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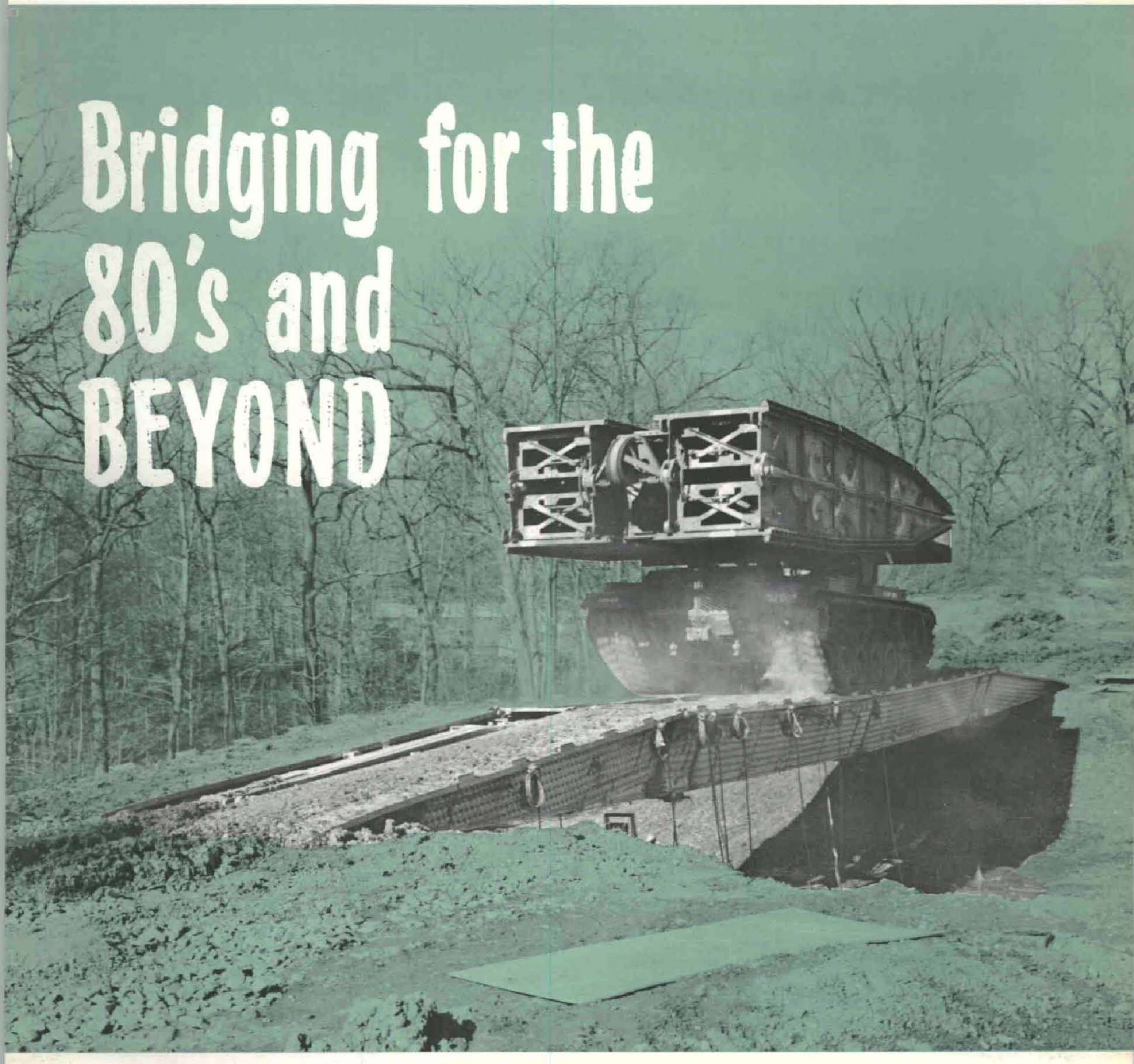
MARCH - APRIL 1981

Bridging for the 80's and BEYOND



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ABOUT THE COVER:

Bridging for the 80s and Beyond is represented on the cover by members of a family of bridges developed with a commonality of components to fulfill bridging requirements for assault, dry-gap and wet-gap support. This commonality reduces procurement, training and logistic costs and allows interoperability among the roles.

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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A New Generation of Mobile Bridges

By Martin Falk

Mobility on the battlefield has always been a critical concern of military planners. As weapons become more sophisticated and lethal, the importance of being able to move quickly on the battlefield continually becomes more important. One essential component of an army's mobility capability is tactical bridging.

31M Bridge on Wheeled Launcher

In an effort to modernize their tactical bridging equipment to meet the needs of the future, the United States, the Federal Republic of Germany, and the United Kingdom agreed to enter into a trilateral effort to develop a new family of bridges called "Bridging in the 80s".

As envisioned, this family would use common components to the maximum extent possible for the three bridging roles, i.e., assault, dry gap support, and wet gap support. This commonality would reduce procurement, training, and logistic costs and allow interoperability among the roles. For example, a dry support launcher could retrive a bridge that had been emplaced by an assault launcher.

Very stringent operational requirements were established with the emphasis on speed and minimizing manpower. The original concept studies indicated that there were several different technical approaches to meeting the requirements, therefore, each country developed different advanced development prototypes so that comparative evaluations could be made and the best design could be chosen as the basis for full-scale development.

The United States system was developed by the Army Mobility Equipment Research and Development Command, Fort Belvoir, VA, with Pacific

32M Ferry With Military Load Class 60

24M Assault Bridge in Transit.

Car and Foundry Co. as the prime contractor. It utilizes the same bridge girder and launching mechanism for all roles, and the same wheeled transporter for the dry and wet support roles. A tank chassis is used to transport the assault bridge and pontoons are added to provide flotation for the wet bridge.

The bridge is constructed of aluminum except for the main connectors which are steel. The trapezoidal shaped treadways have a truss web extrusion deck, four dimple plate webs, and an aluminum plate bottom chord. The two treadways are connected together by steel cross braces which also contain rollers to support the traversing beam which assists in launching the bridge.

The bridge is composed of three different types of modules. At each end of the bridge is a 7.5 meters long ramp. The ramp is attached to a 1 meter long connector bay which acts as an anchor for hydraulic cylinders which permit the ramp to be folded up for transport. The interior sections are 7 meters long.

The bridge, weighing 1,450 pounds per meter including the traversing beam, is designed to support Military Load Class 60 vehicles (about 60 tons) on a normal span of 30 meters. In full scale development a Class 70 capacity will be provided. Spans above 30 meters, up to 50 meters, can be accommodated by adding a reinforcing kit under the bridge.

The wheeled transporter is a 10 x 10 vehicle weighing 62,000 pounds, including the launch mechanism. It is powered by a 450 HP Detroit Diesel engine and has a 5-speed Allison automatic transmission. An air bag suspension system is used to support the load and provide an automatic leveling capability. The front three axles are steerable.

For full scale development, a shorter vehicle with all wheel steering capability will be recommended to improve mobility. The air bag suspension will be replaced by a hydro-pneumatic system to increase load carrying capability. The dual cab will be replaced by a single cab to improve driver visibility.

The launch mechanism includes a steel boom mounted to the chassis with pivots at the front and rear and two lift cylinders at the middle. The boom contains rollers that support the bridge and drive sprockets at the front which drive the traversing beam and bridge across the gap.

Two chains are used to lower the near end of the bridge to the ground or to lift it onto the transporter. The boom has the capability of moving up and down and sideways so that the far end of the bridge can be precisely on the far bank.

In the dry support role, a complete bridge of 17, 24, or 31 meters is carried on the wheeled transporter. To emplace a bridge, the launcher is positioned at the gap and the outriggers are deployed. The ramps are unfolded with hydraulic cylinders until they are locked in the horizontal position.

This unfolding, called the flip ramp approach, distinguishes the U.S. system from those developed by Germany and United Kingdom. The traversing beam is then propelled across the gap. The drive sprocket on the launcher engages on the bottom of the bridge for this purpose. The traversing beam supports the bridge while it is driven by another sprocket and rack mechanism. When the near end is lowered to the ground by the lift/lower chains, the bridge is ready for traffic.

Two launchers are used to transport and launch bridges of 38, 45, and 52 meters. The front vehicle is positioned at the gap and the front ramp is unfolded (for long bridges, one ramp is carried on each transporter). The rear vehicle moves in from behind, the two loads are joined, the bridge is launched by the front vehicle in the same manner as the shorter bridges. These long bridges can also be launched using one launcher. Ten-ton trucks are used to transport the extra bridge sections which are added sequentially at the bridge site.

The reinforcing kit consists of two kingposts and two sets of reinforcing links which are anchored to the connector module. The kingposts and links are assembled prior to launching but the kingposts are not lowered to deploy the reinforcing links until after the bridge is in place.

Assault situations demand that the crew be protected when the bridge is being launched, therefore, the launch mechanism is mounted on a tank chassis for this role. The bridge and launch procedure are the same as for the dry support role.

The assault launcher has the capability of launching reinforced bridges but it is not envisioned that this would normally be done since the crew would be exposed. For assault spans above 30 meters, the preferred procedure is to launch one bridge to bear on the bottom of the gap and then drive out on this bridge and launch another one to the far side in leapfrog fashion.

In order to bridge wet gaps above 50 meters, a floating bridge must be used. The wet support bridge uses the basic components of the dry support bridge - the wheeled launcher and the bridge girder. In order to provide adequate buoyancy and shape, bow pontoons are pinned into the sides and a center pontoon replaces the traversing beam and crossbraces in between the roadways.

Fourteen meter lengths of bridge are carried on the launcher with the bows folded on top. When the vehicle gets to the bridge site, the bows are unfolded and the bridge section is rolled off into the water. Sections are pinned together end to end to form a complete bridge or ferry that very closely resembles the in-service Ribbon Bridge.

At this time, bridge erection boats are used to maneuver the bridge sections and hold them in place against the river current. It is planned to incorporate a water jet propulsion into the center pontoon so that boats are not required.

In order to make the equipment as light as possible, the use of high strength composite materials is being investigated on selected components. The traversing beam is a prime candidate for weight reduction through use of composites.

Beam sections are made of continuous filament-wound graphite strands with the end connectors wound in as integral parts of the structure. Fifty-two meters of the composite beam are being fabricated at this time. The weight for a 31 meter traversing beam will be reduced from 11,000 pounds to an estimated 3,500 pounds.

Another component where graphite is being utilized is the bottom chord of the bridge. The present aluminum plate will be replaced by a member in which graphite is sandwiched between two aluminum plates. This will reduce the bridge weight by four percent and reduce deflection in the structure.

A third area being investigated is the reinforcing kit tension link. Links made of a high strength, low density synthetic fiber known as Kevlar were fabricated and tested with the prototype bridge. Results were not as good as expected due to inefficiencies in the end connectors. Further refinements will be pursued in this area.

The German equipment uses a different approach to achieve similar results. The bridge is carried in two separate sections, one on top of the other, on the transporter. The first step of the launching process involves sliding the lower half forward, lowering the upper half, and then coupling the two halves together.

A further distinction is their capability of launching bridges up to 24 meters long in a cantilever fashion without a traversing beam. The wet bridge utilizes separate pontoons carried on their own launcher. These discrete pontoons are launched into the water, moved to the bridge line, and then the bridge is launched on top of the pontoons.

The U.K. fabricated a prototype only of the bridge and reinforcing kit. Their bridge differs from the U.S. bridge in that it utilizes an open bottom rectangular cross section.

Tables 1, 2, and 3 compare the capabilities of existing bridging equipment with the Bridging in the 80s bridges. Decreases in manpower and time required are significant in the two support roles and there is a large increase in span capability in the assault role.

TABLE 1

Dry Support Bridge	**Medium Girder Bridge**	**BR 80**
Unreinforced span	30m	30m
Reinforced span	50m	50m
Load capacity	MLC 60	MLC70
Emplacement time (30m)	90 min	5 min
Manpower (30m)	24	2

TABLE 2

Wet Support Bridge	**Ribbon Bridge**	**BR 80**
Emplacement time (120m)	40 min	30 min
Manpower	60	33
Load capacity	MLC 70	MLC 70
Max current speed	2.1 m/sec	2.5 m/sec

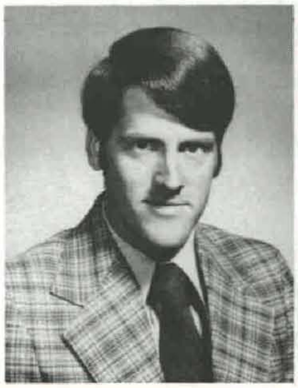
TABLE 3

Assault Bridge	**M60 AVL**	**BR 80**
Span	18m	30m
Load capacity	MLC 60	MLC 70
Manpower	2	2
Emplacement time	3 min	5 min (30m)

The prototype equipment has been undergoing testing for the past two years. A Final Concept Team, composed of members from each country, worked at MERADCOM for the past year to evaluate the test results and recommend a concept that could form the basis for a trilateral full scale development program.

The team's report, which was published in July, did not come to a unanimous conclusion on the best concept. The majority preferred a flip ramp system with the continuous float bridge, but the minority still preferred the slide launch system with a discrete float bridge. Both systems can be developed to meet the requirements but each has its own advantages which depend on the emphasis placed on certain requirements and the method in which the equipment is employed by the user.

The three countries are now making national assessments to determine the nature of future development, including whether or not a cooperative program is possible. Whichever course is taken, Bridging for the 80s offers the opportunity for a giant step forward in military bridging.



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Status of GASOHOL Evaluation & Its Procurement Within DOD

By Maurice E. LePera

Recognizing the need for a capability that extends availabilty of mobility fuels within the Department of Defense, a program was initiated in late FY79 to develop the technology required for utilization of alternative and synthetic fuels.

This effort was given greater visibility with the passage of recently-enacted congressional legislation on alcohol fuels. In November 1979, with the passage of the Defense Authorization Act (PL 96-107), DOD was directed to purchase alcohol fuels to the maximum extent possible.

During the latter part of FY80, the Under Secretary of Defense for Research and Engineering assigned the lead role for alcohol fuels within DOD to the U.S. Army. In response to this task, the Army formulated and initiated a comprehensive 2-year effort to define suitability for using GASOHOL in all gasoline-consuming equipment.

The program's objective is to determine suitability of using GASOHOL in all gasoline-consuming military tactical equipment. When GASOHOL is adopted as an alternative to gasoline, its use will impact on a wide mixture of gasoline-consuming equipment. This is evident, as engine sizes vary from relatively small, 2-cycle, air-cooled engines, found in some soldier support equipment (i.e., power generation units, fuel transfer pumps, etc.), to the large multicylinder, 4-cycle, liquid- and air-cooled powerplants in some of the older tracked vehicles. Table 1 provides a summary listing of gasoline-consuming equipment.

