ARMY R,D&A

- RESEARCH
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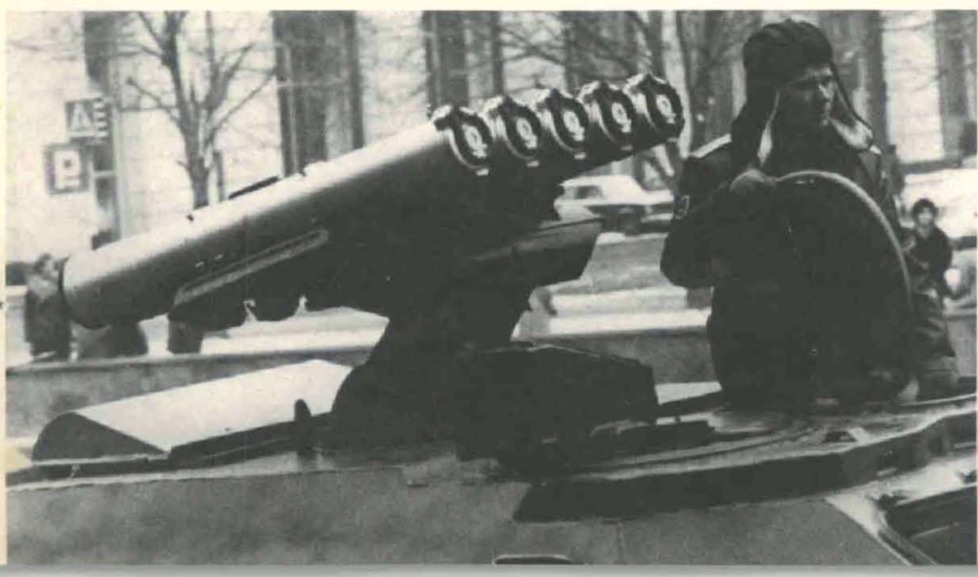
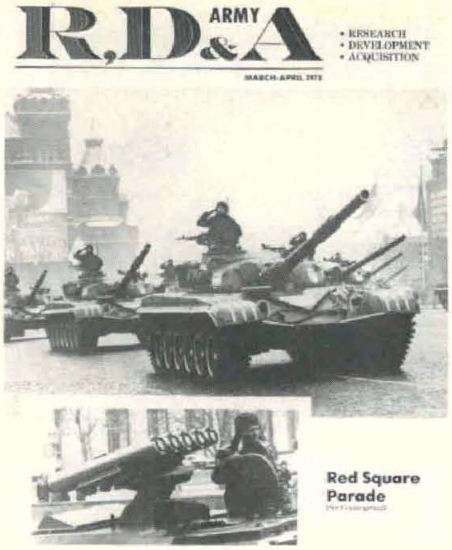
- ACQUISITION

MARCH-APRIL 1978



Red Square Parade

(See Centerspread)



ABOUT THE COVER:

The new Soviet T-72 tank highlighted the 7 Nov. 1977 Moscow parade. The tank previously thought to be their latest and called the T-72, is now designated the T-64. The T-72, seen here, differs slightly in appearance in the suspension and secondary armament. The inset shows a BRDM-2 armored vehicle carrying a new antitank missile system. The missile launcher appears to feature 360° traverse and remote operation from within by means of a rotatable periscopic sight located to the right front of the launcher. Apparently, the launchers can be lowered into the armor protection of the vehicle for reloading.

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FEATURES

DEPARTMENTS

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Army Science Board Holds First Meeting as ASAP Successor

HEADTABLE guests at the Army Science Board banquet (l. to r.) are *Dr. Joseph H. Yang,* **executive director, ASB;** *Dr. Phil E. DePoy,* **director, Operations Evaluation Group, Center for Naval Analysis;** *GEN John R. Guthrie,* **DARCOM commander;** *Dr. J. Ernest Wilkins Jr.,* **associate general manager, EG&G, Inc., chairman designee, ASB; Under Secretary of the Army** *Dr. Walter B. LaBerge; Dr. Percy A. Pierre,* **assistant secretary of the Army (Research, Development and Acquisition); banquet speaker,** *Ambassador Robert W. Komer,* **adviser to the Secretary of Defense on NATO Affairs; Army Vice Chief of Staff** *GEN Walter T. Kerwin; Dr. Bruce A. Reese,* **head, School of Aeronautics and Astronautics, Purdue University; Acting Assistant Secretary of the Army (Civil Works)** *Charles R. Ford.*

The new Army Science Board (ASB) held its first meeting, 2-3 Mar., following its establishment as successor to the former Army Scientific Advisory Panel (see January-February 1978 *Army R&D Magazine*, page 4).

Convened at the Pentagon, the meeting was opened by Army Science Board Executive Director Dr. Joseph H. Yang, who introduced Secretary of the Army Clifford L. Alexander. Secretary Alexander called on the group to be candid in its opinions—"tell the Army what it should be doing, but don't hesitate to tell the Army what it should not be doing."

Problems relative to the balance of forces between the U.S. and its NATO allies and the Soviet Union and its Warsaw Pact allies were discussed by Under Secretary of Defense for Research and Engineering Dr. William J. Perry.

He stressed that the Soviets have been pressing ahead in modernization and expansion of technical capabilities since 1970, while the U.S. has been inconsistent in the allocation of its resources. Technological potential, strong allies, and a good industrial base were cited as compensating factors for the U.S.

Assistant Secretary of the Army (Research, Development, and Acquisition) Dr. Percy A. Pierre, ASB luncheon speaker, called for initiation of direct "Dear Percy" letters. He added that ASB members should serve as the Army's "alter ego,"—they should provide advice relative to what they think is right and what they think is being done wrong.

Dr. Marvin E. Lasser, director of Army Research, presented an overview of the Army's Science and Technology Program. He noted that objectives of the program were to concentrate on high payoff areas, to improve reliability, availability, maintainability and durability of equipment; enhance personnel effectiveness; reduce costs; and conserve life in combat operations.

Dr. Percy A. Pierre, **second from left, joins three former Assistant Army R&D Secretaries,** *Dr. Russell D. O'Neal,* **private consultant, on left;** *Robert L. Johnson,* **president, McDonnell-Douglas Astronautics Co., and** *Willis M. Hawkins,* **president, Lockheed California Co.**

A major step to achieve these objectives, he stated, is greater responsibility and flexibility at the laboratory level. Another innovation, listed by Dr. Lasser, is the Advanced Concept Team. This is a mechanism whereby new promising ideas are evaluated for possible Army funding.

Six key areas of the Army's scientific and technology effort, identified by Dr. Lasser, are millimeter and submillimeter wave radiation, smokes and aerosols, target and background signatures, gun tube wear erosion, armor penetration, and ignition and combustion of propellants.

Banquet speaker Ambassador Robert W. Komer, advisor to the Secretary of Defense on NATO Affairs, addressed the great need for increased U.S. effort toward NATO standardization and interoperability. He emphasized that the Army had more to gain from pursuing this effort and more to lose by not pursuing it than any of the other U.S. Armed Forces.

Specifically, he said, the U.S. Air Force and Navy would be numerically

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BANQUET ATTENDEES (l. to r.) included *Dr. Phil E. DePoy; Dr. J. Ernest Wilkins Jr.; Dr. Percy A. Pierre; GEN John R. Guthrie; GEN Walter T. Kerwin; Prof. Neil Armstrong,* **College of Aerospace Engineering, University of Cincinnati; and Dr. Joseph H. Yang. First women member designees to ASB join others at banquet. L. to r. are** *Dr. Phil E. DePoy; Dr. Irene C. Peden,* **professor of electrical engineering, University of Washington;** *Dr. J. Ernest Wilkins Jr.; Dr. Rhoda Baruch,* **private consultant; and** *Dr. Percy A. Pierre.*

FY79 Army RDA Budget Requests Submitted to Congress

The joint posture statement of Assistant Secretary of the Army (Research, Development, and Acquisition) Dr. Percy A. Pierre and Deputy Chief of Staff for Research, Development, and Acquisition LTG Donald R. Keith, covering the FY 1979 Army RDTE Budget Request for $2.7 billion has been presented to the Congress. A separate FY 1979 Procurement Budget Request, submitted to the Congress by Dr. Pierre and Assistant Deputy Chief of Staff for Research, Development, and Acquisition MG Philip R. Feir, calls for $6.6 billion.

The RDTE statement is introduced by a general review of the vast material advantage the Warsaw Pact currently enjoys over the U.S. and its NATO allies, and the fact that U.S. military analysts see this Warsaw Pact strength in excess of what is believed necessary for a pure defensive posture.

It was noted that the "appearance, in development, of the new T80 [tank] is disturbing." The development of the T80 at a time when their T72 is barely in production, the paper says, indicates one of two things.

First, perhaps the T72 has been found to be grossly defective in some way and will continue in production only until a superior vehicle can be provided. Secondly, and what is believed to be the more probable reason, the new T80 embodies some form of technical breakthrough— possibly in armor or main armament.

The awareness of the T80 development and its possible implications was a consideration that contributed to the decision to arm the XM1 with a 120mm gun.

The Congress was advised, early in the statement, that the next few years will represent something of a crossroad in modernization, with virtually every major item of equipment being replaced by the mid-1980s with systems under development.

In asking for $78.4 million for XM1, to complete Development Test II and Operational Test II, preparation for initial production approval, and several other aspects of FSED/PEP, the statement noted that the "XM1 has been an excellent program, and even with hindsight there is nothing major that we wish we had incorporated in the vehicle or left out."

The Army's urgent need for an infantry fighting vehicle to team up with the XM1 tank was once again stressed. It was admitted that problems existed, but the Congress was told that the subject would be given to the committee in detail. However, whatever may emerge as the desired fighting vehicle approach, the Congress was asked to back the Army in getting the vehicle into the field on a priority basis. A total of $28.9 million was requested to complete contractor and begin government testing, and to begin Operational Test II.

Visualizing the Army's attack helicopters along with the Air Force's ground attack aircraft as the linebackers of U.S. forces in Europe, $177.4 million was requested for the Advanced Attack Helicopter. This amount would cover continuation of the fabrication of three additional prototypes, integration of target acquisition and night vision systems, and live firings of Hellfire antitank missiles, the aircraft's main armor-stopping armament. The statement called attention to the fact that the aircraft's avionics and night vision equipment were of such high effec-

TABLE 1

System	*FY 79 Budget Request ($ in millions)*	*Capsule Summary of Work to be Performed*
Advanced Scout Helicopter	5.5	Project office organized, concept formulation package prepared, request for proposal initiated, NATO interoperability studied.
Patriot	228.4	PEP continued, contractor tests completed, begin DT/OT II, execute Initial Production Facility contract. Twenty-three missiles to be fired.
SINCGARS	12.7	Continue Advanced Development and Combined DT/OT.
TRI–TAC	55.2	Prepare for FY 80 production decision. Complete DT/IOTE on AN/TYC–39 Switch. Begin DT/IOTE on AN/TTC–39 switch.
TOS	36.9	Purchase one division size TOS set. Software development and system integration will continue.
TACSATOM	7.7	Work on anti-jam multi-channel SHF commo. Interface tactical terminal with digital TRI–TAC.
Scatterable Mines	14.9	Type classify ground dispensed mine system and DT/OT II of modular pack mine.
Artillery Locating Radar	6.8	Production acceptance testing, start DT/OT III. Conclude training device, test equipment and survivability program.
Countermortar Radar	4.4	Complete test equipment design, training device development.
Pershing II	10.1	Begin 48 month ED. Engineering model design and limited hardware fabrication.
BMD	227.5	ATP will develop NNK, Particle Beam Laser, MM Wave Technology. STP will select HOE contractor and complete layered Defense initial design.
M60A1 Product Improvement Program	10.0	DT/OT I of muzzle reference system, DT/OT II other items.
GSRS	70.8	Fire 150 rockets. Delivery by contractor of three full up prototype systems. Development work on terminal homing system will begin.

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tiveness "that darkness and fog may even be an asset to it . . . ."

In light of the statement's description of the extent of the Soviet/Warsaw Pact armored threat, it is not surprising that a total of $96.3 million was asked for other anti-armor systems Hellfire, Dragon, TOW, the new AHAMS (Advanced Heavy Antitank Missile System), Viper, and Copperhead. If the figures of $70.8 million for the new General Support Rocket System, and $14.9 million for Scatterable Mines, were added to the total, considering their anti-armor roles, the total would be $182.0 million. If the XM1s total of $78.4 million were included along with the AAH's $177.4 million, the total would be $437.8 million or 16 percent of the total request.

Pointing out that the U.S. Army now has "a relatively weak forward air defense—certainly an inadequate one and absolutely a fair weather one," the statement requests $228.4 million for Patriot and an additional $126.2 million for Chaparral, Improved Hawk, Roland, DIVAD gun, and Stinger. The total requested for air defense is approximately 13 percent of the total Army RDTE request.

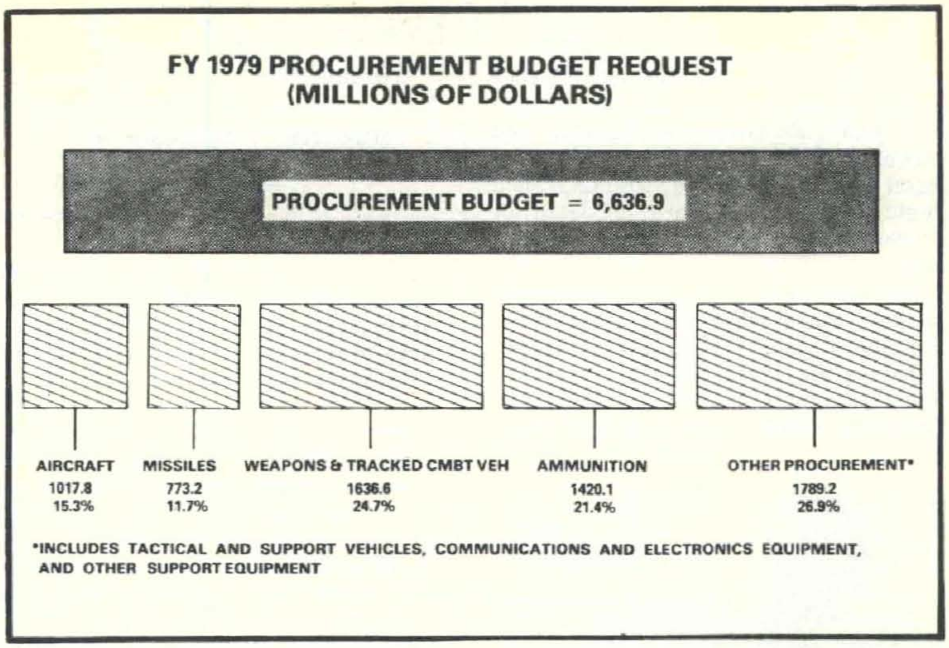
"The chemical threat is ominous and getting worse," the statement noted, followed by a plea for funds to continue research and development of binary munitions. A total of $1.8 million was requested to type-classify the 8-inch binary VX round, and to conduct stability and shelf-life studies.

Another "potential Achilles' heel" was given as communications. The statement took notice of the high priority Soviet doctrine places on jamming. The fact that U.S. forces experienced little jamming in Vietnam, was possibly a factor in not giving during these years sufficient urgency to developing secure, jam-proof tactical communications systems. A total of $75.6 million was asked for TACSATCOM, TRI-TAC, and SINGARS.

The Congress was asked to support what the statement said is a very modest real growth in the science and technology base, $392.5 million in FY78 to $430.0 million in FY79. Past progress in such areas as thermal imagery, frequency hopping, torque stressing, and infrared imaging seekers were cited as proof of pay-offs in the science and technology field. The present status of the technology base was pronounced sound, but the statement cautioned that it is a very fragile commodity that "cannot, if moribund, be turned on instantly no matter how much money is poured on it."

The request concluded with a plea that the Congress heed the need for the Army's new systems, in sufficient quantity, and support the request.

A summary of the funds requested for major programs is shown on Table 1.



The procurement portion of the FY 1979 budget request, as stated in the introduction, is a response to "Total Army Goals" announced earlier in the year by the Secretary of the Army and the Army Chief of Staff. The procurement budget also signals full recognition by the Army of the national commitment to NATO.

In terms of current year dollars, the FY 1979 request exceeds the FY 1978 budget by approximately $1.3 billion, and continues the upward trend in procurement which began in 1975. Fundamental considerations upon which the FY 1979 procurement program evolved included a procurement oriented view of the threat, and a discussion of specific provisions which respond to these factors.

Ominous implications of the Soviet threat, particularly in view of their modernization programs and great strides in improving not only the quantity but the quality of their arms, provided convincing evidence for increased procurement requests, the report states.

"However, we recognize," the FY 1979 statement reports, "that even with total support for the FY 1979 procurement request, we still, in many instances, will have old, obsolete, sometimes inadequate amounts of materiel in the hands of our soldiers."

Cited as examples of the intensified Soviet threat are the introduction of new medium tanks in large quantities; *excellent* infantry combat vehicles which are heavily armed, amphibious, and armored; and long range and high fire rate self-propelled artillery.

Dual capable attack/assault helicopters with aerial platforms, precision guided antitank weapons with long stand-off capabilities, mobile multiple rocket launchers, command and control systems, and advanced mine-laying techniques were cited as other examples of the Soviet threat.

"It is important," the statement says, "to think of this budget request in terms of what it will do for young American soldiers assigned to front line units—for the men whose view will be from a foxhole in the forward edge of the battle area to an enemy perhaps less than 3,000 meters away.

"Should war erupt, a typical NATO battalion task force will, in all likelihood, be opposed initially by an enemy force of at least regimental size consisting of three motorized rifle battalions, each reinforced with a tank company."

Cited as factors which have impacted on the current U.S. materiel status are: defense fiscal priorities which caused deferral of procurement of major items not needed in the Vietnam War; nuclear priorities in strategic warfare and emphasis on air and sea capabilities which resulted in reduced funds for conventional warfare; and the Yom Kippur War which depleted U.S. Army Europe reserve stocks of several important items.

The report emphasizes that insight into current U.S. materiel problems can be provided by examining representative small units stationed at the hypothetical forward edge of the battlefield in Europe.

Attempts to meet requirements in view of insufficient resources, the report states, have led the Army to adopt a procurement strategy which balances modernization in the one hand with near term readiness and sustainability on the other. In terms of dollars, 40 percent of the requested $6.6 billion is directly applicable to modernization, while 60 percent is directed to sustainability.

In addition to filling weapons shortages and replacing outdated equipment, this year's procurement program provides

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INTERVIEW WITH DR. PERCY PIERRE

"We must keep in mind the goal of standardization is a stronger capability of NATO. In order for that to happen, the U.S. cannot go it alone. But that goes for the other NATO nations as well. Any combinations that makes our total combat capability better is worthwhile."

Q—Dr. Pierre, you were appointed to your present position of Assistant Secretary of the Army (Research, Development, and Acquisition) by President Carter, based upon your background, training, and highly competent record as Dean of Howard University's School of Engineering.

The many problems of running an engineering school must be different from running a materiel acquisition business. What are the biggest differences you have found: the bureaucracy, the paper work, justifying a budget, executing a program,

meeting an objective, or what?

A—There have been a number of differences, but I'd like to start by pointing out my familiarity with Defense work precedes my appointment here. Prior to joining Howard University I studied for four years at the Johns Hopkins University at which time I was involved in Navy sponsored research. I did Air Force sponsored research at the RAND Corp. on government programs. So the area is not a totally unfamiliar one to me. I guess I have to say, though, that I had never had any direct contact with the Army.

I said there were some differences, but they are operational differences. At Howard, I was dealing with educating individuals. My management problems were related to that field.

When I came to the Army I had to familiarize myself with my new customer; what are his needs—what kinds of technology are being utilized, what are the systems the Army has in the field, what do we have under development, and what technologies might be applied to Army problems.

But the processes of management, in both environments, the evaluation of problem areas, the weighing of resources, the decision making, are similar. One has the same basic elements involved. The Pentagon is not entirely different from what I was doing. It just boils down to making reasonable judgments based on available decision factors.

