A report on the World Helicopter Championships page 10

SPECIAL REPORT: THE LHX PROGRAM

ARMY AVIATION

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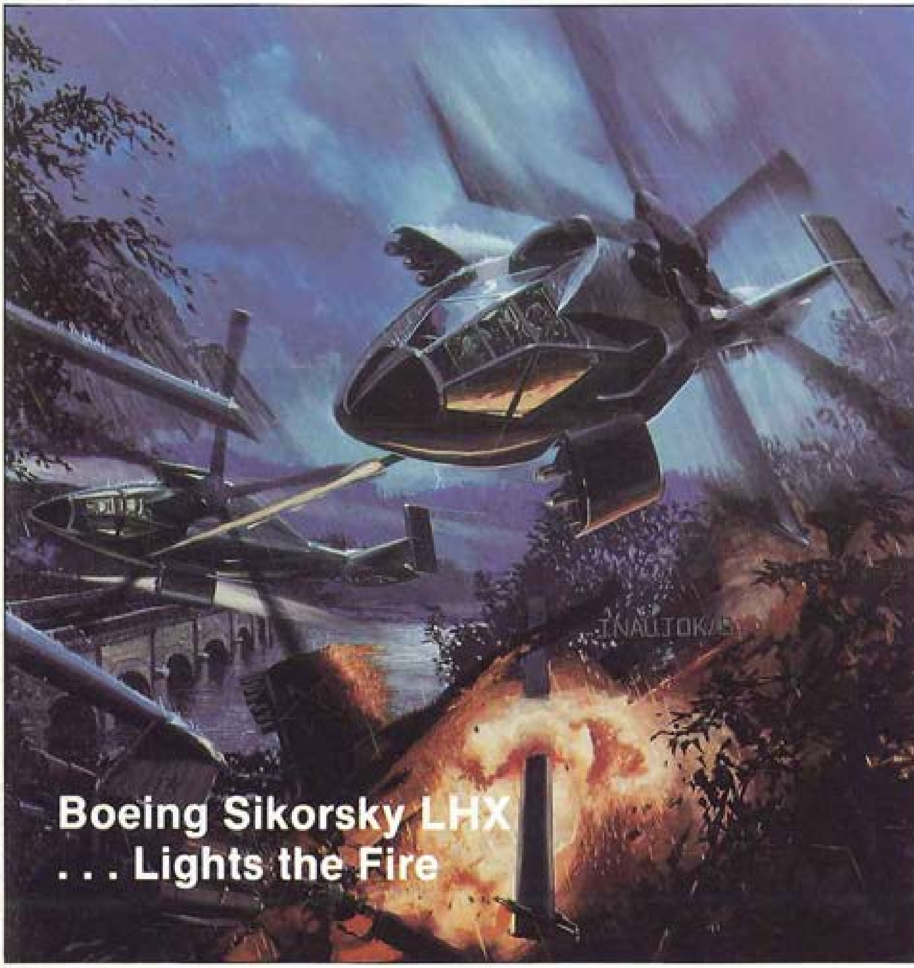

Boeing Sikorsky LHX
. . . Lights the Fire

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VOLUME 38 **NUMBER 11**

The Challenges of LHX

by Lieutenant General Donald S. Pihl

In my present position, I have followed the development of the LHX program from its infancy. As with all childhoods, growth is not without its challenges. With LHX, early challenges, primarily budgetary, required redefinition of the program with the elimination of the LHX utility version and focused attention primarily on the mission equipment package development during the Demonstration/Validation (DEM/VAL) phase.

What has remained constant however, is the extreme importance LHX will play on the future battlefield. The challenge to the Army and industry will be to ensure that the LHX will meet the critical warfighting deficiencies in the area of night and adverse weather aerial reconnaissance. In this role, the LHX must be a lightweight, low cost replacement for the aging AH-1, OH-58 and OH-6 fleets.

Just as critical is the necessity to make the LHX technically superior to counter the rapid advances the Soviets are making and are expected to make in development of combat helicopters and air defense weapons systems.

Programmatic Challenges

Next year will be a critical period in the maturing process of the LHX. Several key events and activities will be conducted that should allow the LHX to continue into further development.

The Cost and Operational Effectiveness Analysis (COEA) being conducted by TRADOC, will be a paramount study in support of the program leading to the Milestone II decision to enter full scale development. The COEA will take a close look at the LHX and possible alternatives to include foreign candidates and compare them with the current baseline fleet and with each other.

LTG Pihl is the Military Deputy to the Assistant Secretary of the Army (R, D & A), Washington, D.C.

The funding request in the FY91 portion of the President's FY90/91 Budget Submission will signal a major increase in contractual efforts necessary to initiate full scale development. The coordinated efforts of DA and OSD need to ensure that members of Congress fully understand the LHX program and remain supportive of it.

Also of significance will be the Source Selection Evaluation Board that will intensely evaluate competitive proposals and select the industry team for full scale development (FSD).

The last event next year will be the Milestone II decision by the Defense Acquisition Board in December 1990, that should allow the program to proceed with FSD.

Technical Challenges

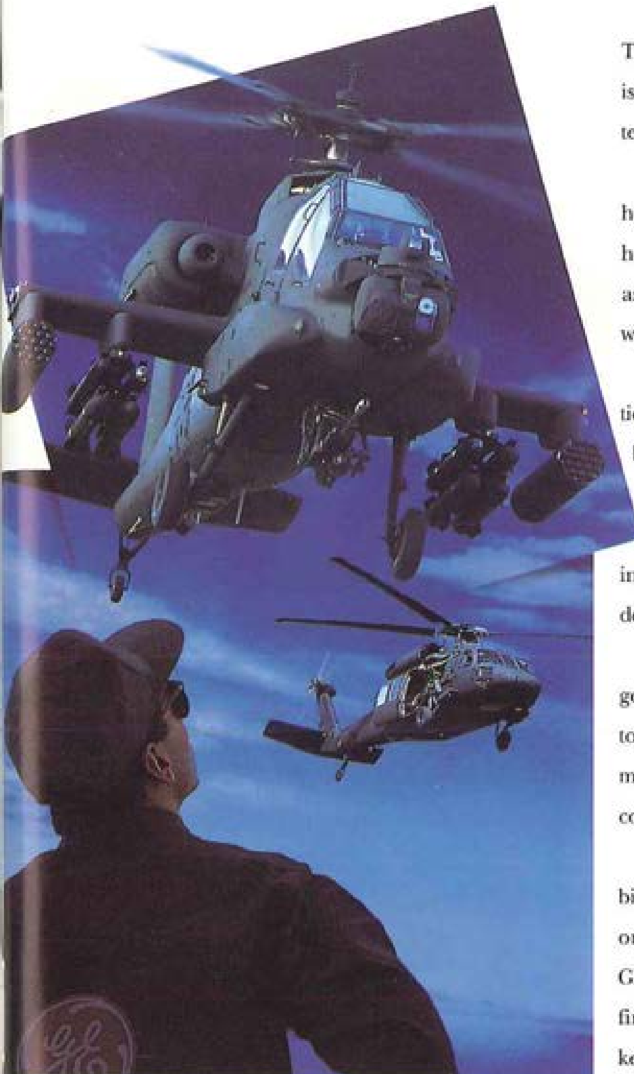
Two technically challenging areas confront the growth potential of the LHX program. The first major challenge is to design an aircraft that has a unit flyaway cost of $7.5 million and weighs 7,500 pounds in a worldwide combat ready configuration. With the addition of crew, fuel and ordnance, the LHX must be able to meet the demanding performance requirements placed on it.

The other challenging area is the integration and optimization of the technically advanced Mission Equipment Package (MEP). This area must be aggressively targeted to not only ensure that the combat effectiveness of the LHX is maximized, but its ability to interact with or complement other weapons systems such as the AH-64 is maximized as well.

The competing teams are closing in on the weight, cost and performance goals of the program and many components of the MEP will be demonstrated during the on-going DEM/VAL phase. Both competing teams and their subcon-

(Challenges of LHX — cont. on page 52)

Close air support.



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GE Aircraft Engines
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A Great Time To Be in Army Aviation!

by Major General Rudolph Ostovich, III

What a great day to be a soldier! I hope you share this same enthusiasm. It truly is a great day in the history of our nation to be serving as a soldier — and more specifically, serving the community of Army Aviation. We are confronted by many challenges, thus we have many opportunities. Consider, for a moment, the dynamics of our world situation. The new and improved relationship among super powers should create at least guarded euphoria. While our relationship with the Soviet Union improves, concern over our national security continues — though in a new direction. We have today an acknowledged military requirement for the war on drugs. The developing nations of this world in many instances are still suffering from social unrest, political instability, and economic uncertainty. Often these regional dramas affect our own national security interests. So, while we continue to provide capable deterrent forces forward deployed in Europe and elsewhere, there is a growing need for flexible, effective, contingency forces.