The Army's GASOHOL Evaluation Program involves three general phases: a Laboratory Characterization and Compatibility Phase, an Engine Durability Phase, and a Controlled Tactical Vehicle Fleet Test Phase. This work will culminate with development and promulgation of a fully-coordinated military specification by the end of FY81. DOD will then be in a position to procure GASOHOL, in lieu of gasoline, for all tactical, administrative, and commercially-designed equipment.

Individual tasks within the FY80/81 program and the responsible activities are listed in Table 2. As is shown, a limited effort is being conducted to define the feasibility for considering ethyl alcohol as an extender for diesel fuels. The specific tasks underway, within the laboratory characterization and compatibility phase, are to assess the effects of GASOHOL and other alcohol fuel mixtures on elastomers, plastics, ferrous and nonferrous materials that are used in fuel environments and distribution equipment.

The intent of this research program is to identify problem areas that may occur with introduction of GASOHOL into the military supply system. Once identified, recommended solutions can be implemented to insure the comprehensive utilization of GASOHOL across the spectrum of powerplant and accessory systems found within DOD.

The program phase on engine and ground-support testing involves engine endurance/durability testing of DOD engine generators, vehicle powerplants and other ground-support equipment. These tests are including a *leaded* version of GASOHOL, as well as unleaded GASOHOL, in anticipation that industry will consider extending use of ethyl alcohol in leaded as well as unleaded gasoline.

The third phase of the GASOHOL program involves fleet testing of tactical vehicles. The limited pilot fleet test was initiated at the Mobility Equipment Research and Development Command (MERADCOM), Ft. Belvoir, VA, in December 1979, to officially start the GASOHOL program for the Army. The four tactical vehicle fleet tests have been started at Forts Belvoir (VA), Lewis (WA), McCoy (WI) and Red River Army Depot (TX), and will continue for approximately one year.

These controlled fleets will involve a set of 20 tactical vehicles

Table 1

GASOLINE – CONSUMING TACTICAL EQUIPMENT WITHIN US ARMY

	TYPE	SERIES	DENSITY WITHIN TYPE
WHEELED VEHICLES:			
	¼ T TRUCKS	M151s & M718	100%
	¾ T TRUCKS	M37s	100%
	1¼ T TRUCKS	M880, M715, & M885/890	75%
	2½ T TRUCKS	M35, M49C, & M211	7%
TRACKED VEHICLES:			
	PERSONNEL CARRIER	M113 & M114	37%/100%
	COMMAND POST & RECOVERY	M577 & M88	22%/100%
SOLDIER SUPPORT:			
	HEATERS, POWER GENERATION, REFRIGERATION, WATER PURIFICATION, & LAUNDRY FACILITIES		
OTHER SUPPORT:			
	BOATS, COMPRESSORS, CRANES, PUMPS, MATERIALS HANDLING, ROCKET LAUNCHERS, LUBRICANTS SERVICING UNITS, AND SPRAYER CARTS		

Table 2

FY80/81 PROGRAM FOR GASOHOL EVALUATION

TASK	PERFORMING ACTIVITY
LABORATORY CHARACTERIZATION & COMPATIBILITY	
• LABORATORY ANALYSES	MERADCOM
• MATERIALS COMPATIBILITY	MERADCOM
• FUEL HANDLING EQUIPMENT TESTING	MERADCOM
ENGINE & GROUND SUPPORT EQUIPMENT TESTING	
• ENGINE GENERATOR PERFORMANCE/ENDURANCE TESTING	MERADCOM
• TACTICAL ENGINE DYNAMOMETER ENDURANCE TESTING	CONTRACTOR, AFLRL
FLEET TEST PROGRAM	
• FORT LEWIS, WA	FORT LEWIS
• FORT BELVOIR, VA	FORT BELVOIR
• FORT McCOY, WI	FORT McCOY
• FORT POLK, LA	FORT POLK
COORDINATION & LIAISON	MERADCOM
EVALUATING DIESEL-ALCOHOL APPLICATION	SB, PANDALI COATINGS

using GASOHOL matched against an identical set of 20 using unleaded gasoline as the control. The vehicles under test, M151 (1/4-ton truck) and M880 (1 VA-ton truck), are tactical or military-designed so that our program does not duplicate those ongoing fleet tests of commercial/administrative vehicles that are being conducted by Department of Energy, GSA, other Federal user agencies, and industry.

At the termination of the fleet test period, selected control and test vehicles will have their engines dismantled to assess whether wear, deposition, etc., have occurred. As mentioned previously, the limited fleet test at MERADCOM was initiated in December 1979, to officially start the GASOHOL effort. The procedures and methodologies that were developed have been transitioned to the four Army tactical fleet test locations.

As the program has been underway approximately six months, some tentative results are beginning to evolve. Within the laboratory characterization phase, the tentative results obtained with the accelerated elastomer-fuel assessments have indicated that the elastomers (i.e., high-acrylonitrile versions) now used in military fuel-handling equipment may be somewhat sensitive to alcohol-fuel mixtures. This will be confirmed with additional testing.

Another important point is the potential microbiological susceptibility of GASOHOL versus unleaded or leaded gasoline. Laboratory tests with GASOHOL samples innoculated with *C. Resinae* (a commonly-found microbiological organism that becomes involved with hydrocarbon fuels) have shown a delayed but good growth after a short period of incubation. This could become extremely problematic when one realizes the unique gasoline consumption and use patterns that prevail within the Army's Post-Camp-Station operations. Further efforts will address the potential for using biocides to retard the growth problem which, if not controlled, would lead to severe filter plugging, fuel system malfunctions and overall corrosion problems.

Preliminary results have also been obtained on the engine dynamometer/durability test phase. These tests were recently completed on 3kW, 5kW and 10kW DOD Military Standard engine generator sets. In the 1500-hour endurance testing with GASOHOL, the power output results and fuel consumption data were found to be essentially equivalent.

Low- and high-ambient temperature testing is being conducted to determine whether hot-fuel handling or cold-start problems will occur in the field. The used oil drain samples have not revealed any abnormally high-wear metal values. Further analyses of these drain samples are continuing, as are detailed inspections of the disassembled test engines. Additional soldier-support equipment is being tested to determine whether GASOHOL will alter any of the performance characteristics and requirements designed into the systems.

As was noted previously, the tactical vehicle fleets were officially initiated in the last quarter of FY80. The problems incurred during the structuring of the vehicle fleet testing of M880 and M151 vehicles resulted from assignment of test vehicles, proper maintenance of these selected vehicles prior to test initiation, securing a source for the GASOHOL, and the methods for dispensing and storage of the test fuel.

The limited availability of GASOHOL has created a requirement to blend on-site for two of the four tactical vehicle fleet test locations. Experience gained with the pilot fleet test at MERADCOM identified that sufficient agitation must be provided to insure *complete* mixing. No phase separation has been found to date in any of our test programs.

A preliminary review of driver survey responses has indicated some driveability problem with use of GASOHOL. As part of a cooperative effort with the Department of Energy (DOE) program on alcohol fuels, a computer data base has been established at Southwest Research Institute to process all driver survey questionnaires being generated at the four test locations, along with those being processed for DOE's Engineering and Reliability fleet tests being conducted with commercial designed vehicles at 15 locations.

This will provide an excellent means to assess the inter-relationships of environment, use, vehicle design, product quality, etc. on overall performance. There has been an increase in replacement of fuel filters, due to the increased solvency of GASOHOL. The initial requirement for 1Q of FY81 projected for each test location is approximately 10,000 gallons of GASOHOL.

GASOHOL activities within the other two services have been limited, due to their monitoring of the Army data being developed. However, the USAF has taken the approach that GASOHOL will only be permitted in those vehicles designed to operate with unleaded gasoline. This approach differs from that being adopted by the Army, as we will introduce GASOHOL into all gasoline-consuming equipment.

The USN has been conducting limited tests with GASOHOL. The Naval Weapons Support Center, (NWSC), at Crane, IN, has operated 26 security vehicles on GASOHOL since May 1979. The purpose of these tests, which were less rigorous than those now underway at the Army test locations, was to gain operational experience with GASOHOL in the areas of maintenance, fuel economy, and vehicle performance. After a one-year test program, positive results were realized, which has allowed NWSC to place its entire fleet of 91 security vehicles (mostly pick-up trucks and station wagons) on GASOHOL.

As part of the Army's GASOHOL Evaluation Program, an extensive degree of coordination outside DOD has been maintained to (1) insure against any duplication of effort and (2) to disseminate that technology being developed. To accomplish this, coordination has been closely maintained with the American Society for Testing of Materials (ASTM) Task Force on Oxygenated Fuel, which is developing an industry standard for GASOHOL.

Coordination has also been maintained with several state agencies that are conducting administrative fleet tests with GASOHOL. This coordination has involved providing technical assistance, performing some fuel and oil sample analyses, and recommending possible solutions to vehicles problems.

Table 3

ISSUANCE OF INTERIM PURCHASE DESCRIPTION PD ME 102B ENTITLED "GASOHOL, AUTOMOTIVE, UNLEADED, 28 MAR 1980"

- DOCUMENT DEVELOPED FOR DEFENSE LOGISTICS AGENCY TO COMPLY WITH DEFENSE AUTHORIZATION ACT OF NOVEMBER 1979
- INTENDED FOR GASOHOL USE WITH ADMINISTRATIVE/COMMERCIAL DESIGN VEHICLES
- SPECIFIES USE OF MINIMUM 98.5% (197°) ETHYL ALCOHOL WITH LIMITATION ON PYRROLE-TYPE DENATURANTS
- PROJECTED STORAGE LIFE NOT TO EXCEED 30 DAYS
- SPECIFIES ETHYL ALCOHOL TO BE DERIVED FROM RENEWABLE SOURCES AND EXCLUDES PRODUCTS FROM PETROLEUM, NATURAL GAS, AND COAL
- PROVIDES FOR FIELD TESTS TO MONITOR ALCOHOL CONTENT AND TO DETECT METHYL ALCOHOL CONTAMINANTS

Table 4

DFSC PROCUREMENT REGIONS

The Department of Energy's (DOE) reliability and engineering fleet test program is an excellent example of a cooperative effort. These fleet tests are being conducted at 15 locations to cover the wide range of climatic conditions. As was mentioned previously, DOE has established a computer retrieval system to tabulate the driver response survey questionnaires being generated from these 12 fleet test locations. As part of a cooperative effort, the driver survey questionnaires being generated at the four Army test locations will also be incorporated into this computer data base.

Other coordination has been established with the Army-Air Force Exchange Service that has started to dispense GASOHOL. However, certain conditions must exist prior to the PX service station location being modified to receive and dispense GASOHOL. No on-site blending of GASOHOL is being permitted: it must be delivered as a finished product.

Other conditions include cleaning and flushing of tanks, installing additional dispensing filters, limitations on certain fuel tank coatings and elastomers, and mandatory testing for water and separation on a daily basis.

As mentioned previously, PL 96-107, the DOD Authorization Act, directs that DOD purchase, under competitive bid procurement processes, domestically produced alcohol or alcohol-gasoline blends that contain at least 10% alcohol for use in DOD-owned or operated vehicles.

To permit implementation of this legislation, the Purchase Decription PD ME-102b was developed and issued in March 1980 to allow DOD a means to procure GASOHOL. Also, Department of the Army issued a message on 11 March 1980, which authorized use of GASOHOL in administrative vehicles only. The principal items contained within PD ME-102b are summarized in Table 3. The key points are its intended use, quality of ethanol (197° min proof) and source of ethanol (derived solely from renewable sources).

The Defense Fuel Supply Center (DFSC), which procures all fuel for DOD and other federal agencies, began to solicit requirements for GASOHOL in Region 7 (CA, NV, UT and AZ). The DFSC procurement regions are shown in Table 4, with procurement actions to date and those planned tabulated in Table 5. As is noted, the coverage within Region 7 was less than anticipated. The 4,000,000 gallons required reflected 14% of the total unleaded gasoline requirement. However, the small amount of GASOHOL actually awarded is somewhat reflective of this region which historically has been marginal in meeting its unleaded gasoline requirement.

The next area under consideration is Region 4. It is anticipated that this region will probably reflect a greater response for GASOHOL.

Table 5

GASOHOL PROCUREMENT STATUS

OFSC REGION	REQMTS DUE DFSC	START DELIVERY	UNLEADED GASOLINE REQUIREMENT	GASOHOL REQUIREMENT	CONTRACTOR RESPONSE	AWARDED
			— VALUES SHOWN ARE MILLION GALLONS —			
7	15 APR	1 NOV	29	4	1.6	0.223
4	15 SEP	1 APR	40	1.7		
5	15 OCT	1 MAY	11	1.9		
6	15 NOV	1 JUN	25			
8	15 DEC	1 JUL	12			
3	15 JAN	1 AUG	32			
1	15 FEB	1 SEP	6			
2	15 MAR	1 OCT	19			

In summary, the recommendation to implement GASOHOL across-the-board for all DOD agencies will be held in abeyance until the Army program has been completed. GASOHOL will be used in administrative vehicles, where available, to provide an extension of the technology base for alcohol fuels. As information develops, the results and facts will be disseminated through the recently established "Army GASOHOL Newsletter".

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Hellfire Achieves High Scores During Operational Tests

The HELLFIRE modular missile system, under development by the Army Missile Command (MICOM) in Huntsville, AL, and intended as the primary armament on the AH-64 Advanced Attack Helicopter, has recently completed a series of operational tests at Fort Ord, CA. The missile system reportedly exceeded the Army's expectations by accumulating one of the best scores ever achieved on a missile program.

HELLFIRE operational tests, which began in mid-April of 1980 and concluded in mid-July 1980, were conducted in two phases. The nonlive portion was completed in late June. Hundreds of target engagements were simulated at Fort Hunter-Liggett, CA, using surrogate advanced attack helicopters and HELLFIRE training missiles vs. instrumented tanks.

The surrogate AAHs were AH-1G Cobras outfitted with Airborne Target Acquisition and Fire Control Systems utilizing laser designators and both TV and imaging infrared sensors. The live firing portion of the tests used these two aircraft and two AH-1G's without ATAFCS as launch helicopters.

The four helicopters were equipped with HELLFIRE fire control systems, two four-rail launchers, and depending upon the mission requirements, up to eight HELLFIRE missiles. When the smoke and dust cleared, the missile had reportedly obtained an excellent 90 percent in-flight reliability. Although the system's probability of hit performance is classified, the operational test showed that the system had met its stringent performance requirements.