Q—What are your impressions of the professional competency, diligence, and productivity of government employes—both military and civilian?

A—I have found government employes, both civilian and military, to be fine, qualified people. This is especially true of those in the top echelon. They are not bureaucrats in the negative sense of that word.

This is not to say that we cannot improve ourselves. We must continually strive to upgrade the quality of our employes, at all levels. Naturally, there are some that are better than others.

Q—What have been your greatest problems or concerns in dealing with U.S. industry?

A—My biggest problem has been getting to know industry. I had not dealt with industry as much as I had dealt with government. I have no serious problems with industry. I have undertaken a deliberate program of traveling to visit industry in all parts of the country, talking with key people, learning their problems in dealing with government, their concerns. I have no particular problems at this time.

Q—What are your views on the so-called military-industrial complex? Is there really such a thing and, if so, is it a bad thing?

A—I first heard the expression at the time President Eisenhower used it. It does exist. There is a collection of industries that are particularly close to the Pentagon. This is not bad, though. It is necessary. It simply means we must be careful, that what is done is in the best interests of both government and industry and that industry remains industry and government remains government. It is a problem only if each does not satisfy its individual responsibility.

Q—There are some people who feel the low bid approach to contracting has serious weakness. One alleged weakness is that a potentially inferior product or component may result, whereas just a little bit more cost will give a far better product.

A—I think we should always look for the low bidder. It puts competition into the system. We cannot get away from the low bid. We just have to have the courage to say so when the low bid is a bad bid. We are getting better at the evaluation process, better at detecting the bad ones. I'm not totally satisfied with our ability to totally evaluate cost and performance data. But we are getting better, particularly in the cost area.

Q—How do you propose to handle the management of both the R&D and the procurement aspect of your responsibilities? Do you intend to delegate authority to one of your staff for the day-to-day running of one of these, or do you intend to become involved yourself with both sides?

A—I will have two principal deputies, one

for R&D and one for procurement. The deputy on the R&D side will concentrate his efforts primarily on research. The Deputy for Material Acquisition, as it is now termed, will worry about procurements and particularly procurement policy. I will probably spend most of my time on major development programs. I guess I'll be like the letter D in RDA; I'll be mostly in the middle.

Q—Do you find the arrangement of having a small personal staff with which you have intimate contact to be a workable and efficient arrangement? Do you plan to continue this, relying on the larger ODCSRDA staff for support for the detailed work?

A—Yes, I find the arrangement works well. Of necessity we have to have a small staff, but I think the present arrangement of relying on the staff of ODCSRDA for much of our support works well. It is a responsive and helpful system and I have no plans to try and change it.

Q—There are some who contend that the ASARC/DSARC process with its lengthy pre-briefs, etc., is too long and drawn out, and frequently does not result in prompt decisions? What are your views?

A—The process is drawn out, there's no question. But several things are accomplished in the process. The presentations are sharpened through this repetition. They become better as they progress. When one realizes that implementation of a program requires education of decision makers in the Pentagon, at every level, of what we are doing, why we're doing it, it results in a better understanding by everyone in the Army and in OSD of a particular program. In Defense we really have a collective management process.

Project managers must understand this, and realize that the seemingly redundant briefings can assist in leading to a favorable decision.

Q—The President's Budget for FY79 has been given to the Congress. What do you see, in general terms, as to the receptivity by the Congress in support of a strong R&D and modernization program for the Army?

A—I think the Congress must look at the situation objectively. What we are asking for is but a small down payment toward what we'll need in the future. Much of what the Army has in the field today represents technology of the 1950's, things like the M-60 tank, the Hercules and Hawk systems, the Vulcan, and the M-109 howitzer.

It must be understood that our procurement curve will rise. It is modest today, but it must continue to rise, if the Army is to modernize its equipment. The Army is still far below the other services in terms of procurement dollars received. We'll have to do better. As far as R&D is concerned, there is only a modest increase in resources. I do not look for any reductions by the Congress here.

Q—Standardization has become a very prominent goal in the furtherance of NATO operational capabilities. We have learned and still are learning lessons in this area. But there are some who contend that there is a point beyond which standardization must not go—in other words, do we accept a European system that meets, say 85 percent of a U.S. requirement in the interest of standardization and interoperability?

A—We must keep in mind the goal of standardization is a stronger operational capability of NATO. In order for that to happen the U.S. cannot go it alone. But that goes for the other NATO nations as well. Any combination that makes our total combat capability better is worthwhile.

Of course the U.S. has another obligation, independent of NATO. Our first obligation is that whatever we do makes sense to the U.S. Army. We must assure that all decisions are good for the Army. If they

help the alliance, so much the better. The 120mm tank gun decision is that kind of a decision. In this case, I believe the decision on the gun will have a tremendous impact on inter-NATO cooperation. U.S. credibility on standardization can no longer be questioned.

Q—Do you believe the Army is doing a good job of exploiting technology to enhance its future military capabilities?

A—I think we are beginning to exploit technology better. We are finding ways to utilize technology that in the past has been under-utilized. This is particularly true in the communications and electronics areas, things like radars, target acquisition systems, lasers, infrared devices, and others. Also, we are making excellent progress in the materials field. Of particular note here, has been the use of new composites in helicopter rotor blades.

In the case of composite materials, we are hoping for greater cost reductions over the life cycle of the systems using them. Any initial increase in cost of composites would be regained in the far greater life cycle savings. However, we are looking for ways to decrease the initial costs of composite materials.

Q—The Army is currently reorganizing, under your leadership, its Scientific Advisory Panel. What are some of the problem areas that you will be giving them to review and advise upon?

A—We have made a number of changes in the Panel. Foremost is that the role will be truly advising. As for problem areas, at the last meeting I asked the members to write me their suggestions as to what they felt should be the Panel's primary concerns. I received a good many substantive replies. These replies will help us set an agenda.

Q—Do you miss the relative calm of academic life and the presumably simpler process of dealing with recalcitrant students?

A—I must say that there is no more calm in the academic world than here. I was at Howard at a time of unrest and considerable turmoil. When I entered this job I found great unrest over the 120mm gun decision. I had to face a very emotional problem. And, as I said earlier, dealing with the problems here are not really that much different from those I encountered at Howard.

FY 79 Army RDA Budget Requests Submitted to Congress

(Continued from page 3)

funding support for the full spectrum of Army materiel acquisition programs. Long-term aspects of the procurement program are designed to take advantage of the payoff from ongoing research and development efforts.

For the past five years the Soviets have reportedly produced an average of 2,400 tanks each year. This is over one fourth of the present Army inventory, and one fifth of the entire Army Acquisition Objective.

Efforts to provide U.S. soldiers with the best weapons and support equipment (in a balanced way) have led to categorization of items into functional areas. These areas are termed capability categories (CAPCATS). Each relates to a specific and significant aspect of combat on the modern battlefield.

Included among some of the new management techniques designed to improve the development and execution of the overall procurement program are Zero-Base Budgeting (initiated this year), the Modernized Army R&D Information System (MARDIS), and Force Packaging Methodology which prioritizes materiel acquisition programs.

The FY 1979 funding request for aircraft totals $1,017.8 million. Funds will be used to procure 78 AH-1S (Cobra/TOW) attack helicopters, 16 CH-47 (Chinook) cargo helicopters, and 129 UH-60A Black Hawks. Support is also being sought for advance procurement of long lead components for the UH-60A Black Hawk. This request will also support aircraft modifications, spares and repair parts, and support equipment and facilities.

A total of $773.2 million is being requested for missile procurement in FY 1979. This represents an increase of $236.3 million from the FY 1978 program. The request includes $648.6 million for continued procurement of the TOW antitank missile system, Improved Hawk, Chaparral, Stinger, the U.S. Roland, and the nuclear Lance and Pershing. The remainder includes $72.7 million for modifications, $29.2 million for spares and repair parts, and $22.7 million for support equipment and facilities.

The request for weapons and tracked combat vehicles calls for $1,636.6 million, an increase of $215.4 million over FY 1978. This request also provides funds for the first quantity production of the XM1 tank and continued development of its production base.

Relative to hardware and production base ammunition, $1,420.1 million is requested. As a general rule, the FY 1979 and outyear programs have been restructured to a lower funding profile level and production at minimum sustaining rates.

Three activities, under the Other Procurement Appropriation, account for a request of $1,789.2 million. This figure includes $284.4 million for tactical and support vehicles, $1,098.9 million for communications and electronics equipment; and $405.9 million for other support equipment.

GEN Guthrie Addresses Senior Service Schools

GEN John R. Guthrie

An update on the organizational structure, missions, and operational philosophy of DARCOM was the topic of recent addresses by GEN John R. Guthrie, commander, USA DARCOM, to students at the U.S. Army War College and the Armed Forces Staff College.

By way of providing a comparison of the magnitude of DARCOM's size, GEN Guthrie noted that in resource comparison, in terms of annual expenditures, fixed assets, number of employes, and payroll, the command ranks among the top 10 U.S. industrial corporations. Its inventory is valued at $37.7 billion, putting DARCOM ahead of such industrial giants as Sears, J. C. Penny, and Montgomery Ward.

GEN Guthrie explained that the recent reorganization was the result of the Army Materiel Acquisition Review Committee recommendation, whereby the development elements of the then existing commodity commands, be separated from the readiness components. Under the new structure the R&D Commands are responsible for research, development, and initial acquisition. At that point there will then be a transition to the Materiel Readiness Commands. However, concurrent with the R&D responsibilities and prior to the transitioning of a system to the Readiness Command, the Readiness Command will be responsible for the integrated logistics support aspects of a new system.

At this point GEN Guthrie noted that the process of transitioning a system has not as yet been accomplished with a major Army program. Up to this time there has been only an assignment of a system to one or the other, based on current status. The General foresaw some growing pains with this step.

After the transition has been accomplished, the Readiness Command will be responsible for supply, maintenance, and follow-on procurement. The R&D side will retain life cycle design integrity and product improvement responsibility.

From the materiel development aspect GEN Guthrie said that the basic goal was to "field a user-satisfied item . . . backed up by a proven technical data package . . . and a field tested plan for integrated logistical support."

The project manager approach to management, he felt, had been successful to the point where it had now begun to assume a sort of status symbol, a condition that he was concerned about. He noted also that the number of project managers had grown from 37 in 1973 to 58 in 1977. Concurrently, the number of skilled people assigned to these offices had grown almost 65 percent. At this point the General cautioned, "If we try to manage everything intensively, we will end up managing nothing." Since it is more expensive in personnel terms, at a time when DARCOM's overall strength has been declining, greater use must be made of existing engineering and functional staffs.

GEN Guthrie's concern for a much stronger developer-user relationship was also one of his stressed points. He felt it was essential to have the user become involved early in the development process, that both sides keep each other informed, that the user recognize that there are technical and practical limits, and that there be a spirit of cooperation and teamwork on the part of both. He emphasized that he did not want any adversary relationship to exist in any way, on the part of either DARCOM or TRADOC.

In addressing NATO Rationalization, Standardization, Interoperability, GEN Guthrie stated that he believed that the interoperability aspect had to come first. After the problems of doctrine and logistics policy are solved, then the problems of equipment will tend to follow into step. But, he emphasized, the RSI concept is a very real one that has the President's personal interest and backing. We will have to make progress. To do so will require solution to conflicting legislative priorities of the Buy America Act and those of the Culver-Nunn Amendment calling for greater use of European technology and industry.

He next turned to the Readiness mission of DARCOM, noting that DARCOM is now the direct supplier to the Army worldwide, responsible for supply, maintenance and follow-on procurement for materiel in the hands of troops and for war reserves, POMCUS and operational project stocks. He discussed briefly, the Modernization of Logistics—1977 to include the DSS and ALOC concept. Results to date had revealed a 31-day Order- Ship-Time (OST); the goal, said GEN Guthrie, is 20 days. He cautioned his audiences not to overlook the fact that during peacetime the Defense Logistics Agency and the General Services Administration fill 55-60 percent of Army requirements; in wartime this rate would probably drop to about 50 percent. Involved are such large volume items as POL, rations, clothing, construction materials, and repair parts.

Readiness, the general noted, has traditionally been thought of simply in terms of unit readiness; i.e., the number of divisions, brigades, battalions at ALO 1, 2, and 3. Army Chief of Staff GEN Bernard Rogers has pointed out that this is only a part of the total readiness picture; ". . . it must include the capability of the force to mobilize, deploy, and to be received, deployed, and sustained overseas." In DARCOM terms, said GEN Guthrie, this means not only a day-to-day or first day ability to sustain initial readiness, but to sustain readiness indefinitely, even under mobilization or surge conditions. DARCOM's capability to meet this goal today is less than required, and, said the General, even with a wartime increase in overtime and productivity there will still be a shortfall under the currently available and foreseen resources. For that reason he emphasized that further reductions in DARCOM personnel strength can only lead to more serious readiness conditions.

Two new missions recently given DARCOM, he told the groups, were those of Single Manager for Conventional Ammunition and role of Executive Agent for Security Assistance.

GEN Guthrie summed up his presentation by saying that the system had to be disciplined to work together, that a team effort was required, and that stability of organization, purpose and policy, funding, and corporate support at all levels were essential to success.

DARCOM Commander's Speech Stresses Progress in RSI

GEN John R. Guthrie, Commander, U.S. Army Materiel Development and Readiness Command, told a combined U.S. and foreign military and industrial audience that progress had been and will continue to be made in furthering NATO rationalization, standardization, and interoperability (RSI).

As the guest of honor and banquet speaker at the International Large Caliber Armaments Symposium: 1985-2000, sponsored by the American Defense Preparedness Association at Fort Belvoir, VA, on 22 Feb. 1978, GEN Guthrie noted that while there are duplications of non-interoperable systems in certain areas, such as combat aircraft and main battle tanks, to cite but two, the United States has begun to make real progress in pushing RSI.

In the artillery area, the General noted, the 155mm, 175mm, and 8-inch rounds are fairly common calibers in NATO armies. Existing agreements state that NATO members should be able to fire each others ammunition in case of wartime emergency. But, he said, while "foreign rounds are produced using the U.S. tech data package, we have never actually fired them." Test and Evaluation Command had no basis on which to issue the required safety release. This situation, said GEN Guthrie, was being resolved and he hoped that U.S. test firings of foreign rounds would begin in April 1978. "It is important that we succeed in demonstrating ammunition interchangeability. I can conceive of few areas where interoperability is more important," he continued.

Retention of existing interoperability is an important aspect not to be overlooked or negated. The M109 self-propelled howitzer has provided a good degree of interoperability since the early 1960s, and in the collective drive to modernize, the General felt that all parties must continue to maintain this capability.

A major study effort was begun a few months ago at DARCOM, he told the audience, to "explore the methods by which international standardization and interoperability of weapons might be achieved, with particular emphasis on the obstacles that must be overcome . . ." He noted that there are basically four methods of international materiel acquisition: direct procurement, cooperative R&D, co-production, and licensed production.

Each approach has its advantages and disadvantages, but the DARCOM study has concluded that none have insurmountable problem areas. The ability— the know-how, to solve the difficulties exists in industry and the Department of Defense. A follow-on effort has already been undertaken in DARCOM, said GEN Guthrie. Qualified people from the major subordinate commands are being brought in to work on problem areas. "We intend to develop specific solutions and a strategy for executing them within DARCOM. In some cases, of course, the solution will rest at a higher level, so we are incorporating a procedure to elevate these issues."

Evidence of increased effort in the international standardization and operability field can be found daily at DARCOM, said GEN Guthrie, where project managers and other materiel developers must become experts on foreign developments in their areas of responsibility. At key decision points in their programs a thorough analysis of a foreign competitor system or systems must be presented as possible alternatives. Today Army project managers are required to demonstrate to the Army and Defense Systems Acquisition Review Councils that their particular programs foster international standardization and interoperability.

The new General Support Rocket System, said the General, was an example of a program where funding was held up until this objective could be adequately proven. Similarly, the recent production decision of Stinger now includes a requirement that a plan for co-production be prepared.

Additional evidence of current progress can be found in the DARCOM project to develop a data bank on foreign systems. Currently being evaluated by Test and Evaluation Command, said GEN Guthrie, are three foreign vehicles, two foreign radars, and a number of other systems. Results will be used to determine whether further testing should be conducted.

One knotty problem that remains to be solved, said the DARCOM commander, is "when do you say that two systems are interoperable?" Is it when they use the same fuel, or the same ammunition, or the same engine? Conceding that this may not be a major policy issue, it does "take on real significance at the operating level." The Army Materiel Systems Analysis Activity is looking at alternative methodologies for presenting data on standardization and interoperability at key decision meetings.

A related issue, he continued, is the question of who is responsible for configuration management. It seemed to him, he remarked, that there are always elements of a foreign system that someone wants to change. "But if all of the changes are to be made, are we not moving rapidly away from the standardization and interoperability we sought in the first place?"

Compounding this tendency is that of the subsequent product improvement changes. "So the real challenge", GEN Guthrie emphasized, "is broader than achieving standardization and interoperability in the first place. We must also develop means to insure that we retain it in the long run. I'm not sure that . . . [this] might not prove more difficult than achieving standardization or interoperability to begin with."

FY 79 RDA Budget

TABLE 1 (Continued from page 2)

System	FY 79 Budget Request ($ in millions)	Capsule Summary of Work to be Performed
Viper	6.3	2,230 rounds tested, system type classified OT II conducted.
XM1 Tank	78.4	Complete DT II and OT II. Prepare for initial production approval. Conduct several activities of FSED/PEP phase.
AHAMS	8.1	AD begun, assembly and test of prototype components.
Copperhead	13.0	Complete DT/OT II. Begin low rate initial production. Validate tech data package.
TOW	3.5	Breadboard flight tests of an improved countermeasures hardened TOW to determine best approach.
Dragon	0.4	ED for night tracker to be completed.
CH-47 Modernization	19.5	Rollout of first two prototypes and first flight of CH-47D. Deliver last five engines to contractor and complete rotor blade development.
Synthetic Flight Training System	4.6	Complete development of UH-60 simulator prototype and begin development of AAH flight and weapons simulator.
Advanced Attack Helicopter	177.4	Continue fabrication of three additional prototypes. Integrate TADS/PNVS. Live firing of HELLFIRE.

(Continued on page 23)

Development of the Aerolastically Conformable Rotor

By William E. Nettles*

During normal operation, helicopter rotor blades experience surprisingly large dynamic motions as they rotate. As forces are produced to lift and propel the aircraft, the blades flex and twist much like a "wet noodle." This motion occurs in virtually all rotor systems, such as those on the UH-1, CH-47, CH-53 and OH-6.

Recognizing that these responses occur, Eustis Directorate engineers have undertaken a study of a new design approach which will use this response to advantage; this is called the Aeroelastically Conformable Rotor (ACR).

The ACR blade aeroelastic properties will be carefully selected to provide a rotor system design in which the blade response is a matter of choice, not chance. In other words, the dynamic twisting and flexing of the blades will be "programed" to improve efficiency, reduce vibration, and improve performance. Thus, this new system will "conform" in a manner to generally benefit helicopter operation.

The ACR is not a rotor "concept"; that is, it does not represent a unique design gimmick that will distinguish it from other rotors because of a radical departure from conventional design. Instead, it is a new design philosophy that represents a conscious effort to tailor rotor properties through the logical and practical application of advanced technology.

There are approximately 20 rotor properties that can be considered in such "tailoring." These properties include such things as blade planform, center of gravity, stiffness, weight, airfoil sections and twist. Thus, the ACR *will not necessarily* have unusual mass distribution, a torsionally soft blade or have a swept tip, *but the design could* include such characteristics once a logical evaluation of blade stiffness, inertia and planform requirements has been made.

Actually, consideration of such characteristics is not new. Every rotor blade built had to be carefully designed (center of gravity, stiffness, weight, etc.), and designers have considered these parameters. However, the ACR is new in terms of the degree to which the dynamicist attempts to control rotor properties during the design process.

In essence, the ACR represents an increased awareness of the effects of aeroelastic properties on rotor behavior, a firm belief that the technology necessary to understand and control these effects can be developed in the foreseeable future, and a commitment to apply this technology in advanced design. Such was the case with high aspect ratio swept-winged aircraft such as the B47 and B52.

