole. The second one then detonates with a time delay fuze, flinging 2 1/2 grain fragments about the target area.

The feasibility of SHAWL has been demonstrated and tests to date have proven most successful. (Editor's Note: See *Army RDA Magazine*, May-June 1979, p. 10, for a more detailed article on SHAWL by Mr. W. E. Zecher.)

As a result of tests against various targets, improvements to the SHAWL design were begun in FY 1979. But major technical problems remain to be solved, and these are being sought at the present time.

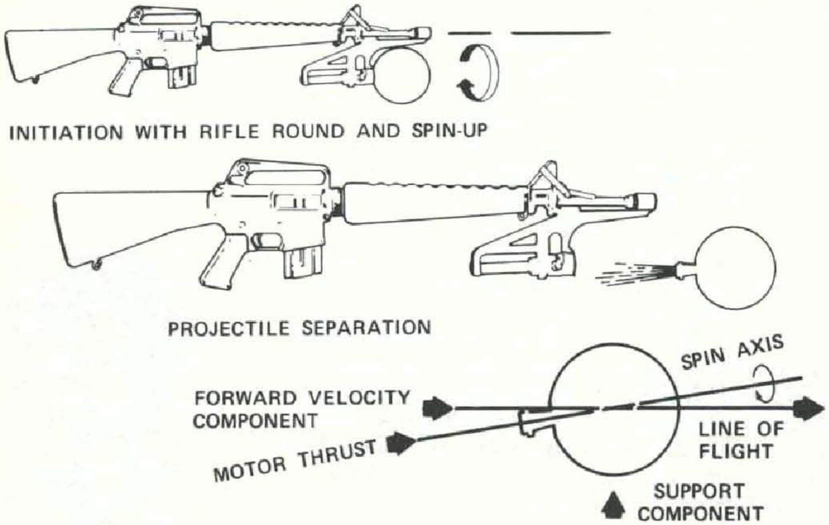
For instance, the second warhead must be optimized for antipersonnel fragmentation, and, the pyrotechnic time delay in the fuze of the second warhead must function within milliseconds of detonation of the first warhead.

The first steps have been taken to integrate SHAWL into Viper hardware, and in FY 1980 critical design improvements will be flight tested, along with demonstrating the integration of SHAWL into Viper hardware.

The second method—the RAW, being developed under contract with the Brunswick Corp., utilizes a unique approach to a flat trajectory rocket. It is a spinning ball propelled by a regressively burning rocket motor. The axis of the ball is inclined at a small angle to provide a 1-g component of thrust upward, thereby maintaining a level flight as long as the rocket motor is burning (approximately 200m).

RAW is initiated by firing the M16 rifle, using either blank or ball rounds, and escaping gases initiate a percussion igniter. When the motor starts burning the gases are forced through two nozzles, 90° to the rifle axis, causing the ball to spin up to 60 revolutions per second. Exhaust gases erode the connecting joint in milliseconds freeing the ball.

RAW has several features which make it a viable candidate for the urban combat and assault role. The first is its weight. The assembly that attaches to the rifle will weigh 6 lbs. of which 3 lbs. or 50 percent is explosive.



RAW Concept

The second feature is the relatively low noise signature—154db.

Most weapons in the field today are at 180db level or greater. The M16 rifle has a signature of 159db. Furthermore, the RAW can be fired from the smallest of inclosures because of the low noise, small backblast and small flow of gases from the rocket motor.

In FY78, wind tunnel tests were conducted verifying the design approach. Recoil and torque were demonstrated to be acceptable, preliminary warhead design was demonstrated, and precision accuracy of 2.58 MILS was demonstrated.

In FY79, development objectives were to improve the propellant characteristics (low sensitivity to temperature), improve accuracy, quantify the blast and debris characteristics when fired from inclosures, and settle on a warhead and fuze design.

In FY80, the effort will consist of demonstrating the system with an optimized warhead and conducting tests to determine the lethality of the warhead against urban area and assault type targets. Another primary test objective is to determine the effects of firing at large depression and elevation angles.

Another ongoing weapon concept at MICOM is the Stinger Airborne Self Defense Weapon. The idea here is to provide a weapon for air-to-air self-defense for attack helicopters. The project was initiated in response to this need, particularly after the emergence of the heavily armed HIND-D Soviet helicopter as a threat to attack helicopter operations.

As early as 1972, study results were indicating the desirability of adapting Stinger to helicopters for self-defense. In response then, to a request from the Aviation Center at Fort Rucker, MICOM demonstrated, in June 1976, the feasibility of remote station adaption of Stinger to fixed forward fire from an AH-1G. Two Stingers were launched at Eglin Air Force Base against a QH-50 drone helicopter.

The first round knocked the antenna from the drone, the other was a near miss—easily close enough to the heat source to have been a hit on a full size helicopter. Success of the feasibility demonstration precipitated interest in operational evaluation of the weapon.

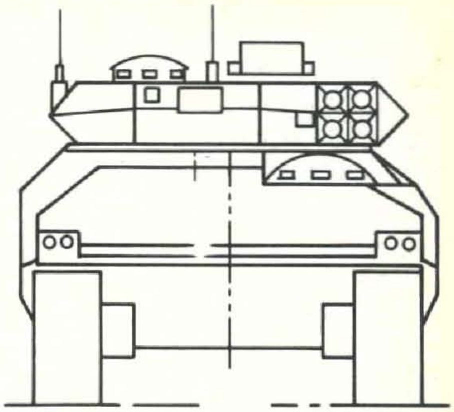
To obtain realistic operational effectiveness data, system hardware was fabricated and installed on a OH-58 Scout and a AH-1 Cobra aircraft and subjected to extensive field tests. Based on the analysis of the test data, a prototype multiple round launcher will be designed and evaluated for compatibility with both the OH-58 and AH-1 aircraft.

Performance of the Stinger missile against helicopters, given a successful launch, was well demonstrated. The issue was to determine an effective interface with the helicopter as the launch platform versus the man's shoulder.

Would an elaborate set of fire control hardware be required for target acquisition and missile launch or would simple sights and the maneuverability of the aircraft itself be adequate to perform these functions?

To insure that the answers to these questions would be obtained from tests under realistic combat conditions, it was arranged to participate in user force-on-force tests where not only Stinger but also the capability of TOW rockets, and the aircraft gun system would be evaluated in the air-to-air role.

These tests were conducted from October 1978 to March 1979, and were called J-CATCH, standing for Joint Countering Attack Helicopter Exercises. This is a joint Army-Air Force program to operationally evaluate the potential to counter armed enemy close support helicopters.



MPWS Vehicle Concept With the TOW Missile

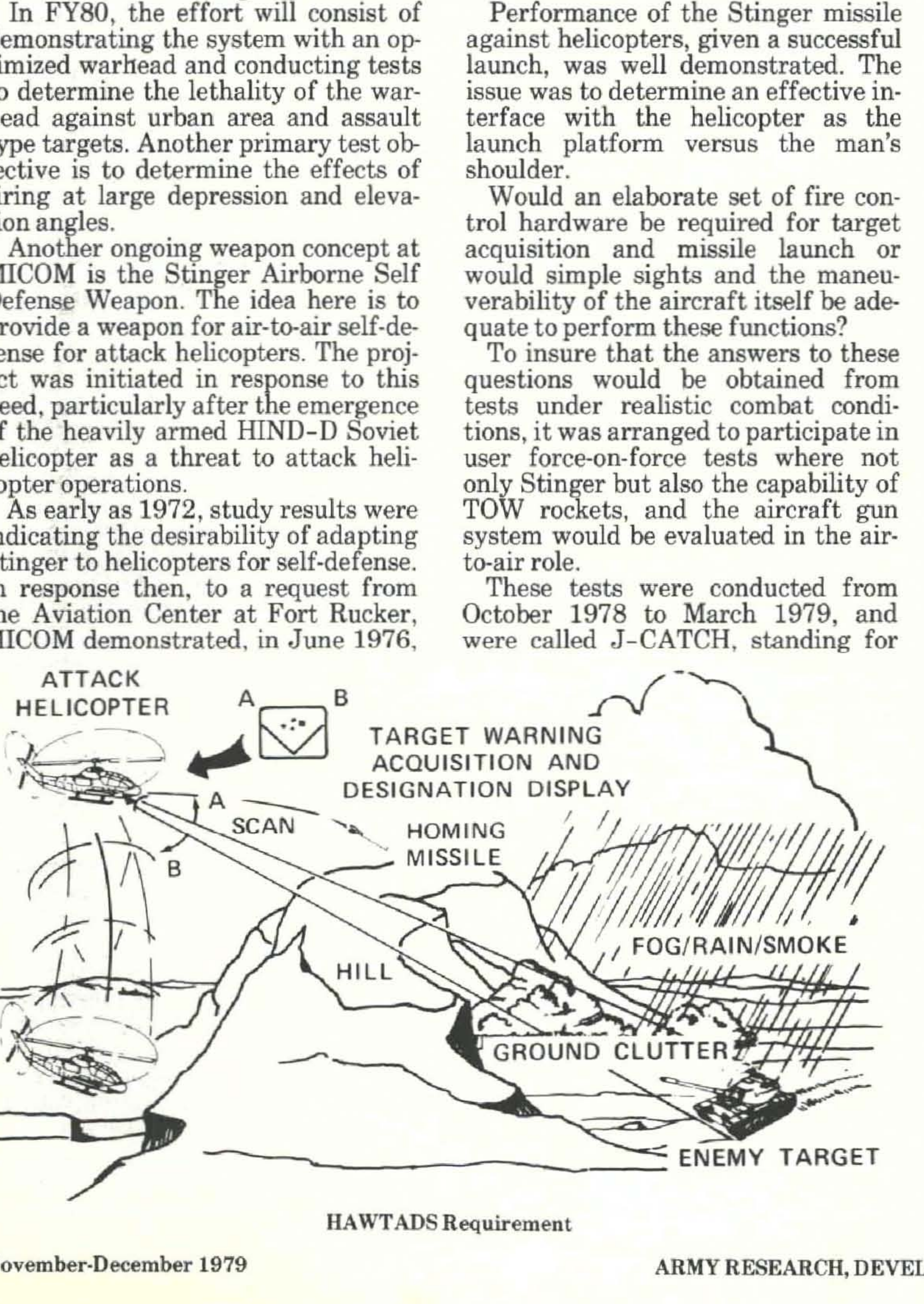
The exercise consists of six phases, four of which have been completed. Phase IV was the coordinated blue air against the red helicopter force in three scenarios: basic FEBA defense, defense of FEBA against heavy assault, and a rear key point defense against an enemy daring raid. Ground forces will be included in Phases V and VI.

J-CATCH conclusively demonstrated Stinger to be a valuable self defense weapon for the blue helicopter force, and favorable results have stimulated extensive analysis of the data to provide insights into the design of a multiple missile launcher compatible with the OH-58 and Cobra aircraft. This experimental program has provided the validation of the air-to-air performance of the Stinger missile.

The third ongoing effort is one called FAMS, Field Artillery Missile System. This is a study effort to examine ways of improving effectiveness of non-nuclear artillery rockets and missiles through the use of computer modeling/simulation and hardware demonstration.

The computer based effort will develop and exercise tools to assess the effectiveness of the FAMS when used as a delivery vehicle for a wide variety of submunitions ranging from sophisticated terminally guided submunitions to relatively simple bomblets.

The hardware demonstration program will provide an evaluation of a ring laser inertial guidance system incorporated into a low risk solid propellant test vehicle (non-tactical), 22 inches in diameter, with a range of about 60 KM. The test vehicle basically derives from the Lance missile and



HAWTADS Requirement

is compatible with the Lance GSE.

For cost consideration, an off-the-shelf guidance system is used. It is expected to show cost advantages as well as improvements in accuracy, flexibility, growth potential such as capability to accept mid-course guidance corrections, and tailored trajectories to include vertical delivery of submunitions.

The T-22 demonstration missile is a solid propellant Lance variant, 22 inches in diameter, 243 inches long, and weighing 3,332 lbs. at launch, with a range of 60 KM. The missile is compatible with the Lance ground support equipment.

Missile guidance is provided by a digital autopilot utilizing strapdown ring laser gyros and accelerometer triad. Growth capability exists for alternate guidance approaches. The missile is roll stabilized and controlled throughout the flight by a pneumatic aft control system utilizing elevons. Demonstration of the T-22 is currently scheduled as a 2-year effort.

Development of navigation system strapdown algorithms (software) was completed in early 1979 and verification in-house was completed this past June. The necessary information (operational requirements, performance expectations, etc.) has been provided WSMR so that flight test planning can be completed.

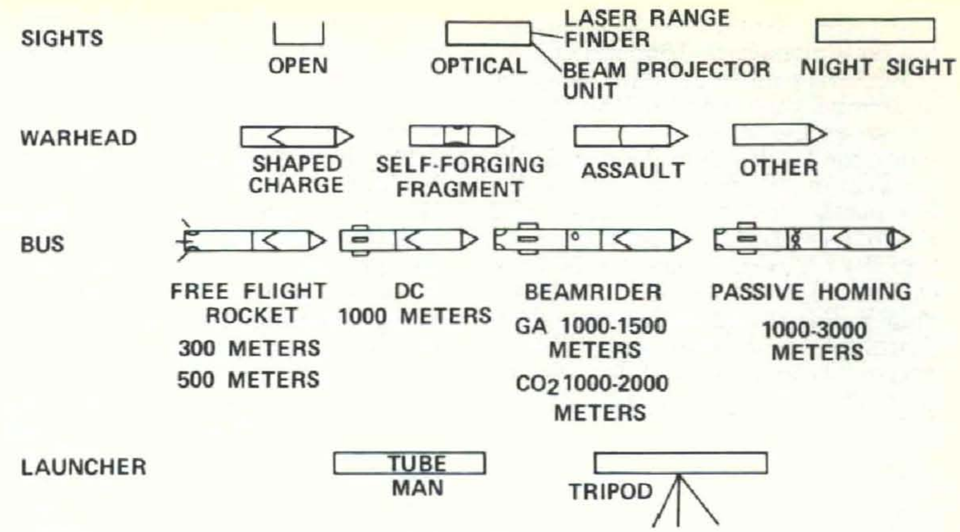
A digital simulation of the system has been developed which will be complemented by a hybrid simulation to reduce computer run time in some of the analyses. These simulations are compatible with the conduct of hardware in the loop testing which is presently underway.

A successful static test of the solid propellant motor has been completed, and the first flight test was ended at WSMR on 30 August. Two additional tests were conducted, one in September and one in November of this year. Analysis of the test results will continue throughout most of FY80.

These tests utilized purely inertial guidance, subsequent to these the laser inertial measuring unit was modified to accept in-flight updating of target information and the simulations developed for assessing this more complex guidance mode.

Finally, in order to expedite the launch of a missile system utilizing this guidance technique, methods for automating the sighting and laying functions will be investigated.

The fourth ongoing project is one that seeks to overcome the current need for U.S. soldiers to be exposed to enemy direct fire weapons. The approach being looked at is called FOG-D, for Fiber Optics Guidance



Modular Missile

Demonstration. This program is designed to demonstrate a true over-the-hill, out of line of sight, missile system. It will locate and lock-on the target after launch and terminally home on the target.

Industry has been developing a fiber optics communication data link with a secure wide bandwidth. This data link consists of a light emitting diode or injection laser, putting analog or digital data into the small glass light pipe, and a photodiode recovering the data at the receiving end. A bi-directional coupler allows data to be simultaneously transmitted in both directions.

The small data link can be wound and payed out in a manner similar to the TOW wire. This has been demonstrated up to 600 feet per second. Since data is transmitted down the data link from the flying missile to the launch station the majority of the high cost data processing can be kept on the launcher and not expended on missile impact.

The missile has an imaging seeker and can be launched conventionally or vertically from a vehicle. After launch the image is transmitted back to the launcher where the operator observes the same scene as the missile sees. The operator controls the missile and searches for targets.

When the desired target is located, the autotracker is locked on the target and it automatically homes to target impact. If lock is broken the operator can relock or select a higher priority target.

The Missile Command has been working with this technology for the past several years, and the current technology program is to demonstrate the fiber optic data link for missile applications. System components are being fabricated in FY79, and system integration, simulation, and flight testing are to be performed in FY80.

I mentioned at the start that I would also cover four new tasks under consideration at MICOM—their objectives and concepts. The first of these is called HAWTADS for Helicopter All Weather Target Acquisition and Destruction Subsystem.