Numerous Scenarios

Though the future is uncertain, I am convinced our Army will do its part in providing for our national security as a strategic force. I am equally convinced that Army Aviation will play an important role in virtually every possible scenario ranging from anti-armor operations in the Fulda Gap to interdicting illegal drug traffic across our borders.

It is especially exciting to be a member of the Army Aviation Branch during this period of its development. During the last few years we have seen the consolidation of our branch, incorporating the U.S. Army Air Traffic Control Activity, and the U.S. Army Aviation Logistics School. We have also developed and implemented the Army Aviation Modernization Plan, the Army Aviation Personnel Plan, and other important long-range plans. Notwithstanding budget constraints of the last two years, we have continued to constantly upgrade our technology in various fields, including automation. The Automated Flight Record System is an excellent example of our recent progress in this area.

MG Ostovich is Chief, Aviation Branch, Commanding General, U.S. Army Aviation Center and Ft. Rucker, AL and Commandant, U.S. Army Aviation Logistics School.

Automated Flight Record System

The Aviation Center recently began distributing Automated Flight Record System (AFRS) software. This software employs microcomputers to automate the procedures for tracking individual flight time. AFRS is designed to reduce the time spent by aviation unit personnel in maintaining flying hour records. It also provides a means for more efficient record storage and retrieval. From what I've seen, the current version of the AFRS has many positive features.

System Features

The AFRS software handles all flight hour computations. Flight hour data is entered onto a "user friendly" screen from Army Aviator Flight Records that document individual flights. Calculations for summary reports and closeouts are accomplished automatically.

Flight records for every individual on flight status in a unit can be accessed through a microcomputer. As a result, a variety of summary reports on the unit flying hour program are available. Future versions of the software will expand the report capabilities as needs arise.

(Great Time — continued on page 55)

Northrop and AIL Systems Inc.

Keeping LHX in flight and out of sight.

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Creating an electronic combat system that can't lose.
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The Army needs a helicopter like that. A helicopter that only the LHX SuperTeam can provide.

LHX
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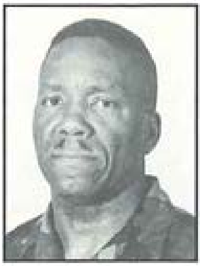

The USAAVNC NCO Academy (NCOA)

by Command Sergeant Major Roy McCormes

On 8 June 1987, the TRADOC Commander approved an exception to policy for the structure of the U.S. Army Aviation Noncommissioned Officer Academy. This allowed all enlisted training at USAAVNC to come under the U.S. Army Aviation NCOA Commandant. The low density of programs of instruction did not justify separation of the Department of Enlisted Training (DOET) which is responsible for all Advanced Individual Training (AIT) and the NCOA which is responsible for training Basic Noncommissioned Officer Course (BNCOC) and Advanced Noncommissioned Officer Course (ANCOC).

With approval of the exception to policy, the U.S. Army Aviation Noncommissioned Officer Academy was provisionally established on 1 July 1987 and officially activated on 2 October 1987. Training for both BNCOC and ANCOC MOS 93C, Air Traffic Controller, and MOS 93P, Aviation Operations Specialist, began in July 1987. These courses were accredited in 1988.

Development and Training

For ANCOC and BNCOC students, the courses involved both leader development and advanced technical training. In accordance with TRADOC guidelines, the USAAVNC NCOA implemented shared training and horizontal integration involving AIT, BNCOC, and ANCOC students during 1988. The ANCOC and BNCOC students gained valuable leadership experience by supervising other students under realistic conditions in field training exercises (FTXs).

CSM McCormes is the Command Sergeant Major of the U.S. Army Aviation Center (USAAVNC) at Fort Rucker, AL.

The USAAVNC planning envisioned vertical integration involving enlisted personnel of all levels along with students from the aviation officer advanced course. This vertical integration phase is still under study. Another innovation was implementing ANCOC and BNCOC small group instruction in March of 1988. Classes were broken down into groups of eight students, with each group under the supervision of an instructor.

In 1988, two ANCOC classes, Career Management Field (CMF) 28 (35P), Avionics Equipment Maintenance Supervisor, and MOS 93D, Air Traffic Control Systems, Subsystems and Equipment Repair Supervisor, were relocated from Fort Gordon to Fort Rucker. The first 35P40 class graduated in December 1988 and the first 93D40 class graduated in March 1989.

New Classes Starting

In October 1989, new CMF 28 BNCOC classes started at Fort Rucker. This increase in programs of instruction, student load, and support personnel requirements necessitated the division of responsibility. Separation of the DOET and the NCOA took place on 1 August 1989. The responsibility for advanced individual training will reside with DOET while BNCOC and ANCOC will come under the NCOA commandant.

At Fort Rucker, the DOET and the NCOA will continue to grow during the 1990s. The separation of these organizations will enhance this growth through a Commandant for the NCOA and a Director for DOET. IIIII

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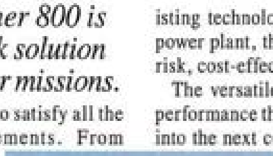

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L T V : L O O K I N G A H E A D

The 1989 United States Precision Helicopter Team: World Champions!

by CW4 E. Daniel Kingsley

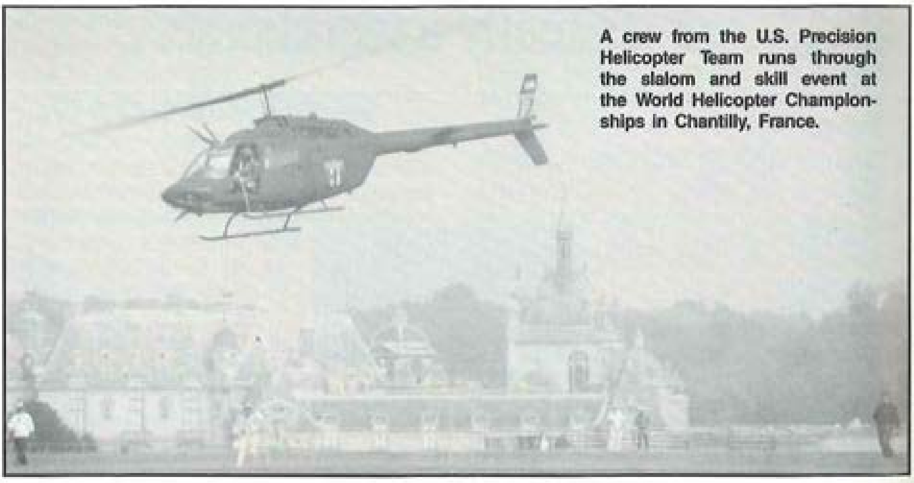
The 1989 United States Precision Helicopter Team (USPHT) has returned from the World Helicopter Championships in Chantilly, France holding both the Individual and Team championship titles! These titles are impressive enough, but we took the first seven places! Even these figures do not truly reflect the effort expended in preparation for the world championship. The story behind the effort shows much more than might be seen on the surface.

When the National Championships were held in March of this year, I saw clearly that the winners of that event had one thing in common. Every one of them had detailed knowledge and some kind of formal training program before coming to compete. Some had been here before, some had trained with someone else who had. But unlike the '86 Nationals, many competitors came to do some serious competing. My opinion is that the competition scores were two months (at least) ahead of the '86 National scores. The USPHT stood ready to jump into the training with a greater advantage in talent and preparation than ever before.

The Training Cell, under CPT Kevin McGrath (pronounced McGraw), had to jump immediately into the laying out of courses for crews already pulling down world class scores, without the spool-up time the '86 Training Cell had, and there was no experience there to assist in anticipation of problems, as there had been in '86. They took their beating well. Darn near spoiled the '89 Team when their work was held up against the organizer of the World Helicopter Competition (WHC), who ended up drafting our training cell to assist *him* in setting up his WHC course. In fact CPT McGrath was selected to be the Chief Judge of the Navigation event, and ran the event exactly as he had run it during Team training.

The Commander, LTC Robert E. Harry, was determined to do some strange things to enhance the training. He had learned during the '86 WHC that changes were the norm, not the exception. Nothing ever could be counted upon to remain the same. As a result, the Team was always under the gun from his changes: deliberate

CW4 Kingsley was the ASO for the USPHT when this article was written. He is now stationed in the Republic of Korea.



A crew from the U.S. Precision Helicopter Team runs through the slalom and skill event at the World Helicopter Championships in Chantilly, France.

The World Helicopter Championship Events

(Did you think your driver's test was hard? Try to imagine performing the following events in a helicopter.)

Timed Arrival & Drop-Off:
The teams were given a map packet with two turn points and five minutes to plan their route. They had to arrive at known points at precise times: points were deducted if the teams were early or late. They had a minute to fly into a box, execute three 90° turns and fly across an arrival line. Again, points were deducted for early or late arrival. They then had to deploy a rope with a bowling pin (skittle) on the end through a hole in a canted roof. The hole was only a third of a meter wide. This had to be done with the skill of the pilot only, the co-pilot could only hold the rope steady.

