ARMY R,D&A

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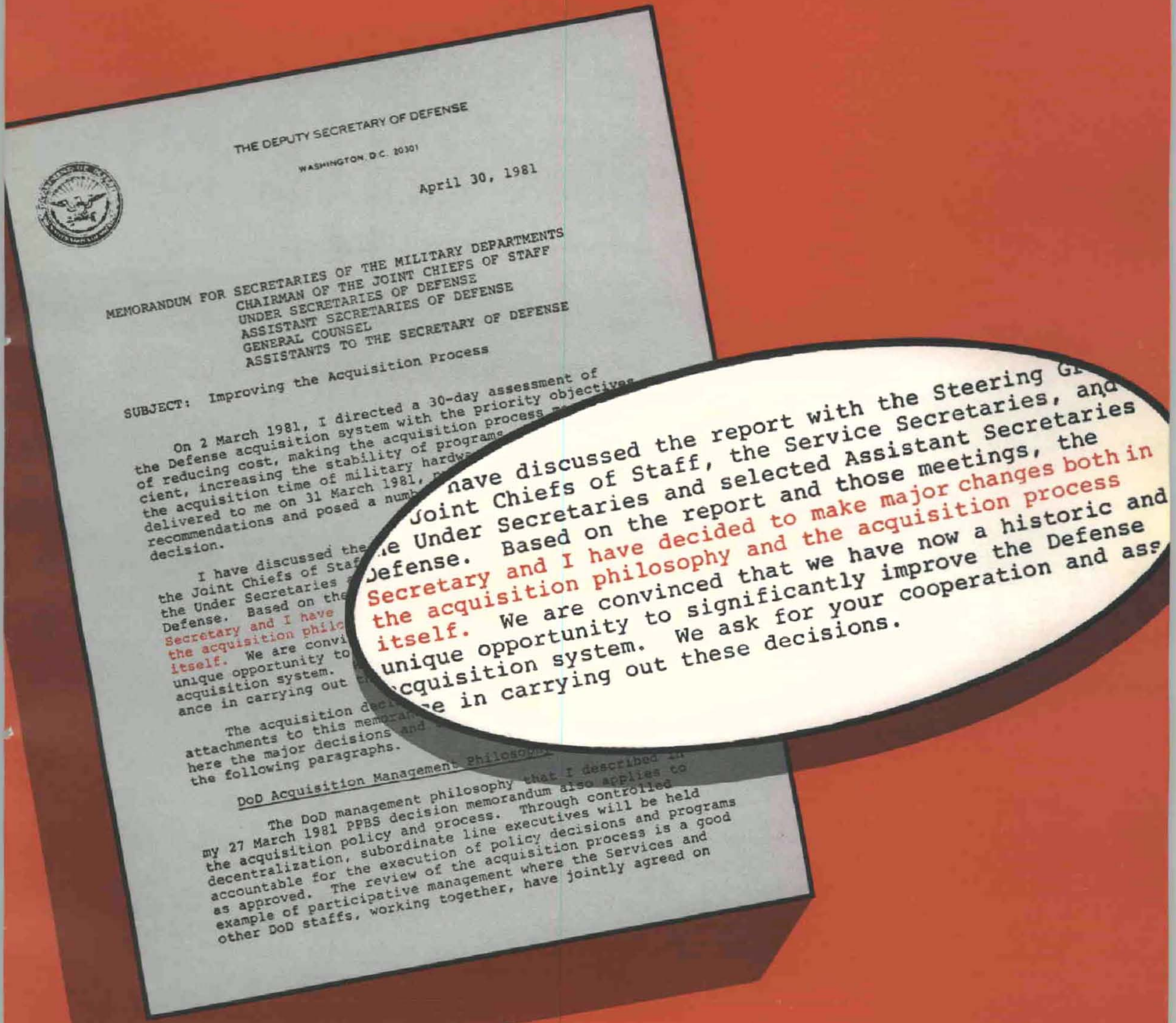
JULY - AUGUST 1981



ARMY R,D&A

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ABOUT THE COVER:

An extract from a recent memorandum by Deputy Secretary of Defense Frank C. Carlucci sets the tone of this month's issue which is devoted to "cost control" and "improvements in the Defense acquisition process."

FEATURES

DEPARTMENTS

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

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Decisions Made on 31 Recommendations to Reduce Costs . . . DOD To Improve Management Principles, Acquisition Process

Secretary of Defense Caspar W. Weinberger has announced that decisions have been made on 31 recommendations and issues to reduce costs and improve the acquisition process throughout the Department of Defense. He also announced a charter of acquisition management principles.

In a memorandum to DOD officials, Deputy Secretary of Defense Frank C. Carlucci said recommendations made for improving the acquisition process indicated a need "to make changes both in the acquisition philosophy and the acquisition process itself. We are convinced that we have now a historic and unique opportunity to significantly improve the Defense acquisition system."

Carlucci emphasized that the primary objectives in streamlining the DOD acquisition process are reducing costs and shortening the acquisition time. "The Secretary and I are determined to reduce substantially cost overruns, deploy adequate quantities of needed systems that are operationally effective and ready, and do this in the shortest possible time," Carlucci stated.

Mr. Carlucci pointed out "while DOD should be tough in contract negotiations as part of the buyer-seller relationship, this does not mean that relationships between management and industry should necessarily be adversarial. Industry and government have a shared responsibility and must assume a new spirit of cooperation. A healthy, innovative, and competitive industrial capability is a primary national objective. I direct all top DOD management, in the Office of the Secretary of Defense, Joint Chiefs of Staff, and in the Services, to ensure this is understood at all levels."

The following are the Department of Defense acquisition management principles:

- To improve long-range planning to enhance acquisition program stability.

- Both OSD and the Services must delegate more responsibility, authority and accountability for programs; in particular, the Service program manager should have the responsibility, authority and resources adequate to execute efficiently the program for which he is responsible.

- To examine evolutionary alternatives which use a lower risk approach to technology than solutions at the frontier of technology.

- To achieve more economic rates of production.

- We must realistically cost, budget, and fully fund in the Five Year Defense Plan, and Extended Planning Annex, procurement, logistics and manpower for major acquisition programs.

- Readiness and sustainability of deployed weapons are primary objectives and must be considered from the start of weapon system programs.

- A strong industrial base is necessary for a strong defense. The proper arms-length relationships with industry should not be interpreted by DOD or industry as adversarial.

Major decisions for improving the acquisition process call for reduced acquisition costs, reduced acquisition times, improved weapons support and readiness, and an improved Defense Acquisition Review Council process. The following are steps for reducing acquisition costs:

- Increase program stability by fully funding R & D and procurement at levels sufficient to ensure efficient cost, supportability and schedule performance, and minimizing changes to the approved program.

- Implement multi-year procurement to improve production processes, increase economy-of-scale lot buying, decrease financial borrowing costs and reduce administrative burden in contracting.

- Reduce administrative costs by simplifying procedures, seeking relief from costly legislative requirements and reducing the number of DOD regulations and directives.

- Encourage capital investment to increase productivity in the defense industry by improved contracting, more reasonable risk sharing, and increased incentives.

- Promote Services use of economic production rates to reduce unit costs and decrease acquisition time.

- Require Services to budget to most likely cost to reduce overruns and provide stability.

Shorter acquisition times will be achieved by preplanned product improvement to reduce unit costs and decrease acquisition time, and by adequate "front end" funding for test hardware.

Improved weapons support and readiness will be aided by stressing acquisition strategies that provide incentives to contractors to attain reliability and maintainability goals, and by establishing readiness objectives early in development programs.

The Defense Acquisition Review Council (DSARC) Process will be improved by moving toward controlled decentralization of the acquisition process to the Services, reducing the data and briefings required by the Services and other DOD staffs, and by tying the acquisition process more closely to the PPBS.

In his memorandum, Deputy Secretary of Defense Carlucci directed the Services and the DOD staffs to insure that these decisions be implemented. He assigned overall responsibility to the Under Secretary of Defense for Research and Engineering and Acquisition for monitoring and follow up of all decisions with the sustained top level involvement of the Services and the DOD staff.

DARCOM's New Program and Cost Control System

By Roy D. Greene

"Costs are out of control" was the comment GEN John R. Guthrie, DARCOM commander, told a formal meeting a year ago. But today HQ DARCOM may have the mechanism close at hand to allow the DARCOM commander to be able to soon say "costs are under control!"

As a result of senior Army-level managerial concern over the pattern of rising program costs, above what can be considered inflation-related, HQ DARCOM is finalizing its new Program and Cost Control System (PCCS). Current systems for reporting program status were found to be fragmentary with no way to provide early identification of program decision alternatives and trends. Baselines were found to be numerous but not stabilized, nor was there an effective system for bringing technical, ILS, quantity or schedule changes under control.

The new PCCS will remedy these weaknesses by establishing a firm baseline with an auditable track, and formalizing a reporting and change process. The reports will be compatible with the Selected Acquisition Reports (SARs) and Cost Performance Reports (CPRs), if these reports are also required of the project or program.

The new system will be described and implemented under a soon to be published DARCOM Circular titled, "DARCOM Program and Cost Control System." It will carry in the purpose paragraph the need to define program objectives, to increase discipline in the materiel acquisition system, to provide increased visibility of program trends, and to identify early in the program decision alternatives. Program control will be managed through formal program change control.

The circular will stress that program and cost control are major concerns of all DARCOM commands and personnel, and that lack of program stability is an Army-wide problem. The principal management actions required will be to instill discipline in the system and maintain program stability.

All program-associated costs will be addressed, to include RDTE, PAA, OMA and MCA, when support of materiel acquisition is involved. Included here will be such things as peculiar support equipment, operational site activation, initial spares, initial repair parts, ammunition, if applicable, etc.

All program guidance that impacts on stability of PCCS designated systems will originate from the HQ DARCOM principal director (See page 9 of this issue for a description of the term principal director) responsible for that system. No change or deferral will be made to amounts appropriated by Congress for systems falling under PCCS without either approval by the HQ DARCOM principal director, or initiating a request for a formal revision before funds are released.

DARCOM appropriation directors are to identify PCCS specific funds, by system or release documents, and no deviation in amounts released will be permitted without HQ DARCOM approval. Any such deviations are to be approved by the principal director.

Project managers will have the responsibility of assuring that *all* program resources (spares, ILS support, operating and support costs, etc.) are programmed, and increases in life-cycle costs based on program changes are identified and minimized.

All program milestones and events that may have a detrimental effect on the intent of the PCCS are true areas of project manager concern, to include such things as site preparation, provision for new equipment training teams, and operating and support costs.

The actual system is described as management actions taken in an integrated process to control program costs, and consisting of four short documents or reports: a Program Directive Document (PDD); an Annual Execution Plan (AEP), actually an appendix to the PDD; a Cost Baseline, another appendix; and a Status Report.

The first of these, the PDD, is the basic document for initiating or changing a program. Limited to six pages, it will include specific costs, schedules, performances, ILS, quantity baselines, goals, and thresholds. It is to provide a clear definition of *the approved program.*

The PDD and its appendices are prepared initially by the project/program manager. The proposed document is then forwarded to the DARCOM commander for approval and next to the DCSRDA for final approval. PDD revisions will normally be initiated at HQDA.

The second document, the AEP, an appendix to the PDD, is limited to four charts. Again, prepared by the project manager, it will contain an *outline* of the entire acquisition program and a yearly plan of execution. Sufficient detail will be given to permit a monthly DARCOM overview of factors identified in the yearly plan of execution.

The Cost Baseline, also an appendix and of four charts length, is a formally approved listing of aggregate program costs that reflect all PDD delineated effort. It is designed to accomplish, establish, and maintain program cost discipline, and to provide a clear definable program cost track.

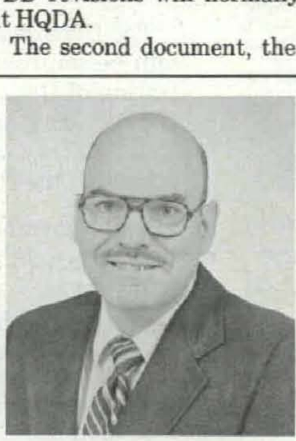
The final document, a 3-page Status Report, is a monthly report identifying significant progress, proposed Cost Baseline changes, and actual or potential problem areas related to acquisition-cost, such as, schedule, quantity, technical performance, and logistics, or operating and support costs.

These documents will be required normally within 60 days of a system being designated as falling under the PCCS. Systems to be included under the PCCS will be designated by the commander, DARCOM.

The PCCS follows the concept of program manager responsibility, along with program control levels above the project manager, by the use of defined trigger prints to allow early high-level management action.

The forthcoming circular will define the responsibilities in the DARCOM PCCS at every involved level, command, and agency, and as appendices, carry samples of each of the four required documents.

As this article was being written, GEN Guthrie approved and sent to the Chief of Staff of the Army his proposed Program and Cost Control Circular for formal approval. Concurrently, LTGs Lunn and Hardin, DARCOM deputies for Materiel Development and for Materiel Readiness, published a DARCOM letter establishing the M1, FVS, and RPV as the first three systems to be brought under the new system, beginning in FY82. Others will follow.



ROY D. GREENE is associate director for Programs and Budget, Development and Engineering Directorate, HQ DARCOM, and has headed the DARCOM task force on program and cost control. Born in Tennessee, Greene has 22 years of civil service experience, and has received four high civilian awards for outstanding service. (see page 30). He is a graduate of Western Kentucky University (BS), American University (MA) and ICAF.

ATLANTA VII - The Opportunity and the Problem

> **". . . Industry and government have a shared responsibility and must assume a new spirit of cooperation. A healthy, innovative, and competitive industrial capability is a primary national objective. I direct all top DOD management, in OSD, in JCS, and in the Services, to ensure this is understood at all levels . . ."**
>
> **Frank C. Carlucci**
> *Deputy Secretary of Defense*
> *30 April 1981*

Meeting within days of Deputy Secretary of Defense Frank C. Carlucci's 30 April memorandum on improving the defense acquisition process, some 325 senior officials from industry and the Army's Development and Readiness Command, got together for two days of down-to-hard-facts discussion. The meeting - Atlanta VII, was conducted under the sponsorship of the American Defense Preparedness Association, and held in Atlanta 11-13 May.

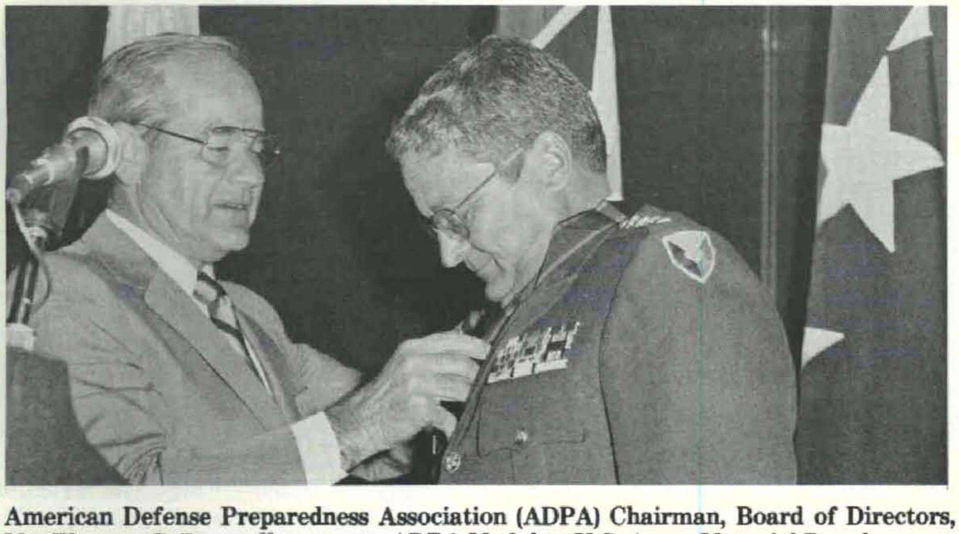
The Atlanta meetings were begun in 1974 to fill a perceived need to bring senior decision and policy making officials of industry and DARCOM together to discuss openly and cordially mutual problem areas.

GEN Henry A. Miley, Jr., USA (Ret), president of the ADPA, noted in his kick-off remarks that Atlanta I had met under the clouds of the Arab-Israeli war and anti-military climate in the United States. Today's attitudes, said Miley, offer an unusually positive opportunity to advance the goals this audience was seeking.

Mr. John D. Blanchard, DARCOM's principal deputy for materiel development, and the prime mover in establishing the Atlanta conference series, told the attendees that the purpose of these meetings was as fresh today as it had been seven years ago. Under the leadership of the new Reagan administration there is a new fresh call for a greater spirit of industry - DOD cooperation Citing the 30 April memorandum by Carlucci, Blanchard noted that Carlucci's wording directed the DOD to implement this policy and stressed that it was a shared responsibility by both DOD and industry. With that goal in mind, this meeting would be one in which each would bring out and discuss openly its concerns and suggestions for improvements.

General John R. Guthrie, DARCOM commander, set the theme for the meeting by talking of the decade ahead. Guthrie reminded the audience of President Reagan's statement of deep concern over the relative military imbalance between the Free World and Soviet Russia, and that the President is on record that allowing "this imbalance to continue is a threat to our national security."

The meeting in Atlanta then, said Guthrie, would be an important step in addressing how this imbalance could be corrected. He stressed the necessity of industry and the military working as a team, enabling them "to exploit as stated by Secretary of Defense Weinberger, 'two of America's greatest potential resources - our technological genius and our industrial process.'"



American Defense Preparedness Association (ADPA) Chairman, Board of Directors, Mr. Thomas G. Pownall, presents ADPA Medal to U.S. Army Materiel Development and Readiness Command Commander, General John R. Guthrie.

Looking back at previous Atlanta meetings, Guthrie expressed great satisfaction with the session held at the National War College in May 1979 and the session in Atlanta in February 1980. Critical acquisition issues and the industrial mobilization base were, through these meetings, brought to the attention of senior leadership in the Department of Defense and the Congress.

Looking ahead, the General saw "newly emerging emphasis on multi-year contracts, advance procurement of components, parts and materials, efficient and economic production rates, and incentives for industry . . ." But there were two subjects of paramount importance - one an opportunity, the second a problem.

The opportunity, said Guthrie, rests in our new environment. "We no longer have a diminishing workforce, with increasing workload, and shrinking budgets with expanding requirements." The defense community had been saying for years, he continued, that if it were but given the tools it could do the job. We are now going to be given the tools. "*Now* it is up to us to *produce* as we have been saying we can," emphasized Guthrie. "This requires a change in state of mine - maybe even a culture shock. But the opportunity is at hand."

The greatest single threat, the most serious problem to be faced and solved is that of *cost control.* Admitting it was a complex issue, he called on the audience for "fresh insights and a basis from which to attack what has became an all pervasive problem." Cost control is fundamental, said Guthrie, to support the nation's needed land force. Exploding costs "result in schedule slips, reductions in quantities or quality or both, and unless corrected, will almost certainly result ultimately in a loss of public confidence and support for our efforts. That we can't afford!"

Rising unit costs despite a rising volume of purchase is puzzling, he noted. Similarly, he noted difficulty in understanding why the Army cannot establish and maintain its priorities "so that our quantitative requirements and our qualitative requirements are not constantly changing." Help is needed, said Guthrie. Industry must report to its stockholders, the Army ultimately to its investors - the taxpayers. Both industry and the military, working together, must solve the cost growth problem.

Program instability was, to Guthrie's mind, the greatest intra-Army contributor to cost growth. "What is needed," he stressed, "was a system that must provide a clear definition of an approved program consistant with the Army's budget, provide an audit trail to affix responsibility for changes, and prevent decisions that modify programs without complete visibility and consideration of all the impacts on the program and budgets."

Lip service, the general emphasized, is not enough. There must be demonstratable progress. "Our civilian leadership is committed to delegating authority for program performance and then holding those responsible strictly accountable for success - or lack thereof."