HELLFIRE development testing has also continued. All-up missiles with live warheads have recently been launched against steel plate and tank targets to demonstrate the integration of all elements in the arming and fuzing chain. Tests in adverse weather conditions and in electronic countermeasure environments will soon be completed.

HELLFIRE Firing From Advanced Attack Helicopter

Development testing, over a 2-year period, has demonstrated successful operation over a wide range of conditions. These have included very short and very long range, day and night, smoke, dust, maneuvering launch aircraft, the sun in field of view of the seeker, and all the various HELLFIRE launch modes. Also included was rapid fire and ripple fire with autonomous and remote designator.

Development testing of HELLFIRE and the AH-64 also continued as final demonstration of successful system integration is accomplished. This testing, which is being conducted at Yuma Proving Ground, is under the auspices of the AH-64 Project Manager's Office, AVRADCOM, St. Louis.

Army Accepting Delivery of Laser Designators

The Army is accepting deliveries of the first production laser designators for U.S. ground forces. The Laser Target Designator (LTD) and Ground/Vehicular Laser Locator Designator (G/VLLD) are being produced by Hughes Aircraft Co. under contracts with the U.S. Army Missile Command (MICOM). Both systems are managed by the HELLFIRE/Ground Laser Designator Project Office at MICOM.

G/VLLD in Initial Production

The LTD is a hand-held laser device configured similar to a shoulder-fired weapon. The primary function of the system is to provide ground forces with a target hand-off capability to aircraft equipped with laser aquisition/tracing system.

LTD also has the capability of designating targets for laser guided munitions at limited ranges. Over 100 production models have been delivered to the Army and Air Force, and their utility in the target hand-off role has been successfully demonstrated in recent post-production field tests.

G/VLLD is a man-transportable, ground or vehicular mounted system for locating and designating both stationary and moving targets with a laser signature on targets and achieve a high probability of first-round hits by laser terminal-homing weapon systems (such as COPPERHEAD and HELLFIRE) during both day and night operations.

The G/VLLD is currently in initial production, with first deliveries scheduled for early 1981. The system will be deployed in the ground-mounted mode initially, and will eventually be incorporated in the Fire Support Team Vehicle (FIST-V).

MLRS — The Future is Now

By MAJ Charles P. Watts

The Multiple Launch Rocket System (MLRS) is an awesome piece of modern day weaponry. Even before the Launcher Loader Module, with its payload of 12 dual purpose submunitioned free-flight rockets, is charged into action by the 3-man crew operating the deceptively simplistic board fire control system, the MLRS is impressive.

MLRS consists of over 25 tons of electronic and mechanical rocket wizardry capable of raining a massive payload of munitions at ranges in excess of 30 KM. The highly mobile, air transportable MLRS will provide both U.S. and NATO forces with an effective equalizer in the unbalanced numbers game on the modern battlefield.

Equally impressive are the accomplishments of a dedicated, select group of men and women of the MLRS Project Office, headed by Project Manager COL Monte J. Hatchett. As members of the U.S. Army Missile Command, Redstone Arsenal, AL, they are bringing to fruition an intensive 5-year development program with the aid of equally dedicated members of the U.S. government and civilian and NATO defense R & D community.

International in concept from the outset, the system has evolved from the General Support Rocket System (GSRS) to its NATO designation as the predominately metric standard Multiple Launch Rocket System (MLRS). It incorporates by Memorandum of Understanding, working level R & D experts from Great Britain, the Federal Republic of Germany and the Republic of France, as members of the Project Office staff. MLRS has laid the very cornerstone of future NATO standardization efforts.

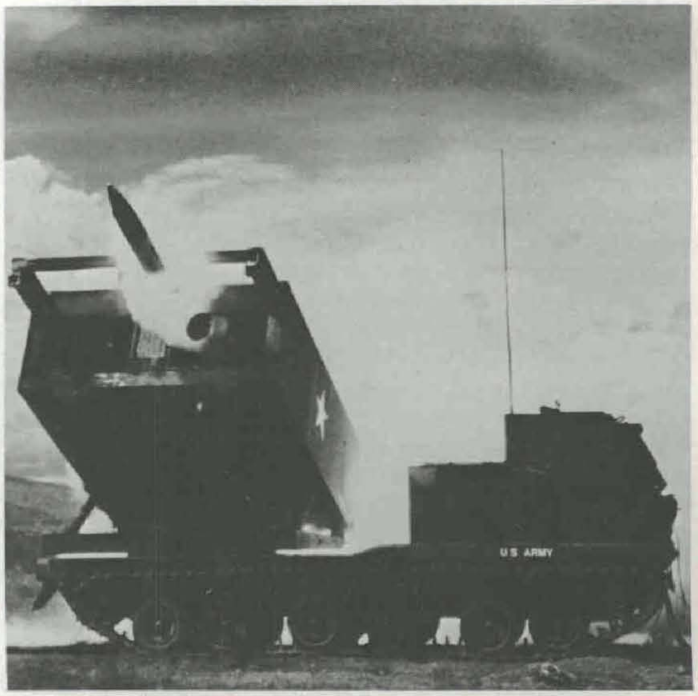
The MLRS accelerated systems acquistion concept compresses schedule time but does not alleviate requirements for thorough system proofing prior to deployment.

The 32-month competitive Concept Validation Phase, comprised of extensive dual contractor and government developmental efforts, culminated in a highly successful ASARC/DSARC III decision which provided approval for the system's entry into a 31-month design maturation and concurrent low rate production phase.

During validation, prototype systems developed by the Vought Corp. and the Boeing Co. were subjected to intensive contractor and government automotive, environmental and system flight development tests leading to the Operational Test I conducted at Fort Sill, OK.

Twenty-four live rocket firings at White Sands Missile Range successfully concluded the rigorous test in February 1980. In all, 223 MLRS rockets were fired during validation at White Sands at various ranges, in single, double, triple and six round ripple modes with both fuzed and unfuzed warhead configurations.

A total of 108 of the flights were scored for competition during development and operational testing. These flight tests, coupled with laboratory and non-flight systems tests at Redstone Arsenal, AL, Eglin AFB, FL, and Aberdeen Proving Ground, MD, provided a basis for evaluation of



Multiple Launch Rocket System (MLRS)

both the Vought and Boeing designs during the competition. This evaluation coupled with the necessary cost consideration led to the selection of the Vought Corp. as the MLRS prime contractor on 29 April 1980.

Government furnished material which was provided during the validation effort included the XM445 fuze (Harry Diamond Laboratories), the MLRS carrier Vehicle (FMC Corp.) and the M42 submunitions (ARRCOM).

In June of 1980, the concurrent Maturation R & D Program and Low Rate Production Program was initiated under the common title of maturation phase. The Maturation R & D Program involves continued system design update hardware fabrication, and completion of the engineering and environmental testing initiated in the validation phase.

The low rate production program is phased to provide sufficient quantities of hardware for production qualification testing and operational test III which will occur in calendar year 1982. The maturation phase is scheduled to end with a DSARC III, a production decision in November 1982.

Included in the tasks to be accomplished during the maturation phase is the development and testing of new component and subsystems of MLRS, designed to fulfill total system requirements. A Position Determining System, which will continuously indicate the Self Propelled Launcher Loader's location, is under development as is a masking device to aid in fire support planning.

A Platoon Leader's Digital Message Device will aid in command, control, and communication within the 3-Platoon MLRS battery. NATO interoperability will be enhanced with inclusion of a multi-language prompting capability in the fire control system and a multiple aim point capability within the fire control system will increase the system's versatility on the battlefield.

Automatic test equipment such as the AN/USM-410, at direct support and general support maintenance levels, will add increased maintenance capability in conjection with the system's own built-in-test-equipment.

These and other software and hardware development will bring the MLRS to the field as an effective, formidable "Soldier's System," as Vought calls it.

Maturation phase testing begins with the maturation development tests to be conducted by Vought and the government as a joint effort. This comprehensive series of tests will begin with component evaluation progressing to a total system evaluation. Maturation development flight tests commenced in November of 1980 at White Sands Missile Range.

The production qualification tests will be conducted following the maturation development tests as a joint contractor/government effort including environmental qualification, rocket performance, and mobility and endurance tests will be performed primarily using low rate production hardware to demonstrate end item and total system performance reliability.

System command, control and communications software and hardware development during the maturation phase will culminate in tests of the Self Propelled Launcher Loader onboard Fire Control System, the Platoon Leader's Digital Message Device and both the Battalion and Battery Fire Direction Systems, which incorporate the Battery Computer Unit of the Army's Battery Computer System.

An important facet of these development efforts is the interface between the MLRS and TACFIRE, which will bring target acquisition information from systems such as RPV, SOTAS and TPQ 36/TPQ 37 to the MLRS Fire Direction System, is a vital requirement for MLRS. This important interface will be tested during informal and formal compatibility and interoperability tests and will be demonstrated during Operational Test III.

The system will also undergo a physical teardown-logistics demonstration designed to verify operator, organizational, direct, and general support maintenance operations. Draft technical manuals will be utilized and procedures verified during the physical teardown-logistics demonstration.

Maturation phase operational testing will include force development testing and experimentation by the U.S. Army Training and Doctrine Command and Operational Test III, the final pre-production test activity wherein the soldier himself will test all aspects of the full up system. British, German and French troops will join their U.S. counterparts for portions of the test. Operational Test III will be conducted with MLRS hardware from the production line employed in a realistic battlefield environment.

TACFIRE and the 10-ton Heavy Expanded Mobility Tactical Truck towing the Heavy Expanded Mobility Ammunition Trailer (ammunition suppliers to the MLRS) will operate with the MLRS test unit consisting of the Battalion Fire Direction System, 2 Battery Fire Direction Systems, 3 Platoon Leader's Digital Message Devices, and 3 Platoons with 3 Self-Propelled Launcher Loaders in each.

A proposed operational test III test site in Canada is being considered by the Army's Operational Test and Evaluation Agency, the test proponent.

In addition to the development activities just described for the basic MLRS program, incorporating a rocket warhead which disperses the M-42, dual purpose submunition, the Federal Republic of Germany is also funding and conducting, a program to adapt its AT 2 Scatterable Mine into an MLRS warhead.

Another joint program is the anti-armor Terminally Guided Warhead currently in the negotiation stage preparatory to concept definition. Clearly, implication for further adaptations of MLRS to meet the ever changing requirements of future U.S. and NATO defense needs are present.

The Multiple Launch Rocket System has entered the research, development, and acquisition scene as an innovator in the concepts of accelerated development, NATO Rationalization, Standardization and Interoperability, and the use of existing technology to provide a needed deterrent for today's Army.

In the foreseeable future, the soldier will receive his system, tested and proven; a system which two and one half years ago was merely a concept in its infancy. The future, in terms of the age-old idea of the rocket's red glare, with MLRS, is now.

MAJ CHARLES P. WATTS is Research and Development coordinator for the Multiple Launch Rocket System in the Product Assurance and Test Division, U.S. Army Missile Command. He holds a BA degree in history from Trinity University and an MBA from Florida Institute of Technology. He is a 1977 distinguished graduate of the Ordnance Officers' Advance Course and a recipient of the Herbert W. Alden Award for leadership and academic excellence.

STINGER

Designed to Meet the Threat

By CPT Joseph G. Korzeniewski

The threat that the United States and allied ground forces face today is a modern, mobile, well-balanced fighting force which is numerically superior in both men and weapons. The threat's forces can be expected to rely heavily on tactical air support to achieve and maintain air superiority and to conduct air strikes in allied rear areas.

Effectiveness of current high-altitude air defense weapons, combined with air defense interceptor fighters, has resulted in the development of threat low-altitude attack aircraft designed to exploit current air defense systems by flying below their radar coverage. These high-performance aircraft and armed helicopters pose a serious battlefield threat to U.S. and allied forces since they are capable of striking anywhere in the combat zone. Stinger provides a highly mobile rapid response counter to this low-altitude threat.

The Stinger Weapon system is a second generation advanced man-portable shoulder-fired air defense system developed to replace the Redeye that is currently deployed with U.S. Forces. It consists of the weapon (missile and launcher), and separable and reusable gripstock containing all of the system's prelaunch electronics, a Battery Coolant Unit (BCU) which provides prelaunch power and detector coolant for the missile, and an Identification, Friend-or Foe (IFF) device which has a capability to challenge aircraft.

Stinger employs an advanced seeker that provides a greater kill probability than Redeye. Its guidance system acquires and tracks targets in all aspects incoming, crossing, or outgoing. This is a significant improvement over Redeye's tail chase only capability, and provides significant immunity to countermeasures.

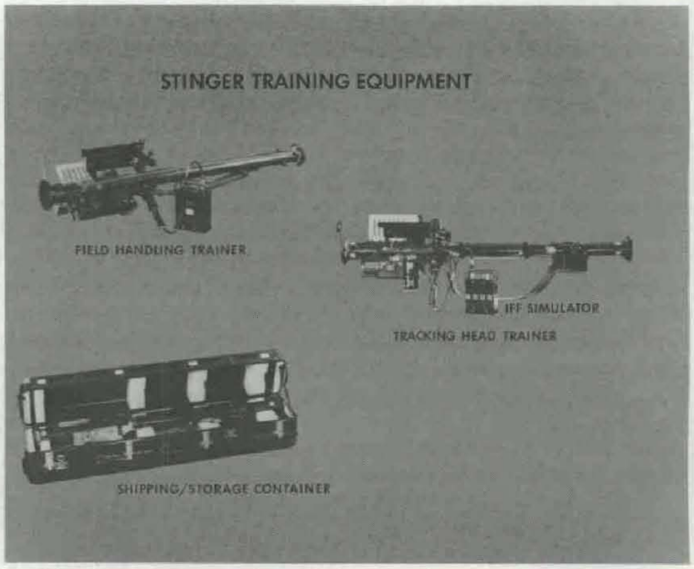
Additionally, increased missile velocity, supplied by the new high performance, dual thrust rocket motor, gives Stinger more maneuverability and greater range than Redeye. The missile is packaged in a disposable launch tube and is delivered as a certified round requiring no field testing or direct support maintenance.

The weapon can be carried and fired by one soldier and employs engagement techniques similar to those used for Redeye. Upon visually acquiring the target, the gunner finds it in the open sight, interrogates by IFF, initiates the missile functions, and launches the missile against aircraft identified as hostile.

IFF interrogation can occur at any time during this sequence prior to launch. Upon launch, the missile guides itself automatically to the target. The gunner is immediately free to take cover or to ready the next round for firing in the event of a multiple target attack.