Precision Flying:
The teams had to fly a rectangular course while maintaining a very specific altitude. To check this altitude, two ropes were left dangling from the helicopters. The first, three meters long, had to always be in contact with the ground. The second, two meters long, could never touch the ground. The team then had to proceed forward, rearward, slide left and right and perform 360° turns. Once through the course, the teams had to set their helicopters down so that a piece of tape on their skid was on a 5cm line.

Long Navigation:
The teams were given a five-minute planning period. They had to plot a route that included three turning points, two of which were provided. They also had to locate a series of navigational panels within a box, entering and exiting the box within a 50 meter "window". They also had to drop two one-kilo bags into five meter circles from an altitude of 35 feet while travelling at about 20 knots. They then had to return to the arrival point at a precise time.

Slalom and Skill:
Teams had to haul a bucket of water (with holes drilled into the side at specific points) through twelve gates which measured two meters tall by one meter wide. Organizers would wait until the time of the event to tell the teams in what the gate sequence would be, to minimize any possible pre-planning. Once through the course, the teams then had to deposit the bucket on a table with a 50-centimeter radius. In the center of the table, a red dot marked the exact outline of the bottom of the bucket. Teams had four minutes to complete this task, and were docked for water spilled and how far off they were from the marker dot on the table.

change, accidental change, it didn't matter.

He took the Phase II fly-offs and turned them into a trial by fire for several of the crews. He had maps mismarked, declared an aircraft broken, changed take-off times, etc. Civilian judges played an integral part of the "unexpected" things involved during these fly-offs. One guy pretended to be a "little Russian", walked up to the aircraft during their five minute planning period (a very intense period which begins exactly five minutes before take-off on Event three) and *climbed into the back of the aircraft!* You cannot imagine the looks on the faces of the crews! The crews were already stressed out for the fly-off competition, and the changes really peeved some of them.

Phase III was flown as our first real measure of the Team since Phase I, and we figured they were getting better.

Destination: Chevres

On the 9th of August the USPHT was sent off in a C-5A out of Dothan, Alabama. Destination was to be Chevres, Belgium. The crews were festive, for the first time since the return from the Team leave in July. It was a good break; no flying for a few days and the excitement of finally getting there. We arrived in Belgium at around 0900 hours local, 0200 Dothan time. We were tired but eager to get started. In a few days we were ready to go. Training started 14 August, and Phase IV training went full tilt until the WHC.

The process of crew evaluation ended with the completion of three days of Phase IV competition on Saturday, 2 September 1989. The competition was very tough, with the scores coming out very close. The fine edge was complete, but the Commander required staff comments prior to his choice of the top five crews (to represent the USA in the competition) and the next two crews (to compete for individual honors). The remaining crew was to be the demonstration crew for the WHC judges, and as such would influence the image as well as the allowable technique for the entire competition. The factors considered and critiqued by the staff were:

- Contribution of the crew to the Team effort
- Crew Attitude, toward each other, toward other crews, toward the Team
- Crew performance under pressure
- Crew physical fitness
- Scores

Every effort was made to ensure that the United States was represented proudly. There was a lot of heated discussion, and every comment offered was heard from every staff member.

(USPHT — continued on page 51)

LHX Program Update

by Major General Ronald K. Andreson

The LHX continues its forward momentum. The program received strong support in the FY90 Senate and House budget process. The Army, OSD and Congressional leadership are behind the program. The Demonstration/Validation (DEM/VAL) Program has been underway for a year with both contractor teams operating at full strength and performing well. This special LHX edition of ARMY AVIATION MAGAZINE should provide you with an excellent picture of the program across the board. Authors from the LHX Program Office are covering their areas of expertise. We have highlighted the Mission Equipment Package (MEP), Total Quality Management (TQM), the LHX test and evaluation plans, and LHX supportability. Needless to say, all are key areas for a successful LHX program. The TRADOC community and ODCSOPS have provided excellent portrayals of the proposed training concepts, doctrinal applications, and force structure. I am confident you will obtain a good understanding of LHX with this year's special LHX edition.

FSD Preparation

As the DEM/VAL phase of the program continues to progress, we are busily preparing for Full Scale Development (FSD). Three significant pre-FSD activities are ongoing. A major thrust is the preparation for and the execution of the Cost and Operational Effectiveness Analysis (COEA). The COEA will attempt to answer a number of critical questions through modeling, simulation, and analysis. Some of those questions are:

- What is the best mix of airframe and mission equipment characteristics?;
- What is the value of a scout helicopter?;
- What is the proper LHX/AH-64 mix?; and
- What is the total cost of LHX versus other alternative aircraft?.

MG Andreson is Program Manager for LHX, LHX PMO, St. Louis, MO.

The COEA will be a very resource intensive effort. It involves the TRADOC community: the Aviation Center (USAAVNC), the Combined Arms Center (CAC), and the TRADOC Analysis Command (TRAC); materiel developers: PM LHX, PM AH-64, TADS/PNVS, AVSCOM, AVSCOM's Aviation Applied Technology Directorate (AATD), and the Missile Command (MICOM); the laboratories: the Army Materiel Systems Analysis Activity (AMSAA), the Missile Space Intelligence Center (MSIC), the Center for Electronic Warfare/Reconnaissance Surveillance Track and Acquisition (EW/RSTA), the Vulnerability Analysis Laboratory (VAL), the Ballistic Research Laboratory (BRL), and the Atmospheric Sciences Laboratory (ASL); and some contractors: Rand, Agusta, and Aerospatiale. The COEA is a major requirement for obtaining approval to begin FSD.

RFP and FSD System Specification

Another major pre-FSD effort is the preparation of the FSD Request for Proposals (RFP) and the government FSD System Specification, accompanied by the establishment of the complete set of FSD source selection criteria: areas, factors, elements, and sub-elements.

A board of experts to handle this monumental effort has been formed. The board includes personnel from many diverse organizations, such as AATD, EW/RSTA, AVSCOM, PM LHX, the Laboratory Command (LABCOM), the Center for Night Vision and Electo-Optics (CNVEO), and AVSCOM's Aviation Research and Development Activity (AVRADA). The goal is to release the FSD RFP to the two contractor teams in June 1990.

A third major area of effort is Milestone II docu-

> **"Technology and performance demonstrations during DEM/VAL continue to show that the LHX concept is sound."**

mentation. The LHX Program Office is in the early stages of revising a series of essential documents that are required as part of the Defense Acquisition Board (DAB) process. Besides the aforementioned COEA, these documents include the LHX Acquisition Strategy Report, the Decision Coordinating Paper, the Program Baseline, the Test and Evaluation Master Plan, the Integrated Logistics Support Plan, the Manpower Estimate Report, the Cost and Training Effectiveness Report, the Common-Use Alternatives Statement, the Cooperative Opportunities Document, and the Independent Cost Estimate.

Other Activities

Other major activities are being pursued besides the normal evaluation and review of the contractor's efforts under the current Extended Risk Reduction and Demonstration/Validation contracts. Presently, the Program Office is heavily committed to managing the teams' progress on the various tasks in those contracts. This calls for many of the Program Office personnel to be gone at any one time as they attend reviews, demonstrations, technical exchange meetings, Joint Integrated Avionics Working Group (JIAWG) meetings, to name just the major planned events and activities.

Because of that fact, outside organizations are assisting the Program Office examine some very pertinent issues. The Institute for Defense Analysis (IDA) is taking a look at whether or not it is cost effective for the LHX to pursue production competition. There is a concern which states that since the total LHX buy is 2,096 aircraft, it may be more cost effective to allow the winning FSD LHX team to share production rather than compete for production beginning at Lot 4, which is the current strategy. IDA is also performing analyses on the proposed LHX electro-optical sensor systems for targeting and pilotage. Another outside organization providing analytical support is the Rand Corporation. Rand is evaluating the LHX maintenance program, reliability goals, and the proposed LHX avionics cooling systems. The LHX Program Office is working closely with these contractors in their efforts to gather data, understand the problems, and perform good analyses.

The Program Office is also assisted by a support contractor team headed by Rail, Inc. Rail has assembled a powerful team to assist the LHX program in the areas of software support, logistics support, and support to the JIAWG effort. The Rail team includes personnel from Advanced Technologies, Inc.; Cobro, Inc.; Georgia Tech Research Institute; and System Dynamics, Inc.

Leading the Way for LHX

Finally, the very successful T800 Engine continues to lead the way for LHX. Since final selection of the winning T800 design in October 1988, over 1800 additional test hours have been completed; the preliminary flight rating awarded; and six additional engines have been purchased to support various flight test programs, including an interservice program with the U.S. Coast Guard. Critical design review is scheduled for February 1990. After that, final qualification testing will intensify throughout the remainder of FSD. A fully qualified, production ready T800 design will be available April 1991, allowing sufficient time for production of 26 T800 engines to support LHX flight testing.