A wealth of aeroelastic data exists to provide the confidence necessary to pursue the ACR. Tests of the Controllable Twist Rotor by Kaman in the Ames 40 x 80-foot wind tunnel showed that blade system response is controllable. "Live Twist" research, conducted by Vertol, has indicated that such control can be achieved without application of active external control input. "Compliant rotor" research performed by Sikorsky, which is currently reflected in the Block Hawk design, has demonstrated the capability to use computer analysis in the qualitative definition of aeroelastic properties.

In addition to the aeroelastic technology, the advanced structures capability necessary to apply the ACR philosophy is also being developed by industry and government agencies to include both advanced metals and composites technology. This advanced structures capability is actually the key to the success of the ACR.

It is this capability that will provide the dynamicist the necessary freedom in controlling the blade zeroelastic properties. For instance, the designer will be free to tailor airfoils, blade stiffness, and planform without the manufacturing and structural constraints experienced in the past.

In summary, it is believed that the ACR principle will become a major design philosophy for advanced rotor systems development in the future. Carefully planned research is already underway in an effort to develop the technological basis necessary to apply this principle.

As results of this research become available, advanced R&D work will be initiated to provide continued evolution in ACR technology and to apply the principle to the design of operational hardware.

It is fully expected that significant elements of this technology will be reflected in virtually all new aircraft and in product improvements to current aircraft in the Army's fleet by the mid 1980s.

**WILLIAM E. NETTLES is an aerospace engineer with the Applied Technology Laboratory, Fort Eustis, VA, of the Army Research & Technology Laboratories, AVRADCOM, Ames Research Center, Moffet Field, CA. A 1958 graduate of Virginia Polytechnic Institute, he has been employed as an engineer at Boeing (1960-62), NASA (1962-65), Eustis, since 1965.*

RTL Awards $619,663 for New Rotor Concept

A double contract totaling $562,663 for a wind-tunnel evaluation of an Aerolastically Conformable Rotor (ACR) was awarded by the Research and Technology Laboratories, AVRADCOM: $265,778 to RASA Division, Systems Research Labs, and $296,885 to Sikorsky Aircraft Division, UTC.

Program objective is to develop technology for the design of an ACR, which is a rotor concept in which blade stiffness, airfoils and mass balance are deliberately designed so that the flexing and twisting of the blades will work to improve helicopter performance and reduce loads.

Project Engineer William E. Nettles, Applied Technology Laboratory, Fort Eustis, VA, RTL's laboratory in charge of the contract, explained that this research will begin with an analysis of rotor deformations, using complicated new computer analysis.

Based on this analysis, model rotors will be built and tested to determine whether the analytical predictions are correct. Results are expected to have a significant impact on the development of a new breed of high-performance Army helicopters.

Sikorsky also received a separate 10-month $57,000 contract to determine potential rotor improvement and impact on mission effectiveness for the new rotor.

Recent analytical and model test studies have demonstrated feasibility of using passive control of blade torsional response to improve various aspects of rotor operating capability, explained Project Engineer Patrick A. Cancro of RTL's Applied Technology Laboratory at Eustis.

Designs that improve performance and or reduce systems loads will be serious candidates for future Army missions. A UH-60A Black Hawk baseline conventional rotor will be used in conjunction with an ACR to determine the benefits to be derived from this technology.

ARRADCOM Announces New Laboratory Ballistic Simulator

Development of a laboratory ballistic simulator, with potential for providing quick and accurate evaluation of M4A2 cannon propellant performance, has been announced by the U.S. Army Armament R&D Command, Dover, NJ.

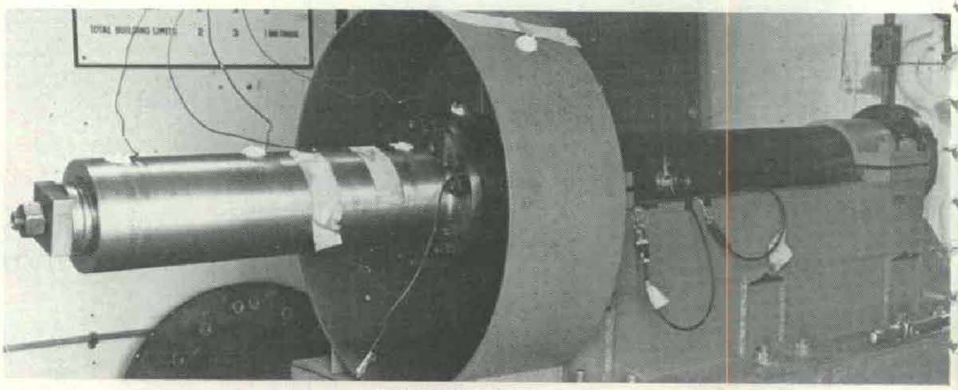
Identified as the dynagun, the device is the result of joint effort by ARRADCOM and the University of Illinois. Final laboratory tests are being conducted at Radford Army Ammunition Plant, Radford, VA, prior to production testing.

The dynagun is intended for use primarily in the new Radford propellant production facilities which will be completed in the early 1980s. A continuous production technique, rather than the traditional batch method, will be employed at the new facilities.

Development of the dynagun was actually prompted by problems arising from the continuous propellant method. Since production is continuous, several million pounds of defective propellant might be produced before being detected. The new device prevents this by providing on-site evaluation.

The dynagun prototype is designed to simulate chemical and physical actions that occur in the chamber of a 155mm M126 Howitzer when an M4A2 propellant charge is fired. Collected data provides a complete pressure and time velocity record.

Measuring six feet in length, the device is a scaled-down gun with a movable and reusable piston which replaces the real projectile. The concept was conceived by ARRADCOM physicist John Demen.



DYNAGUN Prototype

Army Science Board Holds First Meeting

(Continued from page 1)

superior to their NATO partners, while the U.S. Army would initially be numerically inferior.

Summarizing the U.S. Army force structure, Ambassador Komer said that the Army is keyed to NATO requirements, but is not directing adequate attention to the probability of a European War being a coalition war.

The U.S. and its allies, he said, have been too parochial in addressing the need to plan for coalition warfare. Ambassador Komer stressed this by contending that no senior service school currently offers a course in coalition warfare.

It does little good, he noted, to have a superbly equipped U.S. Corps flanked by a less well equipped allied force with whom U.S. commanders cannot converse on secure nets, cannot cross-reinforce, or whose logistics doctrine is quite different.

BG Charles E. Canedy, deputy director and Army aviation officer in the Requirements Directorate, Office, Deputy Chief of Staff for Operations and Plans, spoke on the "Army's Requirements Process." He appealed to the Army Science Board to attack problems associated with capability voids. He said that the ASB can assist the Army by providing a better matchup between technology and requirements.

Assistant Deputy Chief of Staff for Research, Development, and Acquisition MG Philip R. Feir presented a discussion of the Army's R&D mission and philosophy. "Our basic philosophy," MG Feir said, "relegates a special status but not an exclusive role to equipment performance." The fact that it works is a *necessary* but not a sufficient condition, he said.

MG Feir cited the following ground rules which have, for better or worse, become fundamental to the Army's R&D strategy: the belief that product improvement, or evolution, is superior to revolution; significant performance jumps justify new systems; avoid excessive sophistication; demonstrate a promising concept with actual hardware; standardization and interoperability; and recognize the need to preserve the technological base.

He concluded his remarks by citing past contributions of the Army Scientific Advisory Panel and pledging the full support of his staff to the new Army Science Board.

Other featured ASB speakers included Army Vice Chief of Staff GEN Walter T. Kerwin Jr.; Commander of the Army Materiel Development and Readiness Command GEN John R. Guthrie; Commander of the U.S. Army Test and Evaluation Agency MG Julius W. Becton Jr.; Army Assistant Deputy Chief of Staff for Personnel MG J. P. Kingston; and Commander of the Army Concepts Analysis Office MG Ennis C. Whitehead.

Under Secretary of the Army Dr. Walter B. LaBerge delivered a brief closing statement, and ASB Chairman Designee Dr. Ernest Wilkins presented administrative announcements.

Attendees comprised a blend of 15 personnel who had served previously with the Army Scientific Advisory Panel or had held high position in the Army materiel acquisition community, and 12 others who are new to the field. It was notable also that this composition included a representation of American minorities.

Notable among those with prior Army affiliation were former Assistant Secretaries of the Army (R&D) Willis M. Hawkins, president, Lockheed California Co.; Robert L. Johnson, president, McDonnell-Douglas Astronautics Co.; and Dr. Russell D. O'Neal, private consultant.

Former ASAP members included Dr. Harold H. Agnew, director, Los Alamos Scientific Laboratory; LTG Austin W. Betts (USA, Ret.), vice president for Planning, Southwest Research Institute; Kenneth E. Clark, dean, College of Arts and Sciences, University of Rochester, NY; Dr. Ralph E. Fadum, School of Engineering, North Carolina State University (Raleigh); Dr. David L. Fried, president, Optical Science Consultants; Dr. Herbert L. Ley Jr., private consultant;

Robert M. Lockerd, manager, ATC Communications/Navigation Systems, Texas Instruments, Inc.; Dr. Richard A. Montgomery, director of Corporate Development, R&D Associates; Dr. Bruce A. Reese, head, School of Aeronautics and Astronautics, Purdue University; Dr. James J. Renier, executive vice president, Aerospace and Defense Group, Honeywell, Inc.; Dr. G. H. Siu, private consultant; and Dr. Chris J. D. Zarafonetis, Simpson Memorial Institute, University of Michigan.

Prof. Neil A. Armstrong, who won worldwide acclaim as the first human to set foot on the moon during the U.S. Apollo 11 space venture, headed up the list of those joining the Army's research, development, and acquisition community for the first time. Prof. Armstrong is now with the College of Aerospace Engineering, University of Cincinnati.

Other attendees, new to the Army's RDA community, were Dr. Rhoda Baruch, private consultant; Dr. John Blair, director of Research, Raytheon Corp.; Dr. Joseph V. Braddock, vice president for Technical Programs, BDM Corp.; Dr. Phil E. DePoy, director, Operations Evaluation Group, Center for Naval Analysis; Dr. Richard C. Honey, staff scientist, Electromagnetic Sciences Laboratory, Stanford Research Institute; Dr. Fujio Matsuda, president, University of Hawaii; and

Dr. Irene C. Peden, professor of Electrical Engineering, and associate dean, College of Engineering, University of Washington; Dr. L. Albert Scipio II, professor of Space Sciences, Howard University Graduate School; David Shore, division vice president, Advanced Program Development, RCA Government Systems Division; Dr. Wilson K. Talley, professor, Department of Applied Science, University of California (Davis), Lawrence Livermore Laboratory; and Dr. J. Ernest Wilkins Jr., associate general manager, EG&G Idaho, Inc.

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Distribution of this magazine to Army installations and commands is controlled by the number of copies requested by the installation or command publication officer on DA Form 12-5.

Some comments have been received by the magazine staff to the effect that an imbalance exists. Publication officers should be contacted to make necessary changes on DA Form 12-5.

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Also, by filling out one of the Reader's Survey cards in this issue you will be assisting the editorial staff in providing the type of content the audience desires and needs, as well as improving the efficiency of the magazine distribution.

What's New in Advanced Aircraft Engine Developments?

By Dr. Richard M. Carlson and Henry L. Morrow

Significant savings in fuel consumption, initial acquisition costs, and a host of other major improvements are envisioned as a result of several advanced aircraft engine development programs underway at the U.S. Army Research and Technology Laboratories' Applied Technology Laboratory, Fort Eustis, VA.

Two completed programs sponsored by the Propulsion Technical Area of the Fort Eustis-based laboratory are the 1500-hp Demonstrator Engine and the Small Turbine Advanced Gas Generator (STAGG).

The current 800-shaft horsepower Advanced Technology Demonstrator Engine (ATDE) program is the latest effort under the Demonstrator Engine project. A significant fringe benefit of this approach has been the ability of the Army to define objectives for the 1500-hp and 800-hp ATDE programs in sufficient detail to allow specification of firm fixed price contracts for the competitive demonstrator programs. This enhances the competitive atmosphere and should eliminate costly overruns.

The 1500-hp Demonstrator Engine program was initiated in 1967 with the broad objective of validating integrated advanced engine component technology which had already been experimentally tested. This component technology was integrated into a complete engine and the performance capabilities and mechanical integrity were demonstrated.

Two competitive advanced development programs were initiated to allow different technical approaches for demonstration of the advanced technology under a competitive environment. The 1500-hp demonstrator engines were very successful in achieving the performance and mechanical integrity goals of the program.

The competitive aspect of this approach had a significant bearing on its success. The program also provided the opportunity to address maintainability, vulnerability, and reliability of the engine.

During the time frame of the program, requirements for the Army's Utility Tactical Transport Aircraft System (UTTAS) were being firmed up. In 1972, through a competitive procurement process, one of the developers involved in the demonstrator program was selected to enter engineering development of the engine for the UTTAS (subsequently named the Black Hawk).

Many of the lessons learned, in addition to actual component designs that were verified during the 1500-hp Demonstrator Program, evolved into the T700-GE-700 engine, which today powers both the Black Hawk and the Advanced Attack Helicopter (AAH). A modified version of the T700 will power the U.S. Navy's Light Airborne Multi-Purpose System (LAMPS) helicopter. The T700 is also being considered for commercial sales.

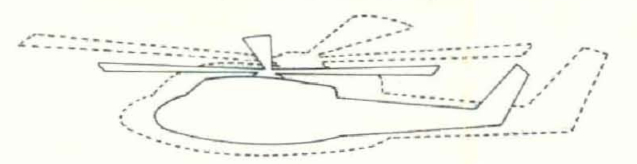
The Small Turbine Advanced Gas Generator Program was initiated in 1971 with four programs for design, fabrication, and testing of a core gas generator (gas producer). The STAGG power range was 200-750 hp or 1-5 lb/sec airflow, with two gas generators in the 1-2 and two in the 3-5 lb/sec airflow size.

The objective of the STAGG program was to validate the core gas generator technology base for Army and Department of Defense future small gas turbines. The STAGG program integrated advanced component technology into a gas generator (compressors, combustors, and turbine), approximately one-third of complete engine, in order to define matching and integration problems at an early date.

STAGG program objectives were: 25-30 percent reduction in specific fuel consumption; 35-45 percent increase in specific power; 10 hours of simulated model qualification test; and 150 hours of performance, endurance and cyclic tests.

Objectives were met or exceeded. The STAGG technology has been successfully transferred into new improved aircraft and ground auxiliary power units and was used as a base for definitizing of the 800-hp ATDE requirements.

EFFECT OF ENGINE TECHNOLOGY
(2.0 HOUR MISSION)



	800 SHP ATDE	CURRENT TECHNOLOGY	PERCENT IMPROVEMENT
NUMBER OF ENGINES	2	2	—
TOTAL SHP	1650	1800	8.3
SHP PER ENGINE	825	900	8.3
DESIGN GROSS WEIGHT (LBS)	7484	8807	15.0
EMPTY WEIGHT (LBS)	4600	5527	16.8
STRUCTURAL (AMPR) WEIGHT (LBS)	3643	4156	12.3
MISSION FUEL (LBS)	947	1329	28.7
DIAMETER (FT)	34.5	41.2	16.3
LENGTH OF AIRCRAFT (FT)	42.0	49.1	14.5

Fig. 1. Effect of Engine Technology on Aircraft Design

It has been determined that the greatest potential improvement in future aircraft systems can be realized through technology verification in an engine of approximately 800 hp. In recent years the need for improvements in engine technology has become more urgent, not only in the areas of vehicle flying performance but in the areas of cost, reliability, maintainability, safety, and survivability as well.

Achievement of the following ATDE program goals will provide an effective and viable means of meeting these requirements: 17-20 percent reduction in fuel consumption*; 25-35 percent increase in specific power; 40-50 percent reduction in vulnerability*; improved reliability; improved maintainability; and infrared suppressor compatibility.

In determining the performance objectives for the ATDE, consideration was not only given to the achieveable thermodynamic performance but also to all other aspects of an engine in its operational environment.

Any engine demonstration program will be most successful if the technology demonstrated is in the form of a complete engine with consideration for operational constraints, the environment in which such an engine would operate (sand, dust, heat, altitude, hostile action taken against the engine/aircraft, etc.), the maintenance system, and any other outside influence that could compromise the actual demonstrated technology. Another very im-

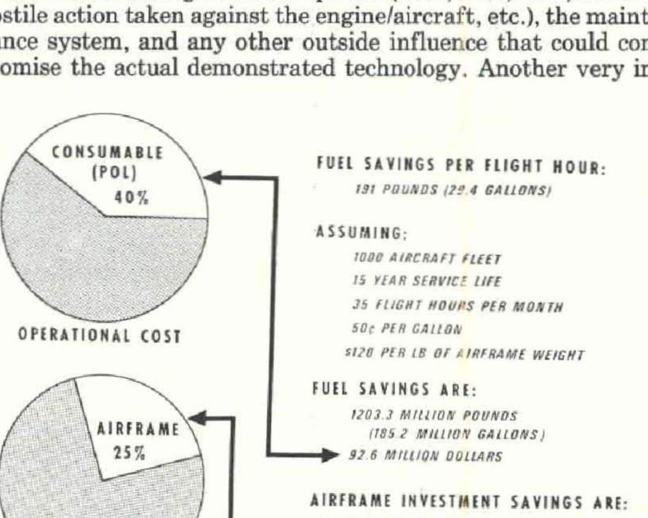


Fig. 2. Effect of Engine Technology on Aircraft
(From engine weight and fuel savings only)

*Compared to production engines in the same power class portant consideration is engine cost—the acquisition cost as well as the total life cycle cost.

The ATDE program will provide two separate approaches to advanced technology turboshaft engines in the 800-hp class. The 48-month program was initiated in February 1977 with the award of firm fixed price contracts to two engine developers. Each program will consist of the design and analysis of the engines, hardware fabrication/procurement, component tests, gas generator tests, and engine tests.

The ATDE will be designed with primary consideration for application to rotary-wing aircraft, however, the technology will be applicable to other DoD and commercial requirements.

Particular emphasis is being placed on reliability and maintainability; ballistic vulnerability; diagnostics and condition monitoring; infrared suppression compatibility; and engine cost and trade-off analysis.

The test phase is divided into three major categories—component, gas generator, and engine development and demonstration testing. Component testing will be conducted to establish the level of performance and to increase design credibility prior to committing the individual components to inclusion in a gas generator test.

Gas generator testing is to determine the performance of the aerodynamic components, as well as of some of the mechanical parts, in an engine environment. Development testing of the complete engine will then be conducted to determine performance and integrity. The first engine testing is scheduled for May 1979.

Final demonstration tests will include performance evaluation, sand and dust evaluation, inlet distortion tests, exhaust emissions analysis, and cyclic durability testing. Approximately 500 hours of engine testing will be conducted.

The effect of engine technology on a new aircraft design is very significant. Figure 1 shows the differences in vehicle characteristics that would result from use of a currently available engine versus the 800-hp ATDE engine.

The two aircraft were designed to meet the same requirements in all respects, including mission, payload, and mission equipment. The resulting aircraft using the ATDE engines is smaller and lighter weight. It should be more agile and would be able to operate in tighter quarters in addition to being more easily transported and stowed.

The lower structural weight translates directly into acquisition cost savings at the rate of about $120 per pound. The reduced fuel consumption of the ATDE engines will result in appreciable savings over the life of the aircraft. With the projection for continually rising fuel costs in the foreseeable future, these savings will continue to increase.

For a fleet of 1000 aircraft and operational conditions shown in Fig. 2, savings of over $92 million in fuel and more than $61 million in acquisition costs could be expected from this aircraft.

Significant savings would also be realized from lower engine acquisition cost, reduced maintenance, and improved survivability characteristics of the advanced technology engines as compared to currently available powerplants.

As mentioned earlier, the T700 engine is already being produced for the Black Hawk and AAH aircraft. A wide range of helicopters from 4,000 to about 30,000-pound gross weight could be powered by various combinations of the T700 or ATDE engines. Figure 3 depicts some of the types of aircraft that could benefit from the use of advanced technology 800-hp engines.