Stinger is to be organic to infantry, armor, and artillery battalions/squadrons within combat divisions, separate brigades and armored cavalry regiments, missile units, and selected separate battalions. Command and control of the Stinger team is provided by an organic 3-man air defense section (one officer and two enlisted men) located in the headquarters of each battalion or armored cavalry squadron assigned Stinger teams.

The division tactical operations center and the division air defense battalion relay changes in rules of engagement and air defense status via radio to each section and team. In addition, early warning and tentative target identification data from a Forward Area Alerting Radar can be received by and displayed on the team's Tar-



get Alert Data Display Set (TADDS). The IFF unit will augment the visual means of aircraft identification by providing greater assurance that a friendly aircraft will not be engaged.

Stinger is deployed in two configurations: a weapon round and a missile round. The weapon round configuration consists of a complete, ready to use firing system (missile in the launch tube, separable gripstock, and BCU's) and is stored in an aluminum construction clam shell design weapon round container. With the lid closed and latched, the weapon round container provides an environmental seal as well as transport protection for the weapon. When opened, using the quick access latches, the container serves as a ready rack for immediate weapon deployment.

The missile round configuration consists of the missile in the launch tube and its BCU's. It is stored in a low cost wire-bound wooden missile round container which provides transport protection for the missile. The missile round is transformed into the weapon round configuration by attaching the reusable separable gripstock from the launch tube of a previously expended weapon to the launch tube of the new missile. The weapon round container from the previously expended missile is then available as the new missile's ready rack.

Both the weapon round container and the missile round container can be integrated with a variety of military vehicles to enable rapid deployment. A 1/4-ton jeep trailer is utilized as the primary carrier for the basic load of the Stinger team.

Two items of training equipment will be issued to support the Stinger system in the field: A Field Handling Trainer and a Tracking Head Trainer.

The Field Handling Trainer consists of a Stinger launch tube assembly ballasted to simulate the weight, inertia, and center of gravity of a tactical weapon round, a ballasted inert BCU, and a gripstock assembly with simulated workable components.

The trainer is used to provide practice in the basic skills of weapon handling to include gripstock removal, reaction drills, sighting, and ranging. Controls and mechanical operations are the same as the tactical weapon but are completely inert. A Field Handling Trainer will be issued to each gunner team in the Stinger section.

The Tracking Head Trainer, located in each Stinger section, contains an active seeker and electronics which allow the gunner to acquire and track aircraft. All of the functions of the tactical weapon are duplicated with the exception of missile launch.

Additionally, an error logic indicator located on the rear of the launch tube allows an instructor to monitor the gunner and determine if he has performed all of the prelaunch functions in the correct sequence.

The Tracking Head Trainer can be used to acquire, track, and simulate firing on actual aircraft or it can be used in conjunction with a Moving Target Simulator (MTS), a device which projects a target image and an IR signature on a 40-foot quadrispherical screen. There are 13 Moving Target Simulators in the inventory at this time and seven more are under contract for installation in FY 81 and FY 82.

Two items of training support equipment are provided to support the Tracking Head Trainer. These devices, a Gas Pumping Unit and a battery charger, are used to recharge the Tracking Head Trainer's cooling system and batteries, respectively. Both of these items are located with the direct support unit.

The maintenance concept for the Stinger Weapon system is based on limiting the maintenance and logistics burden placed on the tactical organizations to the minimum required to assure a combat-ready posture. Therefore, the organizational level maintenance will be simple, requiring only a TL-29 knife (a combination flatblade screwdriver and knife), cleaning materials, and On-Vehicle Equipment (OVE) for the 1/4-ton truck. Stinger team and section personnel will perform this maintenance.

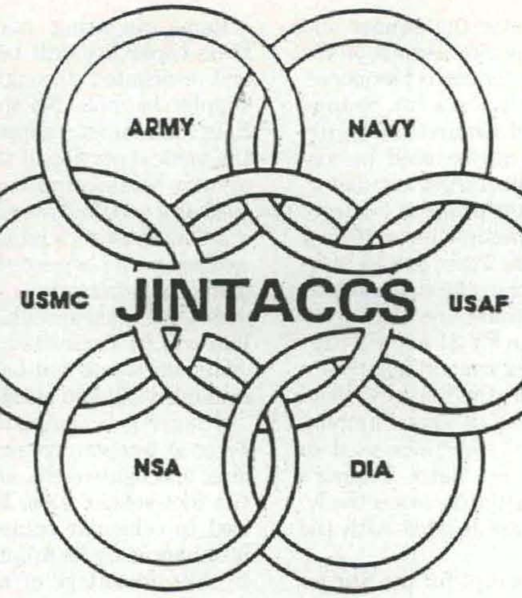
Items requiring maintenance beyond their capability will be direct exchanged and evacuated through the appropriate supply channels. No special categories of field maintenance support are planned for the tactical portion of the Stinger Weapon system because the tactical weapon is issued as a certified round of ammunition.

All maintenance required on the tactical weapon round beyond the capability of the using organization is performed at the depot. Annual surveillance tests of sample lots will be conducted on missiles in the command stock and basic load to provide reliability data on missiles in storage.

Stinger is a complete man-portable air defense weapon system, rugged, dependable, and lightweight, and it goes wherever the foot soldier goes. Mobility is not limited to vehicular transport. Concealment is enhanced by its minimal size and ability to take advantage of terrain and natural features.

Fire and forget operation allows the soldier to maximize his effectiveness, firepower, and survivability. Trained soldiers, publications, and repair parts are ready for Stinger's upcoming deployment. Supplying the firepower for our modern soldier wherever he must fight, Stinger is truly a one-man air defense system designed to meet the threat.

CPT JOSEPH G. KORZENIEWSKI is the management officer of the Stinger Project Office, U.S. Army Missile Command, Redstone Arsenal, AL. He is a graduate of the Army Comptrollership Program and received an MBA in the comptrollership field from Syracuse University in 1979. He has held a variety of field artillery battery and battalion command and staff positions to include commanding a Lance firing battery in USAREEUR.



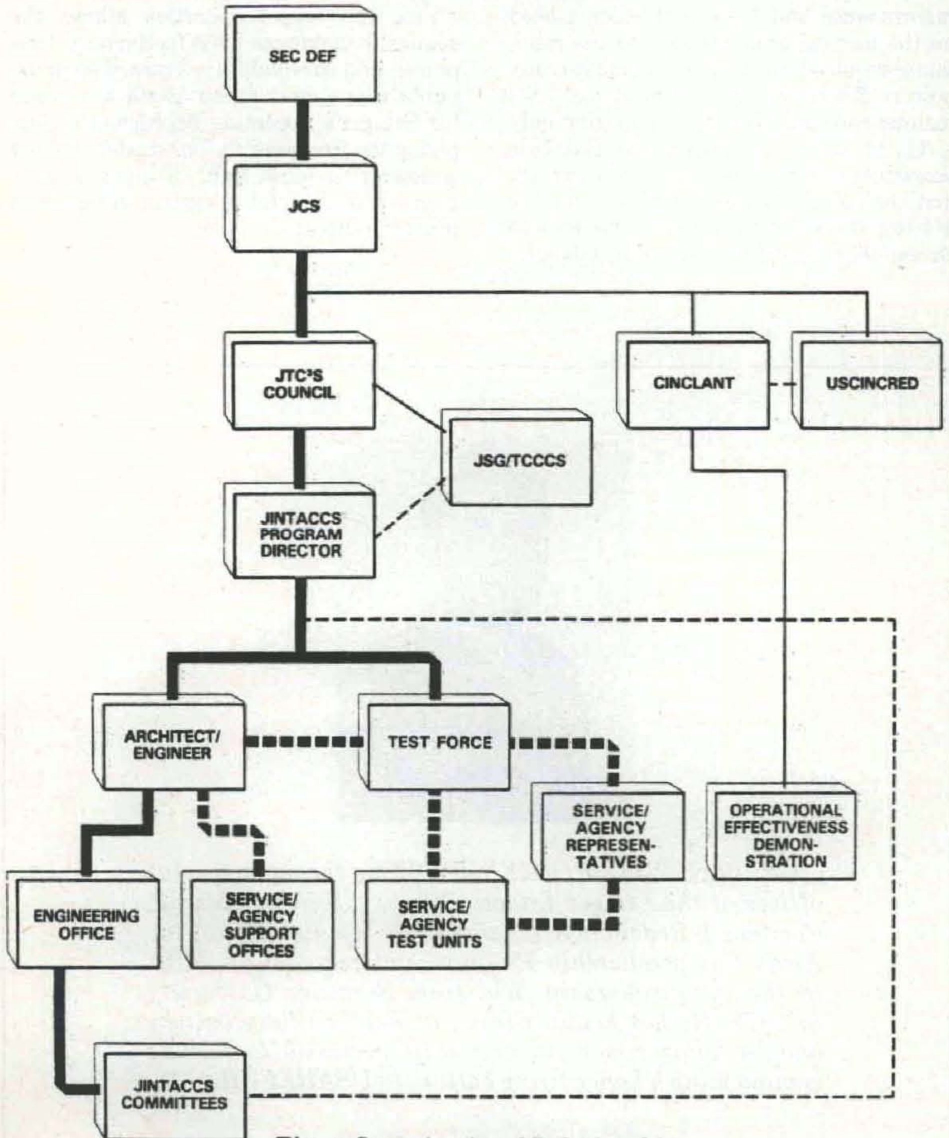


Fig. 1. Organizational Relationships

Joint Inter

The developments of nuclear weapons, high-performance aircraft, sophisticated missile systems, satellite communications, and computers all have contributed to drastic changes in tactics on the modern battlefield. These changes have dictated that compatibility and interoperability be paramount considerations in developing new systems in support of interservice operations.

Historically, the military always has had to perform jointly in a combat situation and, unfortunately, in some cases, has not been prepared to do so due to the nature of the operation or the nature of the systems involved. The degree of success of U.S. joint or combined operations typically has resulted from Service components working together to develop local procedures as an integrated team.

Traditional combat tasks were relatively straight-forward. These were accomplished with manual procedures, using people as the hub of the interoperability scheme. Today, the Services are actively pursuing automation across the tactical equipment spectrum; consequently, joint and combined operations no longer rely solely on manual procedures to provide interoperability.

Interoperability is the capability of one Service to operate with another (or others) in order to increase efficiency or combat power. Compatibility is the key to interoperability, because it is only when all forces, regardless of Service, can exchange information in near real time under extreme conditions that interoperability can be achieved.

To implement and improve the interoperability and compatibility of tactical command and control systems used in joint military operations, the U.S. Department of Defense mounted several joint tactical interoperability programs, one of which was the Joint Interoperability Program for Tactical Command and Control Systems in Support of Ground and Amphibious Military Operations (GAMO) (now called Joint Interoperability of Tactical Command and Control Systems, hereafter referred to as JINTACCS).

COL GEORGE C. SMOLENYAK was commissioned a 2LT in the Signal Corps in 1957. He is a graduate of the U.S. Army Command and General Staff College, British Staff College and the Industrial College of the Armed Forces. He has served as a signal battalion commander in Europe with the 3d Armored Division and is currently the chief of the JINTACCS Architecture/Engineering Office.

...erability of Tactical Command and Control Systems

By COL George C. Smolenyak

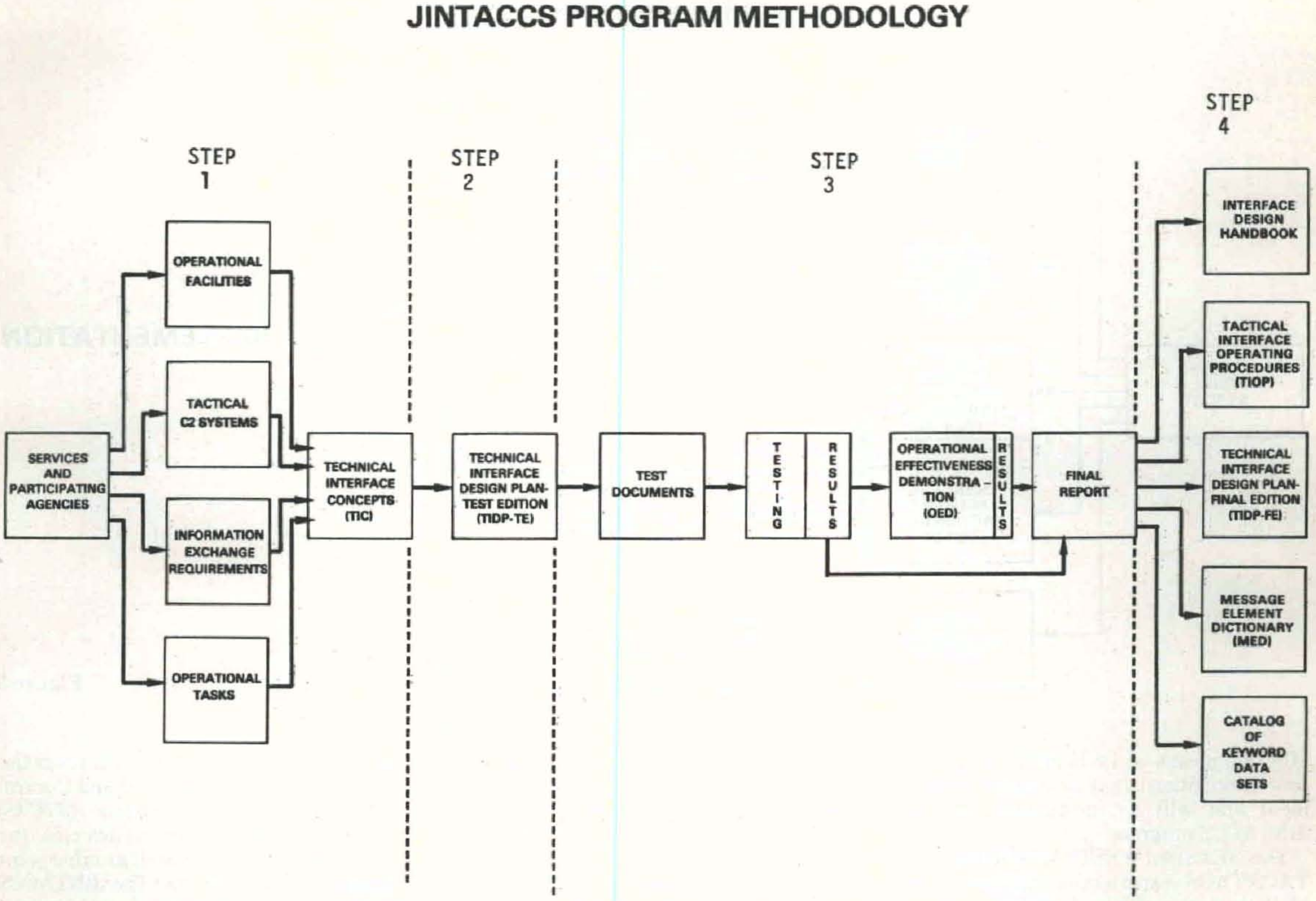


Figure 2

At the completion of the JINTACCS Program each Service and participating agency will have both manual and automated standards and procedures that have been tested and validated within a combat scenario for designing future command and control systems. As a result, the U.S. military forces will have the flexibility to be more efficient in a variety of operational environments, and the capability to more effectively integrate tactical operations with one another. This will also be a giant step toward achieving these same goals with our NATO allies.