Technology and performance demonstrations during DEM/VAL continue to show that the LHX concept is sound. The Army will receive the best 7,500 pound empty weight fighter that will meet the user requirements, perform its required missions, defeat the projected threat, and survive on the future battlefield. It should be apparent that we have the best of industry and the government working the problem. That combination will make it happen. ▮▮▮▮▮

LHX on the Modern Battlefield

by Colonel Theodore T. Sendak
& Captain John E. Angevine

The primary capability Army Aviation provides to the combined arms team is the ability to exploit the aerial dimension of the battlefield to enhance ground combat operations and to accelerate the tempo of combat. This capability fully supports AirLand Battle doctrine. Historically, aviation operations have served a general support function. Future combat operations will need to balance this supporting function with a true air maneuver capability founded in the concentrated employment of combat aviation in order to accelerate the pace of both offensive and defensive operations.

Primary Missions

The primary missions of the LHX are armed reconnaissance, attack helicopter operations for light divisions, and aerial fire support coordination. Air combat is a capability inherent to each mission. The designs of LHX-equipped aviation units will provide corps and division commanders with a tactically flexible, fully integrated multifunctional unit capable of being rapidly tailored to meet the mission. Based upon mission, enemy, terrain, troops, and time, attack companies and reconnaissance troops may be configured to cover the full spectrum of the attack and reconnaissance missions. Only the imagination of the commander and the parameters of the mission limit the possible combinations of LHX-equipped aviation force employment.

The LHX will provide capabilities that far exceed our current light observation and attack aircraft. Since these new capabilities allow Army Aviation to exploit the vertical dimension and time, the combined arms maneuver commander can truly influence the outcome of the battle.

COL Sendak is Director of Combat Developments, USAAVNC, Fort Rucker, AL. CPT Angevine is a Research & Development Staff Officer, Directorate of Combat Developments, USAAVNC.

THE LHX MISSION

(The following vignette highlights the aviator/aircraft interface that exploits the aerial dimension of the modern battlefield.)

Pre-Mission

The squadron commander receives the operations order and issues a warning order to his troop commanders. At the designated time, the LHX crews assemble for the mission brief at the squadron tactical operation center. After the troop commanders report their aircraft and aircrew operational readiness status, the S-3 briefs the mission using overlays on a graphic display screen. The display is divided into three areas: a digital map, Communications Electronic Operating Instruction (CEOI), and team configuration.

The digital map can display:

- Overlays
- Friendly locations
- Known enemy locations updated from the S-2 console
- Air Defense picture updated from Forward Area Air Defense/Command and Control Intelligence (FAAD C^2I) displays
- Planned route of flight
- Observation and battle positions
- Artillery Information
  - Free fire areas
  - Registration points
  - Gun target lines
  - Primary firing unit in support

It also can display: area of coverage of unit's fire, Tactical Decision Aids, Weather, Soil bearing capacity, Illumination, Forward Looking Infrared (FLIR) performance forecast, and line of sight and shadow calculations.

The CEOI section can display:

- Call signs and frequency of all units including sister services and allies
- Laser coding information
- Authentication tables
- Passwords

The team configuration can display:

- Team members
- Weapon loads of team aircraft
- Call signs/frequencies for unit members

After the S-3 presents the complete picture of the operation, he asks the crews if there are any questions. One crew member wants to know the grid coordinates for the next Forward Arming and Refueling Point (FARP). The S-3 displays the location he selected from information provided by the soil-bearing capacity and vegetation plot. Upon completion of the mission brief, the S-3 gives each crew a mission Data Transfer Device (DTD) containing all of the briefed information.

Preflight and Runup

The LHX crews arrive at the aircraft and begin their preflight. The pilot examines the electronic log, checking the status of the aircraft. After the crew climbs in, the pilot turns on the battery. The pre-start display indicates one switch out of position. The pilot re-positions the switch and starts the Auxiliary Power Unit (APU). When auxiliary power comes on-line, the copilot loads briefing information by placing the mission DTD in the fill port. The pilot starts the engines. These operations require three minutes. Although the FLIR is not yet cooled, the crew can depart using the image intensifier and transition to the FLIR later in the operation. "LIZ", the aircraft's interactive voice system, reports that a transmission from the S-3 has been received. The pilot instructs *"LIZ, read"* and she replies *"Hold on APU until released, expect five minute delay."* The pilot asks the copilot to review the Observation Point (OP) list and do a "line-of-sight projection" on the area to be reconnoitered. During the line-of-sight projection, the copilot determines that a bridge in a valley cannot be observed from the preselected OPs. The copilot then selects the area of interest (the bridge) and displays areas from which they can observe the bridge. The copilot tells the pilot he is adding one position to the OP list. The crew simulates flying to that point while running on APU power, verifying that they can see the bridge. LIZ announces message received from operations. The pilot commands LIZ to read message and at once LIZ states *"Depart, no mission change."* The pilot begins his final before-takeoff checks.

The Mission

As the aircraft departs on its assigned mission, the copilot places the Aircraft Survivability Equipment (ASE) suite in passive mode. The mission is a simple zone reconnaissance to establish a screen line, and the pilot has the digital map with his route and tactical overlays of the zone depicted on one of his two multifunction displays. The pilot's other display depicts weapon control functions as a backup to voice control. The copilot has his digital map displayed with the tactical situation overlaid and the Target Acquisition System video with the Aided Target Recognizer on his other display. As the aircraft passes the release point, the crew activates the weapons systems and prepares the aircraft for firing. Approaching the first OP, the aircraft comes to a stop in a masked location. The pilot unmasks, and the copilot initiates an automatic sector search. The pilot then remasks and repositions while the copilot reviews the multiple sensor information from the recorded sector search.

Displaying Targets

The mission processor prioritizes, identifies, and displays the targets. The copilot can update the tactical displays of the entire team with this real-time information. The copilot then directs LIZ to format a spot report based on the tactical display, which she sends to operations via digital data burst. LIZ relays to the copilot *"sent and acknowledged."* The crew continues to unmask at different locations as they move forward to establish the screen line. At a new OP, LIZ alerts the crew that they flew into a chemical environment. They don their protective masks. The copilot immediately sends a Nuclear, Biological, and Chemical (NBC) report to operations. Operations replies they would like the crew to map the area of contamination. LIZ continues to search the area for enemy activity using multiple sensors, while simultaneously conducting the chemical survey. The copilot reports to the pilot that his display shows radar signatures similar to those of an advanced guard of a motorized rifle division.

The pilot replies *"Yes, you're right. Send operations a NBC report and an update of our tactical map. Tell them we are in visual contact and continuing to observe."*

Back at operations the S-3 updates his tactical map with the information. He then transmits it to brigade and higher, providing the division and corps commanders with near real-time intelligence information. The corps commander, using this and other supporting intelligence, determines that the threat is going to push through the contaminated area to attempt to open a gap in his defense. Since the AH-64 does not decontaminate easily, the corps commander elects to commit a LHX attack battalion from his light division. He orders the

cavalry to hold the screen which they have established.

LIZ reports that the troop commander has ordered the crew to hold the screen line and develop the situation. *"Well,"* says the cav pilot, *"I guess we've got it. Let's first take another picture to update operations and provide information to the LHX Attack Battalion."* The pilot unmasks while the copilot initiates an auto search. The tactical display depicts a large valley in which enemy reconnaissance elements are moving. *"Let's take out the command and control vehicle and then use artillery on the others."* The crew knows their duties in an engagement sequence since they have done it so many times in simulation. The pilot remasks as the copilot calls *"target"* and launches a missile. After LIZ alerts *"Radar tracking,"* the pilot commands *"LIZ, Jam"* and tells the copilot one missile remains. LIZ alerts *"Missile launch."* The pilot, seeing the video of the missile impact on the target, accelerates laterally (keeping the jammer orientated toward the threat) and then rapidly transitions to coordinated flight. Repositioned and masked, the copilot touches the tactical screen and directs LIZ to request artillery on a selected location.