The time cycle from the initiation of research at the component level to the final incorporation into an aircraft system for use in the field is a long one. However, there is probably no single technological advancement in helicopter design that would contribute a greater measure of cost effectiveness than does the advanced technology engine.

While conducting current programs to meet today's needs for Army aircraft, the Army propulsion community is continuing to strive to achieve payoffs in the propulsion area that may be applied to future aircraft.

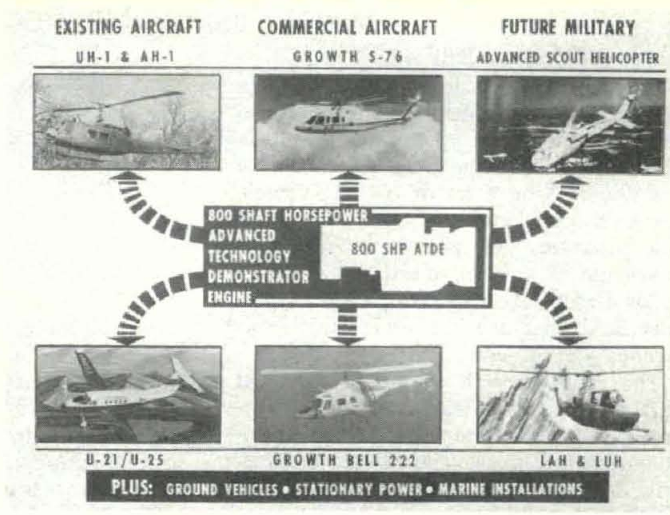


Fig. 3. Potential Applications of 800 hp ATDE

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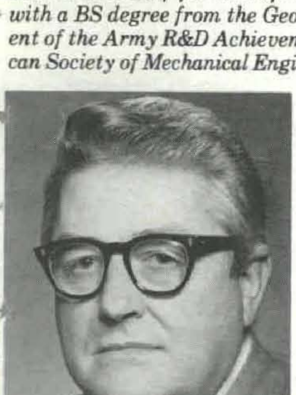
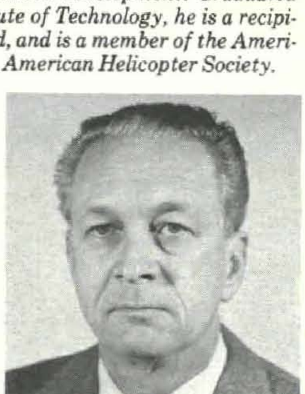
HENRY L. MORROW is chief of the Propulsion Technical Area in RTL's Applied Technology Laboratory. He served formerly as team leader and branch chief for aircraft engine advanced development. Graduated with a BS degree from the Georgia Institute of Technology, he is a recipient of the Army R&D Achievement Award, and is a member of the American Society of Mechanical Engineers, and American Helicopter Society.





Guthrie Accepts First T700 Production Engine

GEN John R. Guthrie, DARCOM commander, accepted the first production T700 from the General Electric Co., in West Lynn, MA, on 13 Mar., 1978.

On 10 Aug. 1966, then BG Guthrie, director of Developments, Office, Chief of Research and Development, DA, signed a memorandum for the Chief of Research and Development directing AMC to undertake a demonstrator engine program. Noting that replacement aircraft for the UH–1D and CH–47 helicopters would eventually be required, with the UTTAS program scheduled to start in FY68, GEN Guthrie stated that "experience has shown . . . the necessity for engine development to lead airframe development."

The program his letter initiated became the 1500-hp Demonstrator Engine Program which culminated in the T700, which will be the standard powerplant in the new Black Hawk and AAH helicopters.

Soviet Pushing Electrochemical Power for Vehicles

By James D. Busi

JAMES D. BUSI is employed as a chemist with the U.S. Army Foreign Science and Technology Center, Charlottesville, VA. He is currently engaged in analyses of foreign research as applied to the areas of electrochemical power sources, electric vehicle technology, and alternate fuels. Additionally, he is a 1970 graduate of Christian Brothers College, Memphis, TN, and is a member of the Interagency Advanced Power Group.

In a major effort to conserve valuable domestic petrochemical resources, and to reduce atmospheric pollution in urban areas throughout the USSR, the Soviets are undertaking a major electric vehicle research, development, test and evaluation program. This program, began five years ago, is well organized, and receives funds directly from the Soviet Ministry of Electrical Engineering and the USSR Academy of Sciences.

The rapid growth of Soviet chemical and plastics industries has greatly increased the demand for limited petrochemical resources. The chemical/industrial demand for these resources will continue to expand, and result in domestic petrochemical shortages in the mid-to-late 1980s. These projected shortages will force the USSR to become a net importer of foreign petrochemical resources by the late 1980s.

The growth and demand for petrochemicals from the Soviet industrial sector of their planned economy parallels the demand for similar fuels in the transportation sector of Western economies. In order to continue industrial growth, the Soviets will have to conserve petrochemical resources used for transportation purposes.

The development and promotion of all-electric and engine-hybrid-electric, i.e., part battery, part heat engine, vehicles will conserve petroleum-based fuels and resources, and reduce atmospheric pollutants caused by automotive emissions. The Soviets estimate that 60 percent of all atmospheric polution in urban areas is caused by emissions from diesel and gasoline-fueled vehicles. The primary pollutant is sulfur dioxide (SO_2) produced by the combustion of domestic fuels having a high-sulfur content.

The basic need in developing practical all-electric vehicles for urban transit within the USSR is the development of adequate electrochemical power sources. These sources must be reliable, correspond to established Soviet industrial and automotive standards, and satisfy predetermined driving and climatic specifications. Three types of electrochemical power sources are being considered:

- Conventional lead-acid and alkaline-type storage batteries.
- Electrochemical fuel cells.
- Advanced, unconventional, high- energy-type traction batteries.

The Soviets initially stressed the development of lead-acid traction batteries for all-electric vehicles. This was due to the ready availability of lead, and the existence of an established industrial production capability in conjunction with a standard battery recycling program.

The primary drawbacks of the lead-acid traction battery are its low-energy density, which limits driving range (60 to 80 km/charge at an average velocity of 60 km/h), and its poor low-temperature charge/discharge characteristics. Because of these serious deficiencies, the Soviets are shifting their traction battery research effort to alkaline systems.

The Soviet development of alkaline traction batteries satisfies both driving range and low-temperature requirements. Furthermore, this shift is supported by a very advanced and well-established alkaline battery industry. Presently, the USSR is the world's largest producer of alkaline storage batteries; moreover, they have adequate domestic metal resources and production facilities to support an expanded alkaline battery program.

From both an industrial and resource standpoint, the Soviets have determined that the nickel-zinc (Ni/KOH/Zn) alkaline traction battery is the *best* alternative electrochemical power source for electric vehicles. Several advanced nickel-zinc batteries have been successfully road tested, and when compared to lead-acid batteries have demonstrated improved driving ranges (120 to 150 km/charge at an average velocity of 60 km/h) and superior low-temperature performance.

Additional improvement in nickel-zinc battery cycle life has been achieved through the use of improved separators and by using chemical additives in the aqueous electrolyte. The Soviets presently employ a hydrated cellulose separator that is treated with silver acetate. This improved separator has resulted in a battery service life greater than 300 cycles.

Further Soviet technological progress is expected through the incorporation of vibrating electrodes. (The vibrating electrodes eliminate shape changes on the zinc electrode during charging.) This research is being conducted at the Scientific Research Battery Institute (NIAI), Leningrad.

Cost and availability of the Soviet nickel-zinc traction battery is presently unknown, but it is estimated that the cost would fall between that of the lead-acid and nickel-cadmium types. The major industrial facilities for producing these batteries are located in the cities of Leningrad, Kursk, Kaliningrad, Riga, and Sverdlovsk. With the exception of Sverdlovsk, all have port facilities for receiving metal ores, mined in the Kola peninsula, and for shipment of finished products.

In the United States, the nickel-zinc alkaline traction battery is also receiving considerable attention, and similar achievements in battery performance have been made. The U.S. prospects for nickel-zinc traction batteries are encouraging, and additional battery research will be funded through the U.S. Department of Energy (DOE).

However, it should be noted that the U.S. presently does not have a large nickel-zinc battery production capability. The USSR already has this capability, and will most likely become the first country to produce this power source on a large scale. Standard Soviet production, distribution, and marketing of this battery can be expected within the next five years. Technical characteristics of this battery are summarized in the following table:

Over the past 10 years, the Soviets have

TABLE 1

Soviet Nickel-Zinc Alkaline Traction Battery Design and Performance Characteristics—1977

Discharge voltage at 20°C	1.6-1.7 V per cell.
Energy density (mass)	40-60 Wh/kg.
Power density (mass)	50 W/kg.
Temperature range	+30°C to −40°C.
Battery cycle life	300+ cycles*.
Vehicle driving range	120-150 km/charge at an average velocity of 60 km/h.
Electrolyte	aqueous KOH plus unknown additives.
Electrolyte specific gravity	1.25 at 20°C.
Low temperature performance	20% loss in capacity at −40°C.
Separator	hydrated cellulose treated with silver acetate.

**300+ cycles—depth of discharge is unknown.*

investigated and demonstrated fuel cells for electric ground-propulsion applications. The Soviets have established an extensive theoretical and fundamental data base but have *not* progressed beyond the advanced development stage.

In 1974 the Soviets road tested the "EK-2", a prototype fuel-cell-powered vehicle similar to a previously developed U.S. vehicle designed by Dr. Karl Kordesch of Union Carbide Corp. After evaluating the EK-2, the Soviets determined that a pure fuel-cell-powered vehicle for urban transit was too complex and too expensive. The Soviets are now considering fuel cell-battery hybrid electric vehicles.

The Soviets are also following Western research on metal hydrides for storing hydrogen. Presently, iron titanium hydride ($FeTiH_{1.6}$) is being used for storing hydrogen in stationary fuel cells used in prototype power substations and is being considered for applications in prototype hydrogen-fueled vehicles.

The overall prospects for commercial fuel-cell-powered vehicles in the USSR is *not* encouraging due to the high cost of catalysts, and onboard fuel storage limitations. It should be noted that the Soviets have the capability to produce special purpose fuel-cell-powered vehicles for military applications. These applications could include small, self-propelled, unmanned surveillance vehicles, and fork-lift trucks for operation in hazardous environments.

The Soviets have conducted basic research and limited exploratory development of unconventional high energy battery systems. These batteries couple strong alkaline earth metals as anodes and strong oxidants such as halogens or chalcogens as cathodes. Analysis of all these potential electrochemical couples has resulted in the sodium-sulfur, and lithium-sulfur battery systems as the most promising unconventional, high-energy battery types for future (beyond 1985) electric vehicle applications.

The Soviets have been very conservative in their approach and development of these unconventional battery systems, and thus lag Western technology by 3 to 5 years. This technological lag is illustrated by their beta alumina ceramic separator used in the sodium-sulfur battery.

The best Soviet beta alumina ceramic separator has a specific resistance of 0.1 to 0.3 ohm-meter at 300°C. In comparison, beta alumina ceramic separators produced by Chloride Silent Power Ltd., of the United Kingdom; Brown, Boveri and Cie (BBC) of West Germany, TOSHIBA of Japan, and Ford Motor Co. of the U.S. all have specific resistances of 0.05 to 0.07 ohm-meter at 300°C. The inferior Soviet beta alumina ceramic will result in greater battery internal resistance.

Soviet quality problems may be due to impurities, and poor fabrication techniques—as indicated by their inability to produce large beta alumina separators. Improvements in these areas are required before the Soviet sodium-sulfur battery becomes practical for electric vehicles and/or off-peak power storage systems.

The Soviets are capable of demonstrating a prototype sodium-sulfur-battery-powered vehicle in the near future, however, standard production of high-performance, high-energy traction batteries is *not* anticipated before the mid-to-late 1980s.

Project BETA—What Is It?

A new project—Battlefield Exploitation and Target Acquisition (BETA)—has been established as a joint U.S. Army-U.S. Air Force-Defense Advanced Research Projects Agency effort to expedite fielding systems that rapidly integrate the vast amount of information obtainable on the Battlefield of the 80s. BETA will process data from up to 15 different Army and Air Force intelligence and surveillance systems, translate this data into useable combat information, and display and disseminate the battlefield situation to include targets to the battle managers.

Studies conducted by DARCOM have indicated that an Army division may receive 60 sensor reports per minute in the 1985 time frame. If this prediction proves to be accurate, how will a commander, or even an automated system, handle such a flow and convert it into a useful product? That is the broad goal of the BETA Test Bed program.

The U.S. Army, DARPA, and the U.S. Air Force have each been working on the problem for several years. In September 1977, Dr. William J. Perry, Under Secretary of Defense for Research and Engineering, directed the establishment of a joint program with the Army as the lead service.

The initial step is to create an experimental test bed, using off-the-shelf hardware and, where possible, software. The objective of BETA is to put a test bed into the hands of the user to assist in defining hard requirements for future systems to solve these complex technical and operational problems. BETA is strictly an experiment at this stage. The questions to be answered include, "What functions should a tactical sensor correlation system perform?" and "How will such a system impact on the management of our forces?" This is in contracts to some systems, whicch are developed before the user is sure he needs or wants them.

The BETA Project Plan calls for demonstration of the test bed in CONUS and Europe during the 1980/1981 time frame. Three Correlation Centers; Air Force, Army corps, and Army division, will be fabricated, working with sensor system interfaces, internal communications, and remote display subsystems. External communications to support the test bed will be a combination of civil and military networks.

The approach will be to use a mix of existing Air Force, Army corps and devision level sensor systems playing in a large scale combat field exercise. Surveillance systems will include SOTAS, OV-1D SLAR's, QUICK LOOK II, GUARDRAIL V, ELS, and Air Force SIGINT, SAR, and QUICK STRIKE RECONNAISSANCE systems.

BETA is a logical follow-on to project ALPHA which is a joint U.S. Air Force Tactical Air Command and USA TRADOC effort to determine how to integrate the air land battlefield. BETA will automate sensor correlation, target generation, and situation display at TACC, Corps, and Division command posts. Sensor data and finished products will be distributed among the various users.

The U.S. Air Force's Tactical Air Control Center is a fairly large organization, with a Tactical Fusion Division to process target acquisition information. BETA Test Bed experience will help define on-going automation developments for the Tactical Fusion Division.

The Army is implementing a new concept for support of the tactical commander with electronic warfare and intelligence assets which have been under the command and control of the Army Security Agency. These assets will be consolidated with surveillance assets into Combat Electronic Warfare and Intelligence units as organic elements of the Army corps and division. Along with this new concept, a new facility has been defined at the Corps and Division level termed the All Source Analysis Center. The Center will support the tactical operations center by controlling, managing, and analyzing the product of all organic sensors (intelligence and Surveillance) and the electronic warfare assets.

The BETA Test Bed will be used by the services to validate automated procedures for correlation and fusion of sensor products into near-real-time target nominations. Those procedures which are validated will be incorporated into the development of automated systems to support the All Source Analysis Center and the Air Force's Tactical Fusion Division. Major difficulties that must be solved include techniques to provide; a real-time display of targets and situation data, adequate data handling capability; and standardized sensor report formats. The experimental program will also explore such issues as the joint use of Army and Air Force sensor systems.

The joint BETA program is guided by a general officer level steering committee, chaired by Air Force LTG Thomas Marsh with Army LTG Robert Baer as the deputy chairman. The balance of the committee is composed of Army, Air Force, Navy, Marine, NSA, DARPA, and representatives of U.S. commands in Europe. Dr. Phil Dickinson, the Project Director, was formerly Deputy Director of Battlefield Systems Integration, HQ DARCOM.

The BETA project office is located at the Harry Diamond Laboratories, Adelphi, MD, and receives administrative support from that organization. The Air Force Deputy and his staff are located with the Electronics Systems Division of the Air Force Systems Command at Hanscom Air Force Base, MA.

On 14 Mar. 1978 the Department of the Army notified TRW, Inc., that they had been selected as the prime contractor for negotiation under the four step source selection process. Teaming with TRW in their proposed BETA effort are BDM, Inc., and Bunker Ramo Corp.

Photos Taken of Red S

Photos on these pages were taken at the 7 Nov. parade in Red Squ Moscow. Fig. 1—Armored Recovery Vehicle M1977, a possible modifi a of an assault gun chassis (note welded opening on front glacis). 2—M Artillery Prime Mover, which can serve as a personnel carrier in Arctic Tundra climates, because of its high flotation. 3—BMP, Infantry Figh Vehicle with 73mm smoothbore gun and uprated or semiauton SAGGER antitank guided missile. The BMP has an amphibious capab and built-in CBR protection. 4—AKD assault rifle, an extensively rev AKM, primarily for airborne use. Modification consists of folding stock vised forearm/handguard, high-efficiency muzzle brake, and plastic m zine. 5—SA-8 Air Defense Missile System is a self-contained fire u recently deployed outside the USSR. 6—BTR-60 Armored Personnel

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re parade— 7 Nov. 1977

er has an amphibious capability and can carry a squad of 8 in addition to a ew of 3. 7—D-30 122mm Divisional Artillery Howitzer features a 360° averse. 8—SA-9 Air Defense Missile System, mounted on a BRDM vehicle, a short-range tactical system that employes the wooden round concept. —BMD, Airborne Amphibious Fighting Vehicle, with 73mm smoothbore in and uprated SAGGER antitank missile, is airdroppable by parachute.)—T-12A 100mm Smoothbore Divisional Antitank Gun. 11—M-1973 52mm Self-propelled Gun-howitzer used in the maneuver division and tillery division role. 12—M-1974 122mm Amphibious Division Howitzer. 3—T-72 Medium Tank, with 125mm smoothbore gun, is not as yet known be deployed outside the USSR. 14—ZSU-23-4 Self-propelled Air Defense ystem has a self-contained shoot-on-the-move capability.

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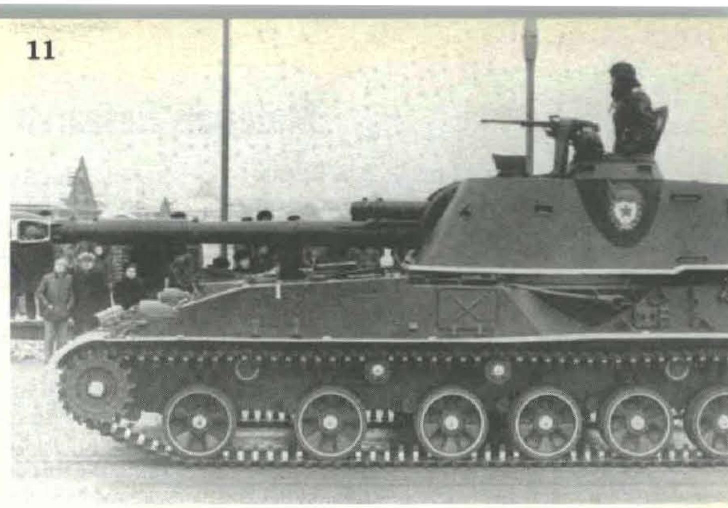

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Materials Research in the Tropics: 1970-1977

By Dr. W. A. Dement and Dr. D. A. Dobbins

The United States began tropic testing in the late 1930s under the auspices of the Panama Canal Co. High equipment failure in the South Pacific during World War II prompted the Army to step up testing of materiel.

With the coming of peace, tropic testing diminished until a permanent facility was recommended in 1959, by the Army Scientific Advisory Panel. The Army Research and Development Office, Panama, was then set up in 1962, first, under the Office of the Chief of Research and Development and, later, under TECOM as the U.S. Army Tropic Test Center.

Early work at the Center exposed materiel to the tropic environment, but failure analyses and degradation measurements were performed in the Continental United States. By 1970, however, Tropic Test Center's scientists and supporting laboratories had improved due to an aggressive modernization program.

Advanced chemistry, biology and materials laboratories, and funding of the test methodology improvement and instrumentation, led to a materials research program. The major objective is to determine tropic micro-environmental effects on materials deterioration rather than development of new tropic-resistant materials.