To give industry a view of how the Army sees itself looking in the years ahead, BG Bo Maddox, assistant deputy chief of staff for Combat Development, TRADOC, gave a run-down of Army-86, its origin, purpose, and status. This study, begun in 1976, will see implementation of some of its recommendations shortly. Maddox described the mission area analysis technique used in the Army-86 study, analyses that covered some 12 mission areas in all. High payoff and affordable new approaches were sought, to provide the Army of the future with greatly enhanced capability to respond, not only to NATO's mission, but to missions in other areas of the world.

Among the objectives sought were systems that reduce reliance on fossil fuels, that are manpower and ILS supportable, that are available to standardization throughout the Army from training and S.O.P. aspects, and were simple enough - albeit incorporating the needed sophistication, to be operated by tomorrow's soldiers.

The doctrine driving Army-86, said Maddox, was to attack both deep and close simultaneously. Enemy initial assault forces would be met and blunted while his follow-on echelons deep in the rear would also be concurrently heavily attacked.

Maddox then ran the excellent new TRADOC "Army-86" film which provided a very lucid, graphic portrayal of the doctrinal thinking behind the study and the new capabilities and organizational structures required by the Army to implement this philosophy.

The need for the creativity and inventive genius of American industry to meet the Army's many needs for the Army of the 80s emerged clearly - particularly the need for reduced weight, simplicity, and enhanced capability.

Problems of modernizing the Army were then laid out for the audience by LTG Donald R. Keith, DCSRDA, who served as chairman of a panel discussing: Equipping The Force. He noted that the Army was now in the process of conducting the greatest modernization effort since World War II, an effort aimed at countering the quantitative and qualitative inferiority status of Army equipment vis-a-vis the Red Army. While the new administration is providing significant new help, the total amount is still short of what the Army feels it needs.

Under previous austere budgets, said Keith, many needed programs were barely kept alive, and procurement costs were consequently high.

". . . Total affordability will be the key," said LTG Donald R. Keith, DCSRDA. "Industry and the Army must have a continuing free exchange of information in order that the best decisions are made, that a proper balance between new technology approaches and product improvement is maintained."

Keith noted that the services were pleased with the theme of the recent memorandum by Frank Carlucci, delegating down to the services greater authority in the management of their materiel acquisition programs. But, he stressed, good management must result if the urgently needed maximum return on the dollar was to be attained.

The window of opportunity that GEN Guthrie had noted, he continued, gives the Army a unique chance. We must plan ahead but plan well. Total affordability will be the key. Industry and the Army must have a continuing free exchange of information in order that the best decisions are made, that a proper balance between new technology approaches and product improvement is maintained.

Mr. John W. Day, executive vice president, Chrysler Defense Corp.; Dr. Malcolm M. Currie, vice president, Missile Systems Group, Hughes Aircraft Co; and Mr. Edward A. Miller, vice president, Federal Systems

EQUIPPING THE FORCE Panel included (l. to r.) LTG Donald R. Keith, DCSRDA; Mr. John W. Day, executive vice president, Chrysler Defense Corp.; Dr. Malcolm M. Currie, vice president, Missile Systems Group, Hughes Aircraft Co.; and Mr. Edward A. Miller, vice president, Federal Systems Group Engineering, Sanders Associates.

Group Engineering, Sanders Associates, joined with Keith in expressing their views on the topic, and in answering questions from the floor.

Day and Currie stressed that the Carlucci philosophy placed greater reliance on the project manager, and therefore there was a need by the services to ensure a flow of well trained people for these jobs. They noted that industry's supplier base was the most critical part of an efficient production program, and needed to be given greater attention. Day also expressed concern that the technology base effort not suffer during this emphasis on modernization.

Mr. Miller commented on the profitable gains he saw in the acquisition system through greater participation by the Army's user community.

A panel headed by LTG Robert J. Lunn, DCG for Materiel Development, DARCOM, then took up the subject of program stability and control. Lunn began the discussion by citing the cost growths reflected in those programs requiring Selected Acquisition Reports (SARs). Ways must be found to control cost growth, said Lunn, or program termination may be the result. The concern is of such magnitude at HQ, DARCOM, he told the audience, that some 60 headquarters spaces were going to be allocated to this effort. The effort will not, Lunn assured the audience, require any additional reporting by contractors or field installations - data will be derived from existing sources.

The program would not be a cure-all Lunn stressed, but it would help stabilize things and it would force project managers to live within their baseline program.

In the ensuing discussion involving panelists Mr. Robert J. Whalen, president, Orlando Aerospace, Martin Marietta; Mr. Adolph M. Quilici, vice president and general manager, Ordnance Division, FMC; and Mr. Robert E. Hilchey, vice president for Operations, Rockwell International, the need for better subcontractor management and for improved Army efforts in the man-technology interface were discussed.

Luncheon speaker Congressman Newt Gingrich (R/GA) drew a standing ovation for his pointed and refreshing thoughts. Noting that he had grown up in an Army family and had become a student of history, he had seen clearly the lessons to be learned from the past.

Gingrich stated that he believed the underlying problem in our defense effort was not money. He pointed out that there were more allied tanks than German tanks at the start of WWII. A computer simulation using current war gaming techniques proved conclusively that the French would win. A second study, said Gingrich, proved the Germans lost.

Congressman Newt Gingrich stated that . . . "this nation has developed over the past 20 years, for a variety of political reasons, a war avoidance and political pacification doctrine which, if it works, will be the cheapest defense we could have." But, he warned of the consequence of its failure. "We are currently a society that is not capable of surviving from late 20th century to the early 21st century except by luck, and luck is a very, very dangerous thing to rely on in lieu of strategy."

What concerned him most was that this nation has "developed over the past 20 years, for a variety of political reasons, a war avoidance and political pacification doctrine which, if it works, will be the cheapest defense we could have." But he warned of the consequence of its failure. "We are currently a society that is not capable of surviving from late 20th century to the early 21st century except by luck, and luck is a very, very dangerous thing to rely on in lieu of strategy."

"The most dangerous single result of the Reagan administration would be for us to spend the money without an intellectual revolution . . ."

Unusual and unstereotyped solutions and approaches are needed. A new military model is required in a world becoming more dangerous daily. By the end of the century, Gingrich noted, there will be "a minimum of 25 countries with nuclear weapons. On any random cycle at least two of those . . . are going to have nuts as leaders . . ."

The Reagan administration should not be regarded as salvation - it represents only breathing space. The U.S. has never had more than three consecutive years since 1950 where there were increases in the defense budget. The country must "use this breathing space to move rapidly into the period of real achievement."

The Congressman expressed deep concern at his inability to find anyone who can tell him what the national strategy is for the survival of this country for the next 20 years.

What is needed then, he continued, are seven actions. First, a new model of military training doctrine must be developed, a model more historically dominated. There is a need for a new procurement model to shorten and improve the process. The industrial preparedness base has to be rethought in terms of a need for a surplus of war production in order to allow for the needed surge.

The nation needs an intellectual program and an increase in sophistication. To him, the single most alarming thing about the Soviet Union was the way they intellectually address the question of warfare - over a vast segment of their society.

The skills of the media need to be refreshed, said Gingrich. One of the legacies of Vietnam is a news media that is inherently anti-military and on any given day assumes it as being deceived or lied to.

Finally, there is the need to build a unified political, economic and military strategy for national survival, a strategy that addresses world conditions, not purely the Soviet threat.

The afternoon session of the first day began with two panels which discussed force readiness and multi-year contracting. Heading the panel on readiness was LTG Harold F. Hardin, DCG for Materiel Readiness, DARCOM. Panel members were Mr. Jerry R. Junkins, vice president and equipment group manager, Texas Instruments; Mr. Lawrence Hyde, president AM General; and Mr. James M. Stone, group vice president, Thiokol. The key topic for this panel was the critical necessity of good and early integrated logistic support planning and implementation. Superior systems are of no value if they cannot be supported in the field. Adequate front end funding is essential in the ILS planning. Its planning is a joint responsibility, of both the government and the contractor. Wars are won by staying power, and as such ILS should receive equal priority with schedule, cost, and performance.

The panel on multi-year contracting was chaired by MG Robert L. Herriford, director of Procurement and Production, DARCOM. Panel members were Mr. Robert N. Parker, senior vice president, Vought Corp., Mr. Clyde A. Parton, vice president Aero-space and Defense Group, Honeywell Inc., and Mr. Frank W. Lynch, senior vice president, Tactical and Electronic Systems Group, Northrop.

MG Herriford noted that the concept of multi-year contracting was not new, but recent studies had indicated that wider use and flexibility in multi-year contracting could save money. While not an answer itself to cost growth, savings on the order of 10-20 percent of total program cost appeared possible. Candidate programs in the FY 83-87 timeframe were being looked at, with some 45 appearing as possible.

The discussions covered the pros and cons of such contracts. Concerns included loss of creativity, productivity, second source, and adaptibility to technical upgrade. There was discussion of the desirability for flexibility in the type of multi-year contract, and the careful need to evaluate and select only those programs where such an approach can work.

The concluding session of the first day was a run-down on the sought-for capability improvement of the light infantry division, as being tested by the 9th Infantry Division High Technology Test Bed. The presentation was given by MG Theodore G. Jenes, deputy commander, Combined Arms Development Activity, Fort Leavenworth, KS. The point was made that concepts were being tested, not hardware, with off-the-shelf commercial equipment in many cases being used to test these concepts. Industry was provided points of contact should they feel able to assist in the effort.

The second day was given over to questions from the floor and discussions by a panel composed of the previous panel chairman and presenters, joined by Mr. Arthur Daoulas, acting assistant Secretary of the Army (RDA) and chaired by Mr. Thomas G. Pownall, chairmen, Board of Directors, ADPA. Comments heard subsequent to this session indicated that this was considered by many of the attendees to be the most beneficial part of the day and a half meeting. Participants from both industry and the "Green Suit" community freely and frankly expressed their views and positions in keeping with the objectives of the meeting. And, it was clearly evident that a spirit and desire to cooperate rather than one of an adversary relationship prevailed.

DARCOM Director of Procurement and Production, MG Robert L. Herriford, noted that multi-year contracting was not new, but recent studies had indicated that wider use of flexibility in multi-year contracting could save money.

General Guthrie then wrapped the meeting up with his closing summary. Once again the point was stressed that for the military-industrial cooperative team a unique but possible short window of opportunity exists. Both parties must together find the means to deliver to the country what it is we say we need and can deliver, and in the quantities promised, when promised, and at the agreed cost. Using the punch line of a joke, Guthrie concluded his wrap-up by saying; "Gentlemen, are we going to talk or fish?"

The meeting ended on a bit of a pleasant surprise when Mr. Pownall presented to GEN Guthrie a handsome medal and citation on behalf of the ADPA. The special award was in grateful recognition, the citation read, of GEN Guthrie's sustained support and active participation in the activities of the association. His wise counsel and superb technical guidance, it contained, "significantly advanced the association's efforts to insure a capable and responsive defense - industry base and to provide unconstrained and productive communication between industrial companies which comprise that base and the United States Army."

Infrared Optical Sensors Monitor ICBM Reentry

The Army has reportedly demonstrated the effectiveness of infrared optical sensors in monitoring the reentry of intercontinental ballistic missiles (ICBMs), according to officials at the Ballistic Missile Defense Advanced Technology Center, Huntsville, AL.

This mission was the fourth in a series of progressively more complex test flights for the Designating Optical Tracker experiment, generally referred to as DOT. DOT is part of the Army's Ballistic Missile Defense research and development effort to provide viable options for defending the U.S. against an enemy ICBM attack.

The long wavelength infrared optics technology demonstrated by the DOT experiment is a key element in the development of an Overlay Defense system capable of tracking and destroying enemy missiles above the atmosphere. Overlay is one of the major thrusts of the Huntsville-based Army BMD program.

During the test flight, the DOT sensor monitored the test firing of a U.S. Air Force Minuteman missile. Several minutes after the U.S. ICBM was launched from Vandenberg Air Force Base, CA, the DOT sensor, mounted in the nose cone of a rocket vehicle, was launched above the atmosphere from Roi-Namur Island in the Kwajalein Missile Range in the Marshall islands.

From its vantage point, the sensor was able to detect and record the incoming ICBM target complex. After successfully gathering the required scientific data, the payload carrying the sensor was parachuted into the ocean and recovered.

Boeing Aerospace Co., prime contractor for the DOT program, built the rocket vehicle, prepared it for flight, and conducted the launch. Hughes Aircraft Co., built the infrared sensor, and Teledyne Corp., furnished the real-time, on-board computer.

Army RDA Magazine Supports Improved Use of Resources

The Army Chief of Staff has charged the total Army to seek out and eliminate waste and fraud, and as a part of that goal the Army staff was directed to develop a comprehensive supporting plan.

Part of that includes a public affairs plan covering actions that this element of the Army can undertake to support GEN Meyer's goal.

Accordingly, the editors of *Army RDA Magazine* encourage the submission of articles that deal with promoting efficiency in the use of Army RDA resources, or on ways to eliminate waste and fraud.

As a matter of observation, it seems to the editors that the existing command and installation "suggestion programs" are not being utilized to the fullest potential. A renewed emphasis of this approach, whereby suggested ways to improve the efficient use of RDA resources could be brought to high level attention should be undertaken.

How about reader comments?

WES Developing Sand-Grid Confinement System

The landing ramp drops and the soldiers storm out across the sandy beach. They must secure the beachead and then capture a nearby harbor at which to unload the vast amounts of supplies and equipment needed to support a fighting army. The enemy harbor will probably be heavily fortified and casualties will be high. But without those supplies the whole operation could be in jeopardy.

This scenario may soon be a part of history, thanks to a sand-grid confinement system being developed by the Geotechnical Laboratory of the U.S. Army Engineer Waterways Experiment Station (WES) in Vicksburg, MS.

The U.S. Army has started utilizing supply containers weighing up to 50,000 pounds loaded for easier handling and transporting of supplies. However, trucks hauling these containers would have little hope of delivering their cargo in either beach or desert sand terrain.

The WES sand-grid confinement system would reportedly solve this problem by providing a beach roadway and even a supply storage area if needed. The system consists of a layer of grid cells filled by the sand and topped by a sprayed-on coat of emulsified asphalt.

During tests, the sand-grid confinement system has supported tandem axle truck loads of 53,000 pounds for 10,000 passes with only slight rutting. In unconfined sand the same truck made only 10 passes in tests before becoming bogged down in 11-inch ruts.

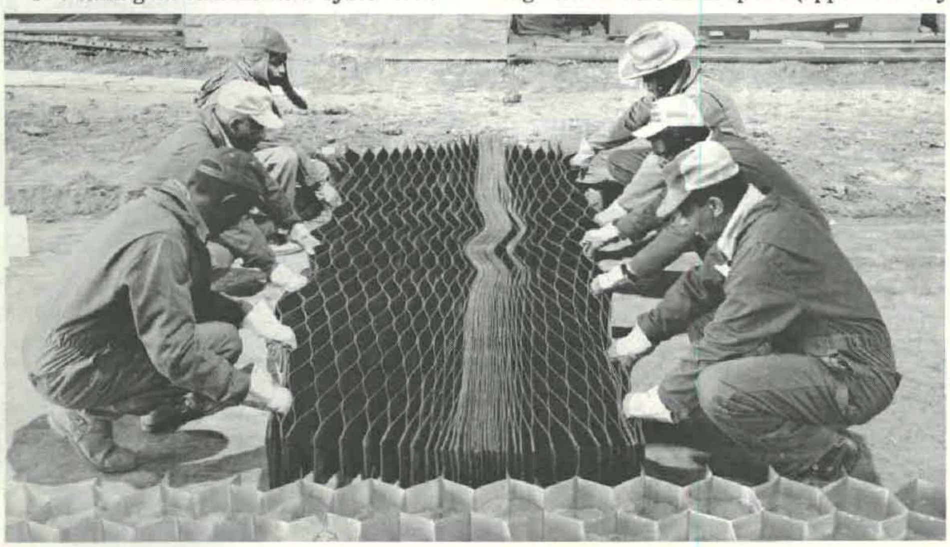
The sand-grid confinement system is an offshoot of the Army tactical bridge approach and adverse weather road construction studies at WES. One of the concepts for these studies was a layer of plastic pipes placed on end and filled with sand. This concept was tested in 1976. Although it was not adopted for use in its intended studies, the merits in other areas of the cell-type layer were recognized.

Mr. Steve Webster, of the WES Geotechnical Laboratory, recognized the potential of grids for confining loose sand for roadway purposes. He was instrumental in obtaining military research funding from the Office, Chief of Engineers, to develop sand confining systems.

During the past several years, design improvements have evolved from testing and evaluating at WES. The initial grid was contructed at WES out of slotted aluminum sheets that formed cubic confinement cells. Subsequent modified designs have been built by various commercial manufacturers.

The sand-grid cells tested were made of such materials as aluminum, paper, high-density polyethylene and recycled plastic. When assembled, the grid layers are like accordians and can be compressed for easy storage and shipment. All worked successfully except the paper, which was not water proofed satisfactorily.

The sand-grid confinement system is relatively simple and quick to install. The grids are expanded and placed on the subgrade. They are filled with sand, which is then compacted. The final step is spraying on an emulsified asphalt (approximately 60 percent asphalt 40 percent water; depending on type) at the rate of one gallon per square yard. This type asphalt does not require heating at ambient temperatures above 70°F and soaks in about one inch, forming a protective wearing surface.



PLASTIC sand-grid confinement system is expanded and placed for testing. In the foreground is an aluminum version of sand-grid cells, also being developed at WES.

As previously stated, the sand-grid confinement system has been tested successfully to 10,000 vehicle passes. The modifications being done now are to reduce the weight and costs of the grids. The honeycomb type aluminum grids presently cost about $2 per square foot.

WES recently received some new grids made of recycled plastic that are thinner and thus lighter, have ultrasonically welded joints, and cost less than one third the aluminum grids. If these grids withstand traffic tests, the next evaluation would be a field demonstration from which an evaluation could be made for adoption into the Army's inventory.

Already several groups have shown interest in the project. The United Nations has included trial sections of the sand-grids in the United Nations road building projects in Africa. Also, the commercial manufacturers of the prototype designs are investing their time and money in the hopes of developing a market for military and commercial applications.

The Army anticipates using the sand-grid confinement system for over-the-shore operations once the design is proven. When the cost becomes competitive with present road building techniques the system will probably see use in the private sector.