Handing Over

Using the Automatic Target Handover System, the copilot directs two Federal Republic of Germany close air support aircraft to the enemy formation. The copilot uses his on-board designator to target close air support *"smart"* munitions to individual enemy vehicles. The pilot contacts flight lead of the inbound attack helicopter battalion. Attack lead, "C54", approaching the area at 170 knots, sends his status report to the cavalry LHX crew. The cavalry pilot then sends the situation report to the entire attack team in milliseconds by data burst. As the cavalry continues to develop the situation, the enemy employs smoke and chemical artillery rounds to screen their movement into and through an open area. The pilot tells the copilot, *"Good job using our fire support to keep them out of that wooded area."*

The LHX attack battalion is conducting a coordinated attack with a mechanized infantry battalion. Brigade established a north-south Restrictive Fire Line (RFL) through the center of the engagement area. The LHX attack battalion will attack the enemy motorized rifle regiment west of the RFL and the mechanized infantry battalion will engage east of the RFL. While moving into position, the attack battalion air mission commander contacts the mechanized infantry battalion to make final coordination and exchange battlefield information. The attack battalion flight lead radios over his UHF HAVE-QUICK radio that the battalion is in position. The cavalry pilot touches his screen and says *"LIZ, Target Handover, send to C54."* LIZ takes the information from the tactical display, formats the Automatic Target Handover System message for C54, and responds *"sent and acknowledged."*

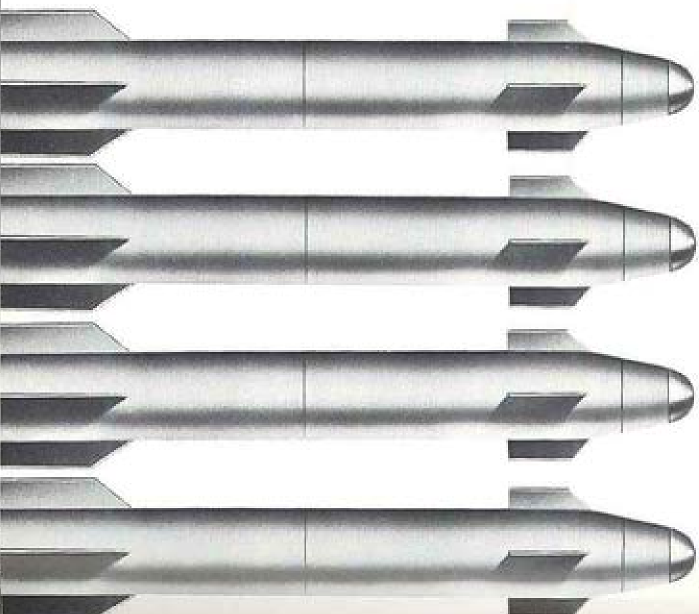
The battlefield obscurants and impacting artillery are beginning to shut down the image intensifier system. The pilot switches to the pilotage FLIR system and continues. C54 and his team begin to engage the threat force using maximum standoff from covered and concealed firing positions.

The Engagement

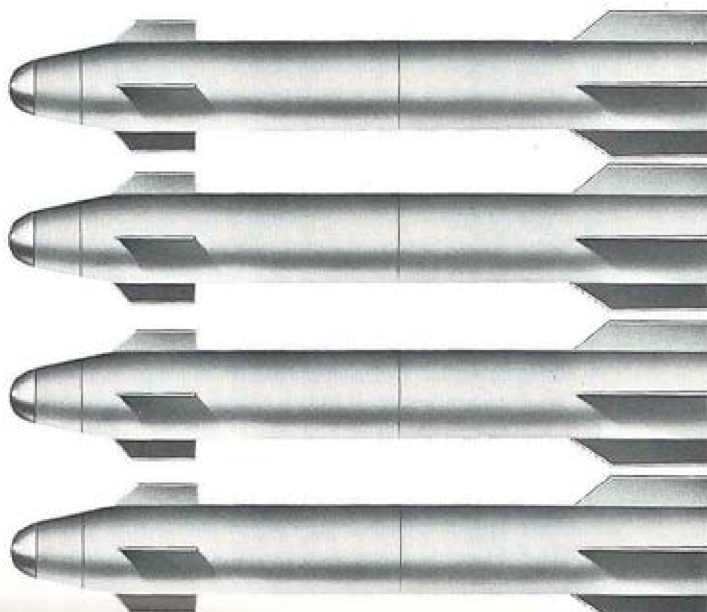
The LHX is linked to the Forward Area Air Defense/Command and Control Intelligence (FAAD C^2I) system via the Enhanced Position Location and Reporting System User Unit. The FAAD C^2I system provides the LHX with a graphic air picture, cueing information, and alerting information to the LHX crew. LIZ reports that threat rotary-wing aircraft are entering the area of operations. The cavalry pilot calls *"LIZ, Display."* LIZ displays the threat aircraft on the tactical map and cues the pilot and copilot to the threat aircraft. The pilot analyzes the cueing information and instructs *"LIZ, Stinger cool."* The cavalry pilot now sees several "hot" targets on his helmet-mounted display FLIR imagery and hears the stinger lock-on tone. He calls *"LIZ, Engage."* One HIND helicopter is destroyed. The pilot calls *"Gunner HINDS."* The copilot slaves his Target Acquisition System (TAS) to the pilot's line-of-sight, calls *"Acquired"* and the TAS automatically tracks three HINDS. The copilot calls *"LIZ, guns"* and the gun system is now under copilot control. The copilot uses the laser to get accurate ranging information for the fire control solutions, fires the

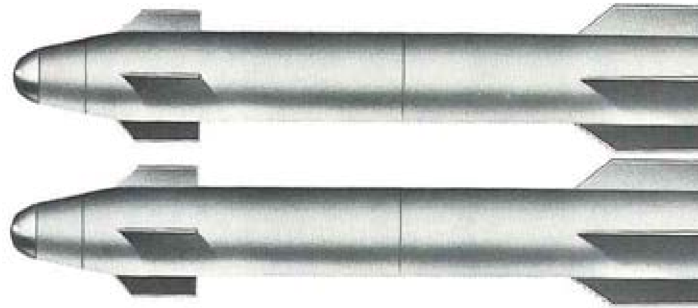
(The Mission — cont. on page 64)

THEIR PAYLOAD WITH NOTAR™



OUR PAYLOAD WITH FANTAIL™





The LHX Force Structure

by Colonel Turner E. Grimsley

Force development is the process of translating projected Department of the Army resources (manpower, fiscal and materiel) into time-phased programs and structure (expressed in dollars, equipment, and units) necessary to accomplish assigned missions and functions. ODCSOPS, Aviation Division manages this process at HQDA for the Aviation force. The key element that drives the force structure is warfighting capability attainable within the projected DA resources.

Projections

The best projections today indicate that fiscal resources (Total Obligation Authority) and manpower (Budgeted End Strength) will be decreasing over time. The decrease in manpower however does not offset inevitable increases in Operations Maintenance Army (OMA) funding requirements over time due to pay raises and increased flying hour costs. Therefore, Research, Development and Acquisition (RDA), often referred to as the investment account, which develops and buys materiel, decreases. Graphically, this is portrayed in Figure 1.

In addition to these projections there are other factors that will impact the LHX force structure, such as:

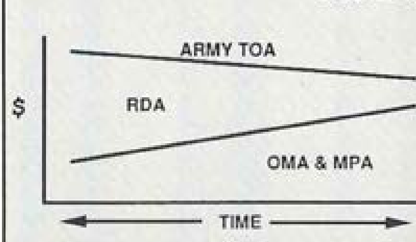
- LHX will be a two pilot aircraft and one of the aircraft it replaces (OH-58A/C/D) has only one pilot authorized.
- The flying hour cost for twin engine aircraft is generally greater than single engine aircraft.
- OSD directed aviation personnel reductions in FY88-89 that will result in the loss of over 3,000 spaces by FY94.
- Congressional desires to reduce the number of Army officers.
- Current attack and cavalry units are designed and resourced to fly approximately 2.2 hours per aircraft per day (LHX will be capable of flying six hours per aircraft per day). The wartime flying hour rate drives the number of maintainers and crews needed by the unit.
- The Army has only enough personnel to resource current active component aviation units at about 70% of the Manpower Authorization Requirement Criteria (MARC) that is based on 2.2 flight hours.
- The Army is only able to resource crews at a ratio of one per cockpit seat.
- The Army desires to eliminate the Officer Distribution Plan (ODP) which distributes shortages between requirements and inventory. With current projections, this can only be done by reducing personnel requirements in the TOEs or TDAs.

COL Grimsley was Chief, Aviation Division, HQDA, ODCSOPS, Washington, D.C. at the time this article was written. COL Dave Carothers is the current Chief, Aviation Div. at ODCSOPS.

Post FY94 Force Structure

The challenges facing the aviation force structure are significant, but not overwhelming. They were considered in the development of the Ar-

FIGURE 1.

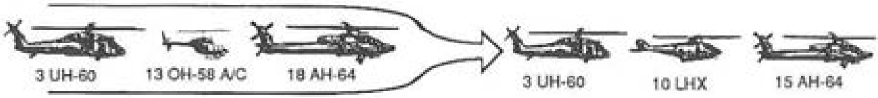


The LHX Replacement Plan

The approximately 2,100 LHX procured will replace:

CURRENT **FUTURE**

ATTACK BATTALION (HEAVY DIVISION/CORPS)

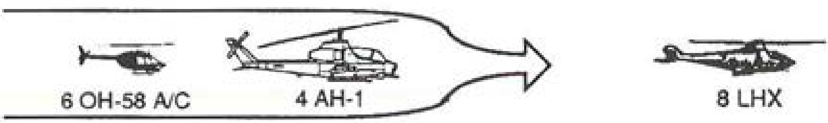


- The 13 OH-58A + /C in the 40 AH-64 battalions with ten LHX. The 18 AH-64 will be reduced to 15 AH-64. The three UH-60 aircraft will remain unchanged.