Degraded weather conditions and battlefield obscurants favor the movement of ground forces while at the same time deny the ability of the attack helicopter to exploit its mobility and firepower. A future evolution of Hellfire is envisioned as a means of achieving a significant improvement in operating capability in these adverse conditions.

During 1978 a DARCOM technical assessment team found that maturing radar technology offered considerable promise of meeting the integrated requirements for target acquisition, discrimination, tracking and engagement. Accordingly, research programs for FY79 and FY80 have been oriented to examine the critical technology issues, and plans are to initiate system level tests, and demonstrations are to begin in FY81.

This experimental program will focus on the key system parameters required to have a viable operational capability. The goal is to demonstrate a target acquisition and engagement range capability in the presence of ground clutter, and rain and smoke at least equivalent to that of laser semi-active Hellfire under no obscurance field conditions.

The ability to achieve small miss distances is the key to meeting the single shot kill probability potential of the basic Hellfire missile. Total reaction time and radar emission detectability will also be important system parameters to be investigated.

The second new effort is Over Armor Technology Synthesis (OATS). Here the objective is development of antiarmor missile delivery system concepts capable of defeating all armor with reasonable sized missiles.

Technology to defeat armor includes the quest to seek the armor's most vulnerable area, is currently considered to be its top. The question arises, "How do you get enough energy on the topside of the tank to defeat it?" The direct fire method of delivery will be explored in this technology effort.

The approach is to determine the feasibility of defeating all armored vehicles by attacking from the top side. Existing direct fire antitank missiles, which include TOW, Dragon and possibly Shillelagh, will be used as warhead delivery systems.

The system will be synthesized using the existing warhead body repackaged with a self-forging fragment warhead and target sensor. Tradeoffs will be analyzed to determine the best technical approach and the appropriateness of this technology for the follow-on missile systems to the TOW and Dragon.

The missile path over the armor needs to be constrained to a small window. In order to be most effective, the warhead should be fired at an angle near vertical to the topside and near the center of the tank. The self forging fragment type warhead can penetrate the vulnerable area and can be adapted to this application.

The self forging fragment type warhead, sufficient in size to defeat the topside armor, can be packaged in a volume whose dimensions permit it to be placed in a warhead 90° to the longitudinal axis of a heavy antiarmor round.

The round can be guided to a close proximity of the top of a tank. Sensors are being developed that will set off the warhead so the self forging fragment will impact near the top center of the tank.

Third is the Mobile Protected Weapon System (MPWS). The objective here is to develop interfaced concepts for adapting current and future antiarmor missiles to concepts of future families of cavalry, infantry, and scout armored fighting vehicles.

The combat development study plan, Armored Combat Vehicle Technology (ACVT) study, dated 10 July 1978, includes the roles of dedicated armament on antiarmor vehicles. Dedicated antiarmor vehicles providing mobility and protection are subdivided into three families: MPWS I, Armored Cavalry Fighting Vehicle (ACFV), MPWS II Armored Scout, and MPWS III the Infantry Fighting Vehicle (IFV).

Primary and secondary armament shall include guns and missiles capable of defeating all armor. The approach includes determining the feasibility of mounting current and future antiarmor missile launchers onto turrets and missile fire controls inside the hulls of MPWS concepts. Tradeoff determinations will be conducted from the appropriate vehicle and missile system characteristics.

Tradeoffs shall assist in the determination of the best technical approach. As the concepts evolve, capabilities will be demonstrated by hardware prototyping to conduct the appropriate laboratory and field experiments to obtain critical data.

Shown on page 15 is a TOW missile launcher attached to a MPWS I vehicle turret. The launcher moves in azimuth with the main turrer and it is envisioned that some antiarmor missile concepts will have an independent elevation control. Fire control will be executed from within the vehicle.

This is a sample of the many form, fit and functional concepts that must be generated, even at this early stage, to provide input to the vehicle tradeoff studies. It is anticipated that by this time next year the number of alternatives will be reduced to a few that proceed to experimental validation in the FY80-FY81 time frame.

The final topic is that called the Modular Missile. The modular missile objective is to develop a design that allows modular/evolutionary approach to meet the infantryman's need in the medium antiarmor/assault, manportable weapon role.

The infantry is interested in a replacement for Dragon and is also interested in a weapon for the range of 500 to 800 meters that can be used in urban areas. These weapons are to be capable of defeating existing and advanced armor and being used to defeat personnel behind walls and in bunkers.

The approach is to design the new system concepts into functional modules using common interfaces and demonstrating critical technology. The photo on page 16 shows a variety of options that must be considered. Using a different bus or delivery system, a weapon concept can be developed for different ranges.

For example, a directional control (DC) rocket or a simple low cost beamrider missile can be utilized to cover ranges up to 1000 meters. Whereas an optimized beamrider or passive homing missile can be utilized to cover ranges up to 3000 meters.

The modular missile approach allows one to do tradeoffs of several systems using common hardware to meet the users needs. If a free flight rocket, a simple beamrider and a passive homing missile were utilized using the same launcher, same warhead and same interfaces, the infantry could be offered a simple rocket to defeat new armor out to a range of 300 meters in the mid 80s, a simple beamrider to defeat new armor up to a range of 1000 meters in the mid to late 80s and a more sophisticated missile to defeat new armor to ranges of 2000 to 3000 meters in the late 80s or early 90s.

By using commonality, the same launcher could be used for all three systems with only minor additions of type of sight, etc. This approach provides the infantry with the flexibility to have one system or a combination of systems to meet their needs, knowing that as a later system is developed major components will be retained.

Exploratory development allows the infantry to choose when they want a system, what combination they want, and which system or combination is most cost effective. It also provides the ability to include other types of warheads.

The key in this program will be the comparison of a modular approach for all candidates versus individually optimized designs. This is a very ambitious objective. However, the potential return on investment requires that both government and industry apply their talents to see if the concept has merit.

Just how many of these 8 items I've described will actually emerge into useable hardware, only time will tell. But it is by this imaginative thinking, along with countless hours of designing and testing, that we can utilize our peculiarly incentive American talents to our best weapon advantages.

COL KENNETH L. CHESAK, Field Artillery, has served as chief of the Advanced Systems Concepts Office, U.S. Army Missile Command, since June 1979. A 1951 distinguished military graduate of the University of Texas (El Paso), he has served in R&D assignments since July 1969 when he was the Department of Army systems staff officer for the Lance Missile System.

Additionally, he is a 1964 graduate of the Army Command and General Staff College, and has served two tours in the Republic of Vietnam.

DARCOM Program/Pr

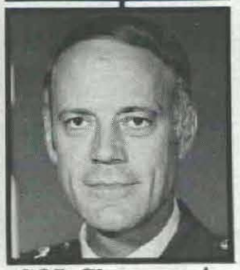
Shown on these pages are 55 of the Army's 58 chart tographs of the ARTADS, GSRS, and Stinger PMs w as of 1 November 1979. Additional information r program may be obtained from the Office of Proje DARCOM, 5001 Eisenhower Ave., Alexandria, VA 2 mercial (202) 274-9572.

A feature story on the 10th Annual Project Manage October 1979 in Orlando, FL, appears on page 21 of th A related story on the presentation of the 1979 Secre Management appears on page 33. This year's award r ization Program PM COL James M. Hesson and COL Production Base Modernization and Expansion. A G grams is also included on page 23.

AAH

BG Edward M. Browne

TADS/PNVS



COL Clarence A. Patnode

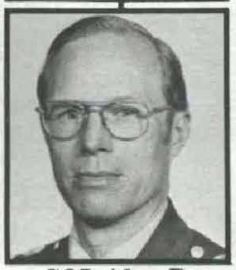
ASH

COL Ivar W. Rundgren

ADTDS

COL David L. Wyatt

TOS/OITDS



COL Alan B. Salisbury

TACFIRE/FATDS

COL Harold E. Luck

PLRS/TIDS

COL Robert D. Morgan

BLACK HAWK

COL Charles F. Drenz

CAWS

COL Ronald E. Philipp

DCSCS

BG Donald R. Lasher

DIVAD

COL Charles C. Adsit

FAMECE/UET

COL Richard H. Benfer

FVS

BG Philip L. Bolte

FVA

COL William R. Sowers

FIREFINDER/REMBASS

COL Thomas F. Cameron

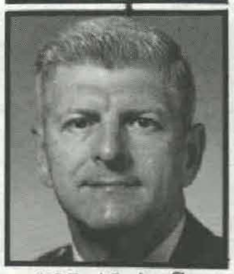
M60 TANKS

COL Paul C. Bayruns

M113/A1

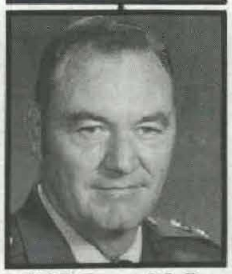
LTC James A. Logan

MEP



COL Alvin G. Rowe

MSCS



COL Donald J. Callahan

PBM

COL Harry V. Dutchyshyn

NAVCON

COL LeRoy White

SMOKE

COL Samuel L. Eure

SEMA

COL Sylvester C. Berdux

SOTAS

COL Wayne B. Davis

RPV

COL George F. Christensen

TMDS

LTC Robert H. Ammerman

TOW/DRAGON

COL Neil S. Williamson III

›ject Managers

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30MM

LTC David W. Logan

ASE

COL Daniel J. DeLany

ACVT

LTC James B. Welch

ATACS

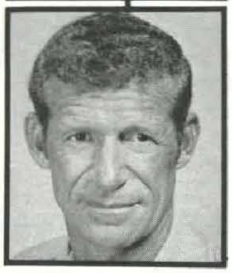
COL Glen L. Rhodes

COPPERHEAD

COL Frederick T. Mullens

CH-47M

COL Terry L. Gordy

CHAP/FAAR

COL Harold E. Stubbs

COBRA

COL Jay W. Pershing

CE

LTC Raymond F. Vachon

CAC

COL Terrence D. Sargent

HAWK

COL Howard C. Whittaker

HET

LTC James M. Durham

HELLFIRE/GLD

COL Benjamin J. Pellegrini

HELS

COL Dirk H. Lueders

ITV

COL James A. Chernault

LANCE

COL Howard C. Jelinek

NUCMUN

COL William P. Farmer

PATRIOT

MG Oliver D. Street

PERSHING

COL William J. Fiorentino

SATCOM

COL Charles F. Lindberg

SANG

BG Gerald T. Bartlett

SINCGARS

COL Aaron E. Wilkins

TRADE

COL Boris Pogoloff

ATD

LTC James K. Cooksey

ROLAND

BG Joseph O. Lax

VIPER

COL Church M. Matthews

XM1 TANK

MG Donald M. Babers

TMAS

COL Peter B. Kenyon

AVRADCOM Awards $101 Million Contract for RPV Development

Lockheed Missiles and Space Co. has received a $101 million U.S. Army contract for full scale engineering development of a new Remotely Piloted Vehicle (RPV) system to be used for aerial target acquisition, designation and reconnaissance missions.

The 43-month contract will be managed by the U.S. Army Aviation R&D Command, St. Louis, MO, with COL George F. Christensen as program manager. The U.S. Army Field Artillery Center and School, Fort Sill, OK, is the user proponent of the system, which is derived from the successful Aquila RPV system technology demonstration which Lockheed conducted for the Army in recent years.

Lockheed will provide the Army with 22 air vehicles, 4 ground control stations, 3 launchers, 3 recovery units, 3 maintenance shelters, and training simulators and manuals to support the program.

The primary RPV mission will be to acquire and locate targets for engagement by artillery weapons including the General Support Rocket System. Through use of its on-board laser and TV camera, the system will provide very accurate target location, artillery adjustment, and designation for precision guided munitions such as the Copperhead. The system can be used to exploit high value targets provided by other systems such as the Stand Off Target Acquisition System.

It is being designed as a high-quality, real-time reconnaissance imagery of targets far beyond the normal range of the ground observer and deep into the enemy's territory. The entire system can be carried in seven standard Army trucks complete with trailers, and can be transported in one C-5A aircraft. The ground control station, launcher, and recovery unit are all truck mounted and can be operated with a crew of 13.

An RPV can be set up and ready for launch in less than one hour after arrival at a tactical location. At the completion of a mission, the system can be stowed and ready for transport in 30 minutes.

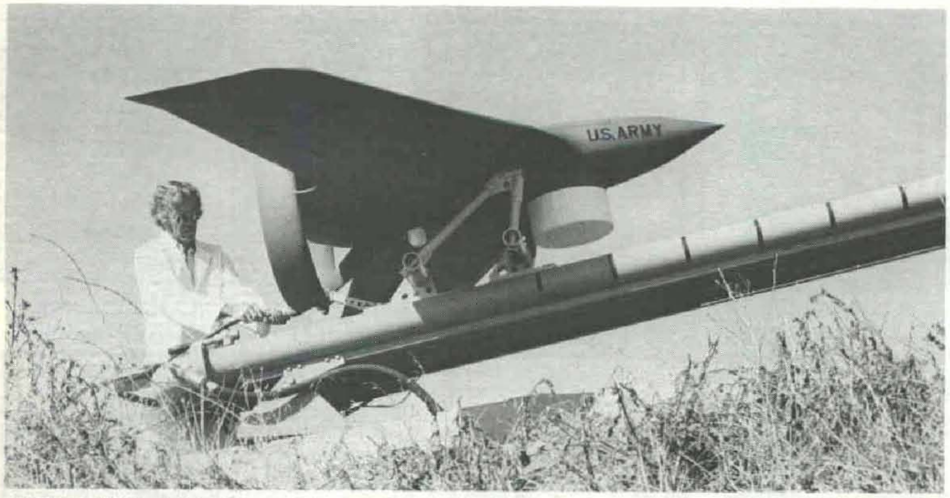
The airframe will be made of Kevlar, and will be approximately 6½ feet long, with a nearly 13-foot wingspan, and weigh 220 pounds at launch. A 24-horsepower engine will provide a top speed in excess of 110 miles per hour, and mission duration is slightly more than three hours.

The mission payload weighs 43 pounds and consists of a single integrated unit which contains a TV camera, target tracker and laser ranger/designator as well as an optical stabilization system and microprocessor electronics for control and processing. The optical line of sight is stabilized, allowing high quality video imagery to be obtained even during fast maneuvers.

The ground control station is the operations center of the system. It houses a 3-man crew consisting of an air vehicle operator, mission payload operator, and the mission commander. Each of the crew members has a control and display console to control mission operations and view the video data gathered by the air vehicle. Also included is an x-y plotter to constantly monitor progress of the vehicle, and video recording and playback equipment to preserve the data for future use.

The launcher is a pneumatically operated catapult for accelerating the vehicle to flight speed. All pneumatic and electrical power is obtained from the truck.

The recovery system is an improved vertical ribbon-barrier similar to that used in more than 200 successful recoveries during the Aquila program. The single net mounts on the back of the 5-ton truck, and it can be raised and lowered quickly after each recovery to maintain a low profile between recovery operations.



UNMANNED, 6-foot-long, 220-pound aircraft is part of a system to be developed for the Army under a $101 million contract. The remotely piloted vehicle will carry a TV camera and laser equipment for aerial target acquisition, designation and reconnaissance missions. Other components of the system include a ground control station, launcher and recovery units, and maintenance shelters.

Lockheed Photo

Once the control and support equipment has been set up at a tactical location, the vehicle can be fueled and placed on the launcher for prelaunch checkout controlled by the ground station computer.

Geographic waypoints, which the craft will pass during its missions, are preprogramed in the ground control station computer prior to launch and sent as intermittent update commands via a data link to the on-board autopilot, which flies the vehicle.

Once the vehicle has been launched it automatically seeks each preprogramed waypoint until it returns to the recovery area, which is the last waypoint programed. The operator can override the preprogramed flight plan and manually send the craft new speed, altitude, and heading commands if desired. At the completion of a manual segment, a flick of a switch will send the vehicle back to its preprogramed mode.

The mission payload operator controls the payload during the flight. He also controls the pointing and the field of view of the television camera, and can actuate the laser for rangefinding and laser designation of targets. An automatic tracking mode can also be selected that will keep the stabilized sensor and a boresighted laser pointed precisely at a selected target or at a point on the ground, regardless of the maneuvers or turbulence. This autotrack mode is effective for both fixed and moving targets.