Measurement of Relative Site Severities. Many have thought the Atlantic side of the Canal Zone was the more severe climate because its annual rainfall, 330 cm, exceeded the Pacific side's 200 cm. These differences at sites only 80 km (50 mi) apart result in different ecological associations, with the Pacific area rarely being used to challenge basic materials.

In February 1971, the Test Center began to determine degradation rate for basic materials—natural polymers (cotton and latex rubber), synthetic polymers (nylon, polyvinyl choloride and butyl rubber) and metals (steel)—at three locations (Pacific coast, Atlantic coast and Mid- Isthmus); with five exposure configurations. The purpose was to identify the most severely degrading sub-environments, and to answer a basic methodological question: "Where is the best test location for a new item?"

Exposures and sampling intervals varied among materials. Four phases throughout the year were used for all materials except steel which was subject to five. The phase approach was to determine which seasonal differences (dry versus rainy) appear in deterioration rates.

Degradation was measured in tensile strength loss for all materials and corrosion weight loss for steel. The Center found deterioration varies widely, depending on the micro-environment; the Pacific side was most severe for some materials, the Atlantic for others. Thus, site selection and exposure mode affect deterioration more than season and, more important, can be used to reduce test time and costs.

Multiple regression was used to develop a predictive model for degradation based on climatic data, i.e., temperature, humidity, rainfall and atmospheric salt concentration. The model provided poor predictions due to high intercorrelations among climatic predictors and restrictions in ranges of climatic parameters. Effects were highly variable, requiring many replications to stabilize them statistically.

An unsuccessful attempt to identify "the" tropic deterioration function led instead to the development of three equations (Table 1).

TABLE 1
Experimental Equations: Percentage Occurrence of Best Fit

Equation	Occurrence of Best Fit (%)
$y_t = gt + L$	44.6
$y_t = yo\,e^{at} + bt^2$	24.6
$y_t = yo\,e^{ct^4}$	30.8

Where: y_t = tensil strength at time t
yo = initial tensile strength
t = exposure time
a. h. e. a. b. c. u = constants

There was no curve that described the tropic deterioration of all materials; however, the linear decay function is sufficient in most instances. Table 2 gives examples of good fits for the three types of equation, as well as showing an example of data for which no equation gave a good fit.

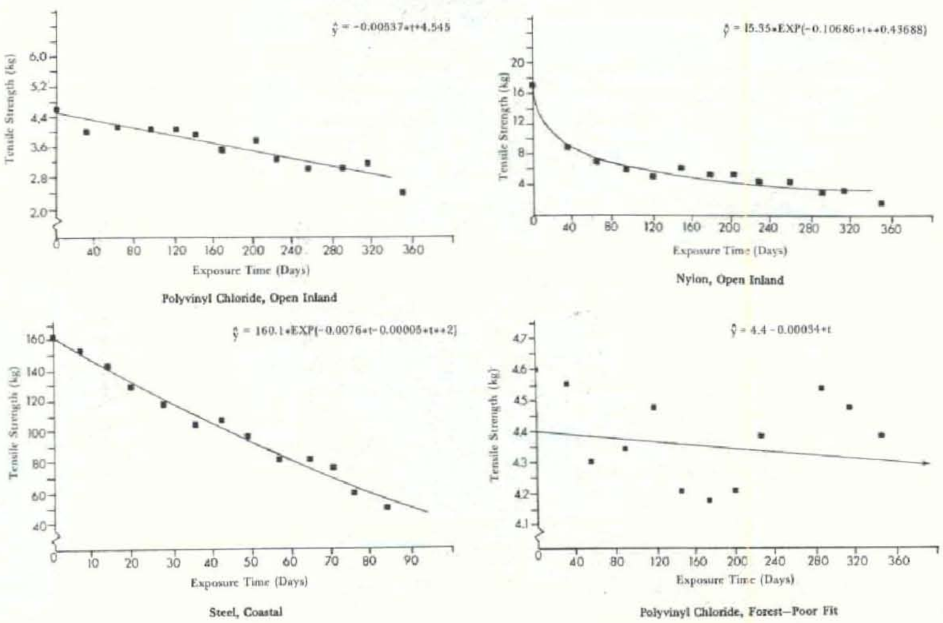
It emerged that synthetic polymers were most subject to actinic degradation and most affected by open exposure at both inland and coastal sites. Natural polymers were subject to actinic degradation, but their deterioration patterns were complicated by their vulnerability to biological attack; natural polymers were severely affected by both open and jungle exposure. Metals were subject to corrosion which is influenced by the electrolyte concentration on the material surface. In general, steel corrosion correlated well with atmospheric salt content as measured by salt candle samplers. The major exception was the most severe site in the study which exhibited only moderate levels of atmospheric salt.

The Mangrove Swamps. Prompted by a single site's high steel corrosion, the Center pioneered exposures in mangrove areas. Steel was exposed at forest sites on both the Atlantic and Pacific coasts with deterioration measured in tensile strength losses.

The first mangrove site was found to be exceptionally severe, while many others were benign. Sites with high corrosion had predominately black mangrove trees. These secrete salt on their leaves' lower surface. Rainwater collected beneath them contained significant chloride levels and tannins. Tannins form water soluble complexes with iron corrosion products and prevent them from adhering to steel after formation. Thus, fresh steel surfaces are continuously re-exposed for corrosive attack. A second finding was that corrosion is significantly higher in the wet season.

Performance Deterioration versus Materials Degradation. The same sub- environments and research design was used in another project, begun in October 1972, in

TABLE 2
Time Delay Functions



Polyvinyl Chloride, Open Inland

Nylon, Open Inland

Steel, Coastal

Polyvinyl Chloride, Forest—Poor Fit

TABLE 3
Test Items to Determine Effects of Exposure on Materiel Performance

Squad Radio:	Transmitter PRT 4A Receiver PRR 9
Batteries:	BA-30 BA-399/u BA-505/u
V-Belt Set	
Automotive Roller Bearings	
POL Products:	MOGAS in cans Diesel in cans
Windshield Wiper:	Motor (Vacuum) Blade
Interval Timer	
Barrier Material (Plastic Film)	
Practice Rockets, 3.5 in	

which selected materiel (Table 3) were exposed at Atlantic, Pacific and Mid-Isthmus sites under open-sided shed, ventilated shed, mangrove pallet/tarp, tropical forest pallet/tarp, and open pallet/tarp exposures.

Deterioration was measured in changes in materiel performance. This 18 months' study supported the original conclusions by illustrating the importance of the microclimate, rather than the average ambient weather, in determining deterioration.

The pallet-tarpaulin exposure proved most severe regardless of geograhpical exposure. Thus, a common field storage method is very severe in materiel deterioration. External appearance did not predict performance, indicating that functional testing is preferable to simply compiling results of visual examinations.

The two studies on site severity show that the Tropic Test Center can shorten test length and better determine test sites and storage modes to assure items are severely, yet realistically, challenged by the tropic environment.

Documentation of Degrading Factors. A second thrust involves identification of factors influencing deterioration. Fungi account for much natural polymer deterioration in tropical forests; however, these micro-organisms are also found with biologically inert material. Colonies may produce metabolic products affecting materiel.

The tropics are rich in microbial diversity. This, along with optimum micro-organism development conditions, poses a severe threat to materiel. The inability of a laboratory fungus test, such as MIL-STD-810C, Method 508, to predict deterioration is due to lack of biological diversity and insufficient test times. By isolating organism strains which contribute to deterioration, the Center is supporting the Army-wide effort both to shorten test time and bring greater realism into laboratory and chamber simulations.

Fungi colonize biologically inert surfaces that have accumulated organic contaminants. Early Center work suggested this accumulation was from volatilization of organic plant products with ensuing condensation and polymerization. But, in 1972, the Army Materials and Mechanics Research Center sponsored a Tropic Test Center project which studied the role of ambient organic compounds in this colonization process, discovered the predominance of fossil fuel combustion products in jungle air, and rejected the transport hypothesis.

The study detected high molecular weight organic substances which would not be volatile at tropic temperatures. The study confirmed that biologically inert substrates inherently form platforms for deposition of organic materials, growth of micro-organisms and possible deterioration of the substrate.

Yet, another aspect of documenting environments involves investigation of storage and surface conditions.

A study was begun in 1973, to measure surface and internal temperatures for a large ventilated warehouse, an ammunition bunker, a Butler building, a 2-man general purpose tent, and a CONEX container. Outside skin and internal airspace temperatures showed high variability. This contrasts to small changes in outdoor ambient conditions. Surface temperatures rose to 83° C. (181° F.), a possible world record. Highest surface temperatures occurred during the rainy season when the atmosphere is clear and winds low. Internal temperatures went to 59° C. (139° F.).

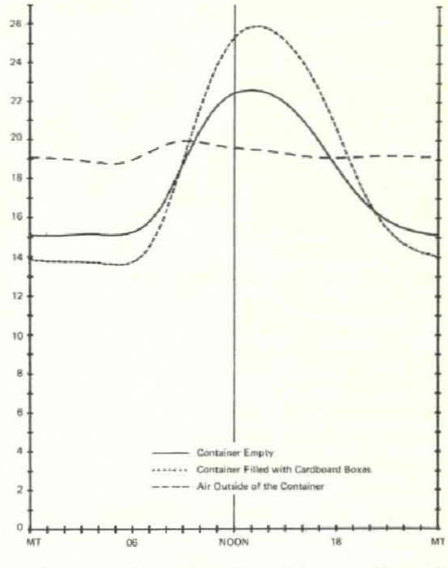
Temperatures of samples in the open were more similar to temperatures inside enclosures than to surface temperatures. Factors possibly more important than the high temperatures were fluctuations up to 12.8° C. in 90 seconds, and 26.7° C. in 6 minutes. These are common in the rainy season and can occur several times daily. The ensuing thermal shocks can influence item performance.

The Tropic Test Center recently furnished new criteria for the revision of MIL-STD-810C on thermal shock. These data ultimately will be used to better design test chambers and narrow the gap between results obtained in tropic chamber simulations and the natural environment.

Moisture conditions within containers also have been investigated. The hypothesis for moisture in sealed test items was that large temperature fluctuations produced a "breathing" effect in which humid air was pulled into the containers at night when temperatures were low, causing condensation, and then expelled as vapor when daytime temperatures rose.

A study of temperature and humidity revealed the breathing effect was negligible compared to absorption and desorption of water by materials. Table 4 shows daytime changes in absolute humidity under solar radiation. The increased absolute humidity in the full container is caused by

TABLE 4
Diurnal Variation of Absolute Humidity



an increase in water-absorbing cardboard. At night the excess water is reabsorbed, preventing significant amounts of internal condensation.

Comparison of Laboratory and Field Exposures. Materials research also compared laboratory and tropics simulations for predicting material performance. Chamber advocates stress lower costs, shortened tests and stricter controls for standardization. Advocates of natural environment testing criticize chamber testing for neglecting synergistic effects, limited selection of environment variables, and shortcomings in human factors considerations, among others. But, is chamber testing valid?

The Test Center examined correlations of chamber work with natural tropic exposure. The survey indicated that laboratory tests were preferable to field tests for time, cost, convenience and precision, but were not sufficiently advanced or predictive to risk replacement of natural environment tests. The fact that simple chamber tests applied sequentially do not predict the results of complex chamber tests with variables applied simultaneously indicates one cause of poor correlations.

Exploring a new concept in simulation, scientists at the White Sands Missile Range, NM, have built a "tropic greenhouse." This is more realistic than a temperature/humidity chamber because it contains tropical vegetation, micro-organisms, diurnal solar cycles and rainfall.

Tropic Test Center scientists and engineers have developed test items which perform optical, electrical, hydraulic and mechanical functions for exposure in the greenhouse, and in open and jungle exposure at the Center. Deterioration is being measured by changes in performance. So

(Continued on page 18)

Materials Research in the Tropics

(Continued from page 17)

TABLE 5
Exposure Modes for UV Study

Exposure Mode	Light Conditions
Plexiglas UV Screen	400 nm →IR
Glass Screen	320 nm →IR
Plexiglas II UVT Screen	290 nm →IR
Opaque Screen	No direct solar radiation
Open	Total solar radiation plus rain

far, data are insufficient to fully assess the usefulness of the tropical greenhouse test methodology, but initial results are promising.

UV Study. The Center is beginning a study of ultra-violet light in tropic deterioration processes. The quality of light reaching a sample will be controlled with screens which selectively absorb different portions of the solar spectrum. Five field exposure modes will be used (Table 5). Differences in deterioration rates of basic materials will determine, quantitatively the importance of different portions of the solar spectrum in weathering materials.

Summary. The approach taken by the Tropic Test Center in its materials research program has been to develop an understanding of the many microenvironments of the humid tropics and to determine which factors are important to materiel deterioration. Results favorably impact on the Army materiel development and acquisition cycle and attempts to shorten it. Proper selection of exposure configuration can reduce test lengths and result in savings. An indirect but important aspect has been an improvement in the fault isolation capabilities; the Center now supplies materiel developers with heretofore unavailable information on the cause of materiel failures and suggests modifications.

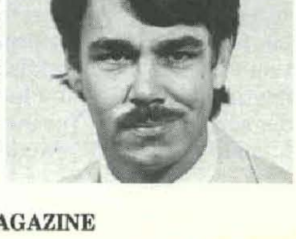
Tropic Test Center data on deterioration factors are improving MIL-STD environmental tests in fungus and thermal shock areas and are leading to new tropic chamber methodologies.

Finally, materials research has added to scientific knowledge in general. Research results highlight the diversity of subenvironments within the humid tropics and their wide range of effects on basic materials and end items. The myriad environmental factors— some identified, some hypothesized and others yet unmeasured—present eloquent testimony for further tropic investigation. The extensive measurements of microenvironments provide much formerly unavailable information about an ecosystem which is among the most complex on the earth's surface.

(Editor's Note: The U.S. Army Tropic Test Center (USATTC), a subordinate of the Army's Test and Evaluation Command (TECOM), has issued a scientific report on various methodology studies of the past seven years for the purpose of acquainting developers with present and evolving capabilities that can assist them in producing tropic-suitable materiel.)

DR. WILLIAM A. DEMENT has been employed at the U.S. Army Tropic Test Center (TTC), Panama, CZ, since 1975, and currently is chief, Technical Support Branch. He holds BA and PhD degrees in biology from the University of Texas (Austin), and has completed four years of postdoctoral training in the population biology group at Stanford University, CA.

DR. DELANEY A. DOBBINS is assigned to the Office of the Deputy to the Commander for Analysis, HQ U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD. He served formerly as chief of the Tropic Test Center's Technical Division, and was also responsible for management of TTC's scientific and engineering laboratories, test facilities, and ranges.



WES Aids in Combating Melaleuca Tree Infestation

Legions of invaders are reportedly squeezing out natural vegetation, driving away wildlife, and slowly drinking the Florida Everglades dry. What are these evil monsters? Scientists from the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, know who they are—and may soon have the invasion under control.

It's the seemingly mild-mannered melaleuca, often called the punk tree. Brought to the U.S. from Australia in 1906, the melaleuca or cajeput tree is a tenacious plant that grows in wet or dry land, seeds profusely, and has a high resistance to disease, insects, and fire.

COMPLETELY UPROOTED, this melaleuca tree refuses to die. Control of the melaleuca is difficult because the tree spreads quickly through seeding, withstands fire, sprouts from uprooted trucks, stumps or felled or cut trees, and seems to be immune to insects and disease.

Because the tree even grows in constantly saturated soil, it was planted in 1940, to protect the Lake Okeechobee levee system from wave attacks during periods of high winds.

However, it now appears that what began as a well-intentioned gesture has had a fickle ending. The trees spread through the marshlands of the lake, adjacent wildlife areas, and even to nearby pasture lands. Today, they can be found all over southern Florida.

The trees flower two to five times annually, producing millions of seeds the size of grains of pepper. These seeds are spread easily by wind and water, and grow readily in wet and dry environments.

Melaleuca can also sprout from the main stem and larger branches. After cold damage, cutting, and even burning, sprouts may occur. In fact, when other plants are killed by fire, the melaleuca responds by releasing seeds, and the subsequent growth excludes revegetion by other plants.

Florida residents claim that the tree's dense growth chokes out native plants, causes allergic reactions in some people and, because of it's high transportation-evaporation rate, uses up water faster than the natural vegetation.

Some people, on the other hand, insist that there are productive uses for the tree. It has been planted along highways for windbreaks and in low-lying areas to stabilize soil. Beekeepers report that it is a prime source of nectar for their bees.

Suggested uses include gift and domestic woodwork, indoor and outdoor furniture, landscape woodwork, hobby and craft supplies, marine structures, agricultural products, and pulp and paper products.

In short, the melaleuca is a real probem for the Army Engineers. It might be compared to their long time friend and foe, the water. Harnessed waters work for man but if left uncontrolled they can destroy him.

Responding to "calls for help" from the Jacksonville, FL, Engineers District, scientists from the Waterways Experiment Station are searching for methods of controlling the melaleuca.

Jack K. Stoll, chief of WES's Environmental Simulation Branch, and Anthony M. B. Rekas, a biologist, are optimistic. They are now looking at two chemicals that will cause the tree to die in dry soil by interfering with the process of photosynthesis. Mechanical and biological controls might also be considered.

Their research program began with a background survey of the melaleuca in Florida. This phase was followed by a "definition of problems" task. The third portion of their efforts will be devoted to a series of field tests, based on research findings. Until the problem is solved, it may continue to be referred to as "the tree that almost ate Florida!"

Let's Collect Field Reliability Data

By Glenn M. Stewart Jr.

There's a search on by the U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, for facts about military equipment reliability.

Engineers in the MERADCOM Product Assurance and Test Directorate need them, particularly when trying to determine a reasonable reliability requirement for a new generation of equipment in the command's four program areas of barrier/counterbarrier systems; countersurveillance systems; energy/environmental systems; and supply distribution/construction equipment systems.

The search to date has seldom revealed reliability data available from the field. Development test data have been found to be sketchy also, particularly where tests had been shortened to conserve funds or meet a scheduled milestone.

Who has the facts about equipment reliability—the developer or the user? Army materiel developers frequently point to development test results to show that equipment reliability is improving. Do the tank drivers, equipment operators and repairmen agree? Probably not, if the number of complaints from the field accurately measures equipment reliability.

The fact is that the Army rarely measures the reliability of Mean-Time-Between-Failure (MTBF) of fielded equipment. Nor does it record operating time to failure, which are necessary data if MTBF is to be computed. MTBF is the common measure of reliability during development. Shouldn't it also be used to measure field reliability? Many of the arguments about failure causes would be eliminated by comparing development testing MTBFs to filed MTBFs. Factual data would be substituted for opinions and perceptions.

Much of the present effort to solve reliability problems consists of the developer and user accusing each other of being responsible for poor field performance and each trying to convince higher commands that the monkey belongs on the other command's back.

These disagreements between developers and users about failures have become stereotyped. The user claims the equipment is poorly designed, the contractor used low quality parts, the workmanship is shoddy, the manuals inadequate, and that the system was not properly tested before release.

The developer claims that the operators and mechanics are poorly trained, the equipment was improperly prepared for operation, the equipment was never designed to operate under the existing field conditions and that the operators seldom read the manuals.

There are, indeed, many causes of field failure and, as you probably suspect, both the user and the developer can be right about the causes. Poor design, low quality parts, shoddy workmanship, deficient manuals, imcompetent operators and repairmen, improper installation, etc. *all* cause failures.

Troops in the field are not as interested in failure causes as they are in repairing equipment, yet, if field failures are to be reduced, failure causes must be identified and eliminated. Parts availability and ease of repair are frequently more important to the field commander than failure causes.

The field commander can often tolerate failures that are easily repairable. Field personnel solve failure problems by identifying failed parts and replacing them, with a minimum effort to determine failure cause.

Usually the designer is not eager to find failure causes either. A fielded item has successfully passed all the full scale development tests, and has been type classified—finding design problems at this stage is embarrassing. Besides, the designer has a next generation equipment in advanced development that is being designed to replace all those equipments the field is complaining about.