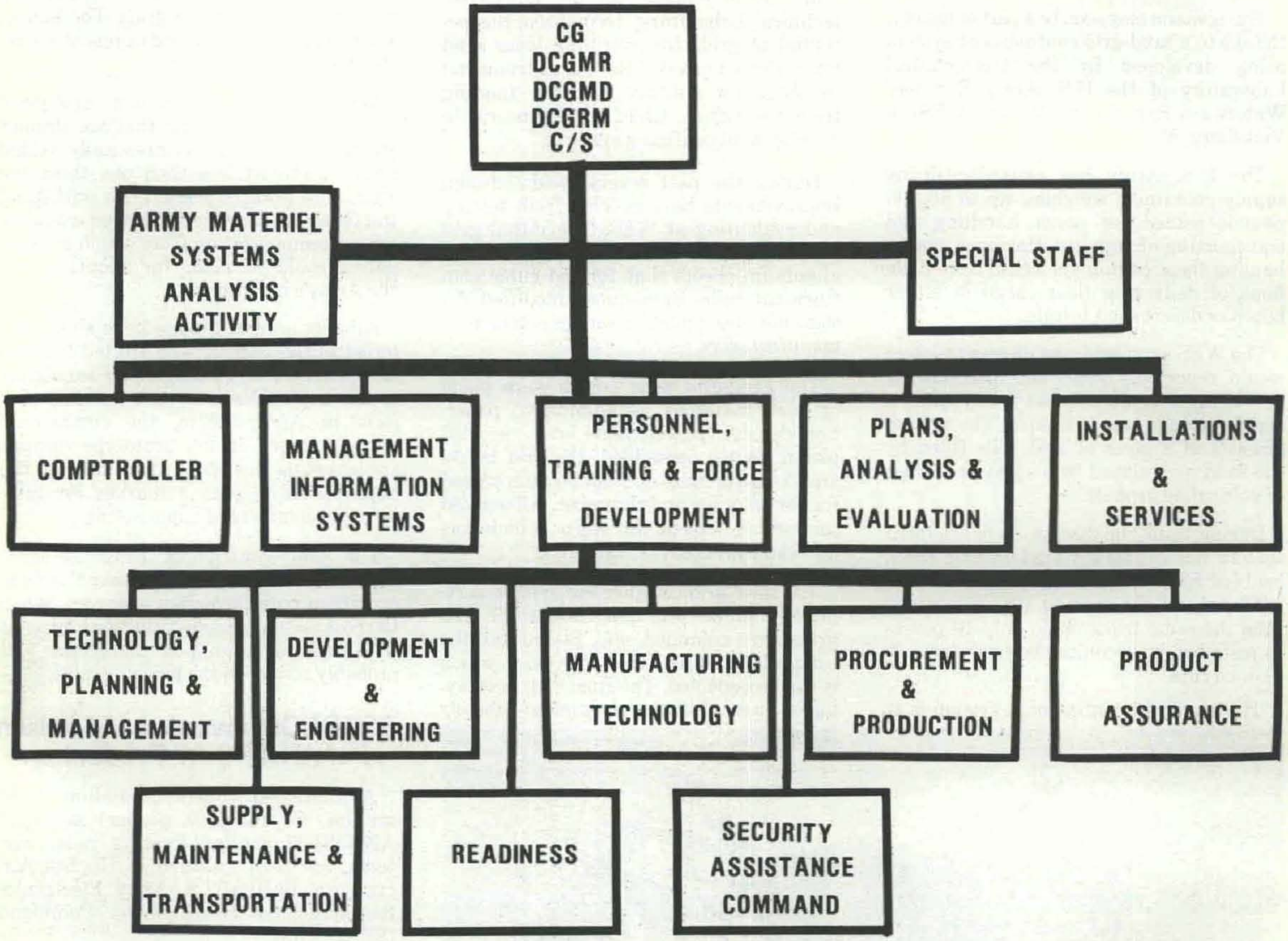
ERADCOM Awards $154 Million For AN/TPQ-37 Production

A multi-year contract, totalling $154 million, for full-scale production of 30 AN/TPQ-37 artillery-locating radar systems, has been awarded to Hughes Aircraft Co. by the U.S. Army Electronics Research and Development Command (ERADCOM).

Believed to be the largest single contract ever awarded by ERADCOM, it calls for more than $94 million for the first year and nearly $60 million for the second year. The AN/TPQ-37 is designed to scan the battlefield with a pencil-shaped beam to determine the sources of enemy artillery firepower.

The AN/TPQ-37, along with the AN/TPQ-36 mortar-locating radar, comprise the complete Firefinder system developed by ERADCOM's Project Manager Firefinder/REMBASS, Fort Monmouth, NJ.

DARCOM HQ REALIGNMENT



HQ DARCOM To Be Realigned

The long awaited HQ, DARCOM realignment was announced on Friday, 29 May 1981, after Army Chief of Staff General Edward C. Myer had given his approval. The study and proposed realignment had been in progress since October 1979, when development of an organizational concept was begun.

The concept that emerged provided for the establishment of a matrix management structure within HQ, DARCOM. There would be two lead directors for systems management - development and engineering, and supply, maintenance and transportation. There would be a centralization of technical leadership for capital investment, and centralized programming for the planning, programming and budgeting system. There would be "a single face to the field."

Among the goals sought by the realignment were the re-establishment of technical expertise - lost since the 1975-reorganization, a better interface with DA and the major subordinate commands, strengthened materiel acquisition and resource control, and elimination of the "two sides" syndrome where almost half of the major subordinate commands were neither pure readiness nor R & D.

One of the driving factors was the fact that since the 1975 HQ, DARCOM reorganization, the workload has been rising while the manpower to respond has been either decreasing or remaining constant. Clearly, help was needed on the manpower space side. DARCOM headquarters strength currently comprises one percent of the command's strength, or 1,485 people. Under the new organization the strength will rise to 1,835. Sources for the additional spaces will be the staffs of the project managers - 50, special activities reporting direct to headquarters activities - 55, major subordinate commands - 100, and the remaining 145 spaces to be provided by DA.

The timetable for the reorganization is extremely tight due to the need to have the revised TDA request reach HQDA by 30 September 1981. The schedule then calls for the new organization to become effective 15 October 1981. However, it will be well into 1982 before the majority of the personnel and organizational actions are completed.

The major changes that impact on the RDA community are the creation of two major "principal directorates" - the new and expanded D & E Directorate whose revised name has not yet been determined, and a Supply, Maintenance, and Transportation Directorate. Additionally, there will be a new Directorate for Program, Analysis and Evaluation which will be the DARCOM planner. The former Office of Laboratory Development and Command Management will be expanded to a Directorate for Technology Planning and Management to handle RDA planning, the 6.1-6.3a technology program management, the development command/laboratory program management, and the engineer/scientist career program management.

Under the realignment, the Development and Engineering Directorate will be responsible for staff supervision of development activities, determination of RDTE program and budget and serve as appropriation director for RDTE, develop acquisition strategy plans, manage the product improvement program, direct international R & D, direct foreign science and technology, and manage battlefield automation. The directorate will be the principal manager for all systems except those transferred by command group decision to the Supply, Maintenance, and Transportation Directorate. Responsibility for the DARCOM program/cost control system will rest with this D & E Directorate.

MG Stan R. Sheridan, director of Development and Engineering, noted that under the revised structure, his new directorate will be organized parallel with the current ODCSRDA division structure. However, said Sheridan, the area of responsibility of his people will extend farther along the life cycle than does the ODCSRDA counterpart. Authority will include, in addition to RDTE and initial procurement, O & M responsibilty after a system is fielded, until such time as a written decision is rendered by the HQ, DARCOM command group transferring responsibility to the Readiness side of the command.

Sheridan has appointed a team of 10 professionals, with Mr. William A. Kracov as chairman, to undertake the massive task of rewriting job descriptions and clearing a new organization structure for the realigned directorate. Working with Kracov will be COL George Rostine as assistant chairman, MAJ Brad Brown, Mr. Paul Bubernak, Mr. Robert Chaillet, Mr. T. H. Meade, Mr. George Myers, Mr. R. Odell, Mr. George Scortia, and Mr. M. E. Westmoreland.

The D & E Directorate prior to 1975 carried a strength of about 340. With the 1975 reorganization, it dropped to 117, and the technical expertise available was not transferred - it was eliminated.

Since that time, the RDTE program and workload has increased and the immediate outlook is a continuation of this growth. Under the new 1981 structure, the strength will be approximately 311.

In a subsequent issue the *Army RDA Magazine* will provide an update on the realigned D & E Directorate.

Army Aircraft Occupant Crash-Impact Protection

By George T. Singley III

For many years, emphasis in aircraft accident investigations was placed on finding the cause of the accident. Very little effort was expended in the crash survival aspects of aviation safety. However, it became apparent, through detailed studies of accident investigation reports, that crash survival could be greatly improved if general crash survivability factors were considered in the initial aircraft design.

Army interest in crash survivability is not a recent thing. Considering the inevitability of accidents, the fact that personnel were being lost due to recurring and avoidable crash injury hazards, and the drain on combat effectiveness from these personnel and materiel losses, the Applied Technology Laboratory (ATL) of the U.S. Army Aviation Research and Development Command initiated a long-range aircraft crashworthiness R & D program in 1959. Experience in the Vietnam war years added emphasis, when it was realized that almost as many losses were due to accidents as were to enemy action.

The Army has had an R & D program which began with the study of data from hundreds of accidents, accident investigations, and full-scale crash testing. From this, an understanding was acquired of crash-impact conditions and consequent hazards. Design concepts, techniques, and criteria were developed and substantiated through testing.

A total of 41 full-scale aircraft crash tests have been performed by the Army to date. Because postcrash fires occurred in 13.3 percent of and contributed to 59.7 percent of the fatalities produced in 1967-69 by 1,000 survivable accidents, the postcrash fire problem was tackled first. This led to ATL's developing the crashworthy fuel system (CWFS) for the UH-1D/H.

All Army helicopters are now equipped with the CWFS, which has prevented thermal fatalities in survivable accidents. Tables 1 and 2 summarize the success of the CWFS and its cost.

Programs in the areas of crashworthy seats, restraint systems, CWFS airframe crashworthiness, and emergency egress led to the publishing by the Army in 1967, of the Document *Crash Survival Design Guide*. The latest revision, USARTL TR 79-22, was extensively coordinated within the Army, Navy, Air Force, NASA, the FAA, and industry. The current edition, the fourth, contains the most comprehensive documentation of all aspects of aircraft crash survival to date.

The guide, published in 5-volume format, can be used as a general text to establish a basic understanding of the crash environment and the techniques that can be employed to improve chances for survival. It also contains design criteria and checklists on many aspects of crash survival and thus can be used as a source of design requirements. The volumes are titled, respectively: I *Design Criteria and Checklists;* II *Aircraft Crash Environment and Human Tolerance;* III *Aircraft Structural Crashworthiness;* IV *Aircraft Seats, Restraints, Litters, and Padding;* and V *Aircraft Postcrash Survival.*

In many ways the *Crash Survival Design Guide* is the most important crashworthiness document the Army has produced. The Advanced Attack Helicopter (AAH) and UH-60A Black Hawk were required to comply with it, and many military specifications have evolved from it. MIL-STD-1290, *Light*

TABLE 2
Crashworthy Fuel System Operational Penalties & Cost Factors

Aircraft	Added weight (pounds)	Fuel penalty (gallons)	Development costs (dollars)	Hardware costs (dollars)	Aircraft modified	Aircraft net cost (dollars)
UH-1D/H	160	11	362,000	7,400	3,077	7,517
UH-1B/C/M	93	18	214,000	9,500	900	9,737
AH-IG	130	6	250,000	4,600	769	4,925
OH-58A	67	1.5	320,000	4,200	2,065	4,354
OH-6A	70	6	631,000	6,900	244	9,486
CH-47A/B/C	610	54	2,215,000	20,000	426	25,200

TABLE 1
1970-1976 Army Helicopter Crash Fatalities & Injuries

Classification	Survivable w/o CWFS	Survivable with CWFS	Nonsurvivable w/o CWFS	Nonsurvivable with CWFS
Thermal Injuries	20	5	5	0
Non-Thermal Injuries	529	386	13	28
Thermal Fatalities	34	0	31	1
Non-Thermal Fatalities	120	44	229	85
Accidents	1160	1258	61	32
Postcrash Fires	43	16	42	18

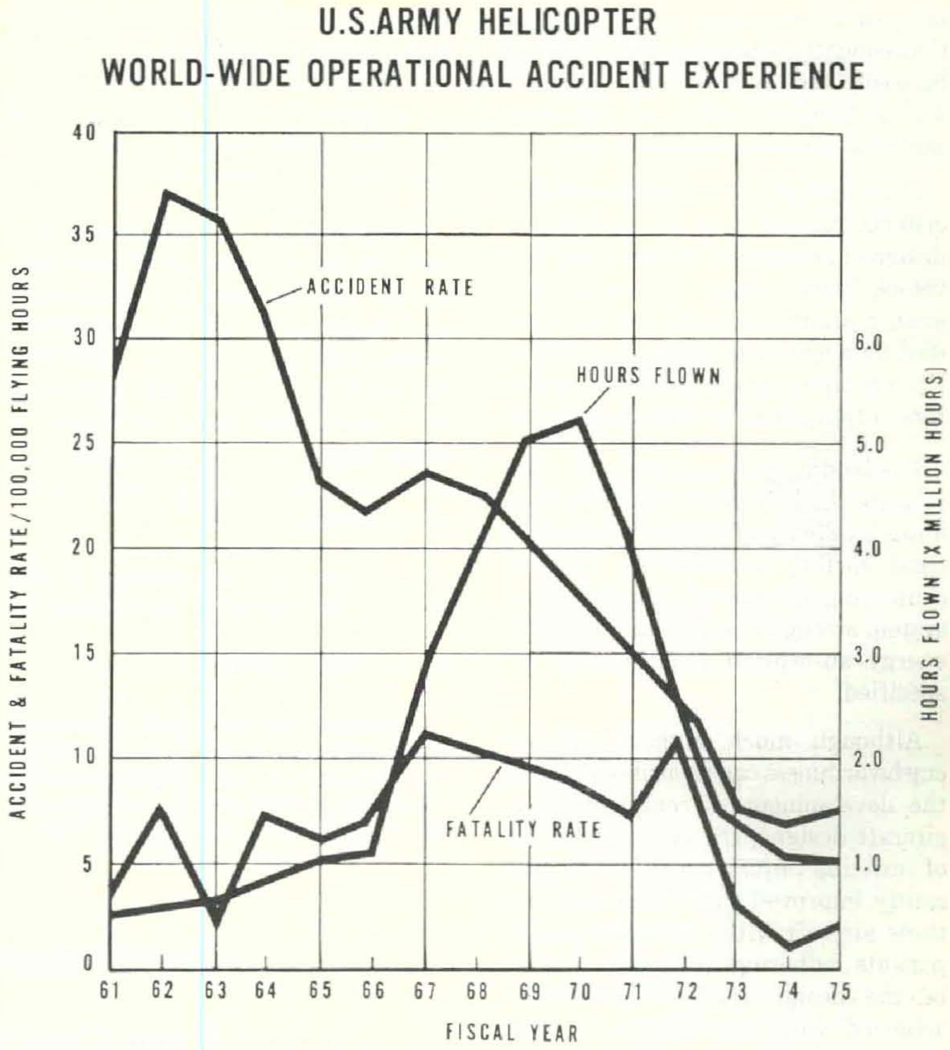
Fixed - and Rotary-Wing Aircraft Crashworthiness, contains the proven design criteria of the *Crash Survival Design Guide,* and states the minimum crashworthiness criteria mandatory for all Army aircraft to be developed in the future.

The overall objective of designing for crashworthiness is to eliminate unnecessary injuries and fatalities in relatively mild impacts. A crashworthy aircraft also reduces crash-impact damage. By minimizing personnel and materiel losses due to crash impact, crashworthiness conserves resources, is a positive morale factor, and improves the combat effectiveness of the fleet.

Results from analyses and research during the past several years have shown that the relatively small cost in dollars and weight of including crashworthiness features is a wise investment. Consequently, new-generation aircraft are being procured to stringent, yet practical, requirements for crashworthiness.

To develop a crashworthy helicopter, the effort must begin with the early design stages, as was the case during the U.S. Army's Utility Tactical Transport Aircraft System (UTTAS) and AAH development programs. The fuselage must be designed to provide a protective shell around the occupants during severe crashes. This means that the fuselage must have sufficient strength, stiffness, and crash—energy absorption characteristics to prevent either collapse of critical structures or loss of retention of high-mass items near the occupants.

In addition to this crash-impact structural integrity requirement, the landing gear, airframe, and seating systems must attenuate crash-impact decelerations input to the occupant in the headward (upward) direction to humanly tolerable levels to avoid spinal injury. Except for lateral loading of side-facing seats, deceleration levels in the directions other than upward, during a potential survivable accident, are within defined human tolerance levels assuming adequate occupant restraint.



In addition to reducing decelerative loading of the seat occupant, crash-force attenuation features in a seat also reduce the loads which the seat structure must withstand. This permits a lower weight structure than would be needed if one were to design for sufficient strength to withstand the non-attenuated crash loads.

Because the seat/restraint system is so critical to occupant survival and because its crashworthiness can be demonstrated relatively inexpensively, extensive seat/restraint system crashworthiness design and test criteria have been developed in the last 18 years.

MIL-S-58095 has been the Army's crashworthy pilot/copilot seat/restraint system criteria document since 1971. Draft military specifications for troop and cabin gunner seat/restraint system criteria have been validated and are in the coordination stage.

Ideally, it would seem most efficient to simply specify human tolerance requirements and vehicle crash-impact conditions and develop the helicopter as a crashworthy system with the combination of crashworthiness features that is most efficient.

Unfortunately, the necessary validated structural and/or human tolerance analytical techniques to perform and evaluate such a maximum freedom design approach to crashworthiness are not available. Furthermore, testing fuselages sufficiently early in the development cycle to permit evaluation of systems concepts is not practical. Consequently, a balance must be struck between the pure system approach and a total definition of necessary performance on a component level.

Current helicopter crashworthiness criteria require that the aircraft be designed as a system to meet specified vehicle impact design conditions. However, minimum criteria are also specified for a few crash critical components. For example, crash tiedown load factors are specified for high-mass items.

The landing gear must be able to decelerate the helicopter from a vertical impact velocity of 20 ft/sec on a level rigid surface without the fuselage contacting the ground. Seat/restraint system strengths and minimum crash energy absorption requirements are specified.

Although much higher levels of crashworthiness can be achieved during the development of completely new aircraft designs, the crashworthiness of existing aircraft can be significantly improved through retrofitting these aircraft with crashworthy components adhering to the principles of the design guide. This can be achieved while expanding the combat effectiveness of the aircraft. An example of this is the successful program wherein all U.S. Army helicopters were retrofitted with crashworthy fuel systems.

The Army's approach to crashworthiness R & D is not only to develop the technology but also to improve the cost effectiveness of this technology. One crashworthiness cost, weight, and benefits analysis showed that the personnel and hardware savings resulting from the UTTAS crashworthiness features would eclipse the costs between 3 and 10 years of operation.

Even if crashworthiness is incorporated at the early design stages, it may increase the helicopter empty weight an estimated 2.5 to 5.1 percent. The cost, weight, and benefits as a function of the level of crashworthiness required as well as a function of the weight class of the helicopter are being further investigated. Also, the cost, weight, and benefits of designing a composite materials helicopter as well as a metal design to MIL-STD-1290 will be investigated.

The effect of the crashworthiness features on the combat effectiveness of the aircraft will be investigated, and those areas of crashworthiness costing the most will be identified. Future R & D efforts will seek ways to further reduce costs yet retain the crash impact protection Army aircraft occupants deserve and combat effectiveness dictates.

The Army's crashworthiness R & D program has spanned more than 20 years and has been characterized by many joint efforts with DOD, NASA, FAA, and even foreign governments. The success of this program is in large part due to the researchers of academia, industry, and the government that pioneered crashworthiness in the 1940-65 timeframe.

Particularly important was the Flight Safety Foundation's Aviation Safety Engineering Research Facility in the 1960's, guided by the then chief of the ATL Safety and Survivability Technical Area Mr. Francis P. McCourt. Also, essential was the support of the U.S. Army Safety Center and the U.S. Army Aeromedical Research Laboratory, both of Fort Rucker, AL.

ABOUT THE AUTHOR:

GEORGE T. SINGLEY, III, is an aerospace engineer assigned to the Safety and Survivability Technical Area, Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, VA. He holds an ME degree in mechanical engineering and engineering mechanics from Old Dominion University, an MBA in business administration from the College of William and Mary, and a BEA in mechanical engineering from the University of Delaware.

New System May Provide Low-Cost CB Shelters

A simple, low cost method of providing U.S. forces with a means for converting existing rooms into chemical-biological (CB) protective shelters is in an advanced stage of development at the Army Chemical Systems Laboratory, Aberdeen Proving Ground, MD.

Developers at CSL believe the system is a practical solution to the need for interior shelters in existing buildings where up to 10 persons can work in a contaminated area without the need for personal protective equipment, such as protective masks and protective clothing.

The system weighs about 500 pounds and will cost less than $6,000. It has three principal components; a vapor resistant polyethylene bag that is filled with filtered air; a collapsible pressurized alumninum doorway, coated with a special fabric that provides a protective entry and exit capability; and a filter-blower unit, providing pressurized filtered air to both the liner and protective entrance.

"The system provides positive protection and the means for efficient operations in a toxic environment," said Robert Lockhoff, the development's project officer. Lockhoff has completed U.S. demonstration tours at Fort Benning, GA., and Fort Lewis, WA.

Designed as a rest and relief area as well as for command, control and communications operations, the system can be erected and inflated by two persons in less than 30 minutes, in almost any interior room of an existing building.