Recovery of the vehicle is automatic. An infrared sensor mounted on the recovery unit picks up the unit and "flys" it into the net by sending a split second course correction command via the computer and the data link during the craft's terminal flight phase.

Lockheed's subcontractors include: Westinghouse Defense and Electronics Systems Center, Baltimore, MD—mission payload subsystems; Dornier GmbH, Friedrichshafen, West Germany—recovery system; Fairchild-Stratos, Manhattan Beach, CA—launcher; Lockheed-Georgia Co., Marietta, GA—air vehicle airframe; DH Enterprises, Lawndale, CA—air vehicle engine, and Kearfoot Singer, Little Falls, NY—attitude reference system.

Harris Corp., Melbourne, FL, is Army prime contractor for the Modular Integrated Communication and Navigation System, which consists of the data link hardware to be furnished by the government for integration into the RPV system.

IMPORTANCE of ILS Stressed at PM Meeting

The 10th annual meeting of Army project managers, held at Orlando, FL, 10-12 October 1979, had as its theme, the vital need for early planning for and implementation of integrated logistics support.

An audience of approximately 140, including 59 project/program managers and designees, and senior level management executives heard DARCOM Commander, GEN John R. Guthrie, open the meeting by remarking that he would address 5 topics: the PM system, the people problem, performance, cohesiveness, and cost control.

First off then, the General said he believed the Army's project management system was alive and well, having come a long way since the program's formal inception.

He was concerned over the inordinate number of non-mandatory retirements over the past year, and he has discussed the problem with the Secretary of the Army and the Chief of Staff.

The civilian high grade reduction has been a serious issue, but DARCOM had succeeded in obtaining a one-year moratorium on further reductions. He had hope that in this period the necessary relief from the remaining mandatory cuts could be obtained.

GEN Guthrie stressed that the management of people was becoming a far more important management duty than has ever been the case. He noted that senior executives in industry spend a good bit of their time in the people management business. Army managers are also going to have to spend more time on these matters; the impact of the new officer efficiency report, the Senior Executive Service and the Civil Service Reform Act will allow nothing less. "Taxpayers dollars have sanctity beyond shareholders dollars," stressed Guthrie, by way of emphasizing the need for careful management of government's human resources.

The General further emphasized his dedication to the objectives of EEO, and that he will ensure adherence in performance and ratings.

Turning to performance, the General noted the vital role ILS must play, but, he stressed, the execution of ILS by the Army through 1978 has not been good. Neither the Army nor industry, he stressed, have given ILS adequate attention. Less than half of the fielded systems are meeting their readiness goals. A better job must and can be done.

As part of performance, General Guthrie cautioned that because of the large number of new PMs with no prior experience, avoidance of repetition of mistakes must be constantly sought.

Personnel shortages are a factor in performance, and he saw no relief from this in the immediate future. He noted that his goal was to try to spread the available talent across a broader base for better overall support, rather than restrict it to individual programs.

The need for cohesiveness, he noted, by everyone in the Army, was a theme of the Chief of Staff. In the past there had been too much factionalism in the Army. Once an ASARC decision has been made, it must be supported. "There is no place in the acquisition community for parochialism," said Guthrie.

As in his remarks of the previous year, the General noted his constant concern for what he called cost conscious—cost conscientiousness theme.

He concluded by extending his congratulations to the newly selected Brigadier Generals, and repeated his belief that the "PM system is alive and well. Getting better is up to you the project managers."

For the remainder of the first day, and over the next two days, the attendees heard over 14 presentations, one panel discussion, and four luncheon/dinner speakers whose topics were directed toward better ways to manage a program and the need for constant attention to ILS.

MG Patrick M. Roddy discussed data interchange—government furnished equipment. Roddy called attention to the abundance of written guidance on the subject in the form of DODIs, ARs, OMB Circulars, and DA pamphlets and letters. The bottom line, said Roddy, was greater command attention to logistic support planning.

COL Ronald E. Philipp gave a rundown on lessons learned in fielding the M198 towed howitzer. His bottom lines stressed for the user, the need for constant user input, for the IOC unit to be the test unit, to see that training was adequate, to check continuously on funding, and to "live there." For the readiness command, the commander's support should be insured early, the ILS manager be of high quality, and it too should keep alert of funding. As for the PM, Philipp stressed he should start early, establish milestones, recognize the nature of ILS elements, think of his program as a system, and constantly review in depth.

A similar lessons learned talk was given by COL Paul C. Bayruns using the M60A3 tank fielding as a case. The first morning's presentations were concluded by Mr. Seymour J. Lorber's presentation on "Lessons Learned—RAM."

The Hon. Percy A. Pierre, Assistant Secretary of the Army (RD&A), gave the luncheon address. He told the audience of the concern in OSD over cost overruns, and of the establishment of a senior level task force, chaired by himself, to look into the Army's acquisition process. He noted of the affordability problem, that he saw the Army's duty as being that of articulating to higher authority what the Army saw as the funding levels required; if these were beyond acceptable levels, then lower levels must prevail.

Increased funds for modernization, said Pierre, will have to come from existing revenue sources rather than new ones.

Following his address, Dr. Pierre then gave awards in the name of the

"Neither the Army nor industry," DARCOM Commander GEN John R. Guthrie stressed, "have given ILS adequate attention. Less than half of the fielded systems are meeting their readiness goals. A better job can and must be done."

Secretary of the Army to two project managers—COL (P) James M. Hesson, PM for CH-47, and COL Harry V. Dutchyshyn, PM for Munitions Production Base. (See page 33 for details of the PM awards.)

MG O. D. Street III kicked off the afternoon session with a discussion of the technological impact on the logistic support concept of Patriot. The bottom line was to take advantage of technological advances to reduce costs.

Mr. James F. Maclin discussed the new techniques used to conduct the XM1 tank readiness review. He was followed by COL Alvin G. Rowe, who gave the group a rundown on the status of the DOD family of mobile electric power generating sources, and the advantages that PMs could accrue from utilizing sources already fielded or under development, i.e., assurance of provisioning, cost, adequately tested, commonality, and reduced lead time.

MG Jere W. Sharp then advised the PMs of the legal implications of the small and disadvantaged business utilization program. MG Jerry R. Currie followed with a discussion of actions taken at TECOM to improve test and evaluation management, such as the areas of test milestone management, test reports, resource allocation, and risk assessments.

The banquet speaker the first night was LTG George Sammet Jr. (USA, Ret.), now a senior executive with Martin-Marietta Co. Noted in the past as a hard-hitting speaker, GEN Sammet gave the group his candid appraisal of the military's materiel acquisition system as seen from the industry side.

He began by stressing that the motivation of defense contractors is survival. They can't sell their product anywhere else. "Profit is a dubious motivator. . . . [A] contractor is much more concerned with his reputation and for the opportunity for new business," said Sammet. "As long as a contractor cannot lose money on a cost-plus contract he is motivated to base his bid not on what the program will cost, but on what will win the competition."

Industry viewed the services, he continued, as having many good people, and a number of others who are bureaucratic and overly conservative. But there are a long list of negative characteristics, such as too many conflicting and competitive factions, lack of experience in building hardware, failure to heed "lessons learned," length of time required to get decisions, lack of or apparent lack of PM authority, and the "committee principle still prevails to prevent fingering a guilty culprit." The result is, said Sammet, that industry can take the lead.

He noted some differences by industry in management practices—overhead a bad word, personal staffs nonexistent, only VPs have a secretary, broader span of control, and therefore industry's response time is shorter.

Sammet remarked that when he was in government he questioned the wisdom of 4-step procurement. He is now convinced total competition on cost-reimbursable development programs is counter-productive. Rather, he said, emphasize competition on the technical side and negotiate the cost. The result will be a higher initial but more realistic and lower ultimate cost.

Turning to the topic of "buying in is bad," GEN Sammet asked "From whose viewpoint?" Answering the question of why companies buy in, he ticked off the reasons: the only game in town, keep the work force employed, keep plants open, "get well" on changes, put business on the books, etc.

But, he noted, contractors have overruns as well. They may underestimate, they may have vendors who bought in, labor problems can have serious impact, and many other reasons can cause an overrun.

So what happens when a contractor signs up for a price he knows he can't meet? Among other things, said Sammet, he starts keeping a log of things the customer asks to be done that impact on the schedule; he suggests engineering changes; he pushes for schedule changes; he utilizes the late GFE clause to its utmost; and there were other tricks in his box as well.

A 5-year budget and plan is necessary, said Sammet, but unfortunately imprecise numbers drive the programs. The first question industry asks is "What is in the budget?" So, he noted, it is not just industry that is buying in.

The hardest nut to crack in the process, he contended, is sticking to a decision as to what projects to fund. The process is difficult in light of the yearly loss of institutional memory, military personnel changes at key points, and industry pressures for new starts or to fund a superior design. "Interest wanes," he noted, "as an item approaches production and technology offers something better."

What can the government do, he asked? It can fund a program realistically, insure early year funding and provide long lead funding, provide TRACE funds, provide multi-year funding, and be realistic in production quantities, were some of the suggestions the general offered.

Commenting on competitive prototyping, he ticked off three advantages, but specified seven disadvantages—not the least being overall higher cost.

He noted the advantages to the "skunk works" approach—less cost, shorter schedule, but also the disadvantages that a PM's flexibility was limited and the end item might not be acceptable.

In summary, Sammet stressed the need to make sure a project is on a realistic schedule and is properly funded; fund it up front adequately, resist changes, realize a fixed price incentive contract is really a cost reimbursable contract in disguise, and decide if you want to have a team effort with your contractor or if you want to manage by conflict—i.e., assuming all contractors are crooks.

In the past, there has been too much factionalism in the Army. Once an ASARC decision has been made, it must be supported. "There is no place in the acquisition community for parochialism."

The second day began with a panel discussion on force modernization. The panel, moderated by MG R. D. Lawrence, included representatives from OVCSA-PA&E, USAREUR, FORSCOM, MILPERCEN, and DARCOM. Short presentations by the panel members highlighted problems in fielding new materiel and the discussion that followed triggered spirited involvement from the floor, by all ranks.

MG Maxwell R. Thurman, director, PA&E, DA, stressed the necessity of interface by the PM with the PPB System, pointing out the "windows where late developing information can be inserted to influence actions."

Mrs. Sally Clements, deputy for Materiel Acquisition Management, OASA (RDA), then spoke to the group on the status and upward mobility of women in the PM community. She recommended certain actions to be taken by the PM community to prepare women for higher level assignments.

Current personnel and management trends and policies was the subject of a presentation by BG W. H. Schneider. The officer shortage problem was discussed, noting that the PM offices were generally above the DARCOM overall average of authorized strength. He stressed the need for better utilization of civilian quotas for training.

The luncheon address on the second day was by MG Alan A. Nord who discussed the elements of ILS and that the program was now well institutionalized in ARs and pamphlets.

Following the Executive Session on the final day, Mr. John D. Blanchard summarized the findings of three major study groups—the Defense Science Board, the Army Science Board, and the recent "Atlanta on the Potomac" meeting held at the National War College. The significant findings of these studies, according to Blanchard, all followed a very similar theme—the principal of which had been put into a report that GEN Guthrie had provided selected senior members of the Army Staff and Secretariat, Army commanders in the field and the Joint Logistic Commanders.

Other third day presentations included an overview of the Army's test, measurement, and diagnostic equipment activity by COL K. L. Shave; and a financial management summary by Mr. Rob R. McGregor.

The final luncheon speaker was Mr. George E. Riedel, staff member of the Senate Committee of the Armed Services. He talked about doing business with the Congress, the dos and don'ts and some of his impressions on pending issues. He noted that this was an unusual year in that there might well be four budgets under action at the same time—the FY79 supplemental, the FY80 and the FY80 supplemental, and the FY81.

He pointed out that the operating rules of the Congress required that the resolution in conference of issues be a position somewhere between the position of each house. Thus an insistence by one for reduction of a certain amount on a certain program can be reinstated by the other house only if a similar reduction is taken elsewhere.

Speaking of ongoing developmental programs, Riedel expressed the opinion that even though the fire-and-forget missile had been zeroed initially, the Senate was open-minded on the fire-and-forget missile issue, though the house was less so. Much depended though, in his opinion, on the fate of the Advanced Attack Helicopter.

In regard to the five percent real growth issue, Mr. Riedel cautioned that he felt this was a goal, a target, that there was a long road between achieving this figure and finding the funds to accomplish it.

Honesty and frankness, said Riedel, are the military's greatest necessity in dealing with the Congress and the staff. Credibility is the greatest asset. Be sure of your data, don't hurry in with bad data.

MERADCOM Awards Contract For LACV-30 Production

Initial production of the Lighter, Air Cushion Vehicle 30-Ton is called for in a $21 million contract recently awarded by the U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA. It is believed to be the largest first year production contract ever awarded by MERADCOM.

Bell Aerospace Textron, contract recipient, will produce four of the craft during the first year, and eight more during succeeding years. First deliveries are scheduled for 1981.

The LACV-30 can carry two 30 foot MILVAN containers and has a total payload capacity of 30 tons. It can also haul wheeled and tracked vehicles, engineer equipment, pallets and other cargo. Since it rides on a cushion of air, the LACV-30 can operate on water, marginal areas, beaches, ice and snow.

The craft will be used for LOTS (lighter, over-the-shore) missions, in combat service support operations, to support secondary missions in coastal, harbor and inland waterways, and for search and rescue and medical emergency missions.

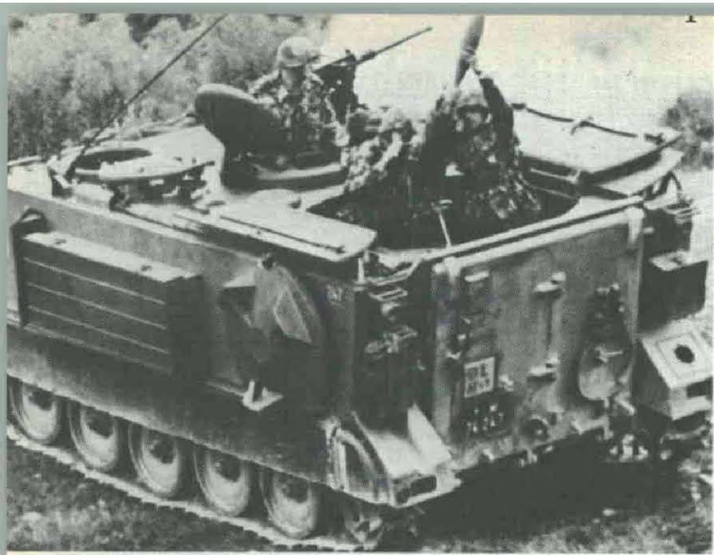
GLOSSARY OF ACRONYMS:

AAH—Advanced Attack Helicopter
TADS/PNVS—Target Acquisition Designation System/Pilot Night Vision System
ASH—Advanced Scout Helicopter
ASE—Aircraft Survivability Equipment
ACVT—Armored Combat Vehicle Technology
ATACS—Army Tactical Communications Systems
ADTDS—Air Defense Tactical Data Systems
TOS/OITDS—Tactical Operations System/Operations & Intelligence Tactical Data Systems
TACFIRE/FATDS—Tactical Fire Direction System/Tactical Information Distribution Systems
PLRS/TIDS—Position Location Reporting System/Tactical Information Distribution Systems
CAWS—Cannon Artillery Weapons Systems
CH-47M—CH-47 Modernization Program
CHAP/FAAR—Chaparral/Forward Area Alert Radar
CE—Commercial Construction & Selected Material Handling Equipment
CAC—Control & Analysis Centers
DCSCS—DCS (Army) Communications Systems
DIVAD—Division Air Defense Gun
FAMECE/UET—Family of Military Engineer Construction Equipment/Universal Engineer Tractor
FVS—Fighting Vehicle Systems
FVA—Fighting Vehicle Armament
FIREFINDER/REMBASS—Firefinder/Remotely Monitored Battlefield Sensor Systems
HET—Heavy Equipment Transporter
HELLFIRE/GLD—Heliborne Laser Fire & Forget Missile System/Ground Laser Designators
HELS—High Energy Laser System
ITV—Improved TOW Vehicle
MEP—Mobile Electric Power
MSCS—Multi-Service Communications Systems
PBM—Munitions Production Base Modernization & Expansion
NAVCON—Navigation Control Systems
NUCMUN—Nuclear Munitions
SANG—Saudi Arabian National Guard Modernization Program
SINCGARS—Single Channel Ground & Airborne Radio Subsystem
SMOKE—Smoke/Obscurants
SEMA—Special Electronic Mission Aircraft
SOTAS—Stand-Off Target Acquisition/Attack System
RPV—Remotely Piloted Vehicles
TMDS—Test Measurement & Diagnostics Systems
TRADE—Training Devices
ATD—Armor Training Devices
TMAS—Tank Main Armament Systems

Foreign Armored

This photospread, prepared by the Armor and Engineer Branches of the U.S. Army Foreign Science and Technology Center, Charlottesville, VA, is the seventh in a series which began in March-April, 1978, with photos of the 1977 Red Square parade. Designation of basic vehicle chassis, in this legend, is shown in parenthesis. All versions except the Piranha multiple rocket launcher are in service or on order.