Meanwhile, the user keeps replacing failed parts and complaining about increasing logistics costs and poor design. The developer gripes about misuse of equipment by the troops and the contractor supplies more spare parts. This cycle continues until the next generation of equipment struggles through full scale development and another set of complaints filters in from the field.

The arguments between user and developer are mostly qualitative: incompetent repairmen, poor design, low quality parts, improper installation, etc. But Mean-Time-Between-Failure is quantitative and hence less subject to opinion.

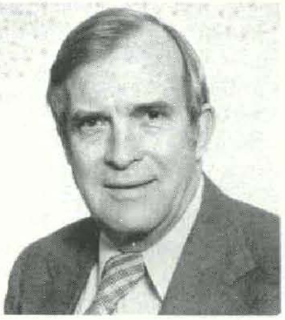
The statistical character of MTBF makes it less precise than meters, or volts, but confidence limits allow quantitative comparisons between two MTBFs. So, to obtain more objectivity in the user-developer disputes about field reliability, development MTBFs could be compared regularly to field MTBFs.

If the field users routinely record all failures and the operating time-to-failure and forward the information to the developer's reliability engineers for analysis, the field and development MTBFs could be calculated and compared.

In addition, the developer's engineers could analyze the field failures to identify the failure modes and the real cause of each failure. This information would be invaluable to the developer for determining where best to commit resources for product improvement efforts and design efforts on second generation equipment.

This recording of field failures is most important for newly fielded systems. EPRs (Equipment Performance Reports), already used in development testing, provide adequate data for reliability analysis, while EIRs (Equipment Improvement Reports) do not.

EIRs provide primarily logistic information. Routine collection of field failure data, for the first year or two of field operation, will bring accurate determination of failure causes, on-target product improvement efforts, and fewer unproductive disputes between the user and developer communities. Let's collect field reliability data, compare MTBFs and get the facts about equipment reliability.



GLENN M. STEWART JR., is a reliability engineer in the Product Assurance and Testing Directorate, U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA. Graduated from the U.S. Naval Academy with a BS degree in engineering, he served with the U.S. Navy during World War II. Prior to entering civil service with MERADCOM in 1971, he was involved in quality assurance activities with the electronics industry. He also is a MERADCOM representative in the Government/Industry Data Exchange Program.

M198 155MM Howitzer Production Line Nears Full Swing

The U.S. Army's Rock Island Arsenal, IL, has reported that its M198 155mm Howitzer production line is nearing full swing and that integration and assembly of the first howitzer should begin, as scheduled, in May.

A $40 million, 5-year contract, calling for production of 19 howitzers, 635 recoil mechanisms, and integration and assembly of 635 howitzers, marks the first time that Rock Island has been assigned responsibilities for "systems integration" of a major weapons system.

Roger Loewenstein, chief of Rock Island's Production Control Division, Operations Directorate, noted that chances of meeting the scheduled deadline are "very good," based on performance and progress studies of items which are manufactured in-house.

Stan Stone, RIA project manager for the M198, said that a new management control system has been initiated and includes a detailed schedule for every M198 part. Production plans indicate when each part should be produced and the data each shop ordered should be completed.

Developed by Rock Island Arsenal, the M198 howitzer is managed by the U.S. Army Materiel Development and Readiness Command project manager for Cannon Artillery Weapons Systems.

The M45 Recoil Mechanism is produced by Rock Island Arsenal, the M39 Carriage is produced by Consolidated Diesel Electric Co., the M199 Cannon is produced by Watervliet (NY) Arsenal, and fire control equipment is being provided by NUMAX Corp.

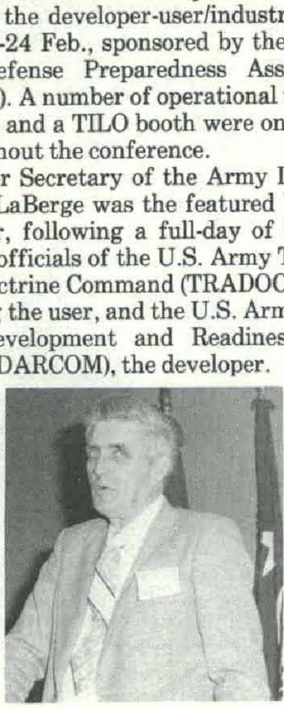
M198 155mm Howitzer

Conference on a New Product Line—Training Systems

Army requirements for training devices designed to simulate the complexity of current and future weapons systems and to sustain the pace of the soldiers who will use them, were presented to industry during a recent conference at Orlando, FL, home of the Office of the Project Manager for Training Devices (PM TRADE).

More than 320 Department of Defense officials and industrial representatives attended the developer-user/industry meeting, 23-24 Feb., sponsored by the American Defense Preparedness Association (ADPA). A number of operational training devices and a TILO booth were on display throughout the conference.

Under Secretary of the Army Dr. Walter B. LaBerge was the featured banquet speaker, following a full-day of briefing by top officials of the U.S. Army Training and Doctrine Command (TRADOC), representing the user, and the U.S. Army Materiel Development and Readiness Command (DARCOM), the developer.



Dr. Walter LaBerge

Dr. LaBerge's address on "The U.S. Army and NATO," covered our commitment to NATO, NATO's present strength relative to the Warsaw Pact nations, and ongoing initiatives aimed at increasing NATO's effectiveness against a background of negotiations aimed at reducing the scope of confrontation (the Strategic Arms Limitations Talks and the Mutual Balanced Force Reductions negotiations). Dr. LaBerge also discussed efforts to develop common plans, procedures and the adoption of compatible equipment within NATO and their impact on the economies of member nations.

MG John W. Seigle, deputy chief of staff for Training, TRADOC, discussed "The Army's Commitment to Training—Now and in the Future," following opening remarks by COL Joseph J. Leszczynski, PM TRADE, and welcoming remarks by Charles Becker, ADPA Florida Peninsula Chapter president. Carl Driskell, Office of the PM TRADE, introduced the speakers.

MG Seigle emphasized the need to break new ground on how we are going to train our soldiers to meet requirements of equipment in the next 5 to 7-year timeframe. In comparing the profiles of today's soldier and the soldier of the future, he noted that the challenge lies in training the soldier to win, while outnumbered, through high performance.

The General discussed the increase in job variety and proficiency of today's soldier and the complexity of training the soldier in either the classroom or the unit environment, because of the increasing range of our weapons and the limitations of space to realistically train the soldier.

COL Pete Cei, U.S. Army Combined Arms Training Developments Activity (CATRADA), challenged industry to come up with new training tools that can be used by commanders and their staffs to simulate battles in the field.

He went on to point out various war gaming simulations at platoon through corps levels that currently are in use or being developed to give the commander an appreciation of the forces that can be used against him. Among these are Dunn Kempf, Pegasus, CATTS, First Battle, War Eagle and CAMMS.

LTG Robert J. Baer

DARCOM Deputy Commander for Materiel Development LTG Robert J. Baer challenged industry to learn the Army's needs to apply their resources and to "build a better mousetrap," during a time when the requirement is no longer design to performance, but cost of ownership.

Multiple Integrated Laser Engagement System (MILES).

LTG Baer emphasized the need to capitalize on simulation in providing realistic cost effective training, because of the prohibitive cost of firing live missiles or training with tanks, aircraft, trucks and other equipment and fuels in short or costly supply. Among recent advances in realistic cost effective training, LTG Baer singled out the Multiple Integrated Laser Engagement System (MILES).

U.S. Army Logistics Center Commander MG Homer D. Smith provided an overview of Integrated Logistics Support (ILS)—A New Major Factor in Awarding Training Device Contracts.

He pointed out that, as modern training devices become more complex, their supportability and provisions for operations support costs become crucial. MILES, he said, is PM TRADE's first training system to incorporate a complete Logistics Support Analysis (LSA).

High technology training devices fielded worldwide require the same level of detailed ILS planning as major operational systems; there is growing recognition of the value of long-term contractor support maintenance.

DARCOM Assistant Deputy for Materiel Development John D. Blanchard, in expounding on Training Device Contracts; Winners vs Also-rans, stated that ". . . for each contract that is won, one (and possibly two) are lost because somebody failed to really give it their best in some simple fundamental detail area . . . ."

Most of the also-rans, he said, lost as a result of failure to apply the fundamentals of the contract business, i.e., ". . . that details are too important to be passed off to the 'detailists.' " In explaining some specific fundamentals, he pointed out that contractors basically should: read the solicitation and follow instructions; challenge and check each estimate; get an independent check on Reliability and Maintainability (R&M) inputs; standardize units, measurements and terms throughout the proposal; screen for duplication and eliminate; check subcontractors and associates' inputs; be sure of your addition; and don't be greedy. Competition is the name of the game.

He concluded by stating that "our whole purpose in being here is to earnestly solicit your (contractor) support to our commitment to provide the best possible training devices, and systems, available to the U.S. soldier in the field."

In leading off a series of PM TRADE presentations, the Army's Project Manager for Training Devices, COL Joseph J.

PM for TRADE COL and Mrs. Joseph J. Leszczynski at reception prior to banquet.

Leszczynski, explained that the real reason for this meeting is to "expand the competitive base" for training devices.

The colonel went on to explain PM TRADE's mission; PM TRADE's role as a DARCOM agent and how it interfaces with TRADOC and industry; where PM TRADE's money comes from, what it buys, and from whom.

In explaining the total PM TRADE effort, COL Leszczynski informed the group that PM TRADE will provide assistance to Army agencies requiring it in the development and procurement of training devices. This includes Army schools, project managers, boards, training aids centers, training centers, and other users of training devices in active Army, National Guard, and Reserve units.

Included among the services PM TRADE stands ready to provide are: cost and leadtime estimates for procurement or modification of training devices; training analyses and human factor studies directed at fulfilling training requirements using media or devices; and

Technical assistance in preparing training device requirements; research, development and procurement of training devices; assistance to systems developers in developing and procuring training devices; and logistics support for non-type-classified items.

Dr. Ronald C. Hofer, chief of the Systems Engineering Division, PM TRADE, followed with a presentation on Exploratory Development and Future Trends.

He informed industrial attendees that they are getting in on the ground floor when they undertake exploratory development, and that there is a need for technology transfer because of the large untapped potential in new training device technology.

Dr. Hofer went on to brief industry on the Army's exploratory development requirements in technology areas supporting engagement, visual, electronics, maintenance, and electro-mechanical simulation and announced the development of a Training Device Technology Data Base in support of these areas.

Speaking on training and human factors involved in meeting Army requirements, he emphasized to the industrial attendees the need to make training objectives more prominent in training device developments; promote and establish safety standards related to training device development, and to develop man-machine interfaces that enhance learning.

"Aviation Systems Simulation" was presented by LTC Truman Maynard, chief of the PM TRADE Aviation Division, in which he reviewed the history of the Synthetic Flight Training System (SFTS) representing a family of high-fidelity flight simulators that will provide aircrew training at the U.S. Army Aviation Center and at worldwide field locations.

He also reviewed the AH-1Q (Cobra) flight simulator which permits either independent pilot and gunner training or integrated crew training. Simulation extends to the firing of all weapons normally carried by the aircraft including the TOW missile, 2.75-inch rocket, and 20mm cannon.

An example of Computer Generated Imagery (CGI) was presented, showing the capabilities of the simulator to digitally store, compute and display total terrain scenes, representing flexibility, weapons effects, sensory imagery, and cost benefits not previously achievable.

LTC Maynard described the requirement for the AH-64 Combat Mission Simulator, describing it as, ". . . more than just a flight and weapons trainer, it is a device to teach tactical decision making. A device that presents an enemy threat and imposes battlefield stress on the attack helicopter crew." He envisioned a simulator that will permit "rehearsal for combat" and enable the combat crew to "fight the first week of the next war" in the simulator. This combat preparation should reduce the losses associated with the early stages of a conflict.

"Armor Related Devices," presented by LTC James K. Cooksey, chief of the PM TRADE Armor Related Devices Division, emphasized the need for simulation in tank crew training, in response to the problem created by training costs, training constraints, and constant proficiency required of tank crews.

LTC Cooksey reviewed some of the armor training devices now in use, and those required in the future to train commanders, drivers, gunners, and loaders, the critical skills needed to act as a team—while on the move.

As an example, he explained the Armor Remoted Target System (ARETS), which will be the standard armor target system consisting of both a full and a half-scale range, each of which will have pop-up and free-moving targets. In addition to a range control system, ARETS includes hit sensors, hit indicators, hostile fire simulators, and thermal signature equipment.

"Engagement Systems" was presented by LTC David Cours, chief of the PM TRADE Engagement Simulation Systems Division. LTC Cours described and demonstrated the Multiple Integrated Laser Engagement System (MILES), which employs the latest in eye-safe lasers and microelectronics to simulate the firing capabilities of rifles, machineguns, and other direct fire weapons.

MAJ Ron Carrne PM TRADE Office, and Al Vincent, Naval Equipment Training Center, discuss IRETS moving target prototype, among displays at conference.

Small battery-operated laser transmitters, which attach easily to conventional field weapons, allow ground troops to fire coded invisible laser pulses instead of live ammunition. Receiving detectors, located on opposing troops and vehicles, pick up the laser pulses and provide audio and visual indications of a hit or near miss.

LTC Cours also detailed engagement simulation needs for air defense and air-ground systems including mine warfare, tactical command and control training, laser guided weapons, and realistic battlefield environments.

MAJ Benjamin D. Blood, chief of PM TRADE Ground Systems Division, described the spectrum of ground system devices in development and their production requirements. Among these are the Infantry Remoted Target Systems (IRETS), the Observed Fire Trainer (OFT), and the Army Training Battle Simulation System.

MAJ(P) William Ostertag, chief of PM TRADE Instructional Systems Division, concluded the presentations with a display and description of the Training Extension Course (TEC) Program. TEC is designed to provide soldiers in the field with job-relevant, performance-oriented, self-paced instruction.

COL Leszczynski, PM TRADE, and Dr. J. J. Renier, vice president, Aerospace and Defense Group, Honeywell, Inc., moderated panel discussions following the presentations each day, which included answering questions submitted by industrial representatives on how industry can most effectively apply its resources in developing training devices and associated equipment to support the Army.

Selective Scanner . . .

The U.S. Army Armament Research and Development Command, Dover, NJ, has reported "steady progress" in development of a new direct fire antitank weapon system termed the Smart Target-Activated Fire and Forget (STAFF).

Representing a variation of the relatively new technology of the target-seeking unguided munition, STAFF combines mechanical scanning techniques with sensors to seek out and ultimately cripple or destroy located targets.

Designed primarily as a vehicle-mounted 155mm gun system, STAFF will also be developed as a dismounted recoilless unit with self-contained fire control. Components include a sustainer rocket motor, two self-forging fragment warheads and two sensors.

It is expected to be extremely fast and accurate with a rapid rate of fire against multiple targets. No guidance will be required after the projectile leaves the launcher. The 155mm launcher barrel is rifled to impart stabilizing spin to the projectile during flight.

The gunner aims directly at the target, while the fire control sets the gun at the correct quadrant elevation to permit the projectile to fly within 50 meters above the ground over the target.

Sensors are positioned 180 degrees apart and pointed 90 degrees from the direction of travel. Each sensor scans the ground for half of each revolution as the projectile flies over the target area. Warheads penetrate the top of the target with high kinetic energy slugs.

More than 30 personnel from ARRADCOM's Large Caliber Weapon Systems Laboratory and numerous employes from other ARRADCOM installations are assigned to the STAFF project. STAFF was conceived in 1976 and a project office to oversee development was established in 1977.

Now nearing the end of its conceptual design phase, STAFF is programed to begin concept demonstration testing in August. Advanced development tests could begin during FY 1979. The system is projected for field use by the mid-1980s.

AN/UGC-74 Project Achieves Major Milestone

A major milestone in the AN/UGC-74 Intelligent Communications Terminal Project, a new teletypewriter, has been reported by the U.S. Army Communications R&D Command, Fort Monmouth, NJ, following successful completion of final qualification tests.

Under development as part of the Army Tactical Communications System (ATACS), the AN/UGC-74 achieved a major milestone in that the production engineering redesign of the electronics and associated microprocessor software have been prototyped and debugged. The baseline design for first article and production equipment was also provided.

The final qualification tests were witnessed by representatives from the U.S. Marine Corps, the U.S. Army Human Engineering Laboratory, and the U.S. Army Training and Doctrine Command.

The next major milestone, programed for July, will be integrated contractor, Army Test and Evaluation Command, and CORADCOM testing of first article equipment.

Development of a new generation of teletypewriters, to replace the existing AN/PGC-1 and TT-98 models, was initiated during the late 1960s. However, the program was delayed until several concept questions could be resolved.

In 1975 these questions were resolved and a decision was made to convert from a proposed electromechanical device to an intelligent device with print memory and the ability to prompt for message format and permit composing and editing before transmission.

A second big change was a decision to go to a constant print speed of 600 words per minute, with the capability to transmit and receive at various speeds ranging from 60 to 1,200 words per minute. Transmitting and receiving procedures are independent from the print speed.

The improved UGC-74 is being designed for a Mean-Time-Before-Failure of 1,800 hours. Existing equipment provides a MTBF rate of only 20 hours. UGC-74 production is scheduled for November 1979, with fielding planned for early 1980.

RTL Awards Helicopter & RPV Technology Contracts

Contracts totaling in excess of $2.4 million were among those recently awarded by the U.S. Army Research and Technology Laboratories, AVRADCOM, Ames Research Center, Moffett Field, CA.

The largest single award went to RASA Division Systems Research Labs for $265,778 and Sikorsky Aircraft Division, VTC, for $296,885 to develop technology for the design of an aeroelastically conformable rotor. (See article on p. 8.)

A contract for $417,700 was awarded to Air Research Manufacturing Co., to design, fabricate, and conduct limited tests of a cooled, high-temperature radial turbine manufactured by a laminated approach. The long-term goal is to develop reliable, low-cost, high-performance, small gas-turbine engines for the Army.

Sikorsky Aircraft Division, VTC, also received contracts totaling $334,400 for identification and analyzation of troubleshooting problems, to design a dual hook external handling system for the Black Hawk; and investigations of advanced structure of such materials as fiberglass, graphite, boron, and Kevlar for aircraft.

Evaluation of the effect of service usage on composite main rotor blades was among the contracts awarded Boeing Vertol. Also awarded to Boeing were contracts to seek ways to minimize fuselage vibration, and to produce a detailed design and analysis of an improved external cargo handling system for the CH-47. These contracts totaled $120,500.

Bell Helicopter Textron received contract awards totaling $251,800, covering obstacle avoidance concepts, ballistic vulnerability reduction investigation, and design criteria to improve survivability from roll-over accidents.

Two contracts were awarded Hughes Helicopter for investigation of hub-pylon drag, and for development of methodology for designing composite joints and attachment fittings for helicopters. These totaled $605,500.

Remotely Piloted Vehicle technology efforts were awarded Developmental Sciences, Inc., to conduct design and test several techniques for automatic recovery of an "RPV" of 200 lbs. or less. The contract award was $66,200. Teledyne Ryan Aeronautical Co. received a $68,000 contract to study the state-of-the-art as it applies to launchers of remotely piloted vehicles in forward combat areas.