"The liner fills quickly with clean air until the bag presses against the boundaries of the room," Lockhoff explained. Soldiers entering the shelter open the outer doorway, allow it to snap shut, and wait for about five minutes as the entrance airlock is purged of contaminants. They can then remove masks and enter the main shelter area through a second door."

Ten of the systems currently being manufactured, will be used for engineering design tests.

A Rebirth of Chemical R & D

While the U.S. chemical defense posture was declining, the Soviet Union has poured money and manpower into preparing Russian troops and their satellite armies for chemical warfare.

This had intensified our fundamental purpose at CSL to accelerate research and development in support of the U.S. chemical warfare and chemical/biological defense programs.

Our current R & D efforts place major emphasis on individual protection, collective protection, detection and identification and decontamination as well as the development of new chemical agents.

For the critical mission that has been entrusted to us, we have assembled a first-rate R & D team of scientists and engineers who are dedicated to developing the chemical munitions and defensive chemical/biological equipment necessary to operate on the integrated battlefield of the future.

Working together with a firmness of purpose, we expect the decade of the 80s to offer new challenges and opportunities to improve the chemical warfare and chemical and biological defensive capabilities of the soldiers, sailors, airmen and marines of the Armed Forces of the United States.

COL (P) Walter W. Kastenmayer
Commander/Director
Army Chemical Systems Laboratory

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Just as it was born out of necessity 63 years ago, Army chemical R & D is having a rebirth, particularly since there is worldwide evidence that our troops will have to survive on the chemical battlefield. This has induced renewed importance in the U.S. military services to train and equip forces to fight in a chemical warfare environment.

The use of chlorine gas in 1915 on the Western Front heralded a new dimension in warfare. But the implications of chemicals as a potential military weapon, unrecognized then, is still not fully accepted, particularly with nerve agents such as Tabun, Sarin, Soman and VX available to today's armies.

A hundred-times more toxic than the crude chlorine or mustard gases used in World War I, nerve agents can be lethal in tiny quantities when inhaled or when they come in contact with the skin. Their relatively unpredictable behavior and potential for overwhelming destruction are causing special concern about their use.

Because of the effects of widespread use of gases during World War I, chemical warfare has always been looked upon as an objectional type of weapon by the world community. In reaction, most nations signed the 1925 Geneva Protocol, the only existing international agreement or accord on chemical warfare. Ratified by the U.S. in 1975, it forbids the first use of chemical weapons but does not restrict nations to manufacture them for retaliation.

The reported use by other nations of lethal chemical agents in Afghanistan, Laos, and Cambodia, has accelerated the U.S. concern for defensive measures as well as the need for a retaliatory capability.

At the Army's Chemical Systems Laboratory (CSL), the chemical R & D activity for the Army Armament Research and Development Command at Aberdeen Proving Ground, MD, the principal mission is to provide U.S. military forces with equipment and material to fight in a type of war that has never been fought by American troops.

Although chemical warfare is still an emotional, tough political issue, CSL's scientists and engineers are continuing the Army's mission of chemical development and readiness originally assigned to Edgewood Arsenal in 1918.

Basically it is a technological program of providing devices for detecting and warning troops of impending danger, protecting them during a chemical attack and providing modern up-to-date decontamination equipment and material that will enable the individual or unit to perform successfully in a toxic environment.

This encompasses a wide range of projects with emphasis on chemical-biological defense developments, including individual and collective protection, decontamination devices, detection and identification, warning and training systems. In addition, the varied program includes the research and development of retaliatory chemical anti-personnel agents and munitions systems and riot control materials.

Another high priority effort for CSL engineers and scientists is to protect U.S. military forces by means of smoke and obscurants.

CSL's technological studies support toxicity determinations, and include physical and analytical chemistry studies of potential threat agents and in the dissemination and dispersion of agents. All CSL development efforts are supported by basic research in the sciences, physical, chemistry, biology, and biochemistry, all geared to the primary objective of fielding material that will enable our military forces to fight and survive in a toxic environment and to retaliate if the need arises.

If chemical weapons are ever required in war, binary munitions could substantially improve the United States capability to retaliate.

Developed in the research laboratories at CSL, binary munitions provide a deterrent capability, as well as many advantages in safety, handling, transportation, and storage.

In a binary munition, non-lethal chemicals are contained in two separate conisters. After the munition is fired, the chemicals mix forming a lethal nerve agent.

For a projectile, the second canister is shipped separately and only placed in the ready-to-fire configuration at the ammunition supply point. This allows for safe storage, handling, and shipping of the munitions. It also allows the deployment of chemical munitions in safe configurations, acceptable for prepositioning any place in the world.

In the Army's 155mm binary projectile, designated M687, the two canisters within the projectile are separated by two facing burst disks. Upon firing, the set back force will break the disks to allow the solutions to mix and react on the way to the target to produce the toxic chemical agent.

Binary weapons represent a versatile concept equally applicable to other projectile configurations as well as rocket warheads and air-delivered weapons.

In line with the emphasis on strengthening U.S. military readiness. CSL scientists and engineers are developing and testing a new generation of chemical-biological (CB) protective masks.

Designated the XM30 series, the masks are designed to provide respiratory, eye and face protection against CB agents, and, with a hose assembly, will furnish protection for aircraft (M33) and combat vehicle (XM34) wearers.

Major improvements offered by the XM30 masks are a large flexible lens to provide optical coupling with weapon sights and optical devices and a unique face seal for improved fit of the entire miltiary population. The easily replaced external gas and aerosal filter canister can be worn on either side of the face to accomodate both right and left-handed soldiers. The canister is being developed by Canada under an international cooperative development agreement.

This new series of masks will replace the current standard M17A1 field protective mask, the M24 aircraft mask, the M25A1 tank protective mask, the M9A1 special purpose mask, and the Navy Mark V mask.

The improved mask design, to be produced in three sizes, also provides a drinking tube, front and side voicemitters, as well as the capability of adding a microphone assembly to allow electronic communication.

Hose quick connect-disconnect operation is available for use with on-board filtered air and oxygen systems.

Improved operational capabilities and reduced logistical burden lead the list of advantages of the new mask that include suitability for wear under a wide range of conditions. Intended to protect military personnel against field concentrations of chemical or biological agents, the new

XM30 Protective Mask

mask may be adopted for Army use as early as next year.

U.S. field forces are now protected from surprise chemical attack by means of an automatic chemical agent alarm. Developed at CSL, the alarm system, designated the M8, is composed of four basic components - the M43 detector, the M42 alarm, the M229 refill, and either a BA 3517 battery or M10 power supply.

The battery powered configuration is man portable and weighs about 13 pounds. The detector requires maintenance every 12 hours in order to renew the chemical reagents required for detection. The unit may also be mounted on vehicles using specially designed mounts.

The system automatically samples the air and detects nerve agents by means of an electro-chemical reaction. A positive response in this reaction triggers an audible signal on the M43 detector and an audible/visual signal on the M42 alarm as warning to troops in the area.

The M43 detector of the M8 system will be replaced by the M43A1, a new detector that does not require chemical reagents, reducing logistics maintenance requirements.

The M43A1 is functionally and physically interchangeable with the M43 detector and its components.

The Demilitarization Protective Ensemble (DPE), developed at CSL for the Army Toxic and Hazardous Materials Agency, has been successfully used for more than 2,000 entries into toxic environments at the Chemical Agent Munitions Disposal System at Tooele, UT.

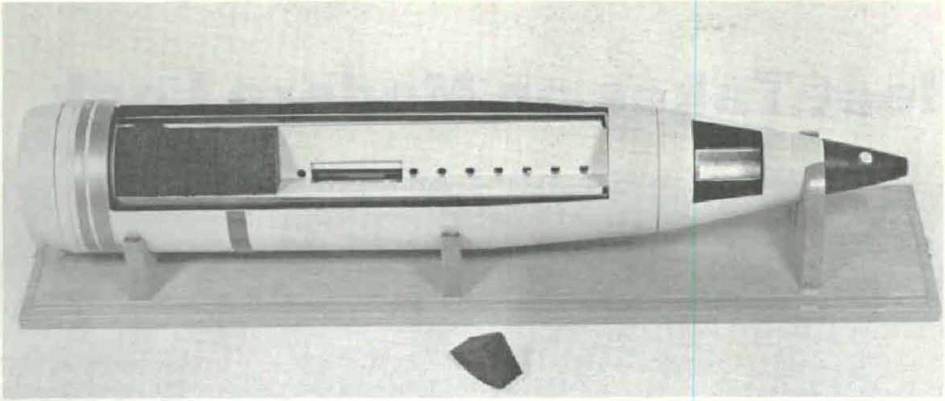
As an outgrowth of the R & D program, a prototype self-contained DPE has been developed which has the potential for filling the requirements for full body protection in remote locations where facility support is not available.

Since Biblical times, ground warfare armies have depended largely on smoke for screening troops, and today that strategy continues on the modern battlefield where armor and artillery rely on the cloak of smoke screens to support tactical operations.

One of the R & D efforts at CSL for the Project Manager for Smoke/Obscurants, was the development and fielding of the Vehicle Engine Exhaust Smoke System (VEESS), adopted by the Army to provide a low-cost, repeatable, on-board vehicle smoke generating capability to complement the smoke-grenade launching system on armored vehicles.

VEESS uses the existing vehicle engineer fuel pump to provide diesel fuel from the vehicle fuel tanks, through solenoid valves and nozzles, to the engine exhaust manifolds where it vaporizes and then recondenses behind the vehicle to form a dense homogeneous smoke screen. The system is driver-actuated and can be operated continuously or intermittently upon command to provide a screen capable of defeating detection, acquisition and tracking devices, including laser range finders.

M8 Chemical Alarm System



XM825 155mm Screening Smoke Projectile

Development of this system for M60A1/A3 tanks was initiated in 1976 with the initial fielding on those vehicles in Europe in 1979. Application was made to M728 CEV's in Europe in 1980 and is planned for M88A1 MRV's in 1981. Application programs are also underway for all U.S. tanks and the Armored Vehicle Launched Bridge (AVLB), and are pending for several air defense vehicles.

In another R & D area for the PM for Smoke/Obscurants, CSL is completing engineering development of the XM825 155mm screening smoke projectile designed to provide a significant improvement in visual ground screen effectiveness over the Army's current standard projectiles.

The XM825 is an artillery-delivered projectile that ejects white-phosphorus (WP) saturated felt wedges above the target area. The wedges fall to the ground producing a dense obscuring cloud up to 250 meters long.

The projectile, which is designed for use with the Army's M109A1 and the M198 howitzer weapon systems, is expected to be adopted for Army use within two years.

An improved man-portable large area screening smoke generator is also under development at CSL to provide the Army with a capability to generate a large area smoke screen. The improved model, designated the XM49, is expected to be capable of providing more than twice the amount of smoke generated by the current model M3A3.

Looking ahead, one of the most important facets in smoke munitions development is to provide the Army with an effective means of countering enemy sensors operating in mid and far-infrared regions. A new development in this area is the XM76 infrared screening grenade, designed to complement or replace visual screening grenades for armored vehicles, and to provide an efficient screen from the more sophisticated battlefield sensors that are expected to be deployed in the future.

A technical achievement of major importance was the completion of a product improvement program (PIP) on the Army's M258 decontaminating kit. The improved kit incorporates towelettes pretreated with decontamination materials hermetically sealed in tear-away impermeable foil packets. The successful PIP provides for more rapid use by the individual field soldier, a 3-fold increase in capacity at the same cost, and a facial decontamination capacity.

A pilot study, completed this past year, investigated the use of a special paint on tactical equipment which would resist sorption of chemical agents thus making the task of agent removal easier. A CSL Test Integration Working Group concluded the Army should adopt this paint because it provides superior chemical agent resistance and durability when compared with other types.

In addition, the use of diesel engines to replace gasoline engines in decontaminating apparatuses was successfully demonstrated in the M12A1 Decontaminating Apparatus at considerable energy and cost savings.

Other development projects included:

- A portable decontamination apparatus of 14-liter capacity being designed to dispense standard chemical decontaminating solutions.

- Jet-exhaust decontamination apparatus being developed for large scale decontamination of equipment (trucks, vans, tanks, etc.) by directing a high-velocity stream of hot exhaust gases from a jet/turbine engine.

- Interior surface decontaminating system to decontaminate interior surfaces of vehicles and shelters, including surfaces of sophisticated electronic equipment.

Protection against chemical-biological (CB) contamination requires protection for the individual in the field as well as for groups in enclosures such as tanks, armored personnel carriers, medical aid stations, portable shelters and field shelters.

The answer is collective protection equipment (CPE) designed to isolate an area from chemical or biological agents. In a contaminated battlefield, CPE allows the soldier to function at maximum efficiency with complete freedom of movement, entering and exiting a dust-free ventilated area through a protective entrance.

In conjunction with this effort, since CPE is designed for each specific application, CSL is pursuing a concept of modular collective protection equipment (MCPE), consisting of interchangeable modules that provide collective (CB) protection for a wide variety of vans, vehicles and shelters.

Basically, MCPE is a family of three end items: a filter unit: protective entrance; and static frequency converter, which assemble functionally to satisfy a specific need.

The readiness and effectiveness of a military chemical system depends on many factors: the interaction of the agent; the method of delivery and dissemination; and the environment in which chemicals are employed.

Knowledge of these factors, as well as an understanding of the cause-and-effect relationship, govern the function of chemical detection, protection and decontamination operations.

Officials at CSL say its a "catch-up game" and believe the improvement in U.S. chemical warfare capabilities will continue to be a high priority effort in the coming years.

End of an Era:
Army Truck Fleet Takes on Modern Look

By LTC John F. Michitsch

The current trend toward increased U.S. defense spending is bringing with it a long overdue modernization of a major portion of the Army's tactical vehicle fleet. Totaling some 600,000 trucks and trailers, this fleet, along with other Army ground vehicles, is under the jurisdiction of the U.S. Army Tank-Automotive Command (TACOM), Warren, MI.

The tactical truck fleet presently consists of general - and special-purpose trucks in the 1/4-ton, 1/2-ton, 1 1/4-ton, 2 1/2-ton, 5-ton, 8-10-ton, 14-20-ton and 22 1/2-ton payload categories.

The 1/4-ton vehicle is comprised of one standard-mobility 4x4 utility truck and variations thereof, including the M718A1 ambulance.

The 1/2-ton category is comprised of one standard-mobility 4x2 vehicle, the M274 utility truck known as the Mule. Introduced in 1965, this truck has not been produced since 1968 and only about 830 remain in the Army inventory. These will be phased out during the current modernization effort.

Two vehicles make up the 1 1/4-ton category. One of these is a high-mobility, special-purpose truck known as the M561 Gama Goat series - an articulated 6x6 personnel/cargo truck. Also included in this series is the M792 ambulance. The other 1 1/4-ton vehicle falls within the standard-mobility classification. It is designated the M880 series commercial truck and includes both 4x2 and 4x4 versions.

The largest number of trucks in the inventory belong in the 2 1/2-ton category. All vehicles in this group are standard-mobility trucks featuring 6x6 design, and belong to the M35A2 family, which includes a basic cargo truck and nine variations thereof.

Five-ton trucks include a high-mobility 8x8, designated the M656, M791, and M757. Other vehicles in this category are standard-mobility 6x6 trucks made up of the M39 and M809 series. Numerous variations are included thereof.

Filling the 8-10-ton category is a high-mobility 4x4 truck known as the M250 Goer series. Three versions of this vehicle are presently in use - a cargo truck, a fuel tanker and a wrecker.

M939 PIP 5-Ton Truck

The 14-20-ton weight class includes the M915 series commercial truck. There is a line-haul truck tractor, a light-and a medium-equipment transporter, a dump truck, a bituminous distributor, and a mobile concrete mixer.

Two trucks, each falling within the standard-mobility classification, come under the 22 1/2-ton category. These are the M911 commercial heavy-equipment transporter and the M746 military heavy equipment transporter.

Despite the diversity of the Army's tactical fleet, many of the current trucks are inadequate by today's standards. A large number of these vehicles, including the 1/4-ton, 2 1/2-ton, 5-ton and 10-ton trucks, feature the same basic designs that were developed during the early 1950's. These trucks did undergo a number of changes, such as the adoption of multi-fuel and diesel engines for some models, that enabled them to meet expanded military requirements of the 1960's. However, advances in combat technology since then now make them unsuitable for meeting certain specific needs.

One critical need that has emerged over the past decade is for a high-mobility vehicle in the 1/4- to 1 1/4-ton payload range that would be used by front-line troops. This vehicle would be capable of performing a variety of joint service roles - serving as a weapons carrier, communications center, cargo and personnel utility carrier, TOW Missile carrier and as a reconnaissance vehicle. Such a vehicle would spend 40 percent of its time in cross-country operation, 30 percent on paved highways and 30 percent on secondary roads.

The High-Mobility Multipurpose Wheeled Vehicle (HMMWV), planned for field introduction in December 1983, will fill this vehicle requirement. The HMMWV is a light, highly mobile vehicle consisting of a 1 1/4-ton common chassis and includes different body configurations to make it suitable for specific roles. This vehicle will replace the M274 Mule, M561 Gama Goat and M792 ambulance. In addition, it will also selectively replace M151 1/4-ton trucks and M880 commercial utility trucks now being used in combat and combat support roles.

The HMMWV will be diesel powered and have an automatic transmission. It will carry a 2,500-pound payload, have a cruising range of 300 miles, accelerate from 0 to 30 MPH within 6 to 8 seconds and achieve a maximum speed to 60 MPH. Since the HMMWV will be operated in forward areas, it will feature run-flat tires and ballistic protection up to 16-grain fragments traveling at 425 meters per second, as well as explosion-proof fuel tanks for some models. The vehicle will use off-the-shelf civilian hardware and military standard parts wherever possible.

Normally it takes seven years for the military to field a new vehicle. But the

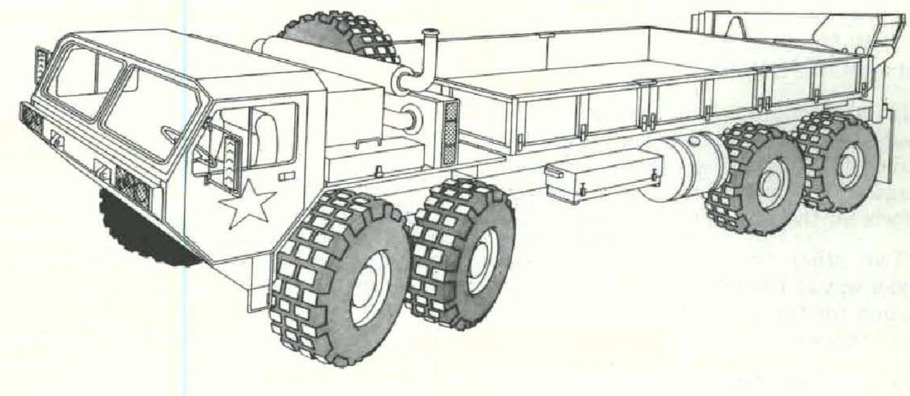
Army hopes to put the HMMWV in service in only three years, thereby making this new vehicle procurement program the shortest to date.

On 27 February, TACOM asked 61 firms, including the major domestic automobile manufacturers, to submit HMMWV technical proposals by 27 April. After evaluating all proposals received, TACOM, on 1 July, awarded contracts to AM General, Division of American Motors Corp.; Chrysler; and Teledyne, calling for each firm to deliver eleven HMMWV prototypes within 10 months.

Following five months of vehicle testing, one of the competing companies will be awarded a 5-year contract for production of approximately 15,000 HMMWVs. If these first vehicles prove to be a success, the Army expects to buy substantially larger quantities of the HMMWV in future years.

Though the need for a high-mobility truck in the 1/4- to 1 1/4-ton weight category has become critical in recent years, there has also been a growing need for a modern standard-mobility tactical vehicle for use in the less severe environment of the rear-line areas - where a more expensive high-mobility truck is not required. If all goes according to current plans, the Army will be buying standard commercial 4x4 trucks to meet this requirement late in 1982.