Fig. 1—Swiss Army MWPZ-64, 120mm mortar carrier (U.S. M106A1, 107mm mortar carrier). 2—West German M113A1 artillery forward observer vehicle. 3—Swiss MOWAG, 8 x 8, 81mm, 30-round multiple rocket launcher (Piranha APC). 4—British Samaritan armored ambulance (Spartan APC). 5—West German TPZ-1, 6 x 6, APC will be



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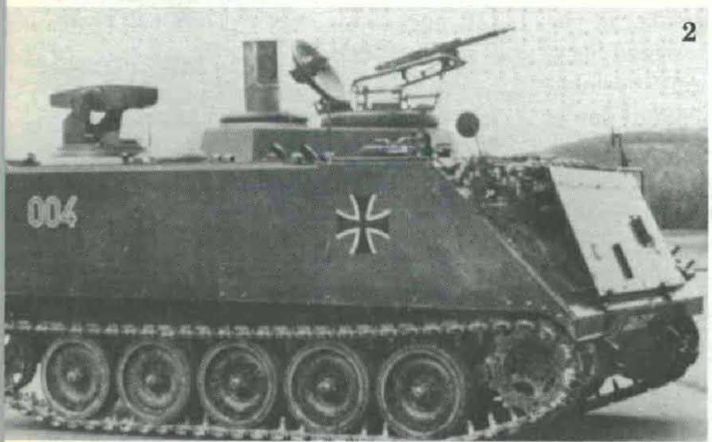

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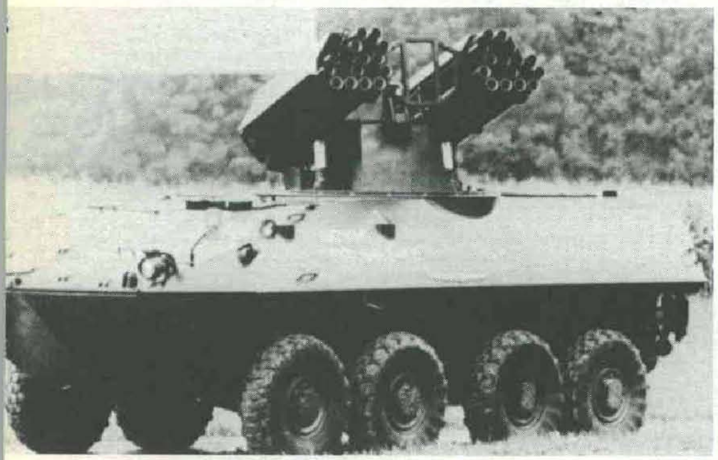

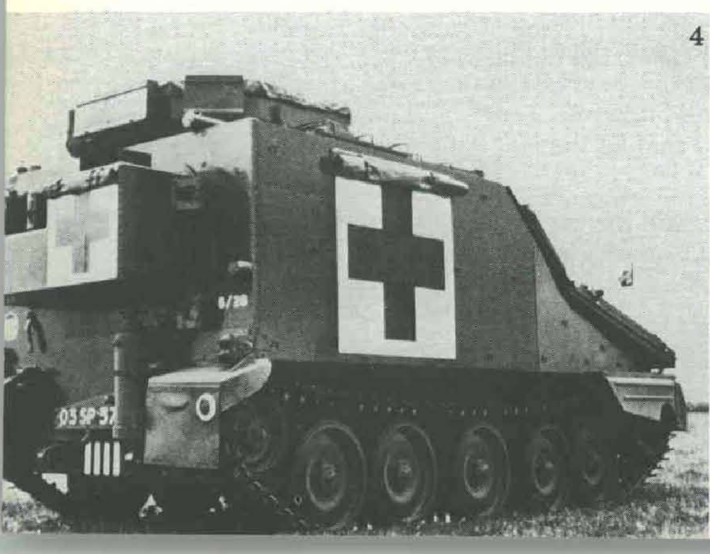

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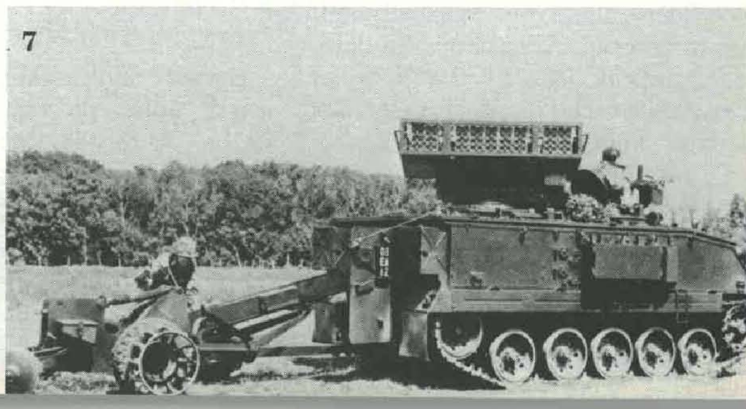

7

Support Vehicles

used in command, electronic warfare, CBR reconnaissance, and radar carrier roles. 6—Swedish BROBV-941 armored bridgelayer ("stretched" PBV-302 IFV). 7—British FV-432 APC with scattermine launcher fitted and towing antitank minelayer. 8—Rumanian 82mm mortar carrier (TAB-72, 8 x 8, APC). 9—Soviet M1974-1 armored artillery command and reconnaissance vehicle (MTLB artillery tractor/APC). 10—British Combat Engineer Tractor (CET) is a unique vehicle designed for improving fords. 11—French AMX-10 RATAC artillery surveillance radar carrier (AMX-10P IFV). 12—Israeli armored ambulance (U.S. M4 Sherman tank). 13—Very versatile Soviet IMR armored engineer tractor (T-55A tank). 14—Swiss tank recover/repair vehicle 65 (PZ-68 tank) lifting a tank engine.

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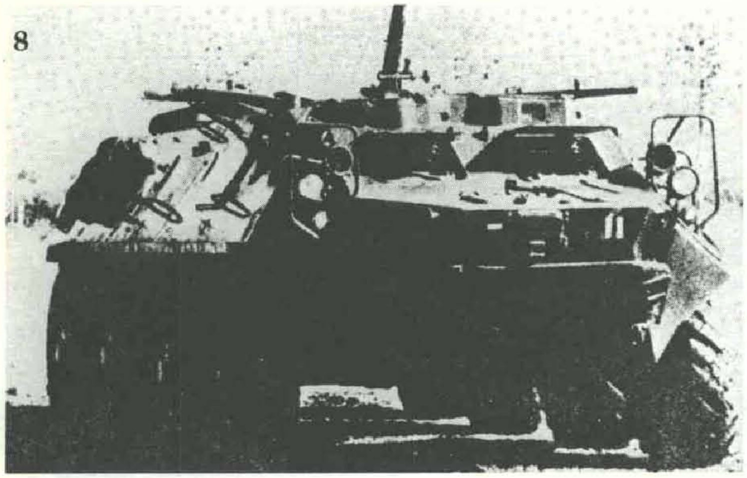

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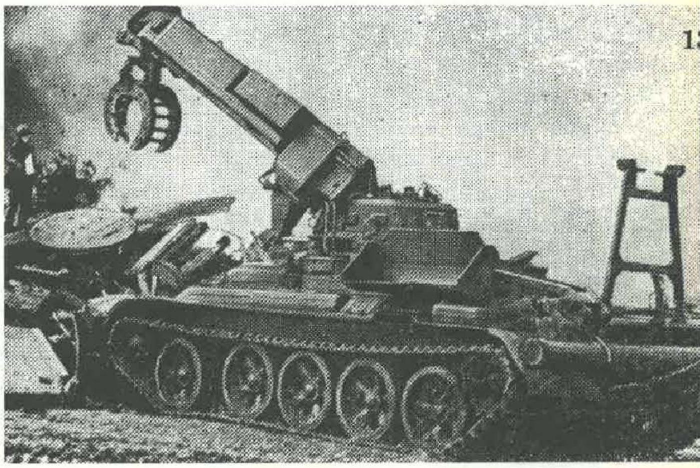


10

Specular Reflectance of 2-Component Polyurethane Colors at 10.6 Micron Laser Radiation

By Krishna K. Deb

Laser technology advancement over the past decade has resulted in increased applications of laser systems in tactical roles. This is largely due to the special characteristics of laser illumination, i.e., coherence, polarization and far-field phenomena.

Laser target designators and laser rangefinders are currently the two most common uses of laser technology in warfare. One laser commonly used as a target designator/rangefinder receiver is the neodymium doped yttrium aluminum garnet (Nd:YAG), operating at a wavelength of 1.06 microns, which is within a good atmospheric transmission window.

The CO_2 gas laser, operating at a wavelength of 10.6 microns, also can be used as a rangefinder on the battlefield.

The ruby laser, operating at a visible wavelength of 0.694 micron has been used in a target designator/rangefinder in Southeast Asia. Because of beam visibility, this laser has been found to be less effective as compared to the other two operating in the infrared.

In order to accumulate data that would provide analytical predictions of laser target signatures of painted equipment under realistic field conditions, reflectance measurements of standard Army paints are of considerable significance to the camouflage objective of the U.S. Army Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA.

Perhaps the most significant approach as a practical countermeasure would be to design and develop techniques of lowering the laser reflective properties of camouflage paints in the infrared.

There appears to be a lack of published data concerning the effectiveness of all the standard Army paints to laser excitations in the infrared. Recently, an In-house Laboratory Independent Research (ILIR) report on reflectance of 1.06 micron laser radiation from alkyd paints has become available.

TABLE 1.
Relative Bidirectional Reflectivities of Polyurethane Colors at 10.6 Micron Wavelength: Variation With Several Aspect Angles

Poly U Color	Bidirectional Reflectivities[a]								Specular[b] Energy (μ joules)
	Aspect Angles (Degrees)								
	0	1	2	3	4	5	7	10	
Dark Green	82.20	7.70	1.63	0.55	0.34	0.145	0.06	0.04	360
Olive Drab	56.80	6.63	1.92	0.64	0.32	0.18	0.08	0.04	300
Earth Yellow	53.61	4.28	1.12	0.41	0.21	0.16	0.09	0.07	260
Yellow	41.62	5.65	1.10	2.03	0.20	0.14	0.10	0.06	225
Light Green	32.65	4.70	1.68	0.60	0.42	0.20	0.14	0.08	210
Forest Green	25.51	3.96	1.60	0.77	0.51	0.30	0.15	0.07	135
Black	22.72	7.55	0.97	0.72	0.59	0.45	0.28	0.15	130
Field Drab	16.85	8.60	3.51	1.48	0.56	0.35	0.13	0.05	92
Desert Sand	16.30	2.15	1.03	0.55	0.41	0.26	0.18	0.09	84
Earth Brown	7.85	0.64	0.54	0.32	0.28	0.26	0.19	0.11	43
Sand	1.53	0.84	0.65	0.56	0.36	0.27	0.16	0.08	8

[a]Reflectivities at aspect angles 2 degrees and above need to be repeated with more sensitive detectors because of the insufficient signal-to-noise in these energy ranges.
[b]Reflected energies by "tweaking" the sample at the exact specular angle for measurement of specular reflectance.

The major finding of the report suggests that most of the colors of Army alkyd paints are highly reflective (diffuse) to laser rangefinders at 1.06 micron wavelength. However, a good deal of work remains to be done with other camouflage paints, such as 2-component polyurethane, acrylic and nitrocellulose binders.

Little has been done relating to effectiveness of these paints against the laser designator configuration. In addition, it is desirable that the program continue to broaden the range of wavelengths to include the 10.6 micron CO_2 laser. All this information will assist in defining vulnerability of Army systems to target designators and rangefinders.

In recent years, tunable solid state lasers (PbSnSe type) have become commercially available. These could be used successfully on the battlefield for wavelengths up to 28 microns. With this in mind, the relative reflectivities of 11 standard colors of polyurethane paint coating systems were examined at 10.6 micron CO_2 laser wavelength.

A rapid and specific laboratory setup simulating action of a laser rangefinder at 10.6 microns was constructed and tested with polyurethane paints. Results of this study have led to interesting new concepts of paint reflectance at longer wavelengths for camouflage adaptability.

Figures 1 and 2 show photographic views of the actual setup developed and used with reflectance measurement of polyurethane paints at the rangefinder location. The laser used was a Coherent Radiation Model 41 CW CO_2 laser in the pulse mode.

Initial energy of the pulses was filtered down through the instrument controls and beam splitter so that the typical energies of the incident pulses were in the low millijoule range. Pyroelectric detectors were used to monitor simultaneously the incident and reflected energies to a Digital Ratiometer.

Each reading was averaged over 10

shots. Typical shot-to-shot energy variations were observed to be less than 5 percent, which is within the accuracy of the ratiometer used in the measurements.

The polyurethane colors were sprayed on aluminum substrates and paint thickness ranged from 3.0 to 5.5 mils.

Initially, the target was set to normal incidence, because at this position the diffuse component of the total reflectance would be predominant. The angular position of the target was then varied from normal to 20 degrees on both sides. This is necessary because, in field situations, the target will be positioned randomly with respect to the incident laser beam.

Results and Discussion. Table 1 summarizes relative reflectivities (arbitrary units) of 11 standard colors of polyurethane coating as a function of aspect angle.

As is commonly reported in the literature, the present results show that all polyurethane colors are considerably reflective at 10.6 micron wavelength at the retroposition of the laser beam with the target at the exact specular angle. However, there is a big decrease of reflectivity ($\sim$96 to 98 percent) due to a very small change in angle of observation, say about 1 to 2 degrees.

The peculiarities of these results reasonably rule out the possibility of any significant contribution of the diffuse reflection to the total reflectivity of a color. The results empirically demonstrate that all the polyurethane colors are highly specular reflectors at near-normal position of the target. However, the specularity of glancing angles has not been investigated.

The broad band reflectance data of polyurethane olive drab and forest green colors have been measured and the results indicate that these colors are about 10 percent reflective near the 10.6 micron wavelength.

Although total reflection is small, the specularity of the reflected beam can reasonably enhance the target acquisition to the seeker on the battlefield at certain preferred configurations of the target relative to the laser source.

Though admittedly qualitative, it appears from the results (Table 1) that polyurethane colors can be classified into three distinct groups according to their relative strength of specular reflection at 10.6 micron wavelength of near-normal incidence which follows these trends:

Highly reflective: Dark Green > Olive Drab = Earth Yellow $\simeq$ Yellow.

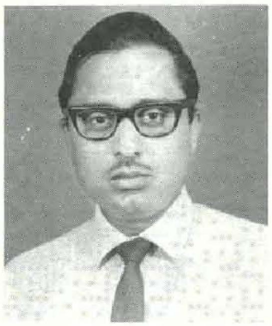
Moderately reflective: Light Green > Forest Green $\simeq$ Black > Field Drab, Desert Sand.

Low reflective: Earth Brown >> Sand.

The question arises as to the reasons for the different reflectivities of these colors in the infrared.

The colored pigment materials responsible for the various visible colors of the polyurethane coating system do not seem to have any substantial effect on these reflective values because none of the candidate pigments exhibits any significant absorption near the 10.6 micron wavelength.

However, organic tinting pigments and IR absorbing dyes (if used), additives, etc., and also basic pigment material size may have appreciable influence on relative reflectivities of these colors at 10.6 microns. In fact, there may be several possible reasons and it is difficult to make a choice at the moment. A careful study of the phenomenon would be specially interesting for camouflage paint development and testing.



DR. KRISHNA K. DEB is assigned to the Camouflage and Topographic Laboratory at MERADCOM. He holds a PhD in physics from Calcutta University and has extensive research experience in the fields of molecular structure and biochemistry. Dr. Deb came to MERADCOM from the University of Hawaii where he was conducting research on the DNA and protein chemistry.