FY 79 RDA Budget

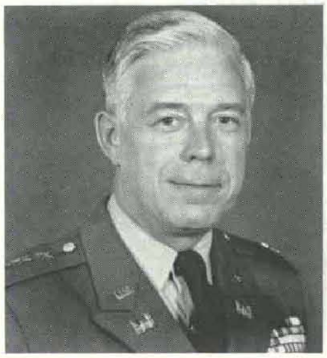
TABLE 1 *(Continued from page 7)*

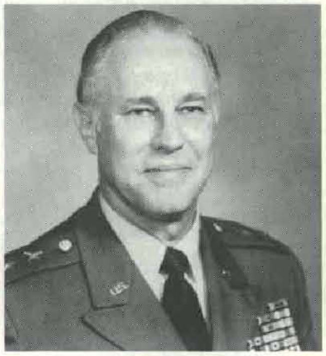
Systems	FY 79 Budget Request ($ in millions)	Capsule Summary of Work to be Performed
Kwajalein Missile Range	87.6	Support Air Force and Army strategic tests.
Hellfire	65.0	Complete qualification tests and prepare for operational tests. Provide missiles and launchers to AAH for integration and testing.
Physical Security	8.9	DT/OT II initiated on interior system. Integration of other services components into DoD system.
Chaparral	0.1	Complete smokeless motor program.
Roland	22.7	Complete OT/DT and conduct arctic and tropic tests. Begin initial production.
Improved Hawk	3.1	Develop ARM countermeasures and planning for HAWK-to-PATRIOT changes.
DIVAD Gun	75.7	Competitive development of pre-production prototypes.
Stinger	24.6	Thirteen test vehicle firings with POST seeker, engineering and planning.
Binary Munitions	1.8	Type classify 8-inch binary VX, conduct stability and shelf life studies.
Remotely Piloted Vehicles	24.2	Award ED contract for acquisition/designation/reconnaissance system. Work on night/adverse weather follow-on.
SOTAS	37.0	Continue ED and build four models for FY 80 test. Fabricate SOTAS/RPV data link.
Unattended Ground Sensors	8.9	DT/OT tests begin leading to production decision.
Infantry Fighting Vehicle	28.9	Complete contractor testing; begin Government testing. 6,000 miles on automotive test rig and begin OT II.

Total FY 79 RDTE budget request: 2721.4

Conferences & Symposia . . .

Army Holds 3d Worldwide Environmental Meet


LTG John W. Morris


MG William R. Wray

Effects of new legislation and current national environmental goals were considered by conferees at the Third Worldwide Army Environmental Conference, 27 Feb.-1 Mar., at Colorado Springs, CO.

More than 130 representatives from the Department of Defense, major Army commands and subcommands, and the U.S. Environmental Protection Agency listened to or participated in "high priority" discussions.

Assistant Chief of Engineers MG William R. Wray opened the meeting with a keynote address on programs and problems associated with the Army's pollution abatement efforts. He stated that more than a billion dollars may be placed in pollution abatement projects before the Army can consider itself in reasonable compliance with environmental legislation.

The Clean Water and Clean Air Acts of last year, he said, will impact on the Army to a greater degree than ever before, because they contain mandatory penalties for non-compliance. He noted that 46 Army installations have been listed by the EPA, in violation of these acts.

He stressed that the highest priority should be placed on attacking the problem of pollution control, and bringing Army facilities into compliance with regulations.

Despite the many existing problems, he indicated that the Army has compiled an impressive record, including funding of more than $400 million for execution of over 1,000 specific air and water pollution abatement projects.

More than 700 of these projects have been completed at a cost of nearly $200 million, and 110, costing about $150 million, are under construction, with many of them nearing completion, he said.

MG Wray added that the FY79 program will allow the Army to correct deficiencies at 22 installations and to bring 16 others into compliance with today's standards.

Factors which contributed to delays in meeting the new pollution stand-

(Continued on page 24)

(Continued from page 23)

ards, as identified by the Government Accounting Office, were reported by MG Wray. They are: lengthy decision processes concerning how to control emissions; prolonged project design phases; the energy crisis; technology; and unforeseen construction delays.

MG Wray called on all major Army commands to do a better job in the timely identification of pollution problems. "Once you've identified a problem," he said, "you've got to move out to identify a solution with the statutory compliance dates in mind."

The General emphasized that the Corps must provide high priority to the design and construction of current and future pollution abatement projects. Business as usual, he said, will *not* be an excuse when someone is hauled into court.

Chief of the U.S. Army Corps of Engineers LTG John W. Morris delivered a featured address on what the Corps is doing to attack pollution abatement problems. He listed the following actions:

- Establish an advisory committee to recommend solutions to current problems, and foresee and eliminate new problems.
- Insure that engineer districts utilize other Army resources such as the Army Environmental Hygiene Agency.
- Investigate the establishment of a project manager for pollution to help, on a mission funded basis, with project identification, criteria development, and act as a central clearinghouse for pollution abatement technology during design and construction phases.

Insure that engineer districts give high priority to design and construction of new projects, and accelerate the design construction of ongoing projects.

COL James G. Ton, deputy chief, Research and Development Office, Office, Chief of Engineers, presented one of several key speeches during a session devoted to "Environmental Quality Research."

He noted that the OCE R&D Office is the Army focal point for technology base in environmental quality R&D. He added that his office operates as if it were a directorate of Office of the Deputy Chief of Staff for Research, Development, and Acquisition.

COL Ton stated that the primary objective of the Environmental Quality Technology Program is to support the Army EQ goals through development of cost effective technology for pollution source reduction, control, and treatment.

He stressed that one of the recommendations, considered fundamental to the success of the EQ R&D Program and potentially to the entire Army program, is that the technical base R&D dollar address *real* Army problems, and that results of R&D efforts be factored into operational missions.

This philosophy of R&D, he said, necessitates user input during the program formulation process, during the research phase, during the technology transfer phase, and during later phases.

COL Ton pointed out that the current application of intensive user-developer coordination to non-materiel technical base R&D is primarily on an ad hoc basis, but is still pertinent to the EQ Program.

He stressed that the Army will always be behind the technology power curve unless it develops a formal long-range plan which shows, in some detail, how it intends to achieve compliance with pollution abatement mandates.

COL Ton concluded his comments by stating that his office is encouraging the Army's developing agencies to include users in their annual program formulation process, and to better identify research results so that more effective technology transfer can be accomplished.

Conferees also heard presentations on *The Environment and Defense—Where Are We Going?* by Deputy Assistant Secretary of Defense (Energy, Environment and Safety) George Marienthal; and *The Role of the Army Environmental Hygiene Agency in Project Design and Construction Process* by COL John A. Piercy, director of Environmental Quality, U.S. Army Environmental Hygiene Agency.

Research Requirements in Determining the Effects of Various Types of Military Training Upon Fragile Ecosystems was presented by Robert J. Davis, U.S. Department of Agriculture Water Quality Management Laboratory.

Other participants included: Bruce Hildebrand, deputy for Environmental Affairs, Office, Assistant Secretary of the Army (Civil Works); Donald Hemke, Office of the Army General Counsel; CPT Walter Jeffress, Office, Judge Advocate General, DA; Dr. Allen Hilsmeier, chief, Environmental Section, U.S. Army Chemical Systems Laboratory; James E. Treggasser, Environmental Office, HQ U.S. Army Materiel Development and Readiness Command; Lee Aikin, chief, Environmental Office, U.S. Army Training and Doctrine Command; and James J. Bickley, Army Environmental Office.

Awards . . .

Receives Second DECS . . .

ARI Technical Director Dr. Uhlaner Retires

One of the rarest honors for U.S. Government employes—a *second* Decoration for Exceptional Civilian Service—climaxed the federal executive career of Dr. Julius E. Uhlaner upon his retirement 1 Mar. as technical director, U.S. Army Research Institute for the Behavioral and Social Sciences, and chief psychologist, U.S. Army.

Presented by Army Deputy Chief of Staff for Personnel LTG DeWitt C. Smith Jr. during ceremonies held at HQ U.S. Army Materiel Development and Readiness Command in Alexandria, VA, the award came 14 months after former Vice President Nelson Rockefeller presented Dr. Uhlaner the Presidential Management Improvement Award.

LTG Smith cited Dr. Uhlaner's federal service role in "pioneering research" as a professional psychologist since 1941. He spoke of his "moral courage and integrity and his ability to keep his eyes perpetually on the horizon, no matter what the immediate crises."

Dr. Uhlaner also was presented a Letter of Appreciation from Secretary of the Army Clifford L. Alexander Jr. and a Certificate of Appreciation from Army Chief of Staff GEN Bernard W. Rogers. Secretary Alexander acclaimed Dr. Uhlaner for leadership and scientific accomplishments during his 35-year distinguished career.

Dr. Uhlaner has accepted a position as vice president of a California research organization. His successor had not been named at press time.

DR. JULIUS E. UHLANER receives his second Decoration for Exceptional Civilian Service, a Secretary of the Army letter, and a congratulatory handshake from Army Deputy Chief of Staff for Personnel LTG DeWitt C. Smith Jr.

Sedlak Promoted in DARCOM D&E Directorate

CERTIFICATE OF APPOINTMENT is presented to Edward M. Sedlak by DARCOM Commander GEN John R. Guthrie. Mrs. Sedlak looks on.

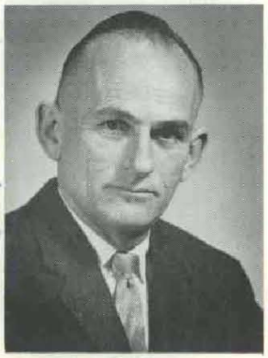
Edward M. Sedlak, a supervisory general engineer, HQ U.S. Army Materiel Development and Readiness Command, was recently appointed associate director for Systems Development in DARCOM's Development and Engineering Directorate.

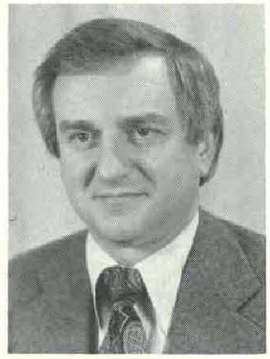
A Certificate of Appointment, presented by DARCOM Commander GEN John R. Guthrie, paid tribute to Sedlak's 28 years of scientific and engineering service to the government and expressed confidence in his potential for continued contributions to the Army's mission.

During the past two years Sedlak served an 8-month assignment as acting associate director for Systems Evaluation and Testing, and a 12 month assignment as the DARCOM focal point for Ground Laser Designators. Additionally, Sedlak has chaired committees tasked with assessing the General Support Rocket System, GRASSBLADE, and has participated in the Laser Weapon Systems Evaluation. He has also been a member of the Army's Advanced Concept Team since 1975.

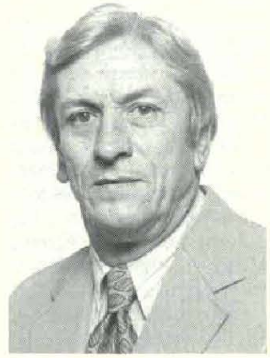
A 1976 recipient of the Department of the Army's Decoration for Exceptional Civilian Service, he holds a BS degree in electrical engineering from the University of Pittsburgh, and has completed the Resident Program for Executive Education at the Federal Executive Institute, and the Defense System Management School's Project Managers' Course.

4 DARCOM Employes Receive Meritorious Awards


Pete J. Rosano


William P. Morris


George W. Gross


Harry Kostiak

Four employes of the U.S. Army Materiel Development and Readiness Command are recent recipients of the Meritorious Civilian Service Award, Department of the Army's second highest honor for civilians.

Harry Kostiak, chief, Aircraft Systems Evaluation Branch, Air Warfare Division, U.S. Army Materiel Systems Analysis Activity, Aberdeen (MD) Proving Ground, received the MCSA for outstanding contributions to U.S. Army combat effectiveness.

He was cited specifically for achievements associated with development of effective and survivable aircraft systems within technical feasibility and funding constraints. Kostiak is a recognized expert in aircraft vulnerability and weapon systems.

A recipient of a 1966 Army R&D Achievement Award, Kostiak holds a BA degree in mathematics from Yale University, has authored or coauthored numerous technical publications, and served on several committees and high-level study groups.

Pete J. Rosano, a shop superintendent at the Sacramento Army Depot, Sacramento, CA, was recognized for outstanding achievements in directing operations of a highly complex maintenance activity during 1967-77. He was cited for formulating plans for expansion and realignment of maintenance shops and shop flows.

During FY70-71, Rosano participated in numerous meetings to develop plans and policies in preparation for SPEEDEX (System Wide Projects for Electronic Equipment for Depots, Extended).

George W. Gross Jr., chief, Facilities Division, U.S. Army Installations and Services Activity, Rock Island Arsenal, IL, was presented the MCSA for 1971-77 services. Included among his achievements was initiation of the automated Real Property Inventory, which has reportedly saved the government about $1 million.

Gross was also recognized for government improvements which resulted in savings valued at $291 million; for his efforts in modernizing facility engineers equipment fleets; and for achievements associated with DARCOM's land use program.

Federally employed for 25 years, Gross has a BS degree in civil engineering from Iowa State University, an MA degree in business administration from the State University of Iowa, and is a registered professional engineer in five states.

William P. Morris, deputy director for Maintenance, Tobyhanna Army Depot, PA, was cited for improving and directing a large, complex production facility which employs 2,000 military and civilian personnel, and for leadership in the use of automated test systems.

Morris is a recognized leader in the Army Maintenance Program, and earned an appointment to the Department of the Army's Automatic Test Equipment Language Standardization Committee. He holds a BS degree from the University of Scranton, PA, where he has also received several graduate credits in business administration.

Roberts Wins Ballistic Lab's Zornig Award


Patricia Roberts

Patricia (Pat) Roberts, chief of the Administrative Support Division, U.S. Army Ballistic Research Laboratory, Aberdeen (MD) Proving Ground, was recently presented BRL's 1977 Zornig Award.

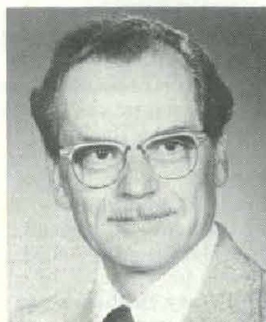
Federally employed for 25 years, Roberts was specifically cited for administrative and fiscal management support, and for competence in providing information for laboratory personnel involved in annual and long-range programs.

BRL Director Dr. Robert J. Eichelberger presented the award, one of the two highest offered annually by the laboratory, along with a gold lapel pin and a plaque bearing the names of former recipients.

Established in 1959, the award honors COL H. H. Zornig, who was largely responsible for organizing BRL in 1939 and was director until 1941. The award recognizes outstanding achievement in technical, administrative, mechanical, and other related fields.

BG David Einsel, deputy commander of the Army Armament Research and Development Command, and COL Robert M. Gomez, BRL's deputy commander, spoke at this year's award ceremonies.

ERADCOM's Dr. Hafner Elected as IEEE Fellow


Dr. Erich Hafner

Dr. Erich Hafner of the U.S. Army Electronics R&D Command recently earned distinction as the sole Department of the Army employe to be elected as a Fellow of the Institute of Electrical and Electronics Engineers for 1978.

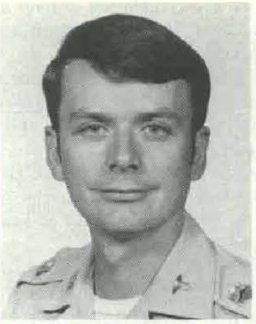
Assigned to ERADCOM's Electronics Technology and Devices Laboratory, he was cited by the IEEE for contributions to the improvement of piezoelectric crystals and frequency control devices.

Dr. Hafner has served as general chairman and technical program committee chairman of IEEE's Frequency Control Symposium for the past three years, and is a member of the American Physical Society, and the New York Academy of Sciences.

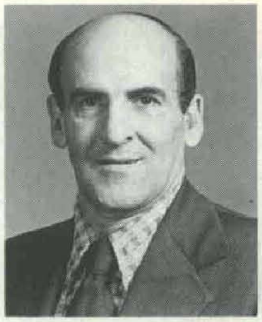
He has published more than 30 technical papers, holds numerous patents, and holds a PhD in physics and mathematics from the University of Graz (Austria), where he was a research assistant in the Department of Theoretical Physics.

Dr. Hafner is currently conducting research on frequency control devices for use in advanced communication and position location systems. His earlier work involved in-depth studies of quartz crystal resonators, precision oscillators, and atomic and molecular frequency standards.

LTC John M. Santoro

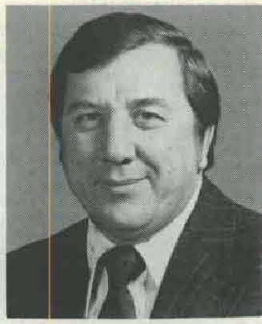


CPT Gary D. Morical

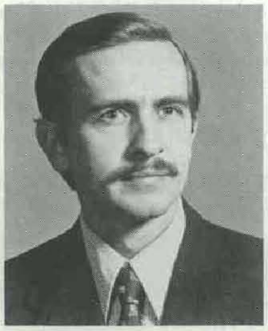


Philip J. Quatrochi

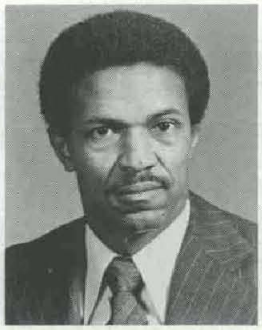
Thomas R. Slack



Andrew Zaycer

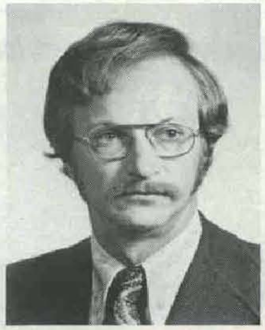


Colin B. Piper

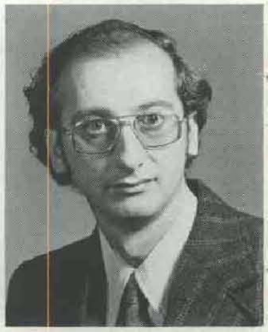


Curtis J. Anderson

Wahling H. Ng



Douglas A. Morlock



Peter C. Bonnett

Outstanding Achievements Cited . . .
FY76 Materiel Acquisition Awards Presented

Two individuals and an 8-man team have been selected as winners of the FY 1976 Secretary of the Army's Award for Outstanding Achievement in Materiel Acquisition.

A silver medallion and a miniaturized lapel pin, depicting the first Secretary of War Henry Knox, are presented annually to a maximum of 10 personnel (military or civilian) in recognition of 12 months of competitive effort in a high-priority program.

Consideration is based on the complexity of a specific problem; the degree of initiative and originality displayed in solving it; the relative significance of the accomplishment in light of the mission of the activity; the potential for direct application or adoption of the contribution by other activities; and the degree of improvement in the management of the program. The new honorees are:

LTC John M. Santoro, former project engineer, Tactical Terminals Division, U.S. Army Satellite Communications Agency, Fort Monmouth, NJ, was cited for exceptional technical direction and materiel acquisition management of a test bed multi-terminal ground-based satellite communication system.

"Through his resourceful leadership," the citation states, "crucial command communications were provided for a highly critical defense system in the European Theater." Improved reliability and operational flexibility are provided by the new system.

Commissioned in the U.S. Army from the Reserve Officer Training Corps, LTC Santoro has a BS degree from St. Peter's College, has completed the Army Command and General Staff College, the National Security Management Course, and has served assignments in Germany, Vietnam, and Turkey.

CPT Gary D. Morical, an administrator in the Department of Obstetrics and Gynecology, Tripler Army Medical Center, HI, received recognition for outstanding achievements which resulted in discovery of a practical method for military dental activities to obtain commercial dental gold alloy at significant monetary savings to the government.

The new method is credited with simplifying and improving the management of operations and procedures of a disciplined supply usage. Substantial savings were achieved by the U.S. Army Regional Dental Activity system.

Commissioned in 1969, CPT Morical holds a BS degree in pre-dental studies from the University of Idaho, and has completed requirements of the AMEDD Officers Advanced and Basic Courses, the patient administration course, and the battalion surgeon assistance course. Included among his earlier assignments were battalion surgeon assistant, Panama, CZ; chief, Drug Survey Team, Vietnam; and Regional Dental Activity, Alameda, CA.

Philip J. Quatrochi, Colin B. Piper, Andrew Zaycer, Curtis J. Anderson, Peter C. Bonnett, and **Thomas R. Slack,** employes of the Army Armament R&D Command, Dover, NJ, and **Douglas A. Morlock,** and **Wahling H. Ng** of the Office, Project Manager for Munitions Production Base Modernization and Expansion, were cited for concept development, engineering design, and demonstration of the Automated Continuous Melt-Pour Process for pumping and pouring molten explosives.

"The new process," the citation states, "is by far the most advanced of its kind, incorporates higher processing rates with lower concentrations of explosives, improves safety aspects, and reduces operating costs."