These trucks will replace roughly 20 percent of the current M151s, as well as selectively replace M561 and many M880 vehicles. They will include a 3/4-ton utility truck and a 1 1/4-ton vehicle that will be available either as a cargo truck or an ambulance. Known as the Commercial Utility Cargo Vehicles (CUCV's), these trucks will be considered as a family of vehicles enjoying commonality of major components.



Artist's Drawing of 10-Ton HEMTT

They will feature diesel engines, automatic transmissions and power streeting. They will have a payload capacity ranging from 1,500 to 2,500 pounds and a crusing range of 250 miles. Additionally, they will employ various kits to make them suitable for specific military applications.

The CUCV program began in 1980 when Congress last July directed the Army to buy commercial trucks to replace many of the current M880 vehicles, some Gama Goats and those 1/4-ton trucks operating in areas where high mobility is not required.

The original program objective had been to introduce the first CUCV's into the field in 1984. However, prompted by the Reagan Administration's emphasis on increased military spending and Congress's willingness to appropriate more money for defense, the Army last February decided to accelerate the program and aim for a 1982 production.

On 27 April TACOM initiated a procurement for 26 candidate commercial trucks for technical feasibility testing to determine a commercial truck's adequacy to meet the Army's mission scenario. These trucks will be tested during the June 1981 to September 1981 timeframe. Pending a successful In-Process Review in December, TACOM will initiate a competitive 2-step procurement with contract award projected for June 1982. The winning contractor will be issued a 2-year contract enabling the Army to fulfill its CUCV requirements with vehicles from two model years.

Acquisition of the HMMWV and CUCV will not only provide the Army with a greatly expanded tactical vehicle capability in the 1/4- to 1 1/4-ton segment of the fleet, but it will also help to alleviate a critical vehicle shortage that presently exists.

The Army currenty needs 110,000 1/4-ton trucks but has only about 58,000 in the inventory - nearly half of which are approaching the end of their expected life of 15 years. A major factor contributing to this problem is that the Army can no longer buy new M151's to replace the aging vehicles, because the engine used in this truck cannot meet current federal exhaust-emission standards.

A similar situation exists in the 1 1/4-ton category. The Army currently has roughly 11,000 Gama Goats in service but has a requirement for about 32,000. In addition, the 40,000 M880 trucks, which were bought during 1976 and 1977, are only two to three years away from the end of

WEST GERMAN-Built 10-Ton M.A.N. Truck

their expected service life of seven years.

Only a small number of 1/2-ton Mules are still in service. These trucks, which have gone far beyond their expected 15-year life, are being used almost exclusively as TOW Missile carriers and will be phased out when the HMMWV is introduced.

In addition to filling its own vehicle needs, the Army will be buying HMMWV's and CUCV's, as well as other new vehicles planned in current fleet modernization efforts for the Marine Corps and Air Force.

Two other truck procurement efforts under way at TACOM will result in modernization for the 5- and 10-ton segments of the Army's tactical fleet.

A new 5-ton truck series known as the M939, planned for introduction to troops late next year, has been designed to provide an improved level of reliability, availability and maintainability over the current M809 and M39 series vehicles.

The new truck is essentially a refined version of its M809 series counterpart, and, like the current vehicle, includes six cargo versions, one wrecker, one dump truck, one tractor, one tractor wrecker and two vans.

The truck features a 5-speed automatic transmission instead of the 5-speed manual unit now in use. Also new is a full air-actuated split brake system in place of the air-hydraulic system used in the M809 vehicles. A one-piece hood and fender unit that tilts forward has been incorporated for ease of maintenance; a wider, 3-man cab which has been insulated to meet federal interior noise standards has also been provided.

Other features include an improved cooling system, relocation of the vehicle batteries for better protection, a hydraulically-driven vehicle-recovery winch and a higher capacity transfer case. In addition to these improvements, the M939 will be the first production vehicle to be adapted for use with the Army's new Simplified Test Equipment for Internal Combustion Engines.

M939 production is slated to begin in May 1982 under terms of a five-year, $600 million contract awarded on 8 April to AM General, Division of American Motors Corp. Under terms of the agreement, AM General will deliver 11,394 trucks to the Army. Production options contained in the pact permit the government to buy an additional 11,394 units.

The Army presently has service requirements for 59,000 5-ton trucks but has only about 32,000 in its inventory. While the current 5-ton truck procurement will not be sufficient to achieve the desired inventory level, it will represent a dramatic improvement in the tactical fleet and will allow the Army to phase out approximately 2,000 5-ton trucks which have served beyond their expected 15-year life.

In the 10-ton category, the Army expects late next year to introduce a tactical truck designed to provide cross-country mobility that is intended to supplement the current 8-ton M520 Goer family.

Introduced in 1973, the Goer has proven to be an excellent off-road vehicle - having both the capability of swimming and operating on rough surfaces - but it is not very suitable for use on paved highways. The new vehicle, dubbed the Heavy Expanded Mobility Tactical Truck (HEMTT), is an 8x8 configuration that performs well both on and off the road. It includes two cargo versions, a petroleum tanker, tractor and wrecker.

The HEMTT features extensive use of commercial automotive components. For example, it uses a standard truck cab, a standard 435 horsepower diesel engine and 4-speed automatic transmission. Also featured is a side-mounted winch that permits rescue operations from either the front or rear of the vehicle (a first for U.S. Army trucks), a commercial crane which provides a self-loading and unloading capability, and radial-ply tires for improved highway and cross-country operations.

The truck has a cruising range of 300 miles and a maximum highway speed of 55 MPH. It has a payload capacity of 22,000 pounds.

Unlike the Goer, the new truck is unable to swim but can ford water up to 48 inches. In order to meet the objective of using commercial components to the maximum extent possible, it was necessary to give up the swimming capability. Since no commercial truck user has a requirement for a vehicle that can swim, commercial components are not designed for this purpose.

The Army will receive delivery of the first trucks next year under terms of a $251,130,318 5-year contract awarded on 22 May to Oshkosh Truck Corp. for production of 2,140 HEMTTs. Like the 5-ton truck contract, the HEMTT agreement contains production options for an additional 5,350 vehicles.

Besides performing normal combat support roles, the HEMTT will support certain missile systems.

In a program related to the HEMTT effort, the Army is purchasing the West German built 10-ton M.A.N. truck, which will be used as missile support vehicles in Europe.

In October, 1980, TACOM awarded a contract to M.A.N. of West Germany for 15 10-ton trucks. The vehicles include three configurations - two tractor versions and a tractor wrecker. These will undergo initial engineering tests through August 1982.

The Army is scheduled to exercise production options contained in the contract for an additional 450 trucks, pending an In Process Review in December 1981.

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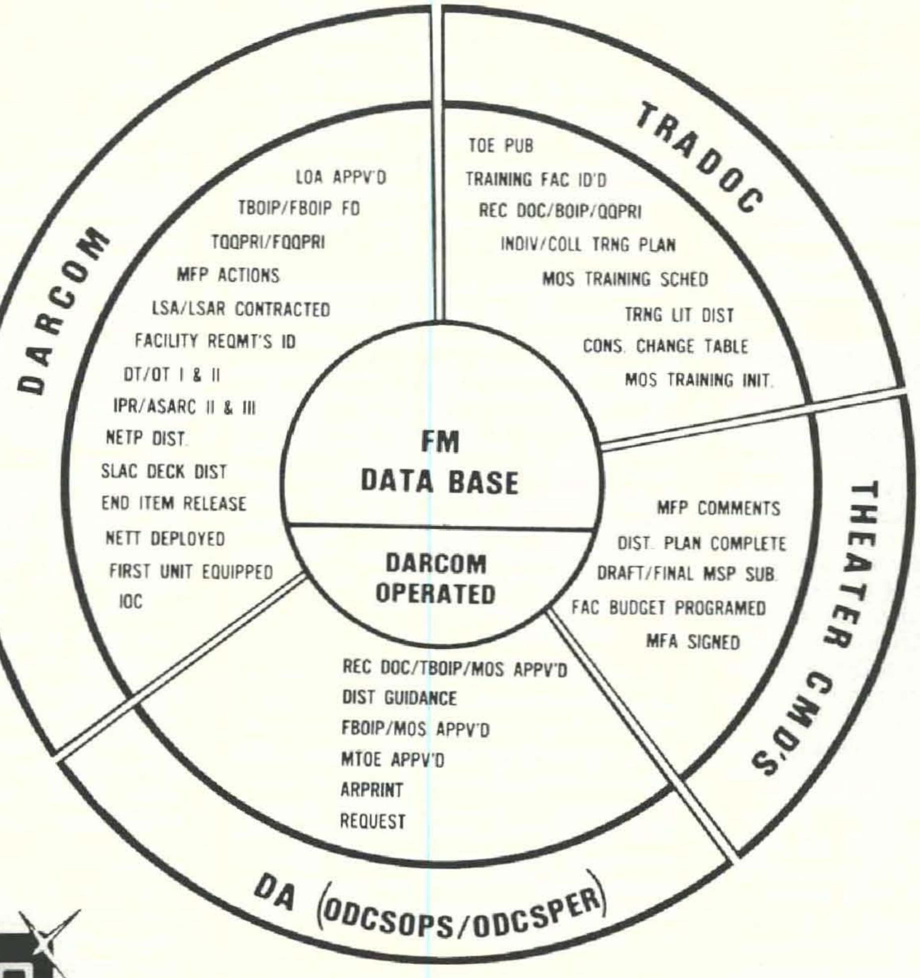
Force Modernization and Materiel Acquisition

By COL Richard L. Nidever



FMMRS

FORCE MODERNIZATION MILESTONE REPORTING SYSTEM (FMMRS)

One of the newer major management areas of growing importance to those in the RDA business is that called Force Modernization. It has come into crucial importance, considering that the Army plans to field billions of dollars of new equipment over the next several years.

There are still a few old timers who can recall the days when the R & D community had virtual free rein to develop a myriad of systems whose technology appeared attractive. Even the Congressional committees were generous at times, offering the Army more RDTE money than it was seeking. There was then no procurement bow-wave problem; few people pondered the ILS impact; and technology was king in appearing to offer a solution to the Army's "outnumbered" problems. Furthermore, the military draft supplied a theoretical cross section of American youth with which to man new systems, with numbers and skills no real problem.

How different conditions are today. The Army is undergoing the most massive modernization effort since World War II, with the new materiel being technology-loaded. The items are costly and very sophisticated. Further, they require special skills and resources to operate and maintain. It is no longer a simple process of discarding an old system and putting a new and slightly better one in its place. Today the process is most complex, and the term being used to describe the process of current and future fielding of new materiel is Force Modernization.

Force Modernization can mean different things to different people. The definition currently used by HQ DARCOM is "all those actions taken to describe, develop, acquire, deploy, and support new or improved weapon systems, support systems, and organizations. This includes the planning for and redistribution of displaced systems . . ." The process covers active and reserve components.

Force Modernization is composed of and impacts on virtually every aspect of the Army's existence - doctrine, organization, manpower, training, facilities, force structure development, procurement, maintenance, and others. Each area must be considered and satisfactory answers and solutions provided to assure successful development and fielding of a new system.

Force Modernization offices have been created at most major command headquarters to ensure that these functional areas are considered and new system fieldings are budgeted and planned for. In a sense, Force Modernization people are involved in everyone's business and work in a gray area somewhere between a functional proponent and an IG, with problems called as they are seen.

In the case of the HQ DARCOM Force Modernization Office (FMO), it monitors actions from HQDA to the gaining commands to assure that developing activities and managers act on those Force Modernization functions necessary to assure successful fielding of a new item.

Let's look at the activity now underway in support of the Army of the 90s. As a result of studies, planning, and analysis during the 1970s on the Army of the future, the Chief of Staff decided in October 1980, to proceed with Army 90 transition planning and implementation. It was also decided that force structure planning and actual reorganization would be accomplished during the 1982-1984 time period.

From a materiel standpoint, the Army takes what it has and redistributes the equipment according to new tables of organization and equipment. It then develops and fields new equipment according to restructured configurations as the items become available. In other words, it is simultaneously moving toward a reorganized Army of the 90s while, at the same time, it is fielding hundreds of new systems.

The magnitude of this is mind-boggling even to today's generation of minds used to hearing budgets in terms of billions and accepting space shots as almost certain successes. Over 400 materiel systems and items will be involved. Almost every unit and organizational structure in the Army will be affected. During the 1983-1987 timeframe, procurement costs may exceed $108 billion and operating and support costs may add another $10 billion. Also, we can add another $1.5 billion for facilities!

This modernization will require some 18,000 additional military spaces and 16,000 civilian spaces. Management will be under stress at all levels, and the need for modernization integration and control will be urgent.

What is involved in this new management area? Early in the conceptual phase of a program the operations, training, and doctrine people develop materiel requirements which are then passed to the RDTE process. Early in the development cycle personnel people, trainers, and users are involved, starting their appropriate actions and plans. Priorities are established, authorization documents created, and procurement actions initated. DARCOM development maintenance engineers and supply people start necessary systems support actions. All must do the right thing at the right time to assure a supportable system that works in the field.

What are the tools of the Force Modernization people? The first is the DA sponsored Army Modernization Information Memorandum (AMIM). It is a document that attempts to tell what is happening, when, and where, and contains resource information of use to gaining commands about specific materiel, manpower, and funding needs of a new system. The data comes from DARCOM, TRADOC, and the Army Staff, and assists major commands in the development of their resource requirements included in their Five Year Defense Programs.

A second tool is the Modernization Resource Information Submission (MRIS). This document, which is submitted to the Army Staff along with the annual PARR (Program Analysis and Resource Review), is primarily a weapon system oriented, OMA funding and manpower requirements document. It represents a new effort to anticipate and develop total systems cost. Both the MRIS and the AMIM are resource and budget oriented.

A third document is the Force Modernization Milestone Reporting System (FMMRS). This is an ODCSLOG sponsored report that addresses critical milestone events and involves all major commands and headquarters involved in the development and fielding process. (See Pie Chart on page 19).

Naturally, the timing on these documents and reports must be scheduled to the annual planning, programming, and budgeting cycle if the required resources are to be obtained when needed. The AMIM, the document directed toward the resource requirements of the gaining command, is published in the August-September timeframe. Army Consolidated Guidance is published in October and outlines the requirements and details of the PARR submission.

At DA, the major command submissions are converted to the Program Objective Memorandum (POM), which is submitted to OSD in May/June of each year. Following decisions of OSD, the POM is converted to a budget and submitted to OSD in September.

The third document mentioned, the FMMRS, is a quarterly report that tracks performance against critical milestone events, updates fielding schedules, and provides redistribution information.

The task of coordinating all the interrelated required actions is vast but must be accomplished across the entire active and reserve component structure. All aspects of the weapon system - people - equipment - training - support activities have to be monitored. A resource impact model has to be developed to provide alternatives for manpower and funding changes. The ILS system must be closely watched to ensure it is being followed for each system being developed so that when the item is fielded it will work and will be supportable.

Total materiel requirements must be assured by seeing that associated support items of equipment are identified and obtained, and that the facilities will support the fielded systems.

As the Army looks to the future, the Force Modernization Office will be devoting substantial effort to support the Army 90 transition and the fielding of hundreds of new items and weapon systems.

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Engineering for Producibility

By John Larry Baer and Paul Chernoff

Ask any corporate manager whether his company actively uses producibility engineering and his response is likely to be a firm "of course we do." Ask him why, and the reply will probably be a nonplussed "well, it's essential. Everbody has to look at the producibility of a new product as it's being generated. It would be stupid not to. Quite frankly, we couldn't afford to compete if we didn't engineer our products for producibility—shaving off pennies or dollars wherever we can without seriously affecting the quality or performance of the product."

And how does industry do it? By placing a production engineer on every new product design team right from the start as shown in Figure 1. He or she will usually be a seasoned engineer with shop experience who will look over the designer's shoulder at every step advising how his design may be made more producible. As time goes by and concerns for production supercede those of "function and effect," more production engineers will be added to the team replacing R & D types to ease the transition into production.

These production-oriented engineers will be in a better position to assess the need for resources such as new manufacturing methods, tools, facilities, and to obtain timely funding to scale laboratory demonstrated procedures into full scale production. The Project Manager for Plant Base Moderization is an excellent example of how this procedure has worked well in the Army.

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PAUL CHERNOFF is a general engineer in the Office of Manufacturing Technology, HQ DARCOM. He has a bachelor's degree in physics from City College of New York, holds a patent for an electrically-controlled triggering circuit for fuzes, and has done graduate work in physics and math, including linear/dynamic programming.

Generally, however, if you ask a military manager how he responds to his charter obligation, "to perform producibility engineering and planning (PEP)," you will get a Gallic shrug. He, too, recognizes that PEP should be done and he programs for it under AMS Code 49 to set aside a portion of his RDTE funds to do PEP. But, as soon as he runs into technical problems he will, perforce, divert that PEP reserve to solve them—otherwise, there would be no product. Logical, No? No!

When two industrial competitors recently each designed a piece of hardware, both met the required specifications. One, however, had a little bit better effect—the other had designed his for greater producibility and, of course, expected to make it at a lower cost (that's the way he

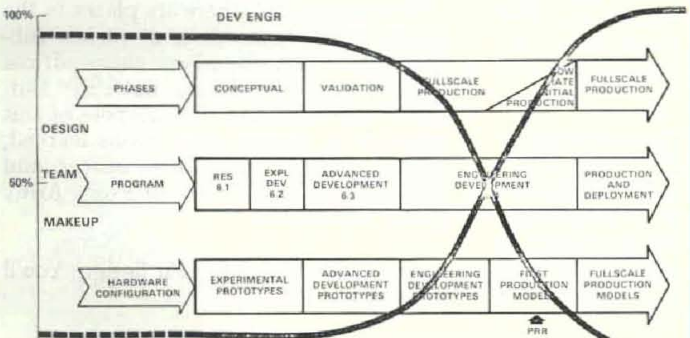


Fig. 1. Phasing Producibility into the Materiel Life Cycle

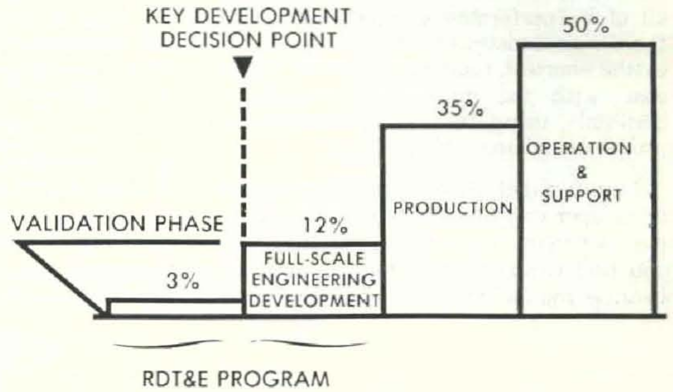


Fig. 2. Distribution of Costs Through the Life Cycle of a Typical Weapon System

was trained). Guess who won the competition. Of course, the one with the edge on effect. The fact that his design ultimately cost about twice that of the more producible competitor is almost irrelevant. Or is it?

Most of our military hardware is no more complex than a good camera; our electronics are comparable to a good color TV; our household goods are functional and yet operable by relatively untrained homemakers. So why do we allow, how do we dare, to crank out multi-million dollar gadgets with no attention to their producibility?

We are paying the price daily in our inability to produce enough tanks, guns, sights—you name it—or as many as we promised, in the time and at the cost we promised. Our inattention to producibility is making liars of us all. What can we do? We can start paying attention to PEP—a pill that cures R & D headaches.

Almost every R & D project manager or project officer has experienced R & D headaches. They come in two major categories: Category one is the technical engineering problems which preclude achieving the project's performance requirement goals. Unfortunately, our PEP pill does not cure that type of R & D headache.

Category two is the R & D which comes after the manager has achieved the project's performance requirements and finds that his product cannot be produced within established cost goals and time constraints in the quantities required using available materials and manufacturing methods. This second category is the headache which our PEP pill can cure. So now you ask how do I take the PEP pill to cure this rather common R & D headache?

The first part of taking the PEP pill is to accept and fully understand that PEP comprises "the inherent elements of a design by which an object, while meeting all of its performance objectives within the design constraints, may be produced in the shortest total time, at the lowest cost, with the most readily available materials, using the most advantageous processes and assembly methods."