The JINTACCS program is a continuation and a consolidation of previous efforts by DOD to achieve interoperability of tactical command and control systems in joint and combined operations. Three of the more significant predecessors of JINTACCS are the Southeast Asia (SEASIA) interface program, the WESTPACNORTH interface program, and the Tactical Air Control Systems/Tactical Air Defense Systems (TACS/TADS) interface program.

The SEASIA interface program evolved from an urgent tactical air control requirement that developed in Southeast Asia. A need existed to integrate the U.S. tactical air control elements such that a continuous display of all airborne aircraft was available to the various commands on land and at sea.

From this requirement, the SEASIA interface program was successfully implemented, and the program permitted the participants to exchange air situation information via digital information link. The SEASIA was operationally effective; however, it was geographically oriented and was terminated when the operational requirement no longer existed.

The WESTPACNORTH compatibility program grew from the requirement of the Japanese self-defense forces to obtain early air traffic warning beyond the reach of the radars in Japan. To satisfy this need a buffer was installed to provide air tracks from the U.S. forces to the Japanese air defense system. This interface was very successful and provided Japan with the needed additional early warning capability.

The TACS/TADS interface program was established as a result of the SEASIA interface. The TACS/TADS program has as a premise that a joint air defense and air control capability may be required anytime, anywhere in the free world.

The TACS/TADS program developed and demonstrated the compatibility, interoperability, and operational effectiveness of selected current and developmental automatic tactical data systems associated with air control and air defense systems. The compatibility and interoperability testing has been completed successfully and the operational effectiveness demonstration has been conducted. This program provides the Services with an effective and

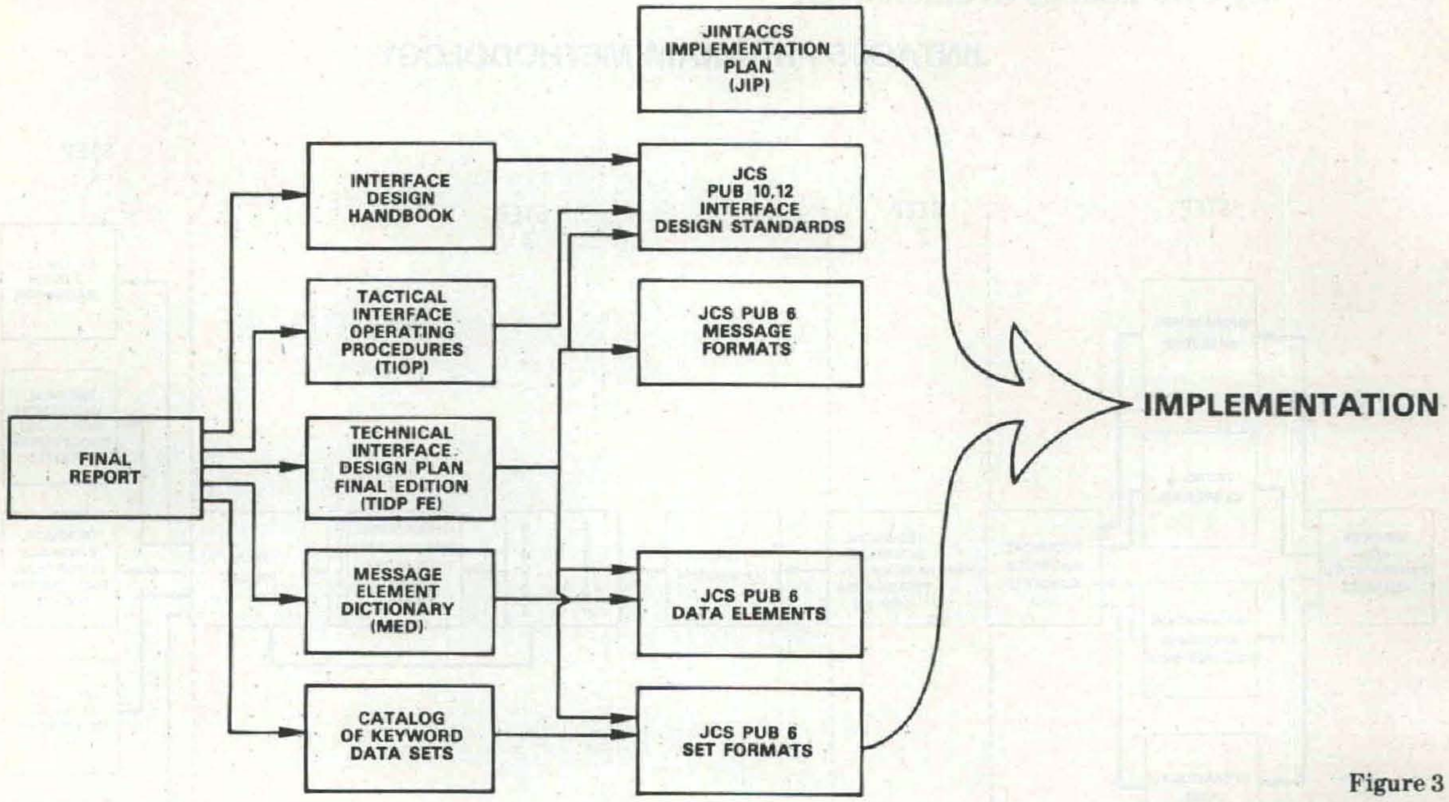


Figure 3

efficient means of exchanging near real-time information in any air combat environment and will be incorporated in the JINTACCS program.

The SEASIA, WESTPACNORTH, and TACS/TADS experiences indicated that after-the-fact system integration is costly and time consuming, that joint interoperability was not easy to achieve after a Service's automated systems were put into operation, that standardization can solve some of the problems, and that joint Service support is an essential ingredient for interoperability. From this experience the JCS identified the urgent need for a joint interoperability program to develop standard procedures, minimize future interface problems, and achieve effective validation.

In retrospect, the fundamental problem in achieving joint interoperability has been the lack of emphasis by the Services on the joint applications of their tactical command and control systems during their initial planning and throughout development. The problem of joint interoperability is mainly one of requirements.

The requirement process must determine the extent to which interoperability is necessary for each system entering development. This is a joint problem whose solution is the responsibility of the JCS. The Service facilities must be capable of interfacing effectively with other Service or agency facilities.

In order to enhance U.S. military capability, the DOD decided that information should be exchanged in joint operations among ground and amphibious tactical command and control systems of the various Services (Army, Navy, Air Force and Marine Corps) and selected agencies (DIA, NSA) in addition to those air control and air defense systems currently within TACS/TADS.

Early in the 1970s, the Services determined that no joint interface program existed to address this extensive DOD requirement, and JINTACCS program was established for this purpose. Its mission is to ensure that standards are developed to achieve technical compatibility and that tests and demonstrations are conducted to exhibit the compatibility, interoperability and operational effectiveness of those developing tactical command and control systems used in support of military operations.

Figure 1 presents the basic organizational relationships of the JINTACCS program. The Joint Tactical Command and Control and Communications System (JTC^3S) Council was established to oversee the JINTACCS program as well as other joint interoperability programs. The JINTACCS program director reports directly to the JTC^3S Council and is responsible for the overall management of the program. He is supported by two organizations, the Architecture/Engineering Office and the Test Force.

The JINTACCS architect/engineer is responsible for the day-to-day management of the program and the preparation of the program planning and design documentation required to formalize the interfaces between systems within the program. The engineer and his staff are supported by the Service and agency support offices, which are staffed by representatives of the Services and participating agencies. These personnel ensure adequate and timely support to the program, and provide a mechanism for resolving differences that may arise.

The Joint Interface Test Force (JITF), located at Ft. Monmouth, NJ, is responsible for conducting tests of the compatibility and interoperability achieved by the tactical systems identified when using the JINTACCS described standards.

The commander and his staff are supported by Service and Agency test units and their associated personnel. Their mutual goal is to prepare for a field operation effectiveness demonstration (OED), after all design requirements have been tested and evaluated for compatibility and interoperability.

The Commander-in-Chief, Atlantic (CINCLANT), in collaboration with the U.S. Commander-in-Chief, Readiness Command (USCINCRED), is responsible for planning, conducting, and evaluating the joint OED.

The JINTACCS program methodology is depicted in Figure 2. The first step was development of the program architecture. This included the development of the management structure and procedures for program execution, and the establishment of the architectural and conceptual foundation.

The identification of tactical operational facilities (OPFACs) and tactical command and control (C^2) systems that would be required to participate in joint tactical military operations in the 1980s and beyond was necessary.

The program then determined the joint interface points and the information to be exchanged between the identified OPFACs by utilizing the information exchange requirements and operational tasks derived from approved JCS documentation. This is documented in the architectural document entitled Technical Interface Concepts (TIC), which was initially approved in 1974 by JCS, updated in March 1977, and is currently being updated and expanded.

The next step of the program was the development of an engineering implementation plan that specifies the technical standards required to achieve compatibility and interoperability as specified in the TIC. This plan includes a comprehensive technical description of the operational interfaces, message standards and implementation methods, information to be exchanged, rules for processing data between OPFACs, and a final list of Services and agencies' facilities/systems. This information is documented in the Technical Interface Design Plan-Test Edition (TIDP-TE), the basic design document utilized to proceed into the testing phase.

In addition to the TIDP-TE, supplementary documents are being developed to maintain the data elements, data sets and communication/data requirements used in exchanging the information outlined in the TIDP-TE. Due to its size, the JINTACCS design effort has been divided into five functional segments—Intelligence, Fire Support, Amphibious, Operations Control, and Air Operations—which have been developed and documented separately.

JINTACCS PROGRAM SCHEDULE

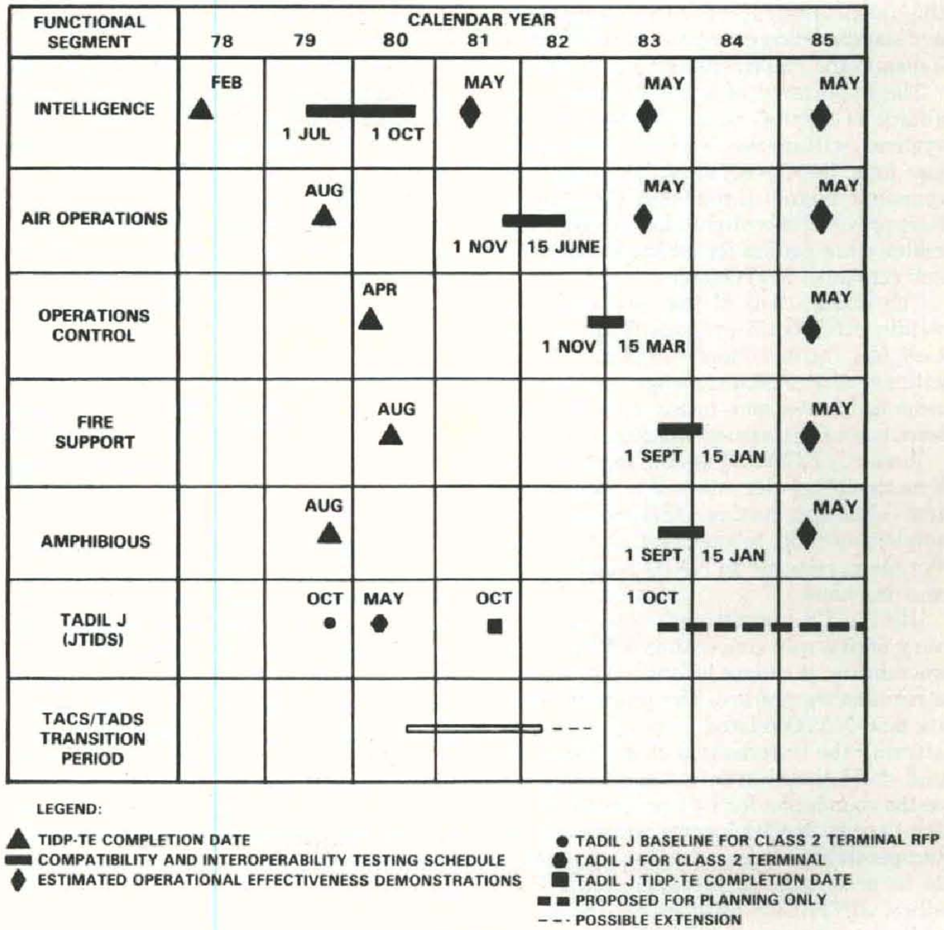


Figure 4

To manage this program, a JINTACCS computer library has been established, where all message elements are categorized for easy access, manipulation, and development into human-readable messages necessary for the modern battlefield. This computer library is also being developed to provide a capability to compare varying U.S. and NATO standards.

Using the TIDP-TE as a basis, the third step of the program consists of developing the test documents, conducting compatibility and interoperability (C&I) tests, demonstrating operational effectiveness, and documenting the results. The test documents describe the test objectives, test responsibilities, and related factors in order to plan, design, conduct, and analyze the JINTACCS test program.

The C&I testing is being conducted functionally and will test the ability of OPFACs and supporting systems to exchange, process, and properly interpret all data prescribed in the TIDP-TE. Following the C&I testing, CINCLANT, in collaboration with USCINCRED, is tasked by JCS to conduct exercises independent of the program, to demonstrate, with operational forces, the operational effectiveness of the interfaces.

Final reports on the testing and demonstrations will be prepared by CINCLANT and the JINTACCS program director and submitted to the JCS. This will result in step four of the program methodology, the publication of approved documents and standard data elements and sets. Figure 3 depicts the implementation methodology.

The importance of achieving interoperability of tactical command and control systems within the NATO environment has long been recognized. Political and economic factors throughout the alliance have provided new stimuli to the traditional military motivation for effective command and control of NATO forces.

The implications of this new emphasis within JINTACCS are significant. Every task has become more complex. Organizational relationships, along with specific responsibilities and terms of reference, have had to be clarified and redefined.

In short, JINTACCS has had to move from a methodology that allowed a "closed system" of design, testing, OED and eventual implementation to one that is far more flexible in response to NATO requirements and decisions.