Quatrochi has been a Department of the Army employe for more than 20 years, has a BS degree in chemical engineering from the University of Missouri School of Mines and Metallurgy, and was a 1976 recipient of a Picatinny Arsenal R&D Achievement Award.

Piper has 12 years of Department of the Army civilian service, holds a BS degree in mechanical engineering from Newark College of Engineering, and received a 1976 Picatinny Arsenal R&D Achievement Award. He has published numerous technical reports.

Zaycer is a former recipient of a Picatinny Arsenal R&D Achievement Award, and two Sustained Superior Performance Awards. He has been employed by the Department of the Army for 17 years and has completed requirements of the Basic Guided Missile Ammunition Course.

Anderson earned a 1961 BS degree in mechanical engineering from Prairie View A&M University, received a Picatinny R&D Achievement Award in 1976, has authored several technical articles, and has been an Army civilian employe for more than 15 years.

Bonnett graduated with a BS degree in chemical engineering from the University of Maine, has eight years of civilian Army service, is a Picatinny R&D Achievement Award winner, and has attended the Stevens Institute of Technology.

Slack has served as a Department of the Army employe for more than 20 years, and is a recipient of a Sustained Superior Performance Award and two Special Act or Service Awards. He has attended the Newark College of Engineering, and has authorized a number of articles.

Morlock is backed by 13 years of Army civilian service, and holds a BS degree in electrical engineering from the Newark College of Engineering and an MS degree in computer information and control engineering from the University of Michigan. He has authored several reports and has a 1973 patent.

Ng has been an Army civilian employe for more than 10 years, and holds a BS degree from the Indiana Institute of Technology and a master's degree from New York University, both in chemical engineering. He was a 1976 recipient of a Picatinny R&D Achievement Award.

Personnel Actions . . .

Ross Commands I Corps (ROK/U.S.) Group

Commander, I Corps (Republic of Korea/United States) Group is the new title of LTG Marion C. Ross, following an assignment as assistant deputy chief of staff for Operations and Plans, Office, Deputy Chief of Staff for Operations and Plans, Washington, DC.

LTG Marion C. Ross

Graduated from the U.S. Military Academy with a BS degree in military science, LTG Ross has an MS degree in international affairs from George Washington University. He has completed requirements at the Command and General Staff College, Army War College, Armed Forces Staff College, the Ground General School (basic course), and the Infantry School (advanced courses).

Listed among his earlier duty tours are commander, 7th Infantry Division and Fort Ord, CA; commander, U.S. Army Training Center, Fort Ord; and director, Human Resources Development, Office, Department of the Army, Washington, DC.

Other key assignments have included deputy director of Operations, Office, Deputy Chief of Staff for Military Operations, DA; assistant division commander, 101st Airborne Division (Airmobile), Fort Campbell, KY; deputy commander, U.S. Army Training Center, Fort Campbell; and commander, 3d Brigade, 4th Infantry Div. (Mechanized), Fort Carson, CO.

LTG Ross is a recipient of the Silver Star, Legion of Merit with two Oak Leaf Clusters (OLC), Distinguished Flying Cross, Bronze Star Medal with "V" device and two OLC, Meritorious Service Medal, Air Medals with "V" device, Joint Service Commendation Medal, Army Commendation Medal, and the Purple Heart.

Graves Directs Security Assistance Agency

Recent assignment of LTG Ernest Graves Jr. as director of the Defense Security Assistance Agency, Washington, DC, followed a 7-month tour of duty as deputy Chief of Engineers in the Office, Chief of Engineers.

LTG Ernest Graves Jr.

LTG Graves also served with OCE from 1975-77 as director of Civil Works, after completing a 2-year assignment as director of Military Application with the U.S. Energy R&D Administration (redesignated from assistant general manager, Military Application), Atomic Energy Commission, Germantown, MD.

During 1970-73 he was division engineer, U.S. Army Engineer Division, North Central, Chicago, IL. He has served also as president, Air Defense Evaluation Board, Office, Assistant Chief of Staff for Force Development, Department of the Army.

LTG Graves graduated from the U.S. Military Academy with a BS degree in military art and engineering, and from Massachusetts Institute of Technology with a PhD degree in physics. He has also completed the Army Command and General Staff College, Army War College, and the Engineer School (basic and advanced courses).

Included among his military decorations are the Distinguished Service Medal, Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal, Air Medals, and the Army Commendation Medal with three OLC.

Zeiberg Chosen as Deputy Under Secretary (S&SS)

Responsibilities for research, engineering development, and acquisition of strategic weapons and military space systems have been assumed by Dr. Seymour L. Zeiberg, following his appointment as Deputy Under Secretary of Defense for Strategic and Space Systems in the Office, Under Secretary of Defense for Research and Engineering.

Formerly employed as associate general manager of Advanced Programs Division, Aerospace Corp., El Segundo, CA, Dr. Zeiberg has a bachelor's degree from the City College of New York, and a master's degree from New York University, both in mechanical engineering.

During 1972-77 he was program office director for Strategic Studies, R&D Associates, Marina Del Ray, CA, where he was responsible for a wide range of efforts, including system synthesis and design, performance evaluation, intelligence analysis, and threat assessments.

While affiliated with Aerospace Corp., San Bernardino, CA, from 1965-72, he was involved with the Advanced Ballistic Reentry Systems Program and was credited with major contributions in the development of penetration aids, and technologies associated with small ballistic and maneuvering reentry vehicles.

He conducted theoretical research in reentry vehicle flow field phenomena, chemically reacting flows and numerical solutions of viscous flow equations during employment with General Applied Science Laboratories, Westbury, NY, from 1962-65.

Dr. Seymour L. Zeiberg

Listed in *Who's Who in the West* and *American Men of Science*, Dr. Zeiberg is a member of the American Society of Mechanical Engineers, American Institute of Aeronautics and Astronautics, and Tau Beta Pi and Pi Tau Sigma honorary engineering societies. He is also a recipient of the U.S. Air Force Systems Command Certificate of Merit.

Baker Commands Walter Reed Army Medical Center

MG Ivan Baker, deputy commander of Walter Reed Army Medical Center, Washington, DC, since 1975, took over in March as WRAMC commander.

During 1969-75 MG Baker served as chief of Orthopedic Service, WRAMC, and during 1968 was assistant chief of Orthopedic Service in Walter Reed's Department of Surgery. He holds a BA degree in mathematics from Syracuse University, and his M.D. from the State University of New York.

His military schooling includes the Army Medical Service Company Officer Course, the Army Command and General Staff College, Army War College, and the U.S. Air Force School of Aerospace Medicine.

MG Baker wears the Legion of Merit, Air Medal w/Oak Leaf Cluster, Army Commendation Medal w/OLC, and Senior Flight Surgeon Badge.

McKinley Picked as MIRADCOM Tech Director

Charles H. McKinley, former director of Land Warfare in the Office, Under Secretary of Defense for Research and Engineering has succeeded Dr. John L. McDaniel as technical director, U.S. Army Missile R&D Command, Redstone Arsenal, AL.

Charles H. McKinley

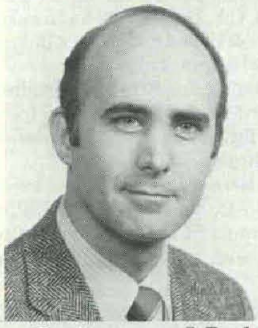
McKinley's new assignment includes responsibilities for MIRADCOM's research programs, the command's three major laboratories (Technology, Engineering, and High Energy Laser) and the Advanced Systems Concepts Office.

He served briefly during 1975 as deputy for Air and Missile Defense in the Office of the Assistant Secretary of the Army for R&D, and was a project engineer and manager at Vought Missiles and Space Co. from 1970-75.

Listed among his earlier career assignments are: senior staff engineer, Martin Marietta; lead aerodynamics design engineer, LTV Corp.; and Autonetics Division, Rockwell International.

McKinley's academic credentials include a BS degree in engineering from Texas A&M, and master's degrees in aerospace engineering from the University of Southern California, and in engineering administration from southern Methodist University. He has also done graduate work at the University of Texas.

Puckett Takes Over as BRL Assistant Director


Dr. Lawrence J. Puckett

Dr. Lawrence J. Puckett, a research physicist at the U.S. Army's Ballistic Research Laboratory, Aberdeen (MD) Proving Ground, was recently appointed as BRL assistant director.

Prior to his appointment, Dr. Puckett coordinated BRL's Air Defense Systems Programs. His new title carries responsibilities associated with planning, developing, and evaluating BRL technical programs. He will also oversee the BRL Independent Research Program, and serve on ARRADCOM's Engineering and Process Review Panel.

His academic credentials include a BS degree in physics from Virginia Military Institute, and master's and PhD degrees from the Georgia Institute of Technology. He began his federal service career in 1968 when he assumed direction of BRL's stationary airflow facility.

In 1970 he received a 1-year appointment as assistant to the BRL director, serving as technical adviser and liaison scientist for research projects and programs. He was reassigned to BRL's Concepts Analysis Laboratory in 1971, and was then appointed as coordinator for BRL's Automatic Cannon Program.

Dr. Puckett has authored or coauthored more than two dozen publications, holds three U.S. Patents, and has served on or chaired more than a dozen technical committees and panels.

Additionally, he was elected a BRL Fellow in 1965 and served as executive secretary in 1976. His professional affiliations include Sigma Xi (Scientific Research Society of North America), American Physical Society, and the American Society of Mass Spectrometry.

Benoit Becomes AMMRC Commander, Director


COL William R. Benoit

Commander/deputy director, U.S. Army Materials and Mechanics Research Center, Watertown, MA, is the new title of COL William R. Benoit, followng service as deputy director of Procurement and Production, U.S. Army Troop Support and Aviation Materiel Readiness Command, St. Louis, MO.

Graduated with a bachelor's degree in mathematics from the University of Nebraska, COL Benoit has completed requirements at the Army Command and General Staff College, Army Flight School, Navy Test Pilot School, and is a distinguished graduate of the Defense Systems Management School.

Listed among his earlier assignments are commander, 67th Maintenance Battalion, Fort Benning, GA; aide-de-camp to the deputy commander, Eighth U.S. Army, Korea; a combat tour in Vietnam; and commander of the Staff and Faculty Battalion, Transportation School, Fort Eustis, VA.

COL Benoit is a recipient of the Bronze Star Medal (two awards), Meritorious Service Medal (two awards), the Distinguished Flying Cross, and the Master Army Aviator award.

Reeves Named Huntsville Deputy Engineer

COL Donald W. Reeves recently assumed new duties as deputy division engineer, Huntsville, AL, following service as deputy director of the Defense Mapping Agency Topographic Center.

Following graduation from the University of Illinois with a BS degree in civil engineering in 1956, COL Reeves served briefly as a structural designer in private industry, before entering military service as an engineer officer at Fort Belvoir, VA.

He has an MS degree in geodetic science from Ohio State University, and is a graduate of the Army Command and General Staff College, the Marine Corps Command and Staff College, Army War College, and the Engineer Officer Basic and Advanced Courses.

Listed among his earlier tours of duty are the 547th Engineer Battalion, Germany; 11th Engineer Battalion, Korea; U.S. Army Engineer Command, Vietnam, and professor of Earth, Space and Graphic Sciences, U.S. Military Academy.

COL Reeves is a recipient of the Legion of Merit, Meritorious Service Medal with two Oak Leaf Clusters, and the Army Commendation Medal.

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on . . .

Army Research Office Alters Divisional Structure

Management improvement realignments in the U.S. Army Research Office (USARO) provide for establishment of a new Office of the Director of Army Technical Information as one of its major elements.

The Research Support Division, the only one of the original six divisions that had retained its name unchanged since USARO was established on Mar. 24, 1958, was abolished. Minus three of its former branches, it was redesignated the Scientific and Technical Information (STI) Division, with three new branches.

Functions of the overseas Research Branch, which was abolished, and the Research Contracts and Grants (RC&G) Branch were transferred from the Research Support Division to the Research Programs Office (RPO), which now includes the RC&G Branch and a Programs Branch.

The STI Division includes a new Referral Branch, a new Special Activities Branch, and a new Publications Branch. The Scientific Information Branch was abolished and its functions absorbed mainly in the Office of the Director of Army Technical Information.

Environmental Sciences (ES) Division changes abolished the Polar and Arctic Branch and the Tropics and Desert Branch. The Geophysical Sciences Branch remains intact and supplements the new Regional Branch and a new Special Proejcts Branch.

The Research Planning (RP) Division was abolished and its operations research function assigned to a redesignated Human Factors and Operations Research Division (formerly Human Factors Division). The technical forecasting function was assigned to the recently established Advanced Technology Group. Plans, planning actions, and research planning methodology functions of the RP Division are now the responsibility of a new Research Plans Office.

Completely unaffected by the organizational changes are the Life Sciences and the Physical Sciences Divisions.

DoD Creates Technical Data Control Council

Formation of a Department of Defense Council on Technical Data and Information, with broad powers to coordinate and control expenditures estimated at about $2 billion annually, was announced recently.

Deputy Director of Defense Cyrus R. Vance directed a memorandum to Secretaries of the Army, Navy and Air Force, the Assistant Secretaries of Defense, and the Directors of Defense Research and Engineering and the Defense Supply Agency.

The Council's task is to unify and integrate the overall DoD effort, that is, 1) to approve all principal projects; 2) to initiate or terminate projects; 3) to review the progress and results of this work; 4) to recommend manpowers and financial requirements in accordance with procedures prescribed by the Assistant Secretary of Defense (Manpower) and the ASD (Comptroller), respectively; 5) to recommend organizational structure changes; and 6) to formulate policies for promulgation through DoD directives and instructions, and revisions to the Armed Services Procurement Regulation (ASPR).

Deputy Director of Defense Vance stated that significant progress has been made in improving DoD practices in acquiring, utilizing and disseminating scientific reports, development and test reports, drawings, standards, specifications, manuals and other technical information.

Program Seeks Use of Technical Societies in Research

An exploratory program focused on better use of national technical societies and associations for information and guidance in research is underway by joint effort of the U.S. Army Materiel Command and the Army Research Office.

One approach considered promising is extension of the "military theme" plan that enables societies to suggest specific areas where research may pay off in strengthening industrial capabilities linked to defense needs.

Under consideration also is a method that would call upon industrial organizations, through employes affiliated with the technical societies, to ensure that the state-of-the-art with respect to projects is completely reviewed. This purpose would be served by having individual organizations divulge, on a confidential basis, research near payoff and unpublished.

A third method of dealing with the problem would acquaint the designer with "on-the-shelf" developments considered important to investigate. The societies could designate specific companies which have developed unusual components or production processes. Army scientists and engineers in in-house R&D facilities then could visit the companies when necessary to "trigger new design concepts."

THE NEW TITLE

With this issue the title of the magazine has been officially changed to reflect altered conditions since the publication's inception in 1960.

The structure of the Office of the Secretary of Defense and that of the Secretary of the Army have recently been realigned to reflect the expanded responsibility of the research and development manager, to include the function of materiel acquisition.

The new concept has been evolving over the past decade, wherein there was a growing awareness of the need to consider not just research and development as a separate entity, but to regard the full aspect of a potential system as an entity. It is no longer simply the technical feasibility and the successful development that concerns the R&D community, but producibility, useability, and affordability must be equally considered and dealt with.

These reasons then, reflect to a large measure, the purposes behind the redesignation of the former Director of Defense Research and Engineering to the Under Secretary of Defense for Research and Engineering, and the restructuring within the Army Secretariat of the new Assistant Secretary for Research, Development, and Acquisition.

Similarly, the Department of the Army Staff was reorganized in 1974 to provide for the disestablishment of the former Office of the Chief of Research and Development and the creation of the new agency, the Office of the Deputy Chief of Staff for Research, Development, and Acquisition.

While Headquarters, U.S. Army Materiel Development and Readiness Command seemingly reflects a sharp division with its two Deputy Commanding Generals for Materiel Development and for Readiness, the fact is that the Deputy CG for Materiel Development does have a major acquisition responsibility. Even in the major DARCOM subordinate commands where separate and distinct R&D and Readiness commands exist, one finds that full responsibility for acquisition and deployment of a new system rests with the R&D command.

The Deputy Chief of Staff for Research, Development, and Acquisition has recently been designated as the DA Staff Proponent for Specialities 51 and 97. The Deputy Chief of Staff for Operations and Plans is the DA Staff Proponent for SC 52 (Current breakouts of enrollment in these programs are shown in Table 1).

This magazine has been given the mission to assist in this effort, and it is toward that end that we will devote our efforts. The magazine has played a significant role in the past toward the R&D community. We will now direct our efforts toward the wider base.

Since the directed reduction of 1973 from a monthly to a bi-monthly basis, the use of the word "news" in newsmagazine is no longer believed appropriate and was therefore dropped from the revised title.

The mission statement of the magazine, as it is carried on the masthead of each issue, now reflects the revised goal.

To assist the staff in carrying out the new mission, tear-out, self-mailing reader survey cards have been included in this issue of the RDA Magazine. Readers are urged to complete a card and return it to the magazine. Readers are also urged to communicate with us freely as to their views on the magazine's operations and content. Our autovon number is 284-9586.

TABLE 1

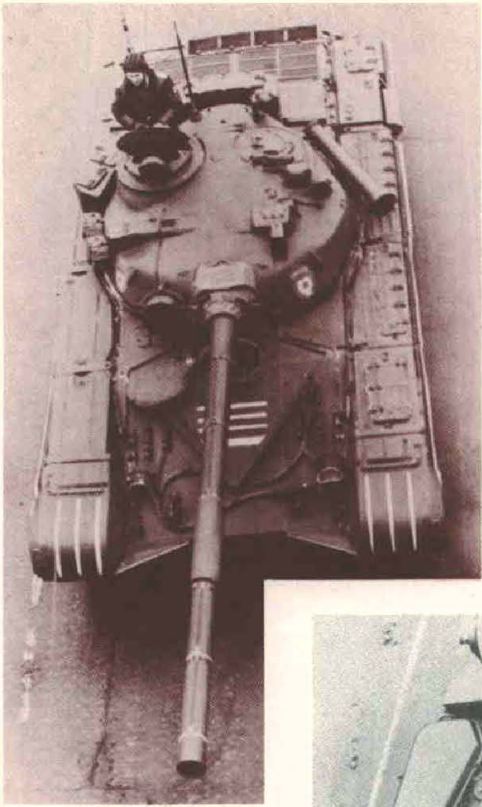
Officers Designated With Primary or Aternate Specialty of:

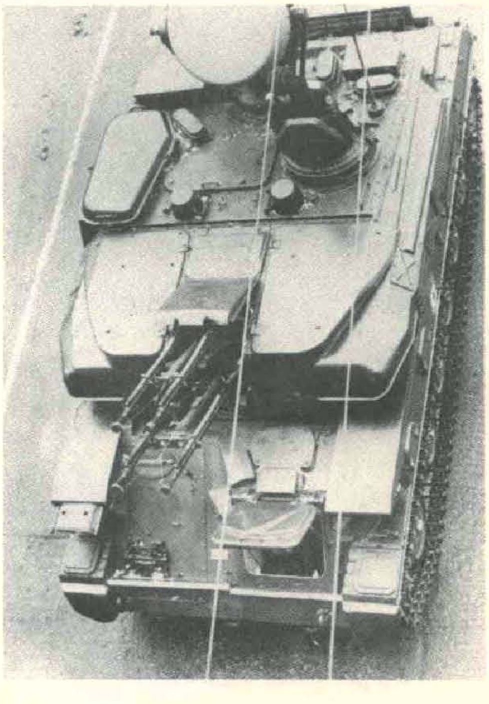
	GRADE				
	COL	*LTC*	*MAJ*	*CPT*	*LT*
R&D (SC 51)	415	878	1023	913	3
Atomic Energy (SC 52)	88	134	160	88	1
Procurement (SC 97)	113	345	447	469	4

NOTE: Officers have two specialties; therefore, not all of these officers are available for assignment in SC 51/52/97. Availability for utilization in SC 51/52/97 depends upon other Army requirements.

Red Square Parade

(See Centerspread)





Overhead view of T–72 (above), and ZSU–23–4