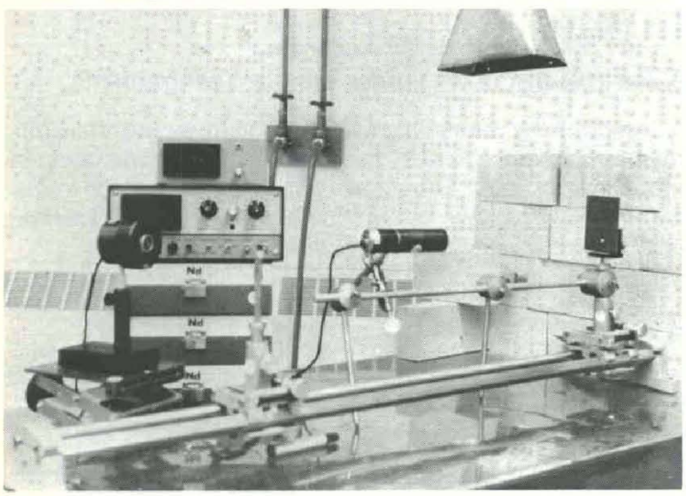


Figure 1

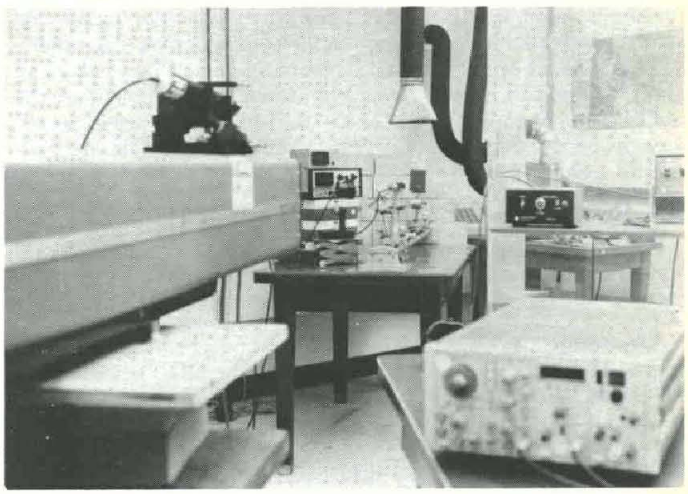


Figure 2

Capsules...

XM2 Tests Termed 'Highly Successful'

Can the XM2 Infantry Fighting Vehicle operate successfully in water? That was the question posed during the latest series of tests of the vehicle at Aberdeen Proving Ground, MD. Preliminary results indicate that the vehicle can operate in water.

APG's Materiel Testing Directorate conducted the tests, which involved driving the XM2 into the APG Spesutie Narrows waterway. Results were termed "highly satisfactory" according to Mr. John P. Sobczyk, head of MTD's Tracked Vehicle Branch.

Prototypes of the new XM2 and the XM3 Cavalry Fighting Vehicle arrived at APG in June as part of a 10-month developmental test program. Both vehicles are designed to complement the Army's new XM1 Main Battle Tank for the 1980s.

APG received two XM2s and an XM3 from the eight prototypes produced by the FMC Corp. FMC kept one prototype for developmental testing and the remaining four were sent to Fort Carson, CO, for operational testing.

Some operational testing involving the vehicles' ability to "swim" will be conducted at APG in the future because of the installation's waterways, Sobczyk said.

During the recent operations, MTD technicians tested the XM2's towing power speed, which was 4.4 miles per hour, and stability and maneuverability in water. They also checked for leaks and the ability of the XM2's bilge pumps to handle water.

Another important phase of the tests was to evaluate the vehicle's "swim curtain," a heavy-duty, vinyl-coated nylon sheet surrounding the top of the vehicle which enables it to displace enough water to remain afloat. The test was conducted with the XM2 at "combat weight," which is about 47,000 pounds.

The Spesutie Narrows are about 10 feet deep at the test site. Since June, MTD has completed safety, tracking and turret testing on the XM2. Th data are reportedly applicable to both vehicles.

Before the vehicles leave APG next April, MTD will complete firing accuracy and mobility testing and check other performance capabilities of the three vehicles. Part of that testing will be to accumulate 6,000 road miles on each vehicle and fire 12,000 rounds from each for a Reliability, Availability and Maintainability assessment.

The XM2 and XM3 are identical in outward appearance, and are essentially identical on the inside, except for differences in crew capacity and weapons and ammunition capabilities and storage capacities.

Both vehicles will replace the Army's M113 series of Armored Personnel Carriers, currently used by the Mechanized Infantry and Armored Cavalry.

The vehicles feature a 2-man turret with a 25mm cannon as the primary weapon that fires both armor-piercing and high-explosive shells, and a 2-missle TOW launcher as the secondary weapon, designed to knock out enemy tanks at ranges over two miles.

The XM2 will be the first U.S. combat vehicle that enables an infantry squad to make a mounted attack. Development of the new system began in November 1976. Both models are expected to be in production by May 1981. Production models are estimated to cost $472,000 each.

DDC Renamed Technical Information Center

The Defense Documentation Center has been renamed the Defense Technical Information Center (DTIC). The name change reportedly represents an upgrading of the role and functions of DTIC.

A comprehensive plan has been drawn up to bring new and improved technical information services to the DOD research and development community and to provide additional support for systems planners and information users.

DTIC, as an integral part of DOD's technical information program, is charged with developing significant improvements and removing barriers to effective information transfer. Broadening DTIC's responsibilities was considered by many to be an essential step in achieving improved productivity and innovation in a DOD Science and Technology Program in the 1980s.

In its expanded role, DTIC will play a leading part in defining the overall DOD technical information environment and in exploring alternative means of achieving the objectives of DOD's technical information program.

Army to Dispose of Chemical Training Sets

Procedures and requirements for large-scale disposal operations will hopefully be developed as a result of pilot test operations involving 1,750 obsolete chemical agent training sets at Rocky Mountain Arsenal, CO.

Conducted under the direction of the Army's Toxic and Hazardous Materials Agency (THAMA), the tests focus on the disposal of 17 different types of chemical training sets. The sets were manufactured and distributed from the early 1930s through 1970.

The obsolete sets are being disposed of by incineration in an existing facility developed for disposal of agent-filled Honest John warheads in 1976. It is constructed of reinforced concrete with welded steel linings.

Other safeguards to prevent escape of the toxic agents include use of negative pressure, air locks and filtering of ventilation air and exhaust gases. All emissions are continuously monitored to assure compliance with all federal and state requirements.

The Army is now considering a proposal to move an additional 20,000 obsolete training sets to Rock Mountain Arsenal for disposal. The sets are located at 15 military installations throughout the U.S., including APG, and Johnston Island in the Pacific Ocean.

Sikorsky Awarded SOTAS Contracts

The second of two multi-million dollar contracts for the aircraft and avionics of the Stand-off Target Acquisition System (SOTAS) has been awarded by the U.S. Army Aviation R&D Command to the Sikorsky Aircraft Division of the United Technologies Corp.

Sikorsky's contract for eight prototypes of the YEH-60B helicopters is for $36.62 million. The avionics contract for the SOTAS, totaling $54.89 million, was awarded earlier this year to the Motorola Corp. The primary mission of SOTAS is to detect the movement of enemy forces on the battlefield and relay the information to personnel on the ground.

Terms of the Sikorsky agreement provide the UH-60A Black Hawk helicopters be converted to the YEH-60B configuration. The contract terms include training, technical data and publications, system test and evaluation, development tests, test and evaluation support and air transportability, component handling adapter and rotor blade deice kits.

First of the eight prototypes of the YEH-60Bs is to be delivered in mid-February 1981, two others in March and one each in April, May, June, August and September of that year. Each SOTAS helicopter will be equipped with a rotating antenna beneath the aircraft and a data terminal inside the cabin.

In Brief . . .

ASA (RDA) Discusses Future Missile Requirements.

Assistant Secretary of the Army for Research, Development and Acquisition Dr. Percy A. Pierre was the banquet speaker at a recent Advanced Planning Briefing for Industry at the U.S. Army Missile Command, Redstone Arsenal, AL. His presentation, edited slightly, follows:

It is a pleasure to be here to address you and to share ideas concerning the U.S. Army's long-range requirements, objectives and goals for missile systems.

I would like to share general views from my perspective with regard to where we are in the materiel acquisition process and where I see us heading during the next decade.

First of all, where are we today? One of the most gratifying trends I can observe is the transition of Army major systems from the R&D phase to the production phase. Recently, in reviewing the status of selected major DOD systems, I noted that both the Navy and Air Force had about equal numbers of their major systems in development and production respectively.

Army systems, on the other hand, were predominantly in R&D. However, this is changing. The Black Hawk and the M198 howitzer are now in production. The Army recently made production decisions on XM1, Roland and Stinger. By 1985, all 14 systems will have met their initial operational capability.

The Army and industry have every right to be tremendously proud of this accomplishment. It shows that the American people are receiving a return at last on dollars expended in R&D. More than that, it adds credibility to the Army and its industrial partners by demonstrating a fruitful R&D program.

On the other hand, I would be less than honest if I did not say at the same time that the transition of such a large number of systems into procurement presents major challenges. From now through the mid-1980s the "bow wave" of required funds we have heard so much about throughout the 1970s becomes an ever intensifying reality. It is interesting.

To recall that about two years ago, a desire to get systems into the field earlier led to schedule compressions for several of our major systems. Patriot, GSRS, and the DIVAD gun come immediately to mind in this regard.

However, as undesirable as it may be, we are now facing a situation where the reverse trend may very well become a necessity. In an era where major systems, some requiring as much as a half billion dollars a year, are competing for procurement dollars, it may now be necessary to stretch procurement programs.

Some stretch-outs will occur naturally due to technical problems. Some are due to a desire for additional testing before production. These will be judgment calls. Other stretch-outs will be dictated by money. This would be totally contrary to everything we have been working to accomplish over the years.

Initial operational capabilities could be delayed, program buy-outs would be extended. Program costs would go up, and, most importantly, the delivery of needed equipment into the hands of troops would be delayed.

Nevertheless, deliberations over the FY81 budget, now going on, indicate clearly that program stretch-outs must be considered as we fight to procure new capabilities within scarce resource dollars. We need also to consider terminating certain programs. This will not be easy. In doing so, we must weigh operational need plus sound business judgments.

In this regard, here is an outstanding opportunity for industry to assist. By holding down costs through aggressive cost control programs while providing alternative economic buy rates, we can insure that maximum return is achieved on the dollar. We can also minimize the necessity for program stretch-out. I would urge each of your companies to give this matter special consideration in the months and years immediately ahead.

However, for the moment, let's assume we are successful in fully funding those systems scheduled for procurement and that each is fielded in accordance with their currently scheduled IOC and buy-out schedule. Where would we then stand vis-a-vis the Warsaw Pact forces and with respect to our long term Army goals?

Until the mid-1960s, it was asserted that the U.S. enjoyed a technological advantage in ground force weaponry over Warsaw Pact forces and that this qualitative advantage was sufficient to compensate for a U.S. quantitative inferiority.

However, the past 15 years have seen the basis for this assertion erode to the point where today, the U.S. Army fielded systems are inferior in virtually every major category of equipment and weapons required to wage and win wars.

It is my personal belief that weapons now entering procurement and scheduled to be introduced into the inventory in the mid-1980s will bring the United States to a position of technological equivalence. The systems now entering production will offer little or no redress for the quantitative disparity which exists between U.S. and Warsaw Pact forces.

Even this assumes that the Army manages to absorb this new equipment and realize its technical potential in the field. Of increasing concern to us is our ability to absorb this equipment.

Such mundane problems as scheduling, training, and maintenance must be solved if we are to avoid a situation in which we have the equipment but do not effectively use it. A special office has been set up reporting to the Chief of Staff to address just these problems.

This brings me then to my perception of what must be done to achieve the Army's long-term goal of harnessing the nation's technological advantages to achieve technological superiority by the 1990s.

With notable exceptions, which I will briefly discuss later, it is clear to me that the late 1980s and early 1990s will, of necessity, be the era of product improvements.

Having just introduced new and complex major systems, at great national expense spanning our total war making capability (tanks, aircraft, air defense, fighting vehicles, field artillery, communications and intelligence), it is inconceivable that we could immediately embark on new R&D programs for replacement systems.

Instead, a vigorous R&D program directed toward the qualitative product improvement of those systems now being fielded will be required if we are to technologically surpass our potential adversaries.

I include in those product improvements, modifications which can be applied to the systems and equipments themselves such as, in the case of missiles, improved seekers, guidance, warheads, propulsion and counter-countermeasures capabilities. I also include those improvements in command and control which would permit the systems to operate more effectively on the battlefield.

This is not to imply that product improvements would necessarily be inexpensive. I fully realize they can be very expensive. It is to say, however, that with proper control for which we must again look to industry for help, improvement in nearly every case should be less expensive than entirely new systems.

In this regard, it is interesting to note that a product improvement concept was given renewed emphasis during the Army Science Board's recent Summer Study Meeting.

The Army Science Board stated its belief that there are major advantages in allowing systems to mature in the field. The ASB recommended that for those systems now in development, the initial specifications and design should be frozen early in the full-scale engineering development phase.

Early planning for Block II PIPs should be legitimized, and requirements for modification to improve performance and respond to changes in the threat should be solicited early in the cycle. This telescoping within the R&D cycle would permit an earlier IOC as well as improved performance of the second and subsequent production blocks.

I look at the Patriot air defense system as a prime example of this product improvement philosophy. In order to get the system fielded, it has been necessary to freeze the design, realizing fully that additional improvements would be desirable.

It is now essential that the Army define those Patriot improvements required to maintain capability against the threat and apply them as Block II improvements to mature Patriot in the field.

I mentioned earlier that there may be notable exceptions to the product improvement philosophy for achieving enhanced capabilities. I am thinking here of three possible situations.

The first is the situation in which an entirely new combat capability is found to be required. The attack of second echelon targets is an example that comes to mind.

It may not be possible to improve existing systems to achieve the range and accuracy required to attack second echelon Warsaw Pact forces. Thus, it may be necessary to develop and produce a new system such as assault breaker or the Corps support weapon system to meet this requirement.

A second situation is when a new technology is found to be available. I have in mind technologies like the Air Force Cruise Missile which gives us a capability that we had not anticipated. The Army needs to be alert to such opportunities.

A third situation where a product improvement approach may not be viable is one in which the existing system has been improved to its practical limit. An example of this situation that comes immediately to mind is the TOW antitank missile system.

As you know, we are in the midst of a TOW product improvement program at this time which should keep the system viable through the 1980s. However, it is difficult for me to envision further improvements to TOW which would result in the fire and forget capability and the effectiveness I would believe to be essential for the 1990s.

In all likelihood it will be necessary to develop a new antitank weapon system to replace TOW in the 1990s. As you know, we are working with our NATO allies in an effort to develop a cooperative program for a new family of antiarmor weapon systems for the late 1980s or early 1990s.

Guthrie Discusses RSI Goals and Problems

In addressing the American Defense Preparedness Association's International Breakfast Meeting in Washington, DC, on 27 September, DARCOM Commander GEN John R. Guthrie stressed the need for more action rather than more talk in the Rationalization, Standardization and Interoperability area.

He noted that progress had been made and that the Army is now involved with the British and the Germans in separate bilateral staff talks to work out the fundamental basic needs of integrated coalition warfare. Through DARCOM's participation "the talks are now moving beyond 'how to fight' to the question of 'with what to fight.' "

The General hit at the need to achieve quickly, "real interoperability" where it is most crucial—at the operational battlefield level.

He cited specific examples of combat during the Korean War involving UK, Commonwealth, and U.S. units, wherein interoperability led to past battlefield success. Today, he noted that progress has been made in the field artillery ammunition area, but agreements were still needed on tank, mortar, 20-40mm caliber ammunition, and small arms interoperability.

Looking further to the future, GEN Guthrie called attention to the fact that 8 systems are now being coproduced by 5 NATO nations; 4 others have already been completed; and 3 additional ones are under consideration. Since January 1976, Tech Data Packages, with licenses to manufacture, have been provided to 8 NATO countries on 61 items, 53 of which involve ammunition.