JINTACCS consequently has taken a very active role concerning NATO interoperability; it cannot afford to sit back in a reactionary posture. The program, with its new NATO-related responsibilities, is offering the introduction of its standards and definitions—even its methodology—as the foundation for U.S. proposals before the various NATO forums addressing interoperability issues. For these proposals to be acceptable in the eyes of the U.S. allies, JINTACCS must assess the needs of the larger community.

JINTACCS, therefore, has evolved into a program of far greater proportions than first envisioned in its earlier days. It is pioneering in the world of tactical command and control interoperability at the international as well as the national level.

This new environment will not undermine U.S. goals or requirements. They remain clear-cut objectives of established priority. However, the technical details to achieve these objectives are often negotiable and changes to effect NATO interoperability can be introduced and accepted without threatening the quality of the end product.

The development of the interface concepts has been completed and the functional volumes defining the character-oriented messages (COMs) of the TIDP-TE have been published. Testing has already begun and test plans are being coordinated with the Services and Agencies.

The first functional group to undergo testing was Intelligence, with the final segment of tests completed in October 1980. Air Operations will be the next functional group to be tested, starting in November 1981.

Figure 4 reflects the JINTACCS program schedule as it pertains to the development of COMs, but which will change as bit-oriented messages (BOMs) associated with automated interfaces are developed.

At the completion of the JINTACCS program, the framework will be laid for Service and agency interoperability. Interfaces and systems requirements will have been identified, testing will have been completed, and interface standards will be released for implementation.

Consideration of NATO requirements will continue to be a significant factor throughout the program development, and U.S. delegates to the various NATO committees will use inputs from the JINTACCS program as a basis for U.S. positions when developing NATO interoperability standards.

JINTACCS provides only a beginning, but it will identify positive information exchange requirements and interfaces, and will provide design specifications for future systems.

MULE Successfully Completes Developmental Tests

The Modular Universal Laser Equipment (MULE) has successfully completed all developmental tests after over one year of thorough and rigorous evaluation, according to an announcement from the Army Missile Command (MICOM). Hughes Aircraft has also completed delivery of the 10 engineering development models to the government for further operational tests at Twenty-nine Palms, CA.

The MULE is a laser designator and rangefinder which will be used by the U.S. Marine Corps forward observers to direct laser guided weapons, and as a precision target locator for conventional artillery.

The system, weighing approximately 42 pounds, consists of three modules: The Laser Designator Rangefinding Module (LDRM), the Stabilized Tracking Tripod Module (STTM), and the North-Finding Module (NFM). It is 2-man portable. Hughes Aircraft has designed and built the LDRM and STTM under contract to the Army, while Sperry is developing the NFM under contract with the Navy.

MULE

MULE is being developed by MICOM to satisfy a U.S. Marine Corps requirement for a lightweight precision laser designator/target locator.

CERL Gets Excellence Award

The U.S. Army Construction Engineering Research Laboratory (CERL) has received the 1981 U.S. Army Award for Excellence. The award, presented by LTG J.K. Bratton, chief of Engineers, recognized CERL's significant contributions to the Army's capabilities and readiness during the 1980 fiscal year.

CERL was cited for achievements in computer-aided design and management, development of materials and construction concepts for fighting positions, work in modeling combat engineering effectiveness on the battlefield, and development of computer programs for energy conservation and environmental quality assessment. CERL was the only Corps of Engineers laboratory to receive an Award of Excellence this year.

Viper Nears Completion of Engineering Development Phase

The XM132 Viper antitank weapon system is nearing the end of its engineering development. Viper is being developed as a replacement for the M-72 LAW (Light Antitank Weapon), and will provide the individual soldier with a lethal antiarmor weapon that has over twice the effective range and four times the accuracy of the LAW.

The Viper warhead offers a significant improvement over its predecessor, according to MAJ Michael R. Roddy, III, Program Management/Procurement and Production Division, Viper Project Office. Viper's highly efficient, in-tube burning rocket motor has reduced the time to target by almost 50 percent.

Viper is composed of five components: the tactical round, a subcaliber practice rocket, a practice rocket launcher, a tracer bullet, and a tracer bullet launcher.

Weighing approximately eight pounds, the 70mm, tactical Viper is a man-portable, shoulder-fired, unguided antitank weapon consisting of an in-tube burning rocket packaged in a disposable, telescoping fiberglass launcher. The rocket is composed of the warhead and rocket motor.

Viper's disposable launcher, which also serves as an environmentally sealed storage and handling container, is composed of two telescoping fiberglass tubes, sights, firing mechanism, and carrying strap.

The 46mm subcaliber practice rocket is comprised of a rocket motor utilizing the same propellant as the tactical round and a marker head which flashes on impact.

Reusable practice rocket trainers use a modified tactical launcher with a stainless steel subcaliber launch tube mounted inside.

The tracer bullet features a standard 7.62mm tracer bullet mated to a specially loaded .30 caliber cartridge case. The reusable tracer bullet launcher uses a modified tactical launcher with a single shot, 7.62mm, breach loading rifle mounted inside.

Trainer launchers have been designed to closely match the look and feel of the tactical round. Both trainer rounds approximate the ballistics of the tactical round providing realistic training at reduced cost.

No maintenance is required on the tactical Viper which will be issued as a certified round of ammunition. Limited organizational maintenance (cleaning, replacement of batteries, replacement of launcher components) will be required on the training launchers.

XM132 Viper Antitank Weapon System

Viper development was initiated in 1976 when General Dynamics, Pomona Division, was selected a prime contractor as the result of a competitive solicitation. General Dynamics is teamed with Bulova Space and Instruments Corp. Valley Stream, NY (fuze); Atlantic Research Corp., Gainesville, VA (rocket motor and practice rocket); Brunswick Defense Division, Lincoln, NB (launch tubes and rocket motor case); Mason and Hanger, Silas Mason Co., Inc., Middletown, IA (warhead); Remington Arms Co. Independence, MO (tracer bullet); and Sturm-Ruger, Southport, CT (rifle assembly).

There are many technological advances in Viper. The composite launcher has most external features molded as part of the manufacturing process which practically eliminates subsequent machining operations. All external components (firing mechanism, sights, etc.) are attached using a fiberglass reinforced tape, further simplifying the assembly process.

The composite rocket motor case (see the January-February 1980 issue of *Army RDA Magazine)* is believed to be the first application of this technology in a man-rated weapon system.

A state-of-the-art propellant mix that has an extremely rapid burning rate is used in the rocket motor. This reduces size and weight, guarantees a complete in-tube burn, and decreases time to target.

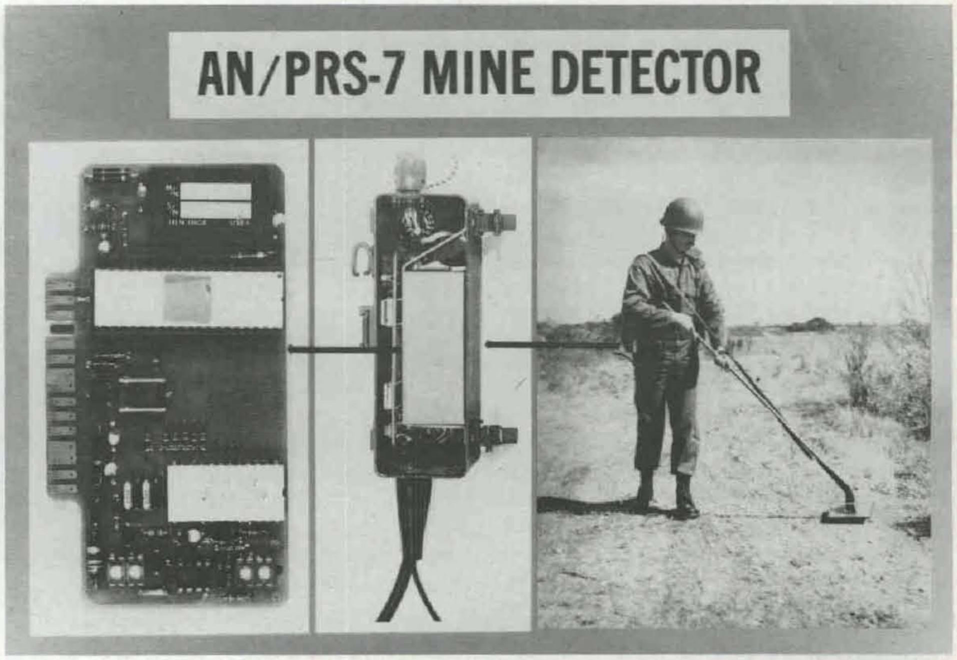
The warhead uses the shaped charge principle to defeat the target. Warhead performance is enhanced by using a precision copper liner, a pressed explosive billet, and a precision initiation coupler. All these technological advances combine to make Viper the individual infantryman's choice as the close-range, man-portable antitank weapon for the 80s, says MAJ Roddy.

Development Verification Testing (DVT) of complete rounds was completed in November 1980. Prototype Qualification Testing (PQT), which begin in late November 1980, was completed by the end of January 1981. Initial man firings of the Viper by contractor personnel (seven males and one female) were completed in December 1980.

First man firings by Army personnel began in January 1981. Operational Testing II (OT II) began in February 1981. Viper is targeted for delivery to operational units in the not too distant future.

Army Solves Desert Mine Detector Problem

By Peter M. Pecori



The Army's standard man-portable detector for metallic and non-metallic mines is the AN/PRS-7. It was successful in detecting mines in the Far East as well as in Europe and the U.S. However, during a mine clearing operation in the Suez Canal region, in the mid 70's, it was learned that this detector had very poor response to nonmetallic mines in desert soils. The U.S. Army Mobility Equipment R & D Command (MERADCOM), Fort Belvoir, VA, has now solved this problem.

The new improved AN/PRS-7, to be redesignated AN/PRS-8, will now achieve a high probability of detections of metallic or nonmetallic mines in arid, desert type soils, and will greatly enhance the capability of the Rapid Deployment Force (RDF) or any force in Middle East type desert environment.

The heart of the improved mine detector is a microcomputer which digitally processes the received signal and controls new wide band RF transmitter and receiver assemblies. The improved detector recently completed Army Test and Evaluation Command (TECOM) sponsored testing at Yuma Proving Ground, an arid soil analog of the Middle East desert environment.

Comparison testing of the improved and standard mine detectors against a complement of inert nonmetallic encased antitank and antipersonnel mines demonstrated an order of magnitude improvement in detection capability. The improved system detected 82 percent of the targets compared to less than 8 percent for the standard system. Inclusion of metallic targets increased the detection rate of over 85 percent for the improved system. Soil moisture levels generally were well under 1 percent during this test. TECOM wet soil testing at Aberdeen Proving Ground has recently been completed. No degredation in this environment has been observed as a result of the dry soil improvement modifications.

A re-type classification action is now scheduled in 1981 to authorize a complete retrofit of the entire Army inventory of AN/PRS-7 mine detectors. The product improvement program was designed to minimize mechanical changes as a cost saving feature during the retrofit action. The result is a cost effective mine detector which externally looks the same as the previous unit but has completely new electronics sections and battery to perform the desert mine detection job.

The standard AN/PRS-7 transmits two signals at UHF frequency which are 180° out of phase with respect to each other. The two transmit antennas produce a null in the field pattern at which a receiving dipole is located. When a different dielectric or conducting object is introduced into the otherwise homogeneous medium, the field will be disturbed and the resulting unbalance will be detected as a change in level at the receive dipole.

These level changes at the receive dipole are peak detected and then are processed with respect to amplitude and amplitude rate, to produce an audible variation in a 1KHz tone. The processing employs a fixed amplitude threshold as well as a frequency selective cancellation feedback loop to reduce the effect of slowly varying signals.

Once the fixed amplitude reference voltage is exceeded, the gain is increased to produce a distinctive amplitude change in the tone presented to the operator via the headset earphone.

In the Middle East environment, a low dielectric contrast between target and background exists due to the extremely low soil moisture levels. Water, with a relatively large dielectric constant, is one of the major contributors to the electromagnetic properties of soil.

As soil moisture drops, loose, homogeneous soils such as sand approach the dielectric constant of the target materials. As the standard mine detector processed mainly by amplitude, when the amplitude decreased, reflecting the loss of dielectric contrast, the levels would fall below threshold and become indiscernable to the operator.

The product improvement program was initiated in FY76 to solve this problem. The initial system employed a tractor mounted minicomputer and wide band multi-channel transmitter/receiver. The signal processing algorithm used on the MERADCOM-developed Vehicle Mounted Road Mine Detector System program was modified and implemented. This adaptive program permits successful operation over a wide range of soil conditions.

A background term and a standard deviation term are computed for each frequency channel from the digitized received data. The background term is subtracted from the instantaneous received data then divided by the standard deviation term. The result is summed over the frequency band.

This has the effect of normalizing soil differences as both the numerator and denominator will decrease in low dielectric constant conditions, i.e., arid soil, while the calculated result will not vary significantly. This version was successfully tested in arid soil conditions in 1976.

Subsequently, the transmitter frequency range was expanded to include additional higher frequencies which are more significant contributors in arid soil conditions. The signal processing algorithm was adapted to portable operation. A metronome signal was employed to aid the operator to control antenna velocity relative to the surface.

A click is heard by the operator at 2.5 second intervals. This click indicates to the operator when he should reverse the antenna movement. In this manner, time can be utilized in the algorithm to approximate distance information as the distance traversed between clicks should be relatively constant.

Distance information is used by the algorithm to provide a weighting function to allow the algorithm to be more responsive to the area most recently traversed. Signal blanking at the sweep reversals reduces false alarms naturally occuring at this time due to antenna tilt by the operator.

Upon target encounter, the microprocessor outputs a geiger counter-like indication. The repetition rate of this signal will vary as a function of the strength of the signal, allowing the operator to pinpoint the mine.

These features allow for the replacement of five operator selected switch positions with two. Additionally, the operator now need not be concerned with antenna sweep speed. Thirdly, a disconcerting single frequency audio tone was eliminated for the operator.

Subsequent hardware changes were developed in 1977 and 1978 and were aimed toward hardware miniaturization for man portable use. A semi-custom integrated circuit was implemented to dramatically reduce the receiver size.

A Texas Instruments single board 9940 microcomputer was implemented as a final step to the miniaturization process to replace the minicomputer system control unit and central processing unit. This device implemented the signal processing algorithm upon the multichannel information as well as controlled the synchronization for the voltage controlled oscillator in the transmitter and subsequent analog to digital converter.

The entire RF package and signal processing package is now located in the former respective mechanical housings. A lithium 2D cell battery is utilized in this mine detector. This battery, the first Army standard lithium 2D cell battery, was developed in parallel with this program. This battery provides the required energy density to power the mine detector while occupying minimum space.