Simply stated, there's probably a better or cheaper way to make the product without sacrificing any of its capabilities. If you find this definition hard to swallow because you feel that it is a burden to the R & D effort, you should realize that this burden is relatively small compared to the costs shown in Figure 2, page 21.

It is cheaper and easier to make an impact on product cost early in R & D before the design becomes set in concrete. More to the point, is the fact that full-scale engineering development (FSED) cannot be considered complete if PEP has been inadequately performed. At this point, you may be willing to swallow the PEP pill except you may not know what PEP efforts are necessary to adequately perform PEP.

The first PEP effort is to plan and program the entire group of efforts to start as early as the validation phase (but no later than the beginning of FSED) and complete them by the end of FSED. At the top of this page is a typical cookbook list of these efforts and when they should be performed.

EFFORT	WHEN
1. Initiate PEP (AR 70-1 Para 4-4).	**ASAP but no later than the start of FSED.**
2. Have an assigned producibility engineer's drawings to suggest alternative designs from a cost reduction and production viewpoint.	**Prior to extensive development operational testing and prior to committing drawings as part of the configuration management set.**
3. Design and producibility engineers jointly select alternative designs for development testing when practicable.	**Prior to committing drawings as part of configuration management set.**
4. Identify "make or buy" components.	**As soon as the decision is made to incorporate a component into the final design.**
5. Identify manufacturing methods and technology (MM&T) or manufacturing technology development (MTD) efforts which are either desired or required.	**As soon as the producibility engineer on the design team realizes that the component or assembly requires a difficult, time consuming or costly manufacturing or inspection process.**
6. Identify production line resources (e.g., facilities, equipment, skills, management structure) which are scarce or unavailable to meet production schedule.	**As soon as possible but no later than DT-I.**
7. Identify that existing producibility problems are solveable and therefore will contribute to the successful completion of FSED.	**As soon as possible, but no later than DT-I.**
8. Complete the Technical Data Package (TDP) including all PEP efforts.	**Completion of FSED. You are now ready to face the first critical question of the production readness review—the question of product producibility.**

The cookbook list, along with the initial planning should provide the prescriptive prevention for most PEP type headaches. If you have any questions on the subject of PEP, the Office of Manufacturing Technology at HQ, DARCOM stands ready to help you.

Without a doubt, there are places in the Army RDTE organization, at various subordinate commands, where entire offices are staffed to do nothing but PEP. But, these offices are rare. The purpose of this article is to pass on the lessons learned, the benefits gained by these offices, and make PEP a way of life for every Army RDTE organization.

Put a little PEP into your design. You'll never regret it.

Evaluation of Engine Designs

By Paul C. Glance and Herbert N. Cohen

ENGINE CANDIDATES

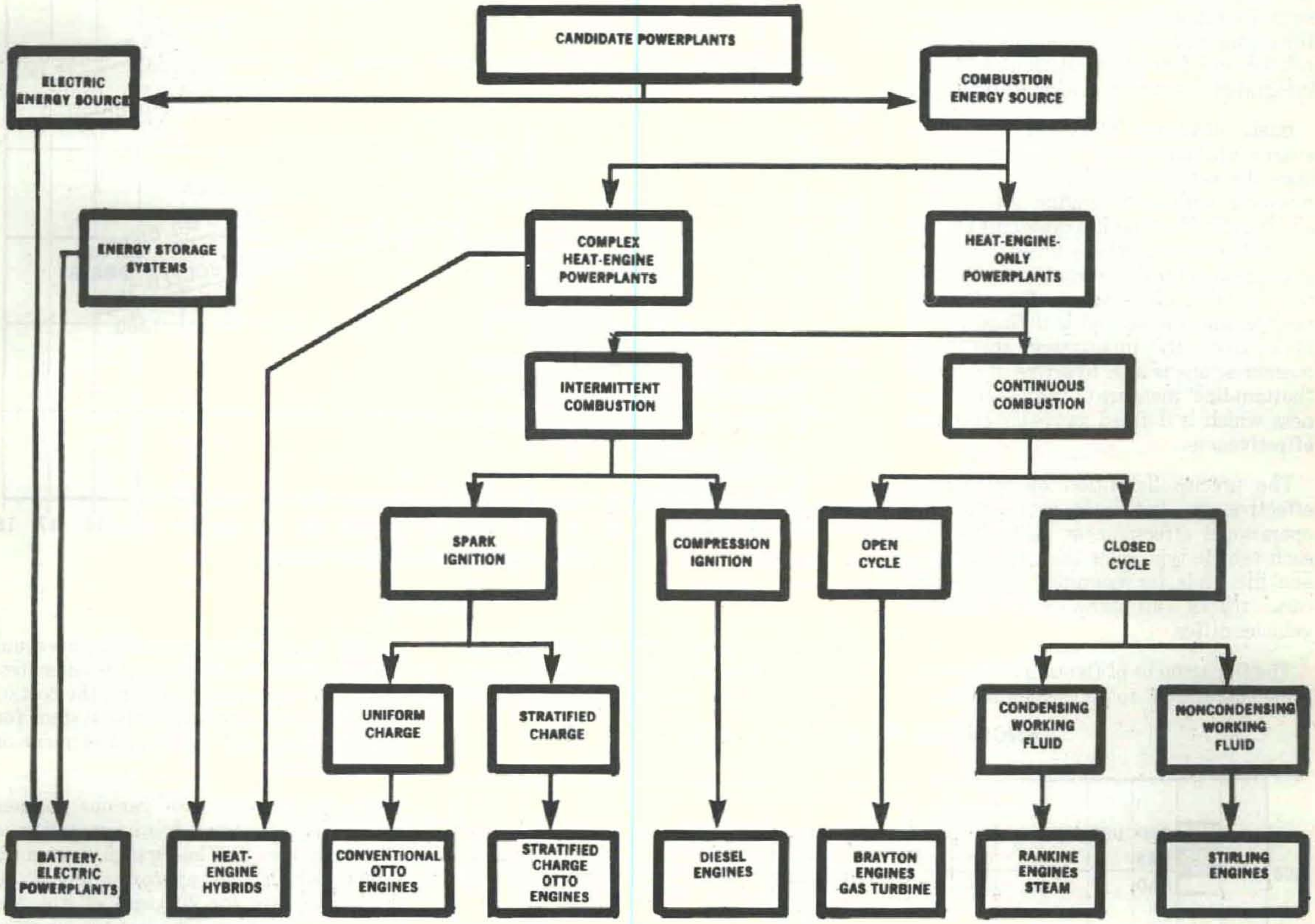


Figure 1

There are numerous possible vehicle engine candidates that currently appear feasible (see Fig. 1). Each engine class has its inherent advantages and disadvantages and within each class there are often hundreds of design variations.

Engine types are so numerous as to admit more than one solution to a given vehicle design requirement. In consequence, there are alternative engine designs which have to be evaluated, either to assess the relative merits of existing engines or to choose the most promising technical approaches to be pursued toward designing new ones.

A common response to the need to evaluate engine designs is to compare, one by one, their individual features, such as, size, power, fuel consumption, reliability, weight and cost. This method is employed by the U.S. Army Tank Automotive Command (TACOM). It is of value when comparing the attributes of engine classes, but it is not sufficient to evaluate the improvement in vehicle effectiveness afforded by each alternative engine. Because the engine is an integral part of a total vehicle system, its evaluation is best conducted within the context of the total vehicle evaluation.

Another approach to the task of evaluating the improvement in vehicle effectiveness afforded by engine alternatives, is to invoke general measures of vehicle effectiveness such as mobility, agility, productivity, and total system cost.

Invoking these traditional concepts helps to clarify discussions by emphasizing the important attributes one seeks in vehicle design, but again such an approach is not sufficient to quantify how the engine contributes to the vehicle system as a whole. For one thing, mobility, agility and productivity do not always lend themselves to precise definitions. More importantly it is by no means clear how the engine and vehicle attributes are interrelated and how, therefore, they should be integrated into an overall evaluation.

With the above approaches to the problem, because the interrelation between attributes must be subjectively determined, the evaluation is largely a matter of personal opinions and subjective judgements. To advance beyond subjectivity, one must start from fundamental principles and develop a "propulsion system evaluation methodology"; the primary function of such a methodology is to determine how the engine and vehicle attributes are interrelated and how these attributes can be integrated into a total system evaluation.

Basic "measures" to be addressed in an engine evaluation are: How successfully does the vehicle (fleet) perform its basic missions with each engine alternative? and what is the total life cycle cost of each alternative engine/vehicle (fleet)? The first measure is defined as operational effectiveness (combat effectiveness for a combat vehicle) and the second is defined as life cycle cost. By integrating these two measures, one is able to arrive at a single "bottom-line" measure of vehicle effectiveness which is defined as cost/operational effectiveness.

The precise definition of operational effectiveness, life cycle cost, and cost/operational effectiveness, will differ for each vehicle type since the basic missions and life cycle for example, of passenger cars, trucks, off-highway and combat vehicles differ.

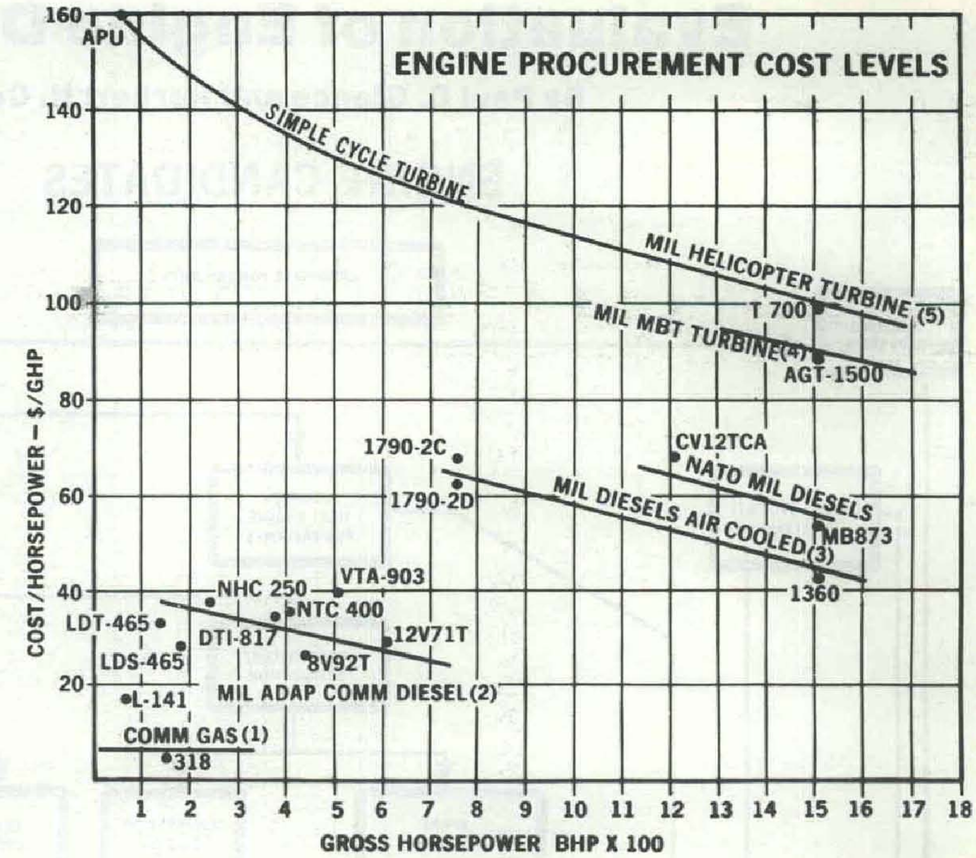


Figure 3

The Department of Defense defines "life cycle cost (LCC)" to be the summation of the costs required to; develop and test (R & D cost), procure (acquisition cost), and operate and support (O & S cost) for the life of the system (including overhaul cost, if any). The life of most weapon systems is 20 years and therefore, the cost of operating and supporting the system for 20 years is usually the largest element of life cycle cost.

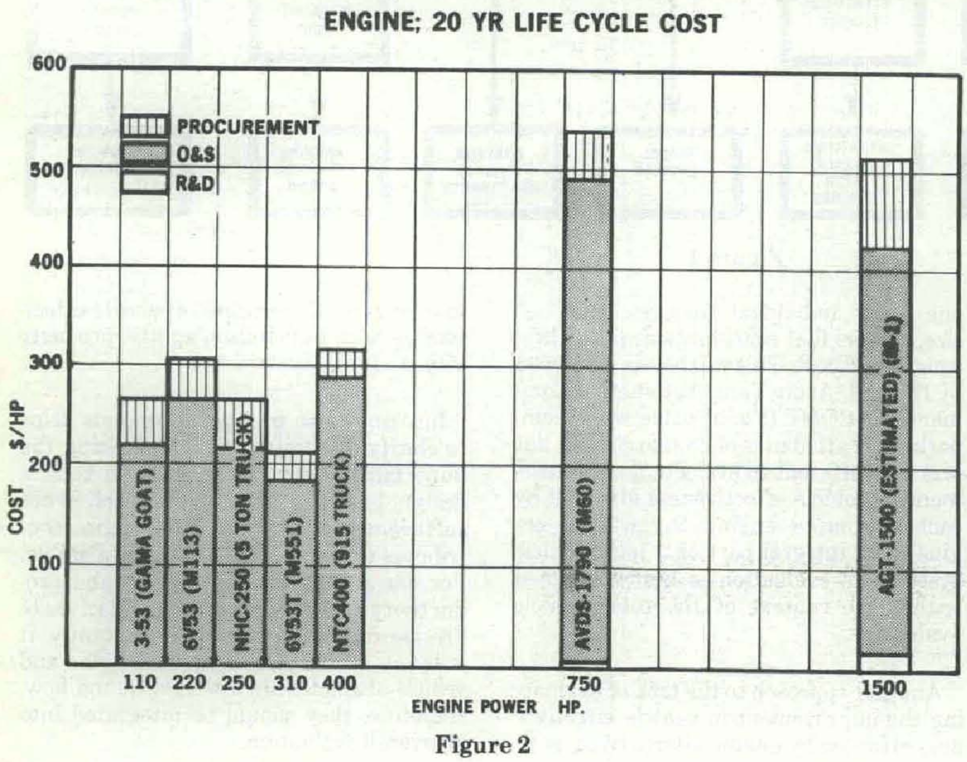


Figure 2

The life cycle cost of various engines which the U.S. Army has in operation is shown in Fig. 2. The first five engines shown, which cost approximately $250 per horsepower for 20 years of life, are commercial engines. The last two engines are main battle tank (special military) engines which have life cycle cost levels of approximately $500 per horsepower for 20 years of life. Note that the R & D costs typically are a small element (less than four percent) of the total life cycle cost.

Each cost element of LCC can be analyzed to determine parametric relationships for the various classes of engines; for example, Fig. 3 is a chart of engine procurement costs and displays some parametric cost trends for five classes of engines and five procurement cost levels; commercial passenger car high production rate gasoline engines ($7/HP), commercial truck medium production rate diesel engines ($30/HP), military (tank) diesel engines ($60/HP), military (tank) regenerative gas turbinee engines ($90/HP), and military helicopter

COST/COMBAT EFFECTIVENESS METHODOLOGY
PROPULSION SYSTEM

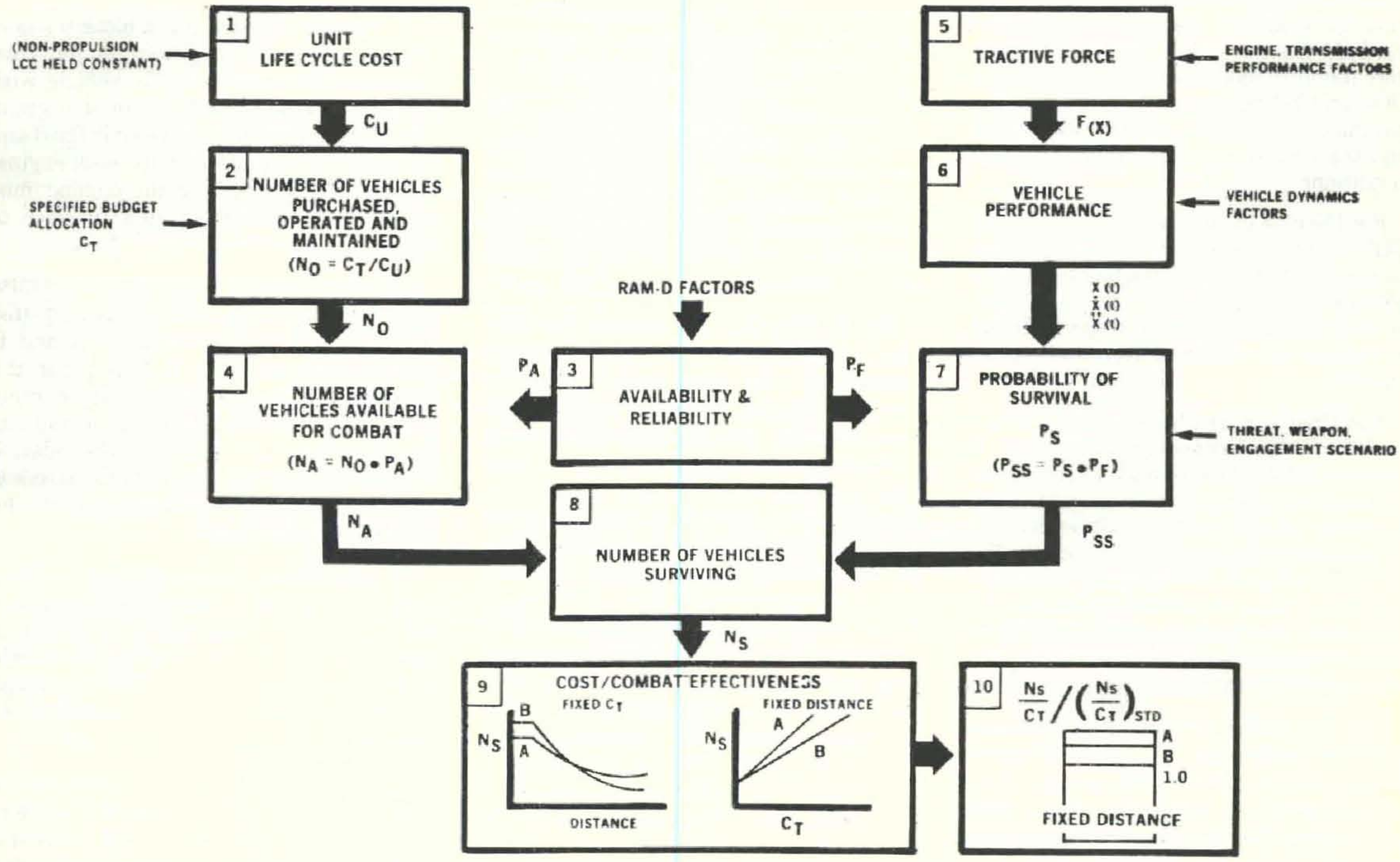


Figure 4

gas turbine engines ($100/HP). This type of parametric cost data can be used to estimate the cost of engine design candidates which have not yet entered production and is often useful in preliminary evaluations.

Once the Life Cycle Cost of the engine candidates have been estimated, the next step is the calculation of operational effectiveness.

The basic question in the evaluation of enhancement in vehicle operational effectiveness afforded by alternative engines is the measurement of how successfully the vehicle performs its missions with all other (non-propulsion) vehicle attributes held constant. Any answer to this implies the capability to accurately calculate the probability of the vehicle successfully performing its missions and then the capability to compare the degree of this success afforded by each alternative engine. The advantage of such a probabilistic approach is that it places the evaluation on a more precise, quantitative basis and, consequently, makes the evaluation more objective.

The assessment of operational effectiveness, therefore, requires a precise definition of the vehicle mission(s) and a precise definition of the methodology to be employed in the calculation of the probability the vehicle will perform the mission.

The general approach to determining the probability of success for a complex mission, begins by dividing the mission into a sequence of independent events. This is followed by the determination of the probability of successfully completing each independent event. The product of these probabilities is the probability of successfully completing the mission.