As far as major systems for the future, Guthrie noted the progress made with Roland. The General Support or Multiple Launch Rocket System (GSRS/MLRS) "probably represents best the kind of cooperative effort desired and needed." Here, he noted, the U.S., Germany, the U.K., and France, all agreed at the start on the threat and the requirement to meet that threat. They then progressed into options to meet the needs of all participants.

GEN Guthrie expressed concern, however, that "none of the major systems involving RSI are with our field troops." He saw a hinderance in the lengthening of the already too lengthy fielding process, because of RSI considerations.

"Foreign political and economic considerations, such as compensating production or offset agreements, obviously have an impact. . . ." The demand for such agreements is increasing, and this adds to the fielding time, he added.

". . . I think we will find that, in the selection of weapons systems for coproduction by alliance nations, the decision will, more and more, be based on the best offset available." He cited the Netherlands decision to go with the German Krauss-Maffei Leopard tank over the Chrysler XM1 often as evidence on point.

There remain several other "gut" issues, he continued, such as differing national approaches to source selection and of optimizing costs of procurement by establishing one or possibly two production lines.

He saw no easy solutions though. Success depends, he stressed, on political will and economic cooperation at all levels on all sectors. The 2-way street must begin with a free flow of information. "We all must be prepared at all times. . . to speak out frankly, and to—not listen—but *hear* each other," he emphasized.

Dr. Davis Reviews DOD Food R&D Program

Deputy Under Secretary of Defense for Research and Advanced Technology Dr. Ruth M. Davis was the keynote speaker at a recent meeting of the Research and Development Associates for Military Food and Packaging Systems at the U.S. Army Natick (MA) R&D Command. Her presentation, which was titled The DOD Food Research, Development, Testing, and Engineering Program—A View From the Top, follows in summary format:

Dr. Davis began her remarks by stating that during the next fiscal year about $275 million will be spent on R&D in support of man. This will include personnel, training, medical, life support and related sciences, and the DOD Food RDT&E program.

She noted that it would be naive to believe that the food RDT&E program is a major contender for time and attention. However, she added, it is of recognized value, and it does represent in microcosm the successes and challenges of the R&D program as a whole.

Although the food RDT&E program has served well since its inception less than 10 years ago, it needs strong participation and partnership with industry if its full potential is to be realized, said Dr. Davis. She outlined several barriers to the success of DOD's food R&D investment strategy.

The first barrier, she explained, is the cost of technology. The impact of growing inflation has tended to be greater in the manpower areas of science and technology. Cost overruns and tight budgets have caused DOD to take a hard look at some of these programs.

In the area of food, nutrition, food packaging and food service technology, the DOD is now participating with other federal agencies to get more for the collective R&D dollar. For example, DOD is now deferring to the Department of Agriculture as the agency with the prime national mission for food and nutrition.

Dr. Davis emphasized that DOD can no longer afford the luxury of its own self-contained program. Said she: "we must reshape our program to concentrate on strictly military needs and defer on common problems to USDA as the lead agency."

The DOD, explained the Deputy Under Secretary, is seriously considering transferring to USDA the irradiated food technology in which DOD invested $55 million in R&D funds during the past 30 years. This is being precipitated, she said, because of an anticipated cost overrun and a delay in completion of the program. It should not be viewed as a failure, but a recognition that the program would be better served by the agency which specializes in food programs.

Dr. Davis stressed that DOD will exploit the emergence of USDA as the lead agency for food and nutrition R&D. Henceforth, our own efforts will continue to respond to strictly military unique requirements, she said.

There is no doubt, she continued, that military needs pose special problems that call for special solutions. "We need to clearly identify these special problems and direct our program at them," she added. These special problems include long shelf life, durable packaging and nutrition education for unique military requirements.

Dr. Davis emphasized that DOD can no longer be in the position of making large scale investments in food RDT&E if there is no response in industry. This, she said, is the second barrier to the success of the food R&D investment strategy—failure to recognize industry's full potential.

Dr. Davis expanded on her point by quoting Under Secretary of Defense for Research and Engineering Dr. William Perry who stated "I believe that industry generally does not produce as efficiently for the defense market as it does for the commercial market. Some of this cost difference results from our unposition of military specifications; some from increased overhead because of government regulations; and some from stifling of management incentives to decrease cost. . . ."

Dr. Davis stated that she was concerned that industry seems increasingly unwilling to accept risk. Said she: "I am told we have had to go more and more to sole source for procurement of newly developed food items due to lack of response to our requests for proposal."

She called on industry participation to bring down unit cost. Industry, DOD and USDA should be equal partners to insure that the new Meal Ready to Eat Technology is appropriately exploited, for example. Freeze dry and compress foods technology, which was developed by DOD, should also be adopted by industry, she said.

Dr. Davis stated that in addition to U.S. interest in irradiated food during the past 30 years, there now appears to be growing interest and R&D investment in irradiated foods overseas.

The Deputy Under Secretary closed her remarks by stating that what the DOD Food RDT&E program needs most is greater industry involvement, greater industry participation, and greater industry responsibility.

The DOD, in turn, must recognize its responsibilities to industry and remove the barriers on its side in order to encourage a more effective partnership. This would result in a more effective food service system.

FOOTNOTE: *Shortly before this issue of the Army RDA Magazine was sent to press, Dr. Davis was nominated for a new position as Assistant Secretary of Energy for Resource Applications, U.S. Department of Energy.*

Conferences & Symposia . . .

Industry Briefed on Army Future Materiel Needs

Three recent classified symposia, cosponsored by the American Defense Preparedness Association and the Army, updated U.S. and Allied industry representatives on Army materiel needs in the missiles, combat vehicle, and small arms areas.

The U.S. Army Missile Command conducted, in cooperation with the ADPA, a 2-session, 2-day series of briefings, 11-12 and 13-14 September 1979, on the direction and needs of the Army missile programs. The sessions lasted a full day and a half, and included in-depth, detailed presentations by the heads of that command's labs and directorates. Presentations were tailored to describe work area, objective, accomplishment, and areas of industry participation. Anticipated funding levels for FY80 and FY81 were included, along with approximations of in-house/out-of-house participation.

In opening the sessions, MG Louis Rachmeler, commander, USAMICOM, noted that this was the first advanced planning briefing the Army missile area had conducted in four years.

He cautioned that the recent realignment of the command should not be taken as a signal that other similar reorganization of other R&D and readiness commands will be quick to follow.

Rachmeler noted several new thrusts in today's materiel acquisition process. Among these were the need to look closer at the energy consumption aspect of each system, the increased stressing of product improvement as an alternative to new starts, and the very real intent to cooperate more closely with our NATO allies in materiel acquisition.

In light of the Soviet and Warsaw Pact numerical preponderance in numbers, continued the MICOM commander, the U.S. simply had to outsmart them. The so-called military-industrial complex, he said, has contributed greatly to the past and current strength of the U.S. and its allies, and he believed the capability was there to continue to maintain this strength through a strong and imaginative R&D effort.

A look at the future battlefield was provided by BG John W. Woodmansee Jr., Acting Deputy Chief of Staff for Combat Developments, U.S. Army Training and Doctrine Command. BG Woodmansee gave a sobering presentation of the TRADOC Battlefield Development Plan.

The banquet speaker for the first session was Dr. Percy Pierre, Assistant Secretary of the Army for RDA.

Dr. Pierre's sobering talk noted that some 14 major Army systems will have met their initial operational capability goal by 1985, but because of money problems the Army may now face stretch-out of procurement programs, in a reversal of the recent effort to field promptly developed items. Dr. Pierre's entire address is found on page 28 of this issue.

Approximately 675 persons representing some 400 corporations and companies attended the two sessions. Stressing the reality of international cooperation, there were over 20 representatives from foreign countries such as the United Kingdom, France, Federal Republic of Germany, Norway, Italy, and Israel.

The attendees were also able to view MICOM displays of technology advancements and to make the acquaintance of the DARCOM and MICOM TILO representatives, the Small Business Adviser, and learn the services offered by these offices.

The combat vehicle session was conducted at Fort Knox, KY, on 20-21 September. An audience of over 380 was welcomed by MG Thomas P. Lynch, commander, U.S. Army Armor Center, and the opening remarks were by Mr. Thomas E. Harvey, Deputy Assistant Secretary of the Army for Acquisition.

The Fort Knox meeting had as its theme "The NATO Thrust," and featured presentations by senior U.S. and NATO nation officials on various aspects of NATO's combat vehicle systems status and direction. LTG Richard H. Groves, deputy adviser to the Secretary and Deputy Secretary of Defense on NATO affairs, in the keynote address, noted that the U.S. joined NATO of its own free will, contracting to enjoy its benefits. But in so doing the U.S. accepted certain responsibilities and obligations, and it gave up a measure of its freedom of action in doing so. The U.S., said Groves, is committed to collective action. Rationalization then, said the general, being the actions that includes all concerted measures taken to strengthen the alliance, is in general acceptance by all Americans.

Presentations on foreign combat vehicle systems included addresses by MG René Gutkaecht, chief, Land Doctrine and Operations, Canadian Defense Forces; Ingr. General d'Armament Bertrand MG Robineau, Char, de Service Mobilite Direction, French Ministry of Defense; and Brigadier Jonathan H. B. Dent, OBE, Director of Munitions, Defense R&D Staff, British Embassy.

The audience received a highly favorable status report on XM1 from MG Donald M. Babers, PM, XM1 Tank, and then witnessed on the St. Vith range an extremely impressive demonstration by 3 XM1s of the vehicle's mobility and firepower.

The banquet speaker was GEN John R. Guthrie, DARCOM commander. His theme was the need by the Army for greater "cohesion," coming together and holding together. A root cause of the lack of cohesion, said Guthrie, has been, in his opinion, "the failure to develop and adhere to an action-oriented scenario for the logical technological evolution of our armed forces." He cited as evidence a finding of the Army Science Board 1979 Summer Study that noted one of the Army's primary problems was "the lack of a team spirit focused on the common goal of getting a new system into the field. In place of this spirit, there appears to be in an adversary environment. . . ." There comes a point when dissidents must be sent to their rooms. . . .

GEN Donn A. Starry featured on the final day's presentations by hitting at training devices and technology shortcomings, and the imperative need for industry to improve its performance and capability in this area.

The 1979 Annual Meeting of the Small Arms Systems Division of the American Defense Preparedness Association was held at Aberdeen Proving Ground, MD. The Armament Research and Development Command and the Ballistic Research Laboratory with the ADPA were joint sponsors of the meeting. The central theme of the meeting was the informational activity relating to small arms systems development.

The technical sessions were scheduled over one and a half days with a display and a test firing of weapons held at Aberdeen's Main Front on the afternoon of the second day. The papers presented covered a wide range of subjects including caseless ammunition, bullet shape optimization, weapons development and program management considerations. Of particular interest to industry and to representatives from abroad was the discussion of the Joint Services Small Arms Program which has been initiated. Under this program, all the United States Services are to consolidate their resources in order to enhance RSI. The concomitant advantages were readily appreciated by the attendees.

The test firing and static display which followed the formal meeting was also well received and provided an excellent opportunity for a "hands on" session.

Additional Army oriented ADPA cosponsored briefings are scheduled for 7-8 November 1979 with the ERADCOM at the Naval Surface Weapons Center, White Oak, MD; and on 30-31 October and 1 November 1979, a symposium on Army Chemical Defense will be held at Fort Belvoir, VA.

ERADCOM Announces 1980 Power Sources Meet

More than 80 technical papers describing present and future work related to batteries and other power systems will be presented during the 29th Power Sources Conference, 9-12 June 1980, at Atlantic City, NJ.

Sponsored by the U.S. Army Electronics Research and Development Command in conjunction with other DOD agencies, NASA, the Communications Satellite Laboratories, and the Department of Energy (DOE), the meeting is believed to be the largest of its kind in the world.

Since 1947 the unclassified conference has provided a forum for representatives of government, industry, and the academic community to discuss topics of mutual interest related to batteries and fuel cells.

Titles and chairmen of technical sessions programed for the 1980 meeting are: Fuel Cell Systems, Mr. Leonard Rogers, DOE; High Temperature Systems, Dr. Duane L. Barney, Argonne National Laboratory; Advanced Secondary Batteries, Mr. J. Charles Smith, DOE; Nickel Secondary Batteries, Mr. James Dunlop, COMSAT Labs; Secondary Batteries, Dr. Tien S. Lee, Argonne National Laboratory; and

Primary Batteries (two sessions), Mr. A. A. Benderly, U.S.

Army Harry Diamond Laboratories; Lithium/SO_2 Primary Batteries, Mr. Charles J. Scuilla, U.S. Army Scientific Liaison and Advisory Group, HQDA; Lithium/Oxychloride Primary Batteries, Mr. Richard Marsh, U.S. Air Force Aero Propulsion Laboratory; and Lithium Primary Batteries, Dr. Carl E. Mueller, U.S. Naval Surface Weapons Center.

Additional information regarding the 29th Power Sources Conference may be obtained from: Doris Yanetta, U.S. Army Electronics R&D Command ATTN: DELET-P, Fort Monmouth, NJ 07703, or commercial phone (201) 544-2662, or AV 995-2662.

WES Hosts Sensor Technology Symposium

More than 160 representatives from military, industrial and academic research communities attended the Third Sensor Technology Symposium at the U.S. Army Engineer Waterways Experiment Station (WES) in Vicksburg, MS.

Conference attendees, representing the United States, Denmark, Germany, the United Kingdom, and The Netherlands, met at WES in conjunction with NATO Panel III Research Study Group-11 (RSG-11), a NATO committee devoted to military application of seismic and acoustic sensors.

Mr. Woodland G. Shockley, WES program manager for military engineering, chaired the 3-day symposium. Mr. Bob O. Benn, chief of the WES Environmental Systems Division, was chairman of RSG-11.

The symposium was designed to promote an exchange of information on sensor concepts and systems that automatically detect, classify, identify, and/or locate intruders or targets in worldwide environments. Included were sensor-related activities for perimeter security, battlefield surveillance and target acquisition, and mine activation using electromagnetic, seismic or acoustic phenomena.

The opening session featured a keynote address by Dr. Jeanne Mintz, from the Office of the Under Secretary of Defense for Research and Engineering, Office of the Assistant for Program Planning. Dr. Mintz spoke on "Sensor Development and Application: A DOD (Department of Defense) Perspective."

She challenged the conferees to join forces and work together to eliminate duplication of effort in sensor research. She also encouraged development of a total sensor concept. Following her address, program managers and security officers discussed the requirements of their agencies.

Thirty technical papers were presented in the areas of sensor concepts and designs and test and evaluation, including such topics as "Acoustical Tracking of Low Flying Aircraft," Sensor Needs for an Integral Security System," and "Testing of Line Sensors in an Artificially Frozen Test Cell," among others.

All papers will be published in conference proceedings to further enhance information exchange.

NATO Research Study Group-11 at Third Sensor Technology Symposium, Vicksburg, MS, included delegates (front row, l. to r.) Richard Gutter, ARRADCOM, Dover, NJ; Dr. James Constantine, AFAL, Eglin AFB, FL; MAJ R. S. Hermanides, The Netherlands; Sehran Tatari, Federal Republic of Germany (FRG); Bob O. Benn, WES, chairman of RSG-11. Second row, l. to r., Dr. Manfred Schober, FRG; Jerry Lundien, WES; Tom Midura, HRA, Inc., Burlington, MA; Dr. Colin Pykett, Great Britain; Howard Wells, Great Britain; Robert O'Neil, BISS, Hanscom AFB, MA; Dr. H.A.J.M. Van Hoof, The Netherlands. Third row, l. to r., Erik Anderson, Denmark; Warren Grabau, U.S. Army Research and Standardization Group (Europe); Dr. Alvin Gudeson, FRG; Richard Beckman, Sandia Labs, Albuquerque, NM; Dr. Dan Cress, WES, secretary of RSG-11; LTC Hans Seufert, FRG.

Career Programs . . .

Dr. Jain Selected for EPM Program Participation

Dr. R. K. Jain, environmental division chief at the U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL, has been selected for a 9-month Education for Public Management (EPM) program. Jain, one of nine Army managers attending eight universities which participate in EPM, will study public administration and policy at Harvard University's John F. Kennedy School of Government.

An employe of the U.S. Army Corps of Engineers for nine years, Jain was nominated by the agency for the EPM. The Army Executive and Professional Development Committee made the final selections. A registered professional engineer, Jain earned his bachelor's and master's degrees in civil engineering from California State University, and his PhD in environmental engineering from Texas Tech University.