The hardware underwent full field comparison tests and environmental tests administered by TECOM as a product improvement test in 1979 and 1980. Human factors evaluations from this test indicate approval of the variable click audio presentation as opposed to the constant tone presentation.

This program fills a gap by providing the Army with a man portable mine detection device capable of desert environment operation.

PETER M. PECORI, project engineer in the Systems and Engineering Division, Countermine Laboratory, has been employed at MERADCOM since 1972.

An electronic engineer, he joined MERADCOM following employment at the Department of Commerce and the U.S. Army Night Vision Labs. He graduated with a BS degree in electrical engineering from Villanova University and has received several U.S. patents for signal processing techniques as well as authoring several papers in related technical areas.

Capsules . . .

Electro-Optical Systems Studied During "Snow-One" Field Experiment

HOLOCAMERA, used to obtain 3-dimensional images of snowflakes is explained by Harold O'Brien, USACRREL, to a group that includes BG James E. Drummond, acting director, U.S. Army Materiel Systems Analysis Activity; Dr. James Choromokos, director, Research and Development Directorate, OCE; Dr. Dean R. Freitag, technical director, USACRREL; and BG Richard W. Wilmot, Office of the Assistant Chief of Staff for Intelligence.

Effects of winter conditions on military electro-optical systems are being studied during the SNOW-ONE field experiment currently being conducted at Camp Ethan Allen Training Center in Vermont. Directed by the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL) in Hanover, NH, the exercise is a part of the Corps of Engineers battlefield environment research program.

More than 40 representatives of Department of Defense agencies were briefed on the field exercises at the test site in January.

Agencies representing the Army, Navy, Air Force, and Marine Corps are assessing the effects of cold, snow, fog, and snow covers on various systems under development. Participants in the study are Air Force Armament Laboratory, Army Atmospheric Sciences Laboratory, Army Ballistic Research Laboratory, Army Dugway Proving Ground, Harry Diamond Laboratories, Army Missile Command, Naval Research Laboratory, Naval Weapons Center, Marine Corps Operations Test and Evaluation Activity, University of Tennessee Space Institute, PM Smoke/Obscurants, Army Aviation Research and Development Command, MIT/Lincoln Laboratories, and AVCO/Sylvania.

A major part of the study will be the determination of the characteristics of cold weather meteorological occurrences which is being conducted by USACRREL and the Atmospheric Sciences Laboratory. The availability of state-of-the-art measurement technology will permit measurement of the number, mass concentration, and size distribution of snow crystals and fog droplets.

The size and shape of snow particles are being measured in 2-dimensional images and in 3-dimensional images using a holographic camera. Measurements are made of the concentration of snow particles in the air and of wind blown snow. Microscopic studies are used to determine snow crystal characteristics.

Program director is Mr. George W. Aitken, chief, Geophysical Sciences Branch, and the field experiment coordinator is Mr. Robert K. Redfield, both of USACRREL.

CSL Graphics Display Duplicates Theoretical Wounds

Development of a computerized color graphics display program for determining future battlefield facial wounds has been announced by the U.S. Army Armament R & D Command's Chemical Systems Laboratory, Aberdeen Proving Ground, MD.

Designed to display cross sections of the facial area with the plotted wound track, the program utilizes the "Computer Man" — a basic computerized methodology of wound ballistic studies. The goal is to predict hypothetical maxillofacial area (face, jaw and teeth) wounds for dental surgeons.

Mr. Victor R. Clare, a research biologist who heads the program, reports that CSL scientists, funded by Army Institute of Dental Research, have programmed the Computer Man to display color-coded tissue types customized for the surgeon, and the video screen can produce any representation of random wound tracts.

In duplicating theoretical wounds, surgeons will reportedly be able to see the wound track of the projectile, what bones, teeth and soft tissue are involved, as well as view the estimated size of the wound. Special surgical training will eventually be devised in advance to meet the needs of future operating room staffs, according to Clare.

In little more than a year, using the Computer Man as the basic tool, the CSL added dental applications and dental nomenclature to the program. CSL also color-coded tissue cells and identified teeth and areas of the maxillofacial area, all tailored to surgical needs.

Additionally, CSL incorporated the effects of fragments travelling through tissue and bone, including the retardation of velocity as they travel as well as the hole size. According to Clare, this information was gleaned from testing with physical models of bone and tissue at CSL.

Clare said the CSL Computer Man technology will be extended to predict workloads for medical personnel working with the wounded during conflicts and provide planning information for logistics and support to treat wounded soldiers.

In addition, plans call for new computerized incapacitation studies of theoretical wartime wounding to be done at CSL for infantrymen and for fixed-wing and rotary-wing pilots.

Other CSL personnel involved in this project are Mr. William P. Ashman and Mr. Alexander P. Michiewichz, both research biologists, and Mr. Paul H. Broome, a mathematician.

Army Product Improves M23 Breathing Apparatus

Explosives and missile fuel handlers as well as firefighters and others who work in toxic or oxygen-deficient environments might soon benefit from improvements made to an Army breathing device developed at the Chemical Systems Laboratory (CSL).

Designated the M23 Breathing Apparatus, the appliance is designed to support explosive ordnance disposal teams and workers who must handle rocket fuels as well as personnel who work in toxic atmospheres.

According to Mr. John Shriver, the breathing apparatus project officer assigned to CSL's Physical Protection Division, the product improvement program includes converting the device to a pressure-demand type that will provide a constant positive pressure breathing system. This will make it much safer and satisfy requirements of the National Institute of Occupational Safety and Health.

"Another valuable aspect of this self-contained apparatus," Shriver said, "is the quick disconnect capability for compressed air bottle replacement. We have also reduced the overall weight of the system as well as cut back on costs."

"Current available systems have severe limitations for use in toxic agent environments, but with the improvements on the M23, such as the hood-jacket, the system will meet all known requirements," he said.

The hood-jacket is being developed to be worn over the M23 to not only protect the wearer but to also protect the apparatus against such severe requirements as red fuming nitiric acid and jet fuel. Certification for Army-wide use is expected later this year.

Stinger Missiles Sent to Army Europe Elements

The Army has announced it has begun supplying soldiers with the new Stinger air defense guided missile system. First combat-ready units to get the man-portable, shoulder-fired weapon are maneuver elements of the U.S. Army in Europe. The U.S. Marine Corps will also use the weapon.

Stinger protects ground forces against attack by low-flying, high-speed jet aircraft and helicopters. It is replacing the Redeye missile. Stinger offers several distant advances in fighting capability. It can engage faster targets at greater range including those flying directly towards the gunner. Stinger has built-in electronics compatible with all NATO aircraft that aid the gunner with aircraft identification.

The missile uses a passive infrared seeker and solid fuel rocket motor. It comes from the factory sealed in a fiberglass tube which converts to a launcher by quick attachment of a reuseable gripstock containing the firing circuits and IFF electronics. Once the missile is fired, the launch tube can be discarded. Missile, launch tube and gripstock weigh about 35 pounds.

COL James E. Rambo is the Stinger Army project manager. He and his staff are part of the U.S. Army Missile Command at Redstone Arsenal, AL. General Dynamics, Pamona, (CA) Division is the system's prime contractor. (See p. 10 for by-line feature on Stinger.)

1st Cavalry Division Receives New AN/TPQ-37

The first of the Army's new artillery-locating radars, the AN/TPQ-37, is in initial operational capability at Ft. Hood, TX, with the 1st Cavalry Division.

Developed by Project Manager FIREFINDER/REMBASS, an element of the Army Electronics R & D Command, it is the first radar set that can locate single or multiple hostile artillery and rocket launchers at their firing sites. A combination of radar techniques and sophisticated computer-controlled signal processing allows the radar to detect and track the hostile projectiles simultaneously. This information is then forwarded either manually or automatically to an artillery fire direction center for use in directing accurate counter fire.

The new radar system, produced by Hughes Aircraft Co., Torrance, CA, will be assigned to field artillery target acquisition batteries at division level. The 1st Cavalry Division is the first Army unit to achieve full operational capability with the new radar sets.

A decision to proceed with full-scale production on the AN/TPQ-37 was made recently by the Army Systems and Review Committee. Full-scale production will start at the end of the extended low-rate-initial production period.

Modifications Expected to Improve Smoke Generator

Engineers at the Army Armament R & D Command's Chemical Systems Laboratory (CSL) are updating the M3A3 Smoke Generator to improve its overall reliability and to reduce maintenance time.

Used by the Army since the early 1960s, the smoke generator is a gasoline-fueled pulse jet engine which produces smoke when fog oil is vaporized in the engine's exhaust system.

Mr. Del Rod, a project officer assigned to CSL's Munitions Division, says the product improvement program will improve engine starting and reliability as well as reduce maintenance. "In addition, we are replacing the current air motor/fog oil pump with a low cost, easily maintained commercial pump," Rod said. Use of diesel fuel instead of fog oil as the smoke agent is also being investigated.

Acceptance by the Army of the proposed modifications is expected late this year with retrofitting of smoke generators scheduled for next year.

$5M Contract Calls for XM-445 Initial Production

A contract for over $5 million for low-rate initial production of the XM-445 fuze has been awarded to KDI Precision Products, Inc., Cincinnati, OH. Harry Diamond Laboratories (HDL), an element of the Army Electronics R & D Command, awarded the contract which calls for 3,740 fuzes to be produced over a 30-month period.

The XM-445, designed and built by HDL, is a low-cost, digital electronic, remotely set time fuze with an air-driven fluidic generator power supply and gearless safety and arming mechanism. The seventh HDL fuze to enter production in the past six years, it is used on the Multiple Launch Rocket System.

Program to Provide Ada Computer Language

The Department of Defense has established a Joint Program Office to complete the development and introduction of Ada, the new common computer programming language for the DOD. The DOD common language effort began in 1974 as a significant step to improve the quality of software in defense systems and to control the burgeoning costs of that software.

The language is named Ada in honor of Augusta Ada Byron, the Countess of Lovelace and daughter of the English poet, Lord Byron. She was the world's first programmer, having prepared the operating instuctions (or programs) for Charles Babbage's analytic engine in the early 1800s.

The AJPO is attached to the Office of the Deputy Under Secretary of Defense (Acquisition Policy). It will provide centralized management of the total DOD effort to implement, introduce and provide lifecycle support for Ada. Ada is to be a DOD-wide standard which will enhance software portability across the many modern computers used and establish a "standard" environment for developing and testing computer software.

Lack of commonality has led, in part, to the high costs often associated with use of computers in defense systems. Ada is not intended to replace COBOL and Fortran, widely used languages in the financial and scientific fields, but rather will be principally for "embedded" uses in tactical and strategic defense systems.

Development of Ada was a joint effort with the military departments, DCA, NSA and Defense Advanced Research Project Agency operating under an organization called the High Order Language Working Group, first chaired by LTC William Whitaker and then Mr. William Carlson. Dr. David Fisher was a technical force in the development of the language requirements.

DARPA has been the principal development agent for the project. LTC Larry Druffel, USAF, has been appointed director of the Ada Joint Program Office. He has been responsible for DARPA management of the Ada program and will supervise the transition of Ada from DARPA to Joint Service management. An Ada program management plan is currently under development.

DOD Establishes Small Firms Technology Program

Establishment of a Defense Small Business Advanced Technology Program to capitalize on the historic creative potential of small high technology firms, has been announced by the DOD.

The program is designed to promote innovative solutions to scientific and technical problems facing the defense community by increasing the participation of small high technology firms in the DOD's R & D initiatives. Approximately 20 R & D project areas of particular interest to the Army, Navy, Air Force and Defense Advanced Research Projects Agency (DARPA), will be identified for exploration under a 3-phase program.

Phase I awards of up to $50,000 each are contemplated for preliminary R & D to demonstrate the feasibility of those proposals deemed most likely to yield solutions to R & D problems identified by the military departments and DARPA.

Contracts under Phase I will last for six months. Based on the results of Phase I efforts, DOD plans to award advanced development contracts ranging from $100,000 to $500,000 each in Phase II for a period of up to two years for the projects judged most promising. Phase III will include follow-on production awards, where appropriate, and/or commercial application of the R & D. Commercial application would be funded with private venture capital.

A key figure of the program is its streamlined procedure for reducing the small firm's initial investment in proposal writing. Phase I proposals are limited to 20 pages.

The Defense Small Business Advanced Technology Program is not a substitute for current unsolicited proposal mechanisms. It is designed to augment existing acquisition processes and to better inform DOD research offices of the technological potential of the small business community.

The Defense Small Business Advanced Technology program Brochure is scheduled for distribution in April 1981, with proposals to be submitted to the respective Services and the Defense Advanced Research Projects Agency by end of August 1981. Awards are expected to be made in December 1981. Program information may be obtained by writing to: Director for Small Business & Economic Utilization Policy, Office of the Under Secretary of Defense, Research and Engineering (Acquisition Policy), Room 2A340, The Pentagon, Washington DC 20310.

Production Testing of LACV-30 Begins in June at Aberdeen PG

Production testing of the first LACV-30 (Lighter Air Cushion Vehicle, 30-ton payload) is scheduled to begin in June at Aberdeen Proving Ground (APG), MD, following contractor testing of a production model by Bell Aerospace Testron near Buffalo, NY.

The Army will acquire 12 LACV-30s during the next few years, with the initial procurement contract valued at $60 million, or about $5 million per craft. However, according to Bryon R. Hawley, senior test director of the LACV-30 for the Materiel Testing Directorate (MTD) at APG, the full production costs will be less than the current figure, because software items, testing and manuals are included in the initial purchase.

Testing of the military air cushion vehicle concept (derived from a commercial craft known as Voyageur in Canada and at some U.S. facilities) has been ongoing for about five years, with developmental testing done at APG, Camp Pendleton, CA, and Panama City, FL.

The military craft is designed to provide the Army logistical system with a fast, economical way of unloading container and break-bulk freighter ships and getting needed supplies and equipment to shore in areas where ready-made port facilities have been destroyed or do not exist.

The military's main means of getting goods to shore was developed about 40 years ago. The Logistics Over the Shore (LOTS) scene has changed drastically since the end of that long-ago war, where most materials were shipped break-bulk or palletized. Now, most military equipment is completely containerized and shipped in 20-foot long milvans.

Current amphibians in Army use, primarily the LARC-5 and LARC-15, are not well suited to modern shipping and LOTS needs, with top speeds of less than 10 mph. Nor are they designed to carry modern milvans, Hawley said.

The 27-foot long LACV-30, according to Hawley, is designed to meet tomorrow's needs. Powered by twin-pac Pratt and Whitney ST6T gas turbine engines that generate up to 1,800 hp, the craft is capable of moving over the water at speeds of more than 50 mph. It can also move through breaking surf, beach areas and land.