ATTACK BATTALION (LIGHT DIVISION & INFANTRY DIVISION)

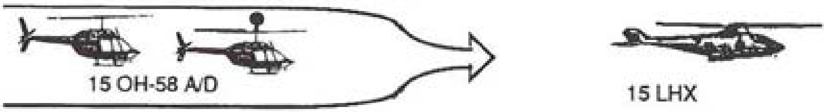
- The 13 OH-58A/C and 21 AH-1 aircraft in the 16 light and infantry division attack battalions will be replaced by 25 LHX. The three UH-60 will remain.

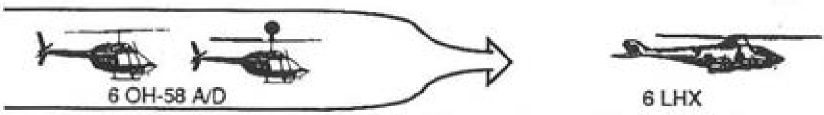
CAVALRY TROOP



- The six OH-58A/C and four AH-1 in our cavalry troops will be replaced by eight LHX.

TARGET ACQUISITION & RECON COMPANY





- The 15 OH-58A/D in the Target Acquisition and Reconnaissance Companies at Corps and the six OH-58A/D in the Target Acquisition Platoon in the Heavy Divisions will be replaced one for one with LHX.
- The remaining LHX will go to the training base and the float/attrition account.

my Aviation Modernization Plan (AAMP). Historically, the Army has assigned equipment to soldiers. Our new modernized aviation equipment is capable of operating longer than the crews. This is illustrated by commanders parking OH-58D aircraft on hilltops with auxiliary power units at the National Training Center when crew endurance has been expended and commanders still need to see the battlefield. To maximize the warfighting capability of the LHX we must resource these units with enough personnel and provide the required sustainment for continuous operational capability.

Conclusion

The result of the LHX fielding, outlined on the facing page are fewer, yet more capable aircraft in each unit. Resourcing these units from Total Army Aviation existing personnel assets to provide increased robustness for sustained and continuous operations will result in enhanced warfighting. How to accomplish this seemingly impossible feat is being worked by the Army Staff and Major Army Commands. The final form for the Aviation Force structure will depend on the Total Army Analysis (TAA) process and the approved Tables of Organization and Equipment (TOE), but will need the following:

• Approval in the TAA process to retain existing spaces within aviation. These spaces are available as a result of having fewer aircraft and could be used to fix Aviation Army of Excellence (AOE) design deficiencies and provide robustness. Success will depend on our ability to articulate and improve the value of increased aviation warfighting capability versus investing in other Army force structure requirements.

• Use of Reserve Component (RC), both ARNG and USAR, aviation manpower to augment selected high priority units (First to Fight) with crews, maintainers and staff augmentation necessary for sustained operations. These augmentation packages may be documented as augmentations to the TOE through Incremental Change Packages (ICP). This concept, a radical departure from previous Reserve Component (RC) organizations, and therefore a potentially emotional issue, is a logical extension of the Total Army concept based on projected resources and provides substantial warfighting capabilities with the economies our Reserve units demonstrate.

Even the limited projected resources available are sufficient to provide an Army Aviation force structure, though smaller than what exists today, with more warfighting capability through the improved capabilities of the LHX.

Maximizing the Investment

There are those who will argue for a return to the pre-AOE designs of fewer but larger units — even with those modern aircraft. The difficulty with this approach is deciding which corps, theater, or division does not need Army Aviation and where we will find the "supermen" who can fight such a large, high capability unit with ultimate efficiency. Also, the Department of the Army system lacks historical perspective. That is to say, once a resource bill is paid, that fact is no longer considered in any future bill payer drills.

This would result in the fewer but larger units being decremented over time leaving us with fewer, smaller units rather than more, smaller units. In summary, LHX will not save the Army personnel, but existing personnel will allow an LHX-equipped force structure to possess an awesome warfighting capability, thereby maximizing our substantial investment in LHX. IIIII

LHX SPECIAL REPORT

Training and LHX — *Not* Business as Usual

by Colonel Stephen S. MacWillie & Major Michael E. Rusho

Currently the Army is halfway through an aggressive LHX demonstration/validation program. We are pursuing the development of an advanced weapons system which is light, fast, highly maneuverable, and capable of increased lethality, agility and survivability in multimission roles. Advances in science and technology such as fly-by-light or fly-by-wire flight control systems, composite airframe structures, Very High Speed Integrated Circuitry (VHSIC), aided targeting and weapons control are being integrated into the LHX weapon system. High technology sensors, systems, and innovative designs make it imperative that training considerations for LHX be fully integrated from the beginning.

Lessons Learned

The 1982 Army Aviation Mission Area Analysis (AAMAA) identified deficiencies which included training. A major concern was that training device development was not initiated early enough in the weapon system procurement cycle. As a result, training devices were not fielded with the aircraft. Training deficiencies documented in the AAMAA are being addressed by the LHX program. In fact, the LHX is not just an air vehicle but a complete weapons system with a totally integrated training system. Early in the Concept Exploration Phase (CEP) a joint effort between the user and materiel developer defined a total Integrated Training System (ITS) for LHX.

Innovative Approach

The LHX totally integrated training concept is a first for the Army (see Chart 1). Traditionally, we have had separate training and materiel development contracts each having separate managers. In November 1988 one contract was awarded to each LHX team for weapon system development which includes the training system. Each contract is managed by the LHX program manager. The development will consist of:

- The concurrent development of the training system with the weapons system.
- The development and production of a fully Integrated Training System by the LHX prime contractors, based on their design.
- The support for schoolhouse, sustainment, and depot level training.
- Training system testing concurrent with weapons system testing. This will measure not only hardware but soldier interface and performance.
- The fielding to support the LHX Initial Operational Capability (IOC) unit and subsequent fielding.

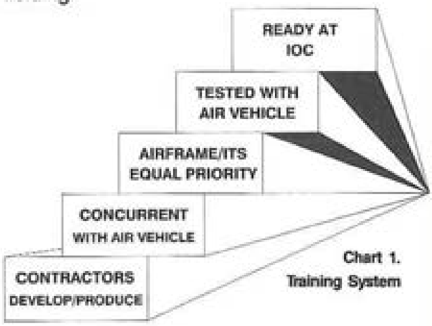


Chart 1. Training System

Requirements

The user has specified "performance oriented requirements" for the LHX training system in the Required Operational Capability (ROC) document rather than using the traditional Training Device

COL MacWillie is the TRADOC System Manager for LHX and MAJ Rusho is the Assistant TSM for LHX (Training) at Ft. Rucker, AL.

Requirement (TDR) document. The ITS will use a building block approach to train LHX operator, maintenance, and support personnel. It will include the identification of all hardware, software, courseware, consumables, facilities, and instructor and support personnel (see Chart 2). Additionally the ITS will provide academic instruction in various aircraft subsystem functions, normal and emergency operating procedures, and mission employment. Hands-on training will be maximized through the integration of interactive video disk training devices, procedural trainers, flight simulators, and the air vehicle. For the field, a training system to support mission and continuation training, skill level advancement, and/or sustainment training — for qualified LHX personnel will be required worldwide. The sustainment training system will address the individual, the unit, and the combined arms training requirements. The emphasis is on keeping devices as simple as the training task will allow, i.e.: training the least difficult tasks on the lower order devices and reserving only the most complex training for high cost combat mission simulators.

Procedural Training

The training device suite for LHX will provide appropriate part task procedural training capability (interactive video disk training, computer based training, procedural trainers, flight simulators, etc.). The use of procedural training devices will maximize mission training time in the aircraft or time spent in a combat mission simulator. We envision procedural trainers to encompass the following areas for the LHX: cockpit, armament, sensors, aircraft survivability equipment; emergency procedures; troubleshooting (diagnostic/prognostic) operations; component removal, replacement, and repair; bulk data preparation, entry and retrieval operations; flight and mission planning; and maintenance test flight operations.

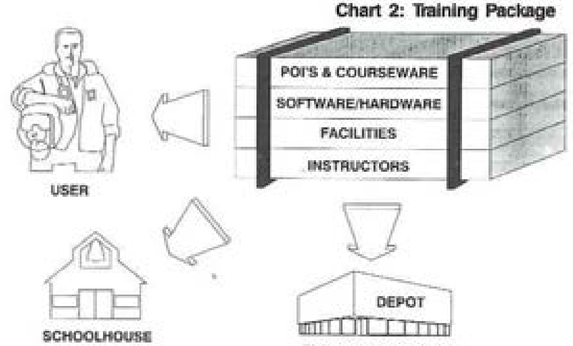
Full Mission Simulation

Consistent with our building block approach, procedural training will lead to combat mission simulation training. A Combat Mission Simulator (CMS) will train air crews in air vehicle system operation and Mission Equipment Package (MEP) employment in a realistic combat environment (NBC, degraded operations, day/night, weather, and obscurants). The CMS will also employ interactive threats representative of those expected to be encountered by LHX. The capability for commanders to select multiple locations/environments and threat reactions/configurations for use in CMS training is being pursued.