He has taught a graduate course in environmental impact analysis at the University of Illinois for the past four years.

McHugh Chosen for Executive Training Program

Raymond E. McHugh

Mr. Raymond E. McHugh, a research biologist with the U.S. Army Armament R&D Command's Chemical Systems Laboratory, Aberdeen (MD) Proving Ground, has become the 33d employe chosen to participate in CSL's Executive-Technical Development Training Program.

Assigned to CSL's Research Division, McHugh began his federal career more than 27 years ago in the Army Scientific and Engineering Program. His new training program includes three months of special training at CSL, and three months at HQ DARCOM, Alexandria, VA.

McHugh's work has included studies on the thermal characteristics of commercially transported chemical compounds, and studies of potential threats to combat soldiers. He is also credited with developing a concept for predicting human mortality and incapacitation from blast overpressure.

He holds a BS degree in biology from Providence College, has authored or coauthored more than 40 publications, and is a member of Sigma Xi Scientific Research Society.

NCOs Suggested for Project Engineer Slots

According to word received from the Army Field Office, HQ USAF Systems Command at Andrews AFB, MD, GEN Alton D. Slay, commander, USAFSC, has stated his desire to utilize noncommissioned officers in engineering positions. His objective is to permit formal transition of qualified NCOs into program management and project engineering jobs. These would be 4-year stabilized tours as "Research and Engineering Technicians."

It was further noted that an Acquisition Management Panel had been established at the USAF Aeronautical System Division to assist managers of major programs to develop an overall system acquisition strategy. Air Force study showed that such panels had been effective in planning contract strategy where membership was tailored to the program involved.

Awards . . .

DARCOM Presents 1978 Systems Analysis Award

Two individuals and a group have been selected as recipients of the 1978 U.S. Army Materiel Development and Readiness Command Systems Analysis Award.

Comprised of an engraved plaque and a citation certificate, the Systems Analysis Award is presented annually in recognition of outstanding achievements in operations research/systems analysis work. Nominees must meet criteria specified in DARCOM Supplement 1 to Army Regulation 672-20.

The 1978 group award recipients are operations research analysts *Mr. Richard P. Richardson, Mr. D. Paul Leitch, Mr. Brian M. Hill, Mr. Paul M. Short,* Food Service Equipment Specialist *Mr. George Turk,* and clerk stenographer *Ms. Doreen J. Horne.* All are employes of the U.S. Army Natick (MA) R&D Command.

The group was cited for their contributions to the DOD Food Program by providing a totally new concept and system design for military food service on Navy aircraft carriers. Their work reportedly resulted in a large reduction in food line waiting time.

Mr. Kosta J. Taras, an electronic engineer with the U.S. Army Missile Command (formerly MIRADCOM), Redstone Arsenal, AL, was selected for an individual Systems Analysis Award. He was credited with developing accurate tactical and operational computer models for air defense systems in the NATO Central Region in the 1980-90 time frame.

Taras specifically devised sophisticated simulations for all of the air defense systems in the U.S. and Western European arsenal, and postulated air threats of the Warsaw Pact nations. These simulations have reportedly gained international acceptance as the best models available.

Mr. George J. Schlenker, an operations research analyst with the U.S. Army Armament Materiel Readiness Command, received the Systems Analysis Award for applying statistical techniques to determine how much testing is required to verify the production rate capability of an ammunition production line.

Sacco Chosen as 1979 Simon Award Recipient

Dr. William J. Sacco

Dr. William J. Sacco, chief of Biophysics Research at the Chemical Systems Laboratory (CSL) in the Edgewood area at Aberdeen Proving Ground, MD, has been named the 1978 recipient of the MG Leslie Earle Simon Award by the U.S. Army Armament Research and Development Command (ARRADCOM), Dover, NJ.

The Simon Award is presented annually in recognition of outstanding scientific achievement in meeting the defense community needs. Dr. Sacco was honored for outstanding scientific contributions to Army research efforts. He was cited for his research in the fields of bio-response to trauma, medicine, chemistry and target detection.

MG Bennett L. Lewis, ARRADCOM's commander, and COL John D. Spence, CSL's commander-director, made the presentation to Dr. Sacco in a headquarters ceremony. CSL is a major research activity of ARRADCOM.

During the past five years, Dr. Sacco has developed a broad class of indices based on anatomical diagnoses and physiological and biochemical data, used by researchers and clinicians at the Maryland Institute for Emergency Medicine, the Washington, DC, Hospital Center, the Monmouth, NJ, Medical Center, as well as hospitals in California, Colorado, Virginia, Pennsylvania and in Canada.

In addition, he was credited for the design of medical decision trees for treatment of chemical and trauma casualties as well as supplying methodological and research analysis to the development of a "Computer Man Program" for wound ballistic assessments. The methodology consists of simulating missile wounds in a computer man, and characterizing the wound, surgical procedures and medical tasks required for treatment.

Since 1975, biophysics researchers, under the direction of Dr. Sacco, have been developing computer techniques for characterizing, clustering and screening chemical compounds for potential biological and pharmacological activity in providing prophylactic and therapeutic treatment against chemical warfare agents.

Author or coauthor of more than 50 publications, Dr. Sacco received a BS degree in mathematics from California State College in 1951, a master of education degree from Loyola College, Baltimore, in 1958, and an MS degree in mathematics in 1960 and a PhD in computer science in 1969, both from the Univesity of Delaware.

2 WSMR Employes Receive Gamble Award

Two electronics engineers at White Sands Missile Range, NM, have received this year's Army Test and Evaluation Command (TECOM) Edward H. Gamble award.

Dr. Alton L. Gilbert and Dr. Michael K. Giles, both assigned to WSMR's Instrumentation Directorate received the award for their research for, and writing of, a scientific paper entitled "A Real-Time Video Tracking System."

The Gamble award is presented annually to authors of outstanding technical papers or reports on topics pertinent to the test and evaluation mission. The award was established in honor of the late Edward H. Gamble, a distinguished TECOM scientist and director of Analysis.

Dr. Gilbert and Dr. Giles were cited for their work which deals with a new type of cinetheodolite, or optical tracking system. A cinetheodolite makes a movie of a missile or rocket flight, then the film is developed.

Gilbert and Giles' idea replaces the film process with television and computers. By combining the intelligence of computers with the real-time convenience of television, they developed a new cinetheodolite system with accurate real-time trajectory data.

A prototype of the system is now at the national range. The engineers have been testing the system in the laboratory and hope to have it in the field in early 1980.

Hesson and Dutchyshyn Win 1979 PM Awards

COL James M. Hesson

COL Harry V. Dutchyshyn

Assistant Secretary of the Army (RDA) Dr. Percy A. Pierre made the 1979 Secretary of the Army award to two project managers at a luncheon ceremony in Orlando on Tuesday, 9 October 1979. The awards were made as part of the program begun in 1976 whereby each year the Secretary of the Army may cite a particular PM or two for outstanding work.

For the second year in a row two awards were given, but in the case of the 1979 awards, both went to low visibility, less well publicized programs.

COL Hesson's citation read: "Secretary of the Army Award for Project Management. Colonel James M. Hesson is cited for outstanding performance as project manager of the CH-47 Modernization Program during the critical period of July 1978 through June 1979. Through his initiative, technical competence, excellent judgment and astute managerial ability, Colonel Hesson managed and coordinated the activities of a complex multi-level project interfacing the development of the CH-47 helicopter, the T55 engine and the CH-47C fiberglass rotor blade improvement programs. His direct leadership and strict fiscal policies have resulted in a development program that is on cost, four months ahead of schedule and meets or exceeds performance objectives, an achievement of great distinction. Colonel Hesson's performance reflects great credit upon himself, the CH-47 Modernization Program and the U. S. Army."

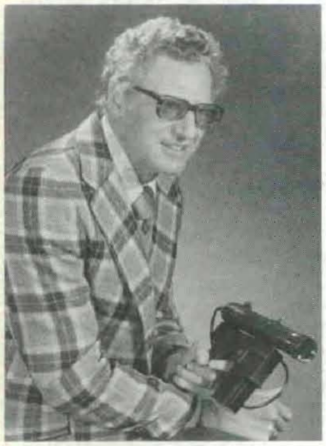
COL Dutchyshyn's citation read: "Secretary of the Army Award for Project Management. Colonel Harry V. Dutchyshyn is cited for outstanding performance as project manager of the Munitions Production Base Modernization and Expansion Program during the critical period of August 1978 through June 1979. Through his initiative, technical competence, excellent judgment and astute managerial ability, Colonel Dutchyshyn expertly managed the multi-billion dollar program involving 28 government-owned ammunition plants and arsenals resulting in savings exceeding ten million dollars and making a substantial contribution to the industrial preparedness of the nation. Colonel Dutchyshyn's performance reflects great credit upon himself, the Munitions Production Base Modernization and Expansion Program and the United States Army."

Pardes Patents Weapons Training Device

Mr. Herman I. Pardes, electronics engineer with the U.S. Army Electronics Research and Development Command, Fort Monmouth, NJ., has been granted a United States patent for a moving target system for use in weapons training.

The device, which uses visible and infrared light projected onto a viewing screen, provides a simulated target scene for marksmanship instruction. The weapon is equipped with infrared detector attachments that receive reflections from the target when the weapon is accurately aimed and fired.

A visible, moving target scene and a superimposed aperture of infrared light are projected onto the screen by a film projection system of mirrors, an apertured mask and a modulating grid.



Herman I. Pardes

The weapon includes an infrared detector, spectral filter and electronic circuitry which activate a hit indicator and display device when the weapon is properly aimed at the target. Several weapons can be controlled in the same manner.

The system is useful in permanent simplified installations such as fixed-target ranges or in amusement parks where wired electrical connections can be made between the weapons and a scoring display. The new system is an alternative to previously patented laser beam devices which may not be feasible because of safety requirements.

COL LAURIS M. EEK JR. (left), chief of DARCOM's Office of Project Management, is shown being officially recognized by the Royal Military College of Science at Shrivenham, England, for the services that he and his office rendered during the past five years to that college. Shown making the award of a plaque bearing the crest of the college is Brigadier Jonathan Dent, OBE, director of Munitions, Defense Equipment Staff, British Embassy. The ceremony was at HQ DARCOM, Alexandria, VA.

Personnel Actions . . .

Richardson Selected as TRADOC Deputy Commander

MG William R. Richardson, director of Requirements, Office, Deputy Chief of Staff for Operations and Plans, has been nominated for 3-star rank and assignment as deputy commander, U.S. Army Training and Doctrine Command.

MG William R. Richardson

MG Richardson will also hold collateral duties as commander, U.S. Army Combined Arms Center; commander, U.S. Army Combined Arms Combat Development Activity; commandant, U.S. Army Command and General Staff College; and commander, U.S. Army Combined Arms Training Development Activity.

A graduate of the U.S. Military Academy, he holds an MSBA degree from George Washington University, and has completed requirements of the Command and General Staff College, Armed Forces Staff College, Industrial College of the Armed Forces, and the Canadian Army Staff College.

MG Richardson served from 1974-77 as commander, 193d Infantry Brigade, CZ, and commander, U.S. Army Security Assistance Agency, Latin America, Fort Amador, CZ. He was assistant commandant, U.S. Army Infantry School from 1972-74.

Other assignments are deputy commander, U.S. Army Training Center (Engineer) and Fort Leonard Wood, MO; chief of staff, 23d Infantry Division, Vietnam; and commander, 198th Infantry Brigade, 23d Infantry Division, Vietnam.

MG Richardson is a recipient of the Silver Star with Oak Leaf Cluster (OLC), Legion of Merit with two OLC, Distinguished Flying Cross, Bronze Star with "V" Device and three OLC, Air Medals with "V" Device, Army Commendation Medal with two OLC, and the Purple Heart.

Wiseman Succeeds Klein as Assistant S&T Deputy

Dr. Robert S. Wiseman, technical director of the U.S. Army Electronics R&D Command since its formation in 1978, has been appointed as Assistant Deputy for Science and Technology, Office of the Deputy Commander for Materiel Development, HQ DARCOM. He succeeds Dr. Norman Klein who retired earlier this year.

Dr. Robert S. Wiseman

Prior to serving as ERADCOM's technical director, Dr. Wiseman was the Army Electronics Command's (ERADCOM's predecessor) director of Laboratories. This followed appointments as ECOM's director of Research, Development and Engineering, and Laboratories.

Dr. Wiseman was selected a ECOM's director of Combat Surveillance in the Night Vision and Target Acquisition Laboratories in 1965. He joined the U.S. Army Engineering Research and Development Laboratories at Fort Belvoir, VA, in 1954, and subsequently established the Army Night Vision Research Program. He later became chief of the Warfare Vision Division and is credited with guiding it through its major growth period.

Graduated from the University of Illinois with BS, MS and PhD degrees in electrical engineering, Dr. Wiseman served as an instructor and assistant professor in the Electrical Engineering Department at Mississippi State College from 1948-51.

He is a Fellow of the Illuminating Engineering Society, and the IEEE, and a member of the Association of the U.S. Army. Additionally, he is a 1965 recipient of an Army R&D Achievement Award, and has authored numerous scientific papers.

Koehler Succeeds Curry as TECOM Commander

MG John J. Koehler

MG John J. Koehler, commander, U.S. Army Air Defense Center and Commandant, U.S. Army Air Defense School since September 1977, has succeeded MG Jerry Curry as commander of the U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD.

A graduate of the U.S. Military Academy, MG Koehler has also completed the U.S. Army War College, Command and General Staff College, Artillery and Missile School Advanced Course, and the Artillery School Basic Course.

During 1975-77 he served as assistant chief of staff J-3, United Nations Command/U.S. Forces, Korea, and as assistant chief of staff G-3, Eighth U.S. Army. He commanded the 38th Artillery Brigade (Air Defense), U.S. Army, Pacific-Korea from 1973-75.

His other key assignments have included deputy commander, 32d Army Air Defense Command, U.S. Army, Europe; commander, 69th Artillery Group, U.S. Army, Europe; and member, Concepts Analysis Branch, Office, Assistant to the Chairman of JCS for Strategic Arms Negotiations, Organization, JCS.

MG Koehler is a recipient of the Silver Star, Legion of Merit, Bronze Star Medal with "V" Device and Oak Leaf Cluster, Meritorious Service Medal, Joint Service Commendation Medal, Army Commendation Medal, and the Purple Heart.

PROMOTION—MG Gordon C. McKeague shown with LTG Donald R. Keith, DCSRDA, on the occasion of General McKeague's recent promotion to 2-star level. General McKeague is a mobilization designee to the Office of the Deputy Chief of Staff for Research, Development and Acquisition. In civilian life, he is manager, Corporate Development, Standard Oil of Indiana. Mrs. McKeague is shown at left.

D'Angelo Directs CERCOM Product Assurance

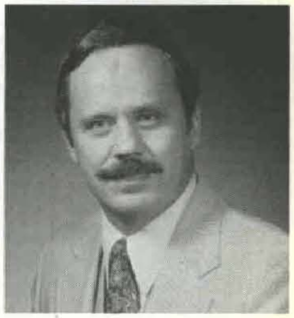
Mr. Andrew R. D'Angelo, former deputy project manager of the Firefinder Weapons Locating Radar project, has assumed new duties as director of Product Assurance for the U.S. Army Communications and Electronics Materiel Readiness Command.

From 1970-73, D'Angelo was deputy director of the Product Assurance Directorate at the former Electronics Command. He served also at the Electronics Command as team chief in the Systems Assessment Agency and as chief of the Quality Engineering Division.

He holds a BS degree from Long Island University, a master of business administration degree from Monmouth College, and graduated in 1978 from the Industrial College of the Armed Forces. He has also attended the Defense Systems Management College.

A 1975 recipient of the Secretary of the Army's Medal for Outstanding Achievement in Materiel Acquisition, D'Angelo has served as chairman of the Army Metric Study Group, and is author of an article which appeared in the November-December 1978 issue of the *Army RDA Magazine*.

Soos Directs Center for Communications Systems



Dr. James E. Soos

Dr. James E. Soos, who was recently appointed as a member of the Federal Senior Executive Service, has been named director of the Center for Communications Systems (CENCOMS), U.S. Army Communications Research and Development Command.

He will direct CORADCOM programs for basic and applied research and exploratory, advanced, and engineering development related to communications systems and equipment.