For the case of a combat vehicle, the primary independent probabilities are usually taken to be:

- The probability of engine/vehicle availability (some vehicles will be non-operational due to scheduled and unscheduled maintenance of the propulsion system).
- The probability of the engine/propulsion system not failing during the mission.
- The combined probability of the vehicle not being detected, hit, and killed, respectively during combat mission.

These three probabilities are functions of the engine/propulsion system attributes. Henceforth, the relative importance of each engine attibute such as cold starting ability, reliability, size, weight, performance level, etc., are quantified by the calculation of the probability of the vehicle successfully completing its mission.

The calculation of these independent probabilities is often done with the aid of a mathematical (or computer) simulation of the vehicle missions. A simulation of a vehicle mission allows one to vary the input parameters, environmental conditions, and engine attributes, one by one, and then measure the probability of successfully completing the mission. In this way, the *relative* importance of each engine attribute, for the vehicle mission under investigation, can be precisely calculated for a wide range of operational conditions.

The Department of Defense has developed a series of simulations which one may employ to calculate vehicle performance. TACOM has developed the NATO Reference Mobility Model which is employed by DOD and NATO to calculate the mobility parameters of vehicle acceleration, speed, and traction over a wide range of terrain conditions.

For the case of combat vehicle missions, DOD also has developed many combat engagement simulations which one may employ to calculate the probabilities of being detected, hit, and killed respectively as a function of vehicle acceleration, speed, and size.

The final stop is the integration of life cycle cost operational effectiveness to obtain a bottom-line measure of cost/operational effectiveness. There are two standard methods of presenting cost/operational effectiveness. In the first method, the life cycle cost of each alternate engine/vehicle fleet is set equal by adjusting the number of vehicles in each fleet and the operational effectiveness of each alternative is then compared with the others.

The alternative with the greater operational effectiveness, i.e., the alternative engine which affords the greater fleet effectiveness, is then the most cost/operational effective engine. The second method is to set the effectiveness of each fleet equal, by adjusting the number of vehicles in each fleet, and then to calculate the life cycle cost of each fleet. The lowest LCC fleet is then the most cost/operational effective alternative. Both methods should yield equivalent results.

Perhaps the best way to understand such a cost/operational effectiveness evaluation is through an explanation of the Propulsion System Evaluation flow chart, Fig. 4, page 25.

For the case of combat vehicles, the probability of successfully completing the mission(s) depends on the probability of the vehicle surviving combat engagements. Therefore the product of probabilities of survival, availability, and not failing (reliability) is the principal measure of combat effectiveness of combat vehicles engines.

One propulsion system candidate is judged to be more effective than another if it can be shown that its performance and dependability are such that it can make combat vehicles less vulnerable to enemy fire. Thus, the approach to evaluating the cost/combat effectiveness of two or more engine candidates is to fix the total budget allocated to the vehicle fleet (for each engine candidate) and then compare the availability, survivability and reliability of the candidates. This is done by first determining the number of vehicles, with each type of engine, that can be purchased, operated and maintained for a fixed total dollar investment, then calculating and comparing the number of combat vehicles that will survive with these engines, giving consideration to the propulsion system performance, availability and reliability.

Fig. 4, page 25, summarizes the principal steps involved in computing and comparing the cost/combat effectiveness of combat vehicle engines. The branch on the left computes the number of vehicles, with each type of engine, available for combat (for a fixed budget allocation) and the branch on the right computes the probability of successfully completing the mission(s), P_{SS}, for the combat vehicle employing each type of engine. These two parameters, number of engines available, N_A, and probability of success, P_{SS}, are multiplied in block 8 to yield the number of vehicles (with each type of engine) successfully completing the combat mission, N_S. The last step (block 9) shows how the results can be presented comparing two different engine candidates, A & B.

The left graph of block 9 plots the number of vehicles successfully completing the combat missions vs. the vehicle exposure distance (i.e., distance between protected defilade positions); this is a key engagement parameter. For illustrative purposes, the graph shows that the cost effectiveness curves of the two engine candidates cross as distance increases. This is because the probability of survival is 1.0 for small distances and therefore, the number of surviving vehicles is controlled by N_A, the number of available vehicles.

N_A is affected by engine availability and unit life cycle engine (vehicle) cost, as shown in the blocks on the left above block 8. At longer exposure distances, the probability of successfully completing the combat mission, $P_{SS} = P_S P_F$, as shown in block 9, dominates over the effects of N_A, the number of vehicles available for combat.

The probability of successfully completing the mission is affected by the acceleration and resulting velocity for each of the two candidate systems. The effect of other engagement parameters, such as threat weapon, range or defensive tactics, also affect the probability of survival of each system.

The graph on the right in block 9 shows the effect of budget allocation on cost/combat effectiveness of the vehicle with the two engine candidates. In this graph the exposure distance traveled is fixed and the number of vehicles (with each engine) successfully completing the combat missions, N_S, is computed as a function of the budget allocation, C_T.

A final method of presenting the results is to calculate the ratio of N_S/C_T (for a fixed distance) for candidate A and B divided by the value of N_S/C_T for the baseline vehicle with the baseline engine. This is shown in Fig. 4, block 10, and has the advantage of indicating the relative improvement in cost/combat effectiveness of each candidate in comparison to the base vehicle and engine.

In calculating the number of vehicle/engines available for battle (left branch of Fig. 4), the first step (block 1) is to compute the unit life cycle cost for the vehicle with each engine type (C_U). The key inputs to this calculation are the various cost factors listed (see accompanying list).

The unit life cycle cost is defined as the total cost required to research, develop, test and evaluate (RDT & E), procure, install, operate and maintain an engine for the lifetime of the combat vehicle, which is generally a specified number of years (15-20 years) and operating hours (2000-10,000 hours).

Included in the life cycle cost are the RAM-D factors, MTBF, MTBO and MTTR. The life cycle costs of all non-propulsion relative components are held constant. The next step is to specify the budget of interest (C_T) and compute the number of vehicles and engines that can be purchased, operated and maintained for the life cycle of the vehicle (block 2).

Next, the availability of the engine is determined (block 3) for the various RAM-D factors shown in the attached list. The product of the probability of availability, P_A, and the number of vehicles with each engine purchased (N_O) gives the number of vehicles available for battle, N_A, (block 4) and completes the left hand branch of Fig. 4.

In calculating the probability of survival (right branch of Fig. 4), the first step is to characterize the engine performance in terms of tractive force as a function of vehicle velocity (block 5). High resolution performance characteristics of the bare engine and transmission as shown in the accompanying list and the propulsion system losses, are both inputs (block 5) to this part of the evaluation. By taking the gross engine torque curve and subtracting off the losses due to engine cooling, alternator, and accessories and making adjustments for installation configuration losses and temperature and altitude corrections, a net torque to the transmission is developed.

Transmission input and output losses are subtracted, the gear ratios and efficiencies are considered, and a curve of tractive force (power to the drive component, wheel or track) vs. engine speed is obtained. The tractive force (vs. speed) is the maximum force available to propel the vehicle at a given speed and gear shift position.

The tractive force information is then combined with the vehicle dynamics factors (see accompanying list) to calculate the velocity and acceleration performance (block 6). In this analysis, the internal inertia of the engine, transmission, and drive train (wheel or track) are all vehicle dynamic factors that are considered as to the force they exert in resisting acceleration. The force available for acceleration is the tractive force minus the internal inertia, rolling resistance, air resistance and any grade resistance. The output of block 6 consists of vehicle performance curves of speed vs. time, distance vs. time, and acceleration vs. time ; X(T), X(T), X(T).

Finally, based on the combat vehicle performance parameters derived from block 6, the probability of survival, P_S, against the threat weapon of interest is computed for specified engagement parameters in block 7. Two vehicle tactics are of particular interest: defilade exit at zero velocity, maximum acceleration and defilade exit at maximum velocity. The threat weapon performance inputs are time of flight, firing rate, aiming errors, etc.

Key engagement conditions to be considered include range from threat weapon to vehicle and exposure distance, i.e., distance between protected defilade positions. The probability of survival, P_S, is next multiplied by the probability of the propulsion system not failing (reliability) during the combat mission, P_F, which yields an overall probability of successfully completing the mission(s), P_{SS} (block 7).

For discussion purposes, the above methodology has been limited to a simplistic example comparing one homogeneous system to another. In practice, the situation is often more complicated. For example, suppose a fleet of 10,000 present inventory tanks were being considered. For a given total life cycle cost, perhaps 6,000 tanks could be retrofitted with a new engine, type A. This would result in 4,000 tanks that are not retrofitted.

The number of surviving tanks from the fleet of 6,000 and 4,000 tanks is then computed, using the kind of methodology described previously, resulting in curve A, a mix of two engine types in block 9. Curve A is then compared with Curve B to determine which mix of tanks (engines) is more cost/combat effective.

The cost/combat effectiveness of candidate combat vehicle systems can be evaluated by means of the methodology presented in Figure 4. In implementing this methodology, a cooperative effort among many offices, two DARCOM commands, and close coordination with combat vehicle PMO's and TRADOC is required. The Tank-Automotive Command (TACOM) has been responsible for developing Unit Life Cycle Cost (block 1), Availability (block 3), Tractive Force (block 4), and Vehicle Dynamics (block 6).

The Army Armament R & D Command (ARRADCOM) has performed the remaining steps. One of the combat scenarios considered is that of an enemy gunner firing at the vehicle as it moves across the enemy field of view from one protected defilade position to another. The probability of survival of the vehicle during the time it takes to reach the next defilade position is determined. The analysis required the modeling of the major performance characteristics of the enemy weapon ammunition and fire control.

Various prediction algorithms are used to determine which one the enemy might use to cause the largest probability of kill (i.e., the lowest probability of survival). Conversely, various vehicle tactics can be explored to determine which tactics cause the greatest probability of survival. These simulation results can then be "handed off" to TRADOC for field test and validation.

The U.S. Army Tank Automotive Command and the U.S. Army Armament R & D Command have developed a propulsion system evaluation methodology consisting of a data base, a series of vehicle performance computer simulations and cost estimating relationships in order to more objectively evaluate the enhancement of combat vehicle cost/combat effectiveness afforded by various propulsion systems.

A similiar methodology is being de-

Input Factors
To Propulsion System Evaluation Methodology

Cost Factors Entering into the Calculation of Unit Life Cycle Cost

Cost of RDT&E
Purchase Price
Cost of Spares
Inventory Managment Cost
Cost of Support Equipment
Cost of Personnel
Cost of Mgt & Tech Data
Cost of Facilities
Cost of Fuel (POL)
Cost of Repairs
MTBF, Mean Time Between Failures
MTBO, Mean Time Between Overhauls
MTTR, Mean Time to Repair

RAM-D Factors Entering into the Calculations of Availability

Probability of Cold Start
Probability of Operation on Available Fuels
Mean Time Between Failures (MTBF)
Mean Time Between Overhauls (MTBO)
Mean Time to Repair (MTTR)

Engine/Power Train Performance Factors Entering into the Tractive Force Computations

Ambient temperature, pressure, altitude
Engine torque versus RPM, HP versus RPM, SFC versus RPM
Engine accessory and installation losses torque losses
Transmission input and output losses
Transmission gear ratio (s)
Final drive gear ratios, final drive wheel diameter

Vehicle Dynamic Factors Entering into Combat Vehicle Performance Computation

Rolling resistance
Inertia of hull, tract and wheels
Gear train inertia
Engine inertia
Suspension/terrain speed limit

veloped to evaluate the enhancement of tactical vehicle cost/operational effectiveness afforded by various propulsion systems. The propulsion system evaluation procedure has been computerized and allows rapid assessments of candidate propulsion systems, relative to current baseline propulsion systems.

The relative sensitivity of the cost/combat effectiveness "answer" can be determined as a function of a wide range of input values such as; propulsion system performance, propulsion system RAM-D, cost of fuel, terrain, size of propulsion system, environmental conditions, R & D cost, procurement cost, mobility tactics, threat weapons, etc.

The propulsion system evaluation methodology will be further developed and used as an evaluation screening tool to objectively determine the most promising engine alternatives warrenting further development, test and evaluation; and consideration for acquisition by the U.S. Army Tank-Automotive Command.

DR. PAUL GLANCE is chief of the Engine Function for the U.S. Army Tank-Automotive Command. His education includes an automotive engineering degree from the Chrysler Institute of Engineering, MS degree in mechanical engineering from the University of Michigan, and a PhD in mechanical engineering from Michigan State University. He is a member of Tau Beta Pi Engineering Honorary Society.

HERBERT N. COHEN is chief of the Systems Modeling and Analysis Branch in the Fire Control and Small Caliber Weapon Systems Laboratory at ARRADCOM. He has an engineering degree from the College of the City of New York and a Masters Degree in mathematics from New York University. His major point of interest is Systems Analysis and its application to new and challenging concepts.

New System Accelerates Processing of Test Information

Development of a new system which reportedly provides faster and more accurate processing of testing information has been announced by the Materiel Testing Directorate at Aberdeen Proving Ground, MD.

Identified as Automatic Data Acquisition and Processing Techniques (ADAPT), the system is a computer array that permits "real time" assembly of data gathered from a multitude of tests at APG.

The first phase of ADAPT was completed in August 1980, following a 5-year, $5 million development program. It reflects state-of-the-art developments in the relatively new science of data acquisition.

Prior to ADAPT, trailers were at each test site where data was recorded on analog tape and hand-carried to a separate building for analysis.

Generally, the turn-around time, or the time it took before a test director could see his information was two to three weeks. ADAPT has reduced this time to less than a minute, says Mr. Harry V. Cunningham, an electronics engineer and an ADAPT team member from the Measurements and Analysis Division of MTD.

ADAPT is really a system of computers that talk to each other. Most are housed in mobile vans and they communicate with a central computer in a building which transmits this data to the third part of the triad, the Test Data Center, also located at APG.

"We put mini-computers in vans which can go to any of our ranges or to any of the test activities we support. These mini-computers are linked by microwave and broad band cable (such as might be found in a cable TV system) to the process controller (PC) or central computer," said Cunningham.

Automotive and test items are fitted with transducers (sensors) which pick up impulses and send them to an encoder mounted on the test item. The encoder takes all the signals and transmits them as a single beam to the data van, where the signals are split out, recorded in the mini-computer and processed to provide the test director with an immediate look at his test results. In the case of ballistic tests, signals are sent to specially designed hardware which help feed it to the mini-computer.

"Once our computers have processed the data, it can be sent on to the test data center for final analysis," Cunningham said.

ADAPT reportedly has a significant value in that it reduces the amount of time needed to process data, improves trouble shooting the item under test and verifies the accuracy of the measuring instrument thereby providing an overall improvement in the quality of data we generate.

Cunningham said that the system has been successful far beyond its original expectations, and when used in combination with other sources, such as television cameras mounted on test items and test targets, can produce results which verify test procedures and components in test items.

Cunningham stresses that ADAPT has broad capabilities. It has been used with the XM1 and IFV-CFC programs, the General Support Rocket System launcher, on bridge testing, vibration testing, cruise missile launcher tests, the PATRIOT Missile system and all routine testing.

One of the things that makes ADAPT special is a piece of equipment developed by MTD for its ballistic trailer terminals, which allows the mini-computers to maximize their somewhat limited storage capabilities.

The device, known as an Automatic Sampling Rate Digitizer, allows the mini-computers to record data only when necessary and gives them the ability to choose the correct sampling speed needed to get information from such high-speed experiences as firing of an artillery round (to record blasts) or reducing the sampling rate for slower operations, such as recording pressure records.

OPERATION CHERRY BLOSSOM Awards and AUSA checks are presented to David B. Mitzi, Marie Christian, and alternate Lisa D. Gibbs, by BG Benjamin J. Pellegrini, deputy commander for R & D, U. S. Army Missile Command, Redstone Arsenal, AL.

LONGON International Youth Science Fortnight winner Larry S. Sherman and alternate Forrest L. Piehl.

Trips to Japan, London Awarded To ISEF Winners Selected by Army

"Operation Cherry Blossom" and "London International Youth Science Fortnight" winners were among 22 winners of Department of the Army Superior and Meritorious Achievement Awards presented at the 32nd International Science & Engineering Fair (ISEF), recently held at Milwaukee, WI.

Sponsored by Science Service, a nonprofit institution whose objective is to stimulate interest in scientific research, the annual ISEF culminates competition among high school students in more than 200 local, state and regional fairs, including some in foreign countries.

Operation Cherry Blossom. Marie Christian, a 16-year-old junior at Dixie High School (H.S.), St. George, UT, and David Brian Mitzi, a 17-year-old senior at Westhill H.S., Stamford, CT, will receive an expenses-paid trip to Tokyo, Japan, to attend the 25th Annual Japan Student Science Awards Program in January 1982.

Miss Christian's exhibit was an investigation of "Power of Integer Polynomials and Their Bernoulli Number Generators." David Mitzi exhibited the "Design and Optimization of a Nitinol Heat Engine." David's exhibit also won him the London Fortnight trip as a Navy selectee.

Army alternate for the Japan trip is Lisa Diane Gibbs, 17 (Sr.), Liberty H.S., Bedford, VA, who was selected as a superior award winner for her exhibit "Possible Explanation for the Abundance of Levorotatory Biochemical Compounds."

The Army has been participating in Operation Cherry Blossom since 1963 when it was initiated in cooperation with the Japanese newspaper *Yomiuri Shimbun.* The Association of the U.S. Army (AUSA) contributes $100 checks to Army winners of the Japan and London trips.

The Army panel of judges consists of laboratory personnel and Reserve officers knowledgeable in the behavioral and social sciences, biochemistry, botony, chemistry, earth and space sciences, engineering, mathematics and computers, medicine and health, microbiology, physics and zoology.

London International Youth Science Fortnight. Larry Scott Sherman, 16, Gompers Secondary School, San Diego, CA, was selected by Army judges to receive an expenses-paid trip to London to attend the London International Youth Fortnight this Summer, for his exhibit "Isolation of Factor Responsible for Glial Tumor Initiation in Neurofibromatosis."

Forrest Lincoln Piehl, 17, Keyser (WV) H.S., was selected as alternate for exhibiting "Ecological and Anatomical Studies of a Plant Buccaneer."

Army Superior Awards, consisting of a Certificate of Achievement, a gold medallion and the choice of an expenses-paid trip to an Army R & D facility, also went to Scott C. Pyfer, 17 (Sr.), St. Pius X H.S., Pottstown, PA, "The Compound Insect Eye, Phase III: Perception of Shape and Color Vision in *Apis mellifera*"; and

Matthew E. Harvey, 17 (Sr.), Renaissance H.S., Detroit, MI, "First Row Transition Metal Tetradentate Schiff Base Complexes"; D. Guy Eristoff III, 18 (Sr.), Atlantic H.S., Delray Beach, FL, "Radioisotope Identification by Laser-Induced Spectrographic Angular Aberration"; and

Robert S. Fogarty, 17 (Sr.), Merritt Island (FL) H.S., "Enhancement of T.N.F. Oncolysis by Ascorbic Acid"; Guido M. Zimmer, 17 (Sr.), Niceville (FL) H.S., "Factors That Influence the Tone Quality of a Violin"; and Patrick Luft, 17 (Jr.), Woodside Priory School, Portola Valley, CA, "Selective Control."

Meritorious Awards, certificates of achievement and silver medallions, went to Sameer N. Shah, 16 (Jr.), Satellite (FL) H.S.; Catinia M. Gregory, 16 (Jr.), Overton H.S., Memphis, TN; Iris S. Terashima, 17 (Sr.), Waialua (Hawaii) H.S.; and

Anne Masters Sholtz, 16 (Soph.), New Ulm (MN) H.S.; Tony Phillips, 16 (Jr.), Niceville (FL) H.S.; Bryan A. Shirley, 16 (Jr.), Franklin County H.S., Winchester, TN; Lance R. Williams, 18 (Sr.), Dallastown Area (PA) H.S.; and

Ann Davis, 15 (Fresh.), Mather H.S., Chicago, IL; H. Paul Moreau, 17 (Jr.), Simmesport (LA) H.S.; Keith R. Hardwicke, 17 (Sr.), Abilene (TX) H.S.; and Christine E. Schmitz, 18 (Sr.), Weber H.S., Ogden, UT.