The final step in LHX training is the actual weapons system. The LHX offers a unique opportunity to consider embedded (built into or added into the aircraft) training capabilities to enhance and maintain skill proficiency of operators and maintainers. The LHX contractors are considering several innovative approaches for embedded training. Each team is performing analyses to determine the proper balance of on-air vehicle versus off-air vehicle training. The key question to ask of all approaches is "What is smart to embed?" The user requires an embedded Multiple Integrated Laser Engagement System (MILES)/Air-to-Ground Engagement Simulation (AGES) type capability. We envision this system to maximize the use of embedded components (A kit) and not to exceed 15 minutes installation/removal time for modular provisions/components (B kit). LHX is striving for a MILES/AGES system which is user friendly, easy to install, and accurately replicates aircraft armament and target ac-

(Training - cont. p. 52)

Chart 2: Training Package



LHX Mission Equipment Progress Report

by James M. Richey

LHX is now entering the 12th month of a 23 month Demonstration/Validation (DEM/VAL) program. The DEM/VAL program is focused on development of the Mission Equipment Package (MEP) and reducing technology risk for the follow-on Full Scale Development (FSD) program. Approximately 75% of the DEM/VAL effort is in direct support of the MEP development. In the first year of DEM/VAL much has been accomplished but there is much more scheduled to be completed in the remaining 11 months. Currently the LHX mission equipment development is progressing well and is on schedule for the Dec. 1990 start of the FSD program.

Technology Base

Both contractor teams, Boeing Sikorsky and McDonnell Bell, have made remarkable progress in demonstrating several key enabling technologies that are necessary to provide LHX the technology base for greatly improved system performance. These demonstrated techniques have reflected significant improvement over fielded technology and have generated considerable excitement in anticipation of the increased operational capabilities and performance improvements they will bring to the LHX.

During the past year, major advances have been made in sensor technology. Both contractor teams have produced imagery with 2nd Generation Focal Plane Array FLIR detectors which have demonstrated significant improvement in resolution and sensitivity over existing FLIR sensors. The imagery has shown fine details in scene content and has been favorably compared to black and white television imagery. In the coming year both teams will install the new FLIRs and an advanced TV sensor in early versions of the LHX target acquisition system.

Mr. Richey is the Chief, Mission Equipment Branch, LHX Program Manager's Office, St. Louis, MO.

The systems will be taken out of the laboratory and placed into field testing using actual tactical targets at representative ranges. These systems will be the first ever capable of automatically searching a large target area and providing the crew a prioritized list of targets for confirmation. They will also provide solid state memory storage of the target scene imagery which will allow the crew to recall the target scene for review/target acquisition from a masked position.

Additionally, next year both teams will be flying early versions of the LHX Night Vision Pilotage System (NVPS) on surrogate aircraft. These systems will employ both wide field-of-view (approximately 30x60 degrees) FLIR and Image Intensified TV sensors coupled to a similarly wide field-of-view Helmet Mounted Display (HMD). Other advanced features, like an electronic map display, will be included in the crewstation of the surrogate aircraft to further assist the crew in reducing workload.

Helmet Mounted Displays

In the area of helmet displays, much progress has been made in the LHX program. Both teams have successfully demonstrated two different types of HMDs and the government has independently demonstrated four additional display types. These HMDs feature large fields-of-view and high performance display electronics for high brightness and resolution in the imagery. The net result has been significant progress in HMD technology and an opportunity to obtain early insight as to which type of display design has the greatest potential to meet the LHX requirements. Although the HMD will be the primary cockpit display, the head down panel displays are equally important and considerable effort is being devoted to developing flat panel Liquid Crystal Displays (LCDs) that provide greater brightness and better image quality than existing Cathode Ray Tubes (CRTs) which are used in existing "glass cockpits". It is expected that the LHX cockpit will have one color and one monochrome LCD for each crewstation. The color display will be used for digital map and flight director functions and the high resolution monochrome display will be the primary target acquisition display. Initial demonstrations of the LCDs are scheduled for this year with more comprehensive demonstrations planned for next year when they will be integrated into the field tests of the target acquisition systems.

Modular Electronics

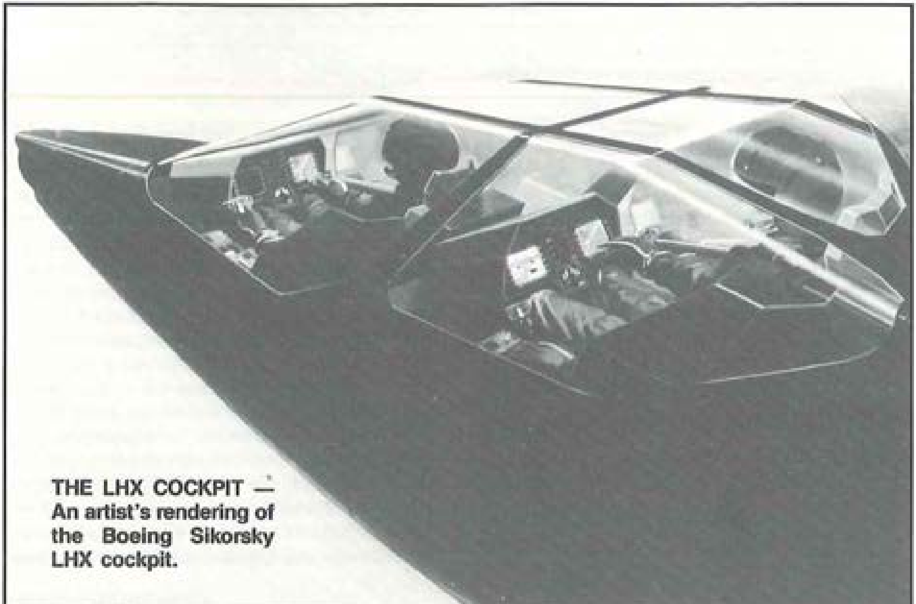
The LHX electronics functions are being designed to comply with the Standard Electronics Module Format E (SEM-E). These modules or cards are approximately 6"x6"x1/2" and will be installed in racks containing 20 to 30 modules. Each rack will provide cooling and electrical interfaces to the other system components.

The processing elements: data processors, signal processors, memory modules, power supplies and interface modules are being designed to the SEM-E format and will be resident in the racks. In 1989 a small "cluster" of these modules will be interfaced to another "cluster" to demonstrate the basic components of the mission computer. In 1990 the number of clusters and modules in the clusters will be increased to represent a fully functional system which will also be demonstrated. Parameters to be investigated include throughput, bus loading, data latency and fault/redundancy management. The cooling approach used in the racks is also being demonstrated to ensure the very high density electronics modules can be cooled sufficiently to provide the high levels of reliability expected of LHX. A fiber optic High Speed Data Bus (HSDB) operating at 50 times the speed of the data busses in fielded aircraft will provide the inter subsystem digital data communications. The HSDB will be demonstrated in FY89.

32-Bit Processing

The progress of technology continuously moves forward in both the commercial and defense sectors of industry. As a result of recent advances in commercial applications of 32-Bit data processors, both LHX teams have announced plans to utilize 32-Bit processors rather than

(LHX MEP — cont. on page 52)



THE LHX COCKPIT — An artist's rendering of the Boeing Sikorsky LHX cockpit.

LHX SPECIAL REPORT

LHX Support Concepts

by Charles J. Reading, Jr.

One of the keynote phrases within the LHX Program Manager's Office is "not business as usual." This phrase certainly applies to support of the aircraft. The LHX support community does not consider Reliability, Availability, and Maintainability (RAM), Integrated Logistics Support (ILS), and Manpower and Personnel Integration (MANPRINT) as separate and distinct areas on the LHX Program. They are fully integrated and each plays a positive role in the planning for overall support of the aircraft.

To start with, Supportability is weighted equally with technical considerations in the Source Selection Process. This means that the LHX contractors have, and will continue to, include supportability considerations very early in the design process. As a Logistician, it is very gratifying to hear design engineers explain their design, and then brief the supportability aspects of that design. The system is working.

Design Changes

Many, many changes have been made in the design in order to increase the supportability aspects of the LHX. In this stage of the DEM/VAL Program, major emphasis is being placed on the inherent availability of the aircraft. The goal is not to exceed 2.66 maintenance manhours per flight hour at the user level, with the other RAM requirements being equally stringent. This will ensure that the LHX can be flown six (6) hours per day under combat conditions. Given that the inherent availability will be as high as possible, the next step is to design and plan for a Logistics Support system that will ensure the highest operational availability possible. Again, the phrase "not business as usual" comes into play.

Mr. Reading is Chief, Integrated Logistics Support Division, LHX PMO, St. Louis, MO.