Dr. Soos was formerly assigned to the U.S. Mission to NATO in Brussels. He worked as a member of NATO groups comprised of national communications experts, responsible for technically screening all NATO Infrastructure Program Communications projects and communications budgets.

Prior to Brussels, he served as chief of the Plans Division of the TRI-TAC Office, Fort Monmouth. He has served also in various communications project engineering positions and helped to develop the first Army 5-year Communications Transition Plan.

Dr. Soos, who has a bachelor's degree in electronic engineering from Iowa State University, holds two master's degrees, one in electronic engineering from Rutgers University, and one in management sciences from the Sloan School of Management, Massachusetts Institute of Technology. He also holds a doctorate in systems sciences from Polytechnic Institute of New York.

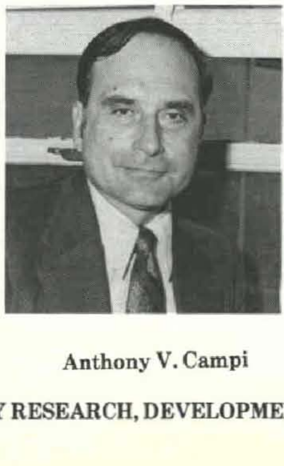
Campi Named ARTADS Deputy Program Manager

Mr. Anthony V. Campi has been appointed to the Federal Senior Executive Service. He has assumed the position of deputy program manager for Army Tactical Data Systems, U.S. Army Communications R&D Command, and he will be a principal Department of the Army adviser on all aspects of the ARTADS program.

He previously served as deputy project manager, Position Locating Reporting System/Tactical Information Distribution System (PLRS/TIDS), where he participated with the project manager in the life cycle management of assigned systems.

Campi has been an employe at Fort Monmouth since 1971. He began his career there with the Communications/Automatic Data Processing Laboratory, where he served in a variety of engineering and management positions until 1975.

He also served as deputy director of the Center for Tactical Computer Systems (CENTACS), where he was responsible for planning, programing and directing the research, development and engineering activities.



Anthony V. Campi

Prior to entering civil service, Campi was an officer in the U.S. Army Signal Corps with duty at White Sands (NM) Missile Range, Puerto Rico, and Fort Monmouth.

He has a bachelor's degree in electrical engineering from the University of Santa Clara, CA, and a master's degree in engineering (computer science) from the University of Pennsylvania. He has completed post graduate studies in software engineering at Stevens Institute.

Mikula Commands Combat Surveillance Laboratory

COL George Mikula recently assumed command of the Combat Surveillance and Target Acquisition Laboratory, Fort Monmouth, NJ, one of seven laboratories of the U.S. Army Electronics Research and Development Command.

COL George Mikula

Formerly assigned as associate director, Battlefield Automation Management, HQ U.S. Army Materiel Development and Readiness Command, COL Mikula also interacted in the areas of foreign science and technology and countermeasures/counter-countermeasures while at DARCOM.

Prior to joining DARCOM, he was a staff officer in the Office, Deputy Chief of Staff for Research, Development, and Acquisition. Other key assignments have included commander, 67th Signal Battalion, Fort Gordon, GA; two tours in Vietnam, and European tours as G-2 for HQ Seventh Army and with the 4th Armored Division.

COL Mikula is a graduate of Rutgers University, holds a master's degree in technology from Georgia Southern College, has done graduate work at Virginia Polytechnic Institute, and has attended the Universities of North Carolina and Maryland.

A master Army aviator with more than 4,000 flying hours, he has completed requirements of the Army Command and General Staff, and is a recipient of the Legion of Merit, Meritorious Service Medal, Bronze Star Medal, Air Medal with 13 Oak Leaf Clusters, and the Army Commendation Medal with two OLC.

Barrere Commands U.S. Army Tropic Test Center

COL Richard P. Barrere has assumed command of the U.S. Army Tropic Test Center, Corozal, CZ, the only Department of Defense test activity in the tropics. He succeeds COL Wendell L. Prince who had served as commander since 1976.

COL Richard P. Barrere

Established in 1962, the Tropic Test Center tests the capacity of military materiel to endure extreme heat and humidity. It is an activity of the U.S. Army Test and Evaluation Command and has a staff of 150 soldiers and civilians.

COL Barrere served previously as chief of the Programs and Requirements Branch of the U.S. Army Security Assistance Agency, Latin America, Fort Amador, CZ. A 25-year Army veteran, he has held command positions from the platoon level to his present assignment. His staff experience includes positions at the battalion and corps levels.

COL Barrere has also served as a branch chief with the Operations Directorate, Office of the Deputy Chief of Staff for Operations, Department of the Army, from 1972 to 1976. He was a battalion adviser in Vietnam from 1962 to 1963, and chief of the Operations Division, XXIV Corps, U.S. Army Vietnam, from 1969 to 1970.

A graduate of the U.S. Army Command and General Staff College, Fort Leavenworth, KS, COL Barrere served also on the faculty of the college from 1966 to 1969. He holds a bachelor of general education degree from the University of Nebraska.

Engineers Name Choromokos R&D Office Chief

Dr. James Choromokos Jr., a former assistant professor of civil engineering at the Illinois Institute of Technology, was recently appointed as chief of the Research and Development Office, U.S. Army Corps of Engineers, Washington, DC.

A retired U.S. Air Force colonel with 23 years of active service, Dr. Choromokos holds a bachelor's degree in civil engineering from the University of Miami, and a master's degree and doctorate in structural engineering from the Univ. of Wyoming.

During his military career, Dr. Choromokos served as director of Construction in Europe; as special assistant to the director of Civil Engineer, Air Force Systems Command; as a member of the White House Federal Council for Science and Technology; and on the Interagency Committee for Excavation Technology.

During the 1960s he was an R&D officer for the Defense Atomic Support Agency, where he conducted research on the effects of air-blast and ground shock from nuclear weapons. In 1972 he was assigned as technical director of a major detonation experiment with the Defense Nuclear Agency.

A registered professional engineer in Ohio, Illinois and Wyoming, Dr. Choromokos has written numerous technical papers for national and international symposiums, and has authored articles for the *Air Force Civil Engineer* and the *Military Engineer* magazines.

He is a member of the American Society of Civil Engineers, the Society of American Military Engineers, the Society of the Sigma Xi, the Societies of Chi Gamma Iota, and the Sigma Tau.

Davis Takes Over as SOTAS Project Manager

COL Wayne B. Davis is the new project manager of the Army's Stand-Off Target Acquisition System, following the reassignment of COL A. M. Ciancialo as commander of the 41st Field Artillery Group in Babenhausen, West Germany.

COL Wayne B. Davis

COL Davis served formerly as head of the Military Science Department at the Georgia Institute of Technology. He has served also in the Office, Joint Chiefs of Staff as a project officer, and as a weapons system coordinator in the Office, Deputy Chief of Staff for Research, Development, and Acquisition.

He was division engineer and commander, 7th Engineer Battalion, 5th Infantry Division, Fort Polk, LA, and company commander and battalion S-3, 326th Airborne Engineers, 101st Airborne Division, Fort Campbell, KY.

A graduate of the Army Command and General Staff College, and the U.S. Navy Experimental Test Pilot School, COL Davis received a degree in mechanical engineering from the University of Tennessee, and a master's degree from the Georgia Institute of Technology.

His military awards include the Distinguished Flying Cross, two Meritorious Service Medals, and the Air Medal for Valor with 21 Oak Leaf Clusters.

Welch Becomes Technology Associate at CSL

Dr. Thomas J. Welch, a supervisory physicist with the U.S. Army Ordnance and Chemical Center and School since 1974, was recently named associate for technology, Office of the Commander/Director, Army Chemical Systems Laboratory, Aberdeen Proving Ground, MD.

Dr. Thomas J. Welch

A career civil servant since 1965, he served from 1965 until 1969 as a physicist with the Army Land Warfare Laboratory. He is a 1978 graduate of the Army War College, and holds a BS degree in physics from St. Bonaventure University, and a master's degree from John Carroll University. In 1974 he received a PhD and a research award from Auburn University.

A recipient of the Army Commendation Medal, he was commissioned in the U.S. Army in 1963 as a distinguished military graduate of ROTC at St. Bonaventure. He was later assigned to the Army Artillery Board at Fort Sill, OK.

Dr. Welch is a member of the American Physical Society, the American Association of Physics Teachers, and has been elected to Sigma Xi Research Society of America.

*U.S. GOVERNMENT PRINTING OFFICE: 311-001:6

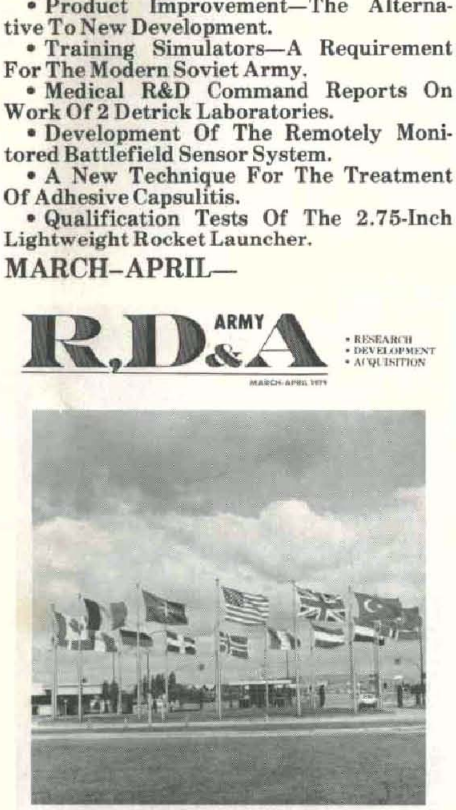
Index of 1979 Key Articles in Army RDA Magazine

The following is a headline list of major articles published during the past year in the **Army Research, Development and Acquisition Magazine.**

JANUARY-FEBRUARY—

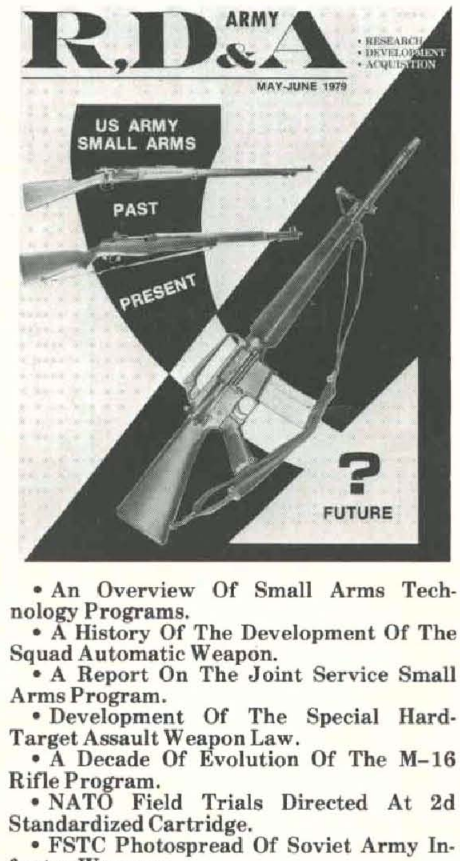
- DARCOM Develops Command-Wide Manpower Baseline Requirement.
- Interview With Army Black Hawk PM COL Richard D. Kenyon.
- Copperhead Missile: New Weight For Stopping Enemy Armor!
- Army Paints And Coatings Technology: A MERADCOM Specialty.
- Tractor Mobility—The Search For The Best Way Continues On.
- Product Improvement—The Alternative To New Development.
- Training Simulators—A Requirement For The Modern Soviet Army.
- Medical R&D Command Reports On Work Of 2 Detrick Laboratories.
- Development Of The Remotely Monitored Battlefield Sensor System.
- A New Technique For The Treatment Of Adhesive Capsulitis.
- Qualification Tests Of The 2.75-Inch Lightweight Rocket Launcher.

MARCH-APRIL—



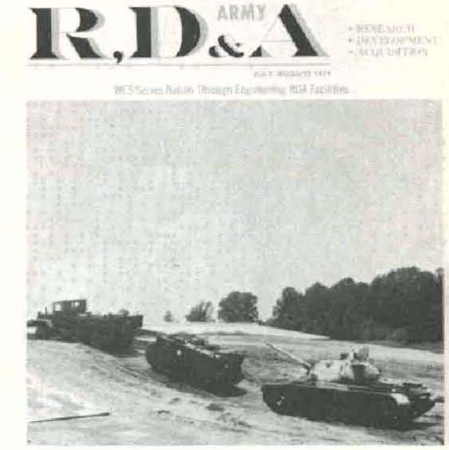
- Analyzing Rationalization, Standardization, And Interoperability.
- The Army Materiel Development And Readiness Command And RSI.
- A Synopsis Of The U.S. Army's Materiel Development Process.
- Research, Development, And Acquisition Of Equipment In Britain.
- Design And Development Of A French Weapon System.
- Federal Republic Of Germany Equipment R&D And Procurement.
- Materiel Acquisition Policies Of The Army Of Canada.
- Foreign Infantry Fighting Vehicles Pictorial Panorama.
- Deputy Under Secretary Of Defense Discusses NATO Initiatives.
- TECOM's Quest For RSI In Military Testing Activities.
- Research, Development, And Acquisition In Smaller NATO Nations.
- The U.S. Army And Foreign Technology—1776 to 1945.

MAY-JUNE—



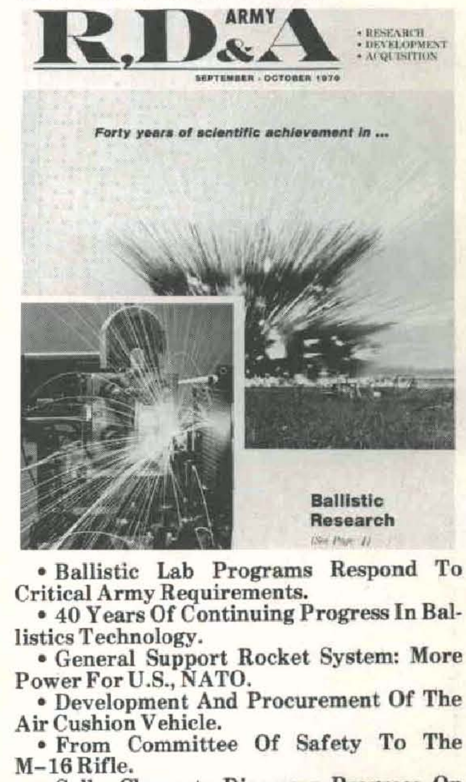
- An Overview Of Small Arms Technology Programs.
- A History Of The Development Of The Squad Automatic Weapon.
- A Report On The Joint Service Small Arms Program.
- Development Of The Special Hard-Target Assault Weapon Law.
- A Decade Of Evolution Of The M-16 Rifle Program.
- NATO Field Trials Directed At 2d Standardized Cartridge.
- FSTC Photospread Of Soviet Army Infantry Weapons.
- An Assessment Of Developments And Trends In Small Arms Ammunition.
- RDTE/Procurement Budget Requests Call For $10 Billion.
- R&D's Responsibility For Integrated Logistic Support.
- 60 Years Of Soviet Small Arms Development.
- Energy R&D Policy Statement Encourages Synthetic Mobility Fuels.
- Conferees Review Small Arms Weapons Candidates at Aberdeen.

JULY-AUGUST—



- WES Continues Proven Reputation For Engineering Excellence.
- Developments In Fuel Cells For Silent Power.
- Army R&D Achievement Awards Recognize 73 In-House Personnel.
- Why The Army Should Use Diesel Fuel In Its Helicopters.
- Army Research Institute Programs Respond To Army Requirements.
- Training System Simulations For Air-Ground Combat.
- Pictorial Review Of Foreign Weapons And Tactical Vehicles.
- The Army Total Risk Assessing Cost Estimate Concept.
- Mobility Equipment Command Electric Vehicle Test Program.
- Career Prospects For The First Manager Of An Army Project.
- Muzzle Blast Of Today's Cannon Type Weapon Systems.

SEPTEMBER-OCTOBER—



- Ballistic Lab Programs Respond To Critical Army Requirements.
- 40 Years Of Continuing Progress In Ballistics Technology.
- General Support Rocket System: More Power For U.S., NATO.
- Development And Procurement Of The Air Cushion Vehicle.
- From Committee Of Safety To The M-16 Rifle.
- Sally Clements Discusses Progress On The 2-Way Street.
- DARCOM Copes With Congressionally Mandated Grade Controls.

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