BG Benjamin J. Pellegrini, deputy commander for R & D, U.S. Army Missile Command, Redstone Arsenal, AL, presented the awards and checks to the Army winners who were selected from more than 425 ISEF finalists, representing 45 of the 50 states and Canada, Great Britain, Japan, Puerto Rico, Republic of Korea and Sweden, who participated in the competition.

Dr. Gordon L. Bushey, U.S. Army Materiel Development & Readiness Command, was chairman of the Army panel of judges; Mrs. Anne G. Taylor, U.S. Army Research Office, Research Triangle Park, NC, was Army project officer for the ISEF Program.

BMD Engineer Gets MIT Sloan Fellowship

Dr. Larry C. Atha

Dr. Larry C. Atha, an engineer at the Army's Ballistic Missile Defense (BMD) Advanced Technology Center in Research Park, has been awarded a fellowship to the Massachusetts Institute of Technology's Alfred P. Sloan School of Management. He is the only person from the entire Army selected for the program this year.

Sloan Fellows are selected annually from among the most promising mid-career executives nominated from the public and private sectors, both in the United States and abroad. The highly selective fellowship is designed to help develop skilled managers for both government and industry. Atha is one of only 57 men and women to participate in the 12-month master's degree program, which began in June.

During his 12-year tenure at the Huntsville Army agency, Atha has been involved in a number of exploratory research projects, including development of missile guidance and control systems and the collection of infrared and radar target signature data. For the past two years, he has served as project manager for the BMD Ballistic Range, a $4.5 million a year flight test simulation program.

Atha earned his BS and MS degrees from the University of Missouri, Rolla, MO. He completed his PhD in mechanical engineering at the University of Missouri, Columbia, MO, in 1969.

He originally came to Huntsville in 1963 as an Army First Lieutenant assigned to the U.S. Army Missile Command at Redstone Arsenal. After leaving the service, he stayed on in Huntsville as a civilian aerospace engineer in the Missile Command's Guidance and Control Laboratory, transferring to the BMD Advanced Technology Center in 1969.

He is a member of the American Society of Mechanical Engineers, the Missouri Society of Professional Engineers, and the American Institute of Aeronautics and Astronautics.

Jefferies Chosen for CSL Executive Training

Mark A. Jefferies

Mr. Mark A. Jefferies, a chemical engineer who started his Federal career in 1966, has been selected for a 6-month technical executive training program at the Armament R & D Command's Chemical Systems Laboratory.

Jefferies is the 40th civilian employee to participate in the on-going executive training program established in 1970 by Dr. B.L. Harris, CSL deputy-director.

Trainees spend the first three months of the program in Edgewood surveying technical programs and preparing briefings for the CSL technical staff.

During the second phase of the training at the Army Materiel Development and Readiness Command (DARCOM), trainees act as liaisons between CSL and DARCOM headquarters in Alexandria, VA, on matters pertaining to technical programs. They prepare a variety of technical and administrative documents relating to plans and budgets.

Triabassi Selected for National War College

Mr. Panfilo Triabassi, a consultant and test architect assigned to the Joint Interface Test Force-Joint Interoperability for Tactical Command and Control Systems, Fort Monmouth, NJ, has been named as the sole Department of the Army civilian to attend the National War College during 1981-82.

Prior to assuming his present position, Triabassi participated in the Joint Tactical Communications TRI-TAC) development programs in an operations research function. He also served with private industry before joining government service in 1968.

He holds a bachelor's degree, a master's degree, and has completed formal course prerequisites for his doctorate, all from Stevens Institute of Technology. Additionally, he has received numerous awards and has published several papers on engineering and operations research.

Awards...

Greene Gets Exceptional Service Decoration

Exceptional Civilian Service Award is presented to Roy Greene by DARCOM Commander GEN John R. Guthrie, in presence of Roy's wife Julianne and mother Mrs. C.J. Greene.

Mr. Roy D. Greene, associate director for Programs and Budget, Development and Engineering Directorate, HQ U.S. Army Materiel Development and Readiness Command, is a recent recipient of the Department of the Army's Decoration for Exceptional Civilian Service.

Assigned to the Army Materiel Command (DARCOM's predecessor) since 1967, Greene is responsible for all activities related to the total DARCOM research, development, test and evaluation program and budget development, review and operation.

An acknowledged authority on planning, programming, budgeting and funding, he was cited for contributing immeasurably to the successful execution of the Army's mission by applying his skills to solve complex problems associated with management of the Army's RDTE program.

Greene was also recognized for contributions in formulating, coordinating, and implementing the automated Modernized Army R & D Information System, and for his efforts resulting in a smooth transition of the RDTE appropriation to the Zero Base Budgeting Process.

A participant on numerous joint committees and ad-hoc working groups, Greene received an earlier Decoration for Exception Civilian Service in 1970, and two previous Decorations for Meritorious Civilian Service.

Additionally, he is an honorary faculty member of the U.S. Army Logistics Management Center, and a member of the National Political Science Honor Society. He holds a BS degree in agricultural biologics from Western Kentucky University and a master's degree in public administration from American University.

Hesson Receives Materiel Acquisition Award

BG James M. Hesson, deputy commander of the U.S. Army Troop Support and Aviation Materiel Readiness Command, was presented recently with the Secretary of the Army Award for Outstanding Achievement in Materiel Acquisition. He was recognized for earlier service as project manager, CH-47 Helicopter Modernization Program.

Presented by MG Emil L. Konopnicki, TSARCOM commander and MG Story C. Stevens, commander, AVRADCOM, the award specifically cited BG Hesson for achievements in innovative cost control management by seeking new methods and sharing lessons learned.

This is the second major citation that BG Hesson has received for his work in the CH-47 program. He was previously presented with the Secretary of the Army Award for Project Management.

BG Hesson began his military career in the Minnesota and Wisconsin National Guard. He enlisted in the regular Army in 1950 and attained the rank of sergeant before attending the Engineer Officer Candidate School where he was commissioned a second lieutenant.

MG Stevens Honored at AHS Forum

MG Story C. Stevens was honored recently at the American Helicopter Society's National Forum, when he received the Society's Honorary Fellowship ". . . in recognition of many notable achievements in advancing the state-of-the-art of rotary wing aircraft."

MG Story C. Stevens

MG Stevens commands the U.S. Army Aviation Research and Development Command, headquartered in St. Louis. The command, which he conceptualized and formed in 1977, has five laboratories, three plant activities, and an engineering flight test activity, located throughout the country.

Personnel Actions . . .

Hoeber Takes Over as Deputy ASA for R & D

Ms. Amoretta M. Hoeber, formerly a consultant in the Office of the Assistant Secretary of the Army (Research, Development and Acquisition), has succeeded Dr. Joseph H. Yang as Deputy Assistant Secretary of the Army (R & D), Office of the Assistant Secretary of the Army (RDA).

Ms. Amoretta M. Hoeber

Graduated from Stanford University in 1963 with an A.B. degree in political science, she has completed two years of graduate work in mathematics at Stanford University, American University, and the University of California at Los Angeles.

Prior to joining the Department of the Army, Hoeber was deputy to the Director, Policy and Strategy Analysis Division, System Planning Corp. During 1974-75, she was director of the Department of Military Policy Analysis, General Research, Corp.

Additionally, Hoeber served as a consultant with several defense study companies from 1971-74, was on the Economics Department research staff of the Rand Corp. from 1968-71, served as a research staff member with Analytic Services, Inc. from 1966-68, and was with Stanford Research Institute from 1963-65.

Recently elected as president of the Military Operations Research Society, she has also served on their Board of Directors and as their vice president for Symposium Operations. Her other professional affiliations include the U.S. Naval Institute, International Institute of Strategic Studies, and the American Institute of Aeronautics and Astronautics.

Hoeber has authored or coauthored numerous monographs and articles, including *The Chemistry of Defeat, Conventional War and Escalation, Soviet Strategy for Nuclear War,* "The Soviet View of Deterrence," "The Neglected Threat of Chemical Warfare," and "Reality and Salt."

Haley Becomes DARCOM Assistant S & T Deputy

Dr. Richard L. Haley, U.S. Army Materiel Development and Readiness Command deputy director for Development and Engineering since 1975, has assumed new duties as DARCOM assistant deputy for Science and Technology, following the recent retirement of Dr. Robert S. Wiseman.

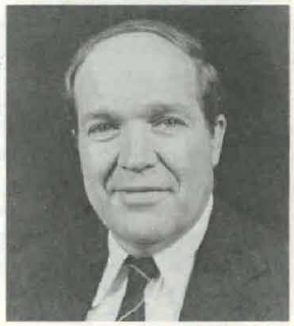
Backed by more than 35 years of civilian government and military service, Haley served, prior to joining DARCOM, as science advisor to the director of Combat Support Systems, Office, Deputy Chief of Staff for Research, Development and Acquisition. He also served with NASA and as advisor to the director of Missiles and Space in the former Office, Chief of R & D, Department of the Army.

Graduated from the U.S. Military Academy with a BS degree, he holds master's and PhD degrees in electrical engineering from the University of Pennsylvania, and is a member of the American Institute of Aeronautics and Astronautics, Association of the U.S. Army, Association of the U.S. Air Force, and the American Management Association.

In 1979, Haley was presented with the Department of the Army's second highest award for civilian employees—the Decoration for Meritorious Civilian Service. He was cited at that time for his "excellence of service" as DARCOM's deputy director of Development and Engineering.

Oswald Becomes ERADCOM Technical Director

Dr. Robert B. Oswald, Jr., a nuclear engineer, has been named technical director of the Army Electronics Research and Development Command (ERADCOM) Adelphi, MD. The appointment ends an 18-month search for a successor to the vacancy left by Dr. Robert S. Wiseman, now assistant deputy for Science and Technology, US Army Materiel Development and Readiness Command.



Dr. Robert B. Oswald

Oswald comes from the Defense Nuclear Agency (DNA) where he was assistant to the deputy director (Science and Technology) for Theoretical Research. During his 2½-year tenure at DNA, Oswald supervised activities in theater nuclear warfare, theater nuclear force safety, survivability and security, transient radiation effects on electronics, and aerospace systems.

He started his federal career in 1964 as a research physicist with HDL, progressing over the next 15 years through increasingly responsible positions to acting associate technical director. He left HDL for DNA in 1979.

Oswald is credited with major contributions to the development of hardened electronic components for strategic systems and pulsed electron beam techniques for the measurement of thermal mechanical properties of materials used in the development of hardened reentry vehicle heat shield materials.

Among his awards he holds the largest Special Act award ever given by HDL for his contributions to the DARCOM nuclear weapons programs. Oswald's other awards include the Louis J. Hamilton Award, the HDL Hinman Award for Technical Achievement and the Army R & D Achievement Award.

He is a member of the Institute of Electrical and Electronics Engineers, the American Physical Society, Tau Beta Phi, Pi Tau Sigma, and Sigma Xi. Oswald holds a bachelor and master of science degree in mechanical engineering and a doctorate in nuclear engineering, all from the University of Michigan.

COL Humphrey Assumes Duties at TECOM

COL Johnny M. Humphrey, former commander of the U.S. Army Criminal Investigation Laboratory, Frankfurt, Germany, has assumed new duties as chief of the U.S. Army Test and Evaluation Command's Test Operations and Policy Office.


COL J. M. Humphrey

Graduated with BS and BA degrees in mathematics and chemistry from Jacksonville State College (distinguished military graduate), he also received an MS in mathematics from Auburn University. His military schooling includes the Armed Forces Staff College and the Army War College.

COL Humphrey is a recipient of the Legion of Merit, Bronze Star Medal with three Oak Leaf Clusters (OLC), Meritorious Service Medal with OLC, Air Medal with five OLC, and the Joint Service Commendation Medal.

COL Demick Assumes Duties at USACSA

COL Harold B. Demick has assumed duties as deputy commander, U.S. Army Communications Systems Agency/deputy project manager, Defense Communications Systems (Army). He succeeds COL Payton R. McDonald, Jr. who has retired from military service.


COL Harold B. Demick

COL Demick will be responsible for the centralized management of development, acquisition, installation and life cycle support of specified communications systems.

Demick comes to the U.S. Army Communications Systems Agency following a tour of duty as chief of staff, U.S. Army Communications Research and Development Command, also located at Fort Monmouth, NJ. He served in that position from June 1980 through May 1981.

He is a 1955 graduate of Norwich University, where he earned a Bachelor of Science degree. He has also graduated from the U.S. Army Command and General Staff College.

From June 1977 to June 1980, COL Demick served as chief of staff, HQ, 5th Signal Command, Worms, Germany; from June 1974 through June 1977 he was assigned as chief, Planning, Programming and Budgeting, Directorate, Telecommunications Command and Control, Office of the Deputy Chief of Staff, Department of the Army, Washington, DC.

In addition to stateside assignments at Fort Bragg, NC and Fort Huachuca, Arizona, he has served overseas in Vietnam, Germany and Korea. He has commanded the 82nd Signal Battalion, 82nd Airborne Division and has been an assistant professor of military science.

He has twice been awarded the Legion of Merit, Meritorious Service Medal and Army Commendation Medals, and wears the Bronze Star Medal.

Conferences & Symposia . . .

DOD Seminar To Stress Carlucci Objectives

"Current Initiatives in the Defense Standardization and Specification Program (DSSP) to improve the Acquisition Process," is the theme of a seminar sponsored by the Department of Defense, 3-5 November 1981, at the Xerox Training Center, Leesburg, VA.

Intended to highlight the objectives of Deputy Secretary of Defense Frank C. Carlucci's memorandum on improving the acquisition process, the seminar is limited to DOD personnel. The initial session, which should be of special interest to DOD acquisition executives, will feature an overview of the DSS Program.

Near-term and long-term potential solutions to standardization problems and materiel acquisition cost reduction efforts will be discussed in several planned workshops. Emphasis will also be placed on means for improving weapon systems support and mission readiness.

Listed among topics slated for discussion panels are: product improvement, multi-year procurement, economic production rates, improved support, increased capital investment, improved reliability, better budget estimating, lower technology risk, and more appropriate design-to-cost goals.

The Defense Materiel Specifications Office, focal point for the seminar, has announced that transportation costs to and from Leesburg, will be the only expense to be incurred by an attendee's organization. Program brochures and registration forms will be available in mid-August.

Additional seminar information may be obtained from the Defense Materiel Specifications and Standards Office, Two Skyline Place, Suite 1403, 5203 Leesburg Pike, Falls Church, VA 22041 (Attn: Mr. Douglas Reeves or Mr. Kurt Greene), or commercial phone (703) 756-2343 or Autovon 289-2343.

R & D Associates Plan Fall Meeting at Natick

The Research and Development Associates for Military Food and Packaging Systems, Inc. has announced that its 1981 Fall meeting will be held 16-17 September at the U.S. Army Natick R & D Laboratories, Natick, MA.

The R & D Associates is a non-profit organization which serves as a forum for the exchange of technical information between industry, academia, and the Armed Forces. Specific subjects of discussion include food, feeding systems, and food packaging.

Joint Army-Marine Project Manager Office Established for LAV

In early May 1981, Deputy Secretary of Defense Carlucci in a memorandum to the Secretaries of the Army and Navy, wherein he approved the Marine Corps' MENS for a Light Armored Vehicle, simultaneously recognized anticipated Army needs for a similar vehicle.

Carlucci stressed that while the Army had not defined its needs as of that time, the Army's interest was understood. But, only one program would be authorized to acquire a near-term light armored vehicle, and this program must meet the needs of both services.

In view of the Army's experience in acquiring armored vehicles, said Carlucci, that service would be the contracting agency with overall acquisition responsibility for the USMC LAV program, and the Army was directed to support fully the Corps' needs for this program. The Marines' planned IOC date of 1983 must be met, the Deputy Secretary stated.

As a result the Army had assigned program responsibility to MG Oscar Decker, CG, U.S. Army Tank-Automotive Command, Warren, MI, and on 5 Jun 81, General Decker and MG H.G. Glasgow, Deputy for Development, Marine Corps Development and Educational Center at Quantico, VA, signed a Memorandum of Agreement for the conduct of the joint program.

The agreement cites the recognition "that extraordinary means be taken to tailor the acquisition process to meet the planned IOC of 1983." The Corps is to provide, as a minimum, the program manager and the chairman of the Source Selection Evaluation Board. Both services will provide independent user evaluations.

The agreement states that the LAV "must be capable of being projected to any crisis area of the world rapidly to provide fire support and tactical mobility for maneuver elements . . . The vehicle must provide protection from suppressive fires for the embarked personnel and be capable of defeating armored vehicles, materiel, and personnel targets."

Since the Marine Corps had already undertaken a good bit of work on this program prior to Carlucci's memorandum to include establishing a LAV office at Quantico and issuing of REPs, a phased transitioning plan was included in the agreement to shift the operation to the new joint establishment. The first step was the assumption by the Army of responsibility as Source Selection Authority. The awarding of the test and evaluation contracts will follow. The Commanding General, U.S. Marine Corps Development and Education Center, will assist the Source Selection Authority as requested, with the Corps providing facilities for the support of the Source Selection Advisory Committee and the Source Selection Evaluation Board.

A project management office will be established at HQ TACOM with a target date of 31 August 1981 for staffing by both Marine and Army personnel.

Conducting the coordinated test and evaluation of the candidate systems, with help from the Army, will be the responsibility of the Marine Corps.

Preparation of the production RFP will be an Army responsibility though close coordination with the Corps is called for to ensure that USMC requirements are properly described.

The transition of the base of operations for the LAV program from Quantico, VA, to HQ TACOM, Warren, MI, will be accomplished when the Commander, TACOM, and the Director, Marine Corps Development and Education Center (MDEC), determine the time of best suitability. However, again the target date is 31 August 1981.

Under the terms of the agreement a fully integrated joint program office will be established with participation and staffing by both services. HQ USMC (I&L) and MDEC will support the joint program office in areas of Corps ILS, manpower, training and training device requirements, and facility requirements.

HQ TACOM is charged with writing the charter establishing the joint LAV PMO, and it will address such things as PMO mission responsibilities, authority, major functions, and relationship of LAV with organizations of the two services which will support the LAV PMO. It will also describe and assign responsibility for satisfying peculiar management requirements of the two services.

The agreement specifies that the Marine Corps has agreed to fully fund the contract for test and evaluation of the candidate vehicles, but any peculiar service requirement requiring RDTE funding above that required for the presently approved MENS will be funded by the sponsoring service unless otherwise agreed. And, each service will provide procurement funds to meet its own requirements. Funding the operation of the LAV PMO will be shared. Any Military Construction Program funds needed will be provided by the affected service.

While theses actions to transition to the LAV PMO in Warren are being taken, the momentum of the program, started unilaterally by the Corps on 14 April with a bidders' conference held at Quantico, continues. Originally the closing date for bids back to the Corps was to be 15 June, but this slipped to 30 June because of changes in the technical specifications concerning both vehicle and weapon's. Upon receipt of the RFPs, operation of the program will be assumed by HQ TACOM.

As of the writing of this article, considerable interest has been shown in the program by companies with vehicles in being. Among these are Bell Textron, General Motors of Canada, Cadillac Gage, Vought, and FMC. The potential candidate vehicles are all wheeled with the exception of FMC's.

The schedule calls for selection to be made in September 1981 for up to four contractors who will provide four vehicles for test and evaluation. A production decision and contract award to a single contractor for the winning vehicle would be made in July 1982. This schedule then, provides for an IOC in late 1983.

Under the RFP each selected contractor will agree to provide four vehicles. Two of these may carry a weapon system in the 20-30mm range. The third will be an assault gun variant, i.e., equipped with a 75mm to 105mm low recoil weapon. The fourth will be armed with the Army furnished M242 25mm cannon in a 2-man turret configuration, the cannon and ammunition to be Government furnished. The first three vehicles are to be delivered 60 days after contract award, the fourth vehicle to follow.

DEPARTMENT OF THE ARMY

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