Unlike conventional ships and boats, and ACV rides on top of the water on a cushion of air that is channeled through special vents in the bottom of the craft to give required lift and stability. Air is moved into the vent system by two large lift fans. Forward movement is provided by large aircraft-type variable pitch propellers.

Fully loaded, the craft weighs about 115,000 pounds. For all its bulk and payload capacity, however, the craft is easily transported by truck, rail or ship. The craft is designed as 17 modules, which are held together by about 2,000 bolts. Assembly from loose modules to operating ACV takes only about a week, says Hawley.

The main advantage of ACV's over true amphibians, Hawley said, are speed of trans-shipping goods from freighter to shore, size of cargoes that can be handled, and its stability in high coastal surfs. He adds that the craft is easy to operate and crewpersons can be cross-trained from other fields such as helicopter aviation and water operations with minimum difficulty, although ACVs require some high-technology skills.

"ACVs don't introduce new skills to the Army, but they do apply skills and technology in a different way. An ACV incorporates aviation skills and naval skills, but it is neither aircraft nor boat . . . it's a blend," he says.

Helicopter False Mission Aborts Examined

Army helicopter's unusually high rate of false mission aborts will be researched by Boeing Vertol, under an 18-month $198,254 contract awarded by the Army Applied Technology Laboratory, Fort Eustis, VA, one of 4 labs of the Army Research & Technology Laboratory, AVRADCOM, Moffett Field, CA.

Boeing Vertol, in checking helicopter mission reliability, will identify the leading causes for mission aborts, reports project engineer G. William Hogg, who points out that "an analysis will be conducted to identify the critical parameters necessary to monitor for safe flight, in order to specify more reliable condition-monitoring techniques . . . part of this effort will be a Government-controlled follow-on program set up to demonstrate candidate condition-monitoring systems that are cost effective."

Advanced Structures To Be Researched

The Army Applied Technology Laboratory, Fort Eustis, VA, awarded a 23-month $222,400 contract to Sikorsky Aircraft Division, United Technologies, to develop advanced structures maintenance concepts.

Army project engineer Richard Scharpf explained that the contract goal covers "advanced composite structures now in service, under development, or proposed for Army helicopters, also, maintainability design and repair techniques will be looked at and developed as required."

Overall objectives are to develop damage assessment and repair techniques, where required, including the associated maintenance concepts . . . and these concepts developed during this research will eventually be included in the Army's present service maintenance concepts and policies as advanced structures concepts are introduced into service on Army helicopters.

The Applied Technology Laboratory is one of 4 labs of the Army Research & Technology Laboratories, AVRADCOM, Moffett Field, CA.

Awards...

Hurban Receives BRL's 1980 Zornig Award

John M. Hurban

Mr. John M. Hurban, who began his Federal civil service career as a draftsman 29 years ago at Frankford Arsenal, PA, has been awarded the 1980 Zornig Award by the Ballistic Research Laboratory (BRL), a major research activity of the Army Armament R & D Command.

Established in honor of COL H.H. Zornig, who was responsible for the creation of the Research Division at Aberdeen Proving Ground, MD, in 1935, and its evolution into BRL in 1938, the award is presented annually to a person for outstanding technical, administrative, mechanical or custodial work in support of BRL's research mission. Zornig served as BRL's director until 1941.

Hurban serves as assistant to BRL's Interior Ballistics Division chief. He is the 22nd recipient of the award. He received a bachelor of science degree in mechanical engineering from Lafayette College in 1960, the same year he began employment at BRL's Interior Ballistics Laboratory.

Assigned as the BRL team chief of the ARRADCOM Implementation Task Force in 1976, he was integral in bringing about the smooth transition into the Army's new Armament R & D Command.

Hurban is currently involved in the management and direction of BRL's interior ballistics research including efforts relating to in-bore structural analyses of projectiles and to the exploratory development of projectiles.

A member of the American Society of Mechanical Engineers, he served last year as the gun propulsion area chairman for the Joint Army-Navy-NASA-Air Force (JANNAF) Propulsion Meeting held in Monterey, CA.

Personnel Actions . . .

Long Directs AVRADCOM Structures Lab

Richard L. Long

Mr. Richard L. Long has been named director of the Army Structures Laboratory, NASA Langley Research Center, Hampton, VA. The Structures Laboratory is one of four labs of the U.S. Army Research & Technology Laboratories (RTL) (AVRADCOM), NASA Ames Research Center, Moffett Field, CA.

Long was formerly deputy director of the Directorate for Systems Engineering and Development, Army Aviation Research & Development Command (AVRADCOM), St. Louis, MO. He is a charter member of the Senior Executive Service of the federal civil service system.

Long did his undergraduate work in aeronautical engineering at Purdue University and earned his master's degree in the same discipline from Princeton University, and another master's degree in international affairs from George Washington University. He also attended the Command and General Staff College, Army War College, Army Management School, Sloan Institute and the Federal Executive Institute.

Additionally, he is a member of the American Helicopter Society and in 1969-70 was national president of the Army Aviation Association of America. He has written and published several technical papers, is a master Army aviator, and is rated as a commercial pilot for both fixed and rotary wing aircraft.

Shipley Chosen as Applied Technology Lab Deputy

John L. Shipley

Mr. John L. Shipley has been named deputy director of the Applied Technology Laboratory (ATL), Fort Eustis, VA. He succeeds Mr. George T. Singley, Jr., who retired with more than 37 years of federal service. ATL is one of four labs of the U.S. Army Research and Technology Laboratories (RTL) within the Aviation R & D Command (AVRADCOM).

Shipley was formerly with the Structures Laboratory, another of the four RTL labs, located at the NASA Langley Research Center, Hampton, VA., where he served as chief of the Army Aeronautical Research Group. In this capacity he served as deputy director with technical responsibility for the Army's independent research programs, as well as those conducted in joint participation with NASA at the Langley Research Center.

After serving two years in the Army, he earned his undergraduate degree in mechanical engineering with an aero option at North Carolina State in 1960. He also has a master's degree from North

Carolina State University.

From 1960-1967, Shipley was employed as a flight test engineer at the Naval Air Test Center, Flight Test Division, Patuxent River, MD. He transferred to the U.S. Army Aviation Materiel Laboratories (AVLABS), a predecessor organization of ATL in 1967 and to the newly formed Structures Laboratory in 1970, where he was instrumental in the development and formulation of the joint Army/NASA research program.

Shipley is a member of the American Helicopter Society and Sigma Xi, a national honorary society. He has authored or coauthored numerous publications, reports and technical papers. He is the recipient of 1970 AVLABS Commander's Award for Exceptional Service and five outstanding performance awards since coming to work for the Army in 1967.

Career Programs . . .

Cherry Blossom Award Winners Visit Japan

OPERATION CHERRY BLOSSOM AWARD winners Naomi Taylor and William F. Doyle flank Japan Student Science Award winners Yukiko Ohashi (left center) and Isao Nishikawa, during recent awards ceremonies in Tokyo, Japan.

Mr. William F. Doyle of Ellicott City, MD, and Miss Naomi Taylor, Bayside, NY, represented the United States earlier this year at the 24th Annual Japan Student Science Awards ceremonies in Tokyo, Japan. The two were guests of honor where approximately 340 Japanese students were recognized for their high school science projects.

Participation in the Japan Student Science Awards ceremonies is included as part of the Army and Navy sponsored Operation Cherry Blossom Award. The Army has provided this award since 1963, when it was initiated in cooperation with the Japanese newspaper, *Yomiuri Shimbun,* as part of an effort to stimulate, encourage, and reward exceptionally talented high school students in physical and life sciences.

Doyle, now a freshman at Massachusetts Institute of Technology, was selected winner of the Operation Cherry Blossom Award by a panel of Army judges at the 31st International Science and Enginerring Fair held last year at St. Paul, MN. Through his project, "Quantitative Analysis of Photographic Characteristics Using Video Techniques," he developed an inexpensive system for measuring photographic characteristics which could perform many scanning microdensitometer type functions.

Taylor was chosen by the Navy as their representative for her project on "The Effect of *Pseudomonas hirudinia* and *Staphylococcus aureus* on Hemolysis and Erythrocyte Fragility."

In addition to participation in the Japanese Student Science Awards ceremonies, an 8-day intinerary included visits to various scientific laboratories and cultural points of interest. The students also visited ancient Japan in the Kyoto and Nara area. On the return trip home, they made a 3-day stop in Hawaii as guests of the Navy.

U.S. Army participation in the ISEF is arranged by the U.S. Army Research Office, Research Triangle Park, NC. Miss Doris Ellis, ARO, was escort for the student's visit to Japan.

New Course Will Emphasize Software Problems

The Naval Research Laboratory and the Naval Postgraduate School have announced that a 2-week "Software Engineering Principles" course will be presented 3-14 August at the Naval Postgraduate School, Monterey, CA.

Open to all DOD civilian and military personnel engaged in the acquisition or development of software, the course will emphasize technical problems of software design. It is intended to improve the ability to evaluate software requirements, specifications, design, correctness, and maintainability.

Contract personnel recommended by a DOD activity may also attend the course after DOD requests are satisfied. All applicants should have a basic knowledge of DOD software problems and policies and should be familiar with FORTRAN or other programming languages such as PL/I or COBOL.

Course enrollment will be limited to 50 students and applications must be received by 1 July. Tuition is $400 and an activities fee of $35 is required. Additional information may be obtained from Janet Stroup, Code 7590, Naval Research Laboratory, Washington, DC 20375, commercial phone (202) 767-2774 or AUTOVON 297-2774.

International T&E Association Established

Notice has been received of the creation of the International Test and Evaluation Association - ITEA. The association seeks to foster communication, advance the art, and secure recognition for the vital role of T & E as a full partner in the work of government, industry, and academia. ITEA's president is Dr. Allen R. Matthews.

Army RDA Magazine readers interested in further information should call Mr. David A. Herrelko, (301) 981-3266 or write to: ITEA, ATTN: Membership Committee, P.O. Box 603, Lexington Park, MD 20653.

Moving - Being Transferred?

To ensure continued receipt of the magazine, persons, both Active and Reserve, who are authorized individual copies, should give timely notice of their new address. Instructions on where to send address corrections are given on the inside of the front cover. DO NOT SEND CORRECTIONS to the magazine editorial office, as mailing labels are provided to the magazine by the agencies mentioned in the instructions. Change of address must be given to your duty station military personnel office. Regulations also require that you receive the magazine at your duty station address, not your home.

Weinberger Announces FY81/82 Defense Budget Revisions

Secretary of Defense Caspar Weinberger has announced details of revisions to the Department of Defense budgets for FY81 and FY82. They are reportedly substantial and are intended to give the U.S. the defense posture it needs to meet the security challenges of the 1980s.

There is a net additional supplemental request of $6.8 billion requested for FY81, bringing the total defense requirement to $178.0 billion for total obligational authority (TOA). The FY82 budget request is being increased to a level of $222.2 billion. FY81 outlays are estimated at $158.6 billion and FY82 at $184.8 billion, an increase of about 17 percent.

The budget revisions are designed to increase readiness, to improve the ability to recruit and retain personnel, to modernize the forces, and to ensure naval supremacy.

Major Budget Changes. The FY81 supplemental includes $2.3 billion in "fact-of-life" changes. These cover such items as fuel cost increases, underpricing of civilian pay, procurement cost growth, force deployments and operations which were unplanned at the time of budget preparation, and a variety of other essential items. Failure to price and fund these actions now will require later reprogrammings, and thus undercut the planned progress and funding of operations in other program areas.

Changes to improve the quality-of-life of military personnel total $.7 billion in FY81 and $2.8 billion in FY82. These include $.4 billion in FY81 and $1.8 billion in FY82 based on a new 5.3 percent military pay raise proposed to start on the first of July this year. This is in addition to the 11.7 percent pay raise already in effect for this fiscal year.

The revised budget also provides for improvements to living and working facilities that have deteriorated, a cost of living allowance for single personnel on overseas tours, and bonuses designed to improve retention of service members with special skills and experience.

Readiness improvements total $2.8 billion in FY81 and $8.7 billion in FY82. The funds will provide improved maintenance; reduce the shortfall in critical wartime spares, supplies, and munitions; increase training; and procure equipment such as protective masks, desert camouflage uniforms, medical supplies, and mobility support equipment. Procurement of additional aircraft, missiles, torpedoes, and tanks is also included.

Modernization improvements total $2.0 billion in FY81 and $13.7 billion in FY82. Among the programs included are, for the Army, UH-60 BLACK HAWK helicopter, the ROLAND Air Defense system, the DIVAD gun, XM-1 tanks, and Infantry Fighting Vehicles; for the Navy, LAMPS helicopters, A-6E, EA-6B, F14, F-18 and P3C aircraft, HARM and TOMAHAWK missiles, improved communications and other ship systems; for the Marine Corps AV-88 aircraft, CH 53E helicopters, new weapon development and facility modernization; and for the Air Force, aircraft such as the Long Range Combat Aircraft, F-15, A-10, and KC-10, AWACS, as well as electronic gear and simulator modifications.

Increases in ship building recognize both the need for U.S. naval superiority and the need to increase our ability to project forces. The revisions will procure one additional CG-47 Cruiser, two FFG-7 Frigates, one SSN-688 submarine, conversion of six SL-7 Container Ships, and the reactivation of the battleships *New Jersey,* and *Iowa,* as well as the aircraft carrier *Oriskany.* Also, procurement of the long lead items for a CVN-72 to be fully funded in FY83 will be initiated.

Manpower, Active military manpower will increase by 10,000 in FY81, to 2,075,356, and by 25,900 in FY82, to 2,199,500. This additional manpower will enhance readiness directly by increased combat unit manning and indirectly, through increased manning in technical training and maintenance activities.

Civilian personnel in FY81 increased by 19,600 from the January budget to the current total of 1,014,000; in FY82, 30,000 people are added for a revised total of 1,025,000. These increases reflect expanded use of civilian personnel in tasks that will allow military personnel to return to combat and combat related positions, higher depot maintenance levels and requirements associated with supply and contract administration.

The acquisition process is said to be especially promising for innovative management, both in the way acquisition decisions are made and in the way they are funded. Secretary Weinberger plans a comprehensive internal review of the acquisition process under the direction of Deputy Secretary Carlucci. This review will identify opportunities to work with the Congress and with industry in order to realize major savings through efficiencies in the acquisition programs. Also, a comprehensive review has been started to ensure that the Planning Programming Budgeting (PPB) process best meets the needs to carefully and critically evaluate defense resource requirements.

DEPARTMENT OF THE ARMY

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