The LHX concept is two-level: aviation user and depot maintenance. The user level will perform on-aircraft maintenance tasks only, and will not perform maintenance in support of the supply system. Components removed at the user level, such as line replaceable modules (electronic) and line replaceable units (mechanical), will be sent back to the depot for repair. No Aviation Intermediate Maintenance (AVIM) is envisioned for the LHX. This maintenance concept is driving the design of the LHX and must be proven by the contractors through the use of Repair Level Analysis (RLA) models which will ensure a two-level design is being proposed. Government logisticians are also running RLA models as a second check to verify the two-level design.

Built-in Tests

Achievement of the two-level concept is absolutely dependent on high levels of built-in-test with ambiguity groups as low as technically possible. Automatic test equipment at user level is not desired. However, if absolutely required, a small bit verifier is allowed. The primary purpose of the depot level of maintenance is to support the supply system and perform those extensive on-aircraft repairs beyond the capability of the user. Depot level maintenance will be performed by CONUS and OCONUS depots as required. The primary Army depot for airframe and component maintenance is Corpus Christi Army Depot and electronic/avionics maintenance is planned for Sacramento Army Depot. The estimated peacetime depot workload for LHX is expected to be significantly reduced from the existing light fleet depot workload, due to the increased reliability of the LHX and increased efficiency of depot repair achieved by commonality (replacing three aircraft with one) and technology improvements.

Manpower (number of people) and personnel (skill levels of people) are domains of both ILS and MANPRINT. Regardless of origin, much work is being accomplished in this area. It is absolutely essential that the LHX fit within the footprint of the existing light fleet, and that no additional maintainers are required over and above those currently supporting AH-1 and OH-58 aircraft. The LHX contractors are spending considerable time and money, learning first-hand what the real problems are in the field, and designing the aircraft to eliminate those problems. MOS consolidation for the LHX is a reality with the current government estimate at not more than six or seven different MOSs required to maintain the aircraft. In addition, the government has provided to the contractors target audience descriptions for both soldiers in the field and civilian depot personnel. The goal of the LHX program is to decrease the user workload by a minimum of 40%, as compared to the current light fleet workload. Current analysis of existing designs verifies that the 40% reduction is achievable and that additional savings are possible.

Supply Support

Supply support for the LHX will be three level: Prescribed Load List (PLL), Authorized Stockage List (ASL), and Depot. Special emphasis is currently being given to automating the supply system to the maximum extent possible. The LHX will fit into the newly proposed objective supply system and will reduce the range and quantity of parts stocked at the user level of maintenance by stocking line replaceable items only, and not stocking repair piece parts. In addition, the LHX will use common modules in the MEP design. The Joint Integrated Avionics Working Group (JIAWG) ties the LHX, the Air Force's Advanced Tactical Fighter, and the Navy's A-12 aircraft together through the use of common avionics modules, which will ensure a lower cost per unit (module) and a continual source of supply, by having a higher demand rate for these modules.

The LHX will eliminate all requirements for special tools at the user level of maintenance by imposing stringent guidelines to design to what the user currently has available in the field. With proper levels of built-in-test, the LHX will eliminate all requirements for off-board automatic test equipment. In order to increase combat mobility, special emphasis is being given to reducing common support requirements to the maximum extent possible.

The LHX training system is integral to the LHX system (similar to the engine), and not an add-on. Design, development, and production of the training system is the responsibility of the prime LHX contractors who will act as the system integrators. Provision of the training system by the primes will result in unprecedented benefits. For instance, concurrent design and development of the training system with the aircraft will permit training before Initial Operational Capability (IOC), and on equipment replicating that which will be found in the field. Throughout the life cycle, the aircraft and training system will receive equal priority. As a result, hardware and training system configuration inconsistencies will be eliminated.

Technical Data

For the LHX, technical data will be digitized and presented to the user through a device similar to today's lap top computers. Updates will be accomplished by simply slipping a new disk into the computer and throwing your old disk away. In addition, troubleshooting information, fully integrated with the aircraft built-in-test, will be presented in a simple and concise manner. Schematic data and other required visuals will also be integrated in the computer.

Perhaps the most challenging aspect of the entire support concept will be software support, both in the field and at the depot or contractor's facility. Current thoughts on software support are to develop a software support facility at Sacramento Army Depot, and having an organic capability not later than IOC. This concept could possibly change, depending on how the contractors propose software updates, consistent with Operation & Support (O&S) cost guarantees.

During Full Scale Development (FSD), the contractors will review the container design retrieval system and utilize existing containers when possible. If existing containers are not available, new containers will be developed, tested, and available to support IOC.

Transportation and Transportability

The LHX will be transportable in C-130, C-141B, C-5, and C-17 cargo aircraft. Embark and debark times will not exceed one hour for the C-130 and C-141B, or 30 minutes for the C-5 or C-17.

(LHX Support — cont. on page 53)

LHX Total Quality Management

by David J. Trosky

The Japanese call it Total Quality Control. In this country it is known as Total Quality Management, or simply TQM. Whatever the name, the idea and the principle behind it is the same. Basically, TQM is an initiative for continuously improving the performance of an organization at every level. The Japanese have been practicing it since the early 1950's when Dr. W. Edwards Deming first taught it to them. Since that time, this simple idea has driven their economic and industrial revitalization.

Commercial industry in this country has also come to realize the value of this philosophy. A number of companies have utilized this concept to make dramatic improvements in the quality and cost of their products, thus enhancing their competitive posture in the marketplace. In turn, their success has not gone unnoticed by DoD. During his tenure as Secretary of Defense, Frank Carlucci promulgated the TQM initiative and paved the way for its application within the department and the U.S. defense industry. In June of 1988, the LHX program received approval from the Defense Acquisition Board to proceed into the Demonstration/Validation (DEM/VAL) phase of its life cycle. One stipulation of this approval was that TQM would be emphasized during this phase.

Preserving Dollars

Since November 1988, when the LHX DEM/VAL contract was signed, both teams of LHX contractors have been working toward the all encompassing TQM objective of continuous improvement of their products and services. Some anticipated fallouts of this objective include an expected improvement in the levels of quality previously attained, a corresponding reduction in the cost of quality, and a resultant shortening in the development and acquisition schedule. This is of benefit to both DoD and the LHX contractors. For DoD it preserves scarce defense dollars. For the contractors, it enhances their competitive position in the industry making their products less expensive and more desirable.

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Defect Prevention

The LHX program has now been operating under the TQM banner for about one year. Initially, it was expected to be a difficult task due to the cultural change involved. Implementing a program which requires shifting emphasis from inspecting for defects to one of prevention of defects requires considerable planning. Both teams have acted promptly to do exactly that by immediately installing the right personnel for overseeing its implementation. They did their homework, visited the successful practitioners of TQM to learn from them, and set the implementation plans in place. The speed and ease in doing this was surprising and was made possible due to the degree of commitment by management. This is one of the pillars of TQM. Without the emphasis and commitment of management, TQM cannot be successfully practiced.

Management commitment was also manifested in the next step. As a new philosophy, most persons on the teams were unfamiliar with TQM. Aggressive training programs were structured to provide appropriate knowledge to the upper and middle level managers. This allowed creation of an infrastructure for accomplishing the objectives of TQM. Over the course of the program, this will be expanded. In time, the teams will have provided some form of TQM training to all persons taking part in the LHX program. The combina-

"Due to the highly competitive aspect of the program ... most companies have seen the need for change."

tion of management commitment and training has created enthusiasm for the potential of TQM.

One of the basic tenets of TQM is that of prevention of defects. This implies upfront actions to make it happen. The principal concept for achieving this is an idea called Concurrent Engineering and is defined as an integration of product and process design. It was applied on the LHX preliminary design shortly after commencing the DEM/VAL phase.

Natural Work Groups

The contractors are bringing this about by using multifunction teams called Natural Work Groups (NWG). These are composed of all the various disciplines who work as a unit to design not only the LHX hardware, but also all other manufacturing and support processes. This activity includes not only the designers, but also the logisticians, producibility engineers, reliability engineers, and others who seek to develop a high quality product that can be efficiently produced, is reliable in operation, and can be easily supported in the field.

There are a number of other TQM tools and techniques which are being applied on the LHX. Some of these are: Quality Function Deployment, which is a fancy way of saying that the contractor has listened to his customer and has considered his needs and desires; Taguchi Design of Experiments, which is a process of conducting simple experiments to provide data for determining approaches to be followed; and straightforward techniques such as the use of Pareto charts to focus on areas which require attention.

The contractors are utilizing the ideas of Cost-of-Quality and Loss Function and are finding other existing techniques they are incorporating as tools for TQM. Last but not least, a major TQM application tool is Statistical Process Control. This is not a new procedure, but is a very significant part of TQM. Its objective is to prevent defects by controlling the variability of processes. If any particular process can be measured, then its variability can be charted and controlled. This, in turn, favorably impacts the cost of quality since it avoids waste by preventing the occurrence of defects or steps which require repeating. This technique has seen its beginning on the LHX and is expected to be utilized with increasing frequency as the program picks up speed on its way toward Full Scale Development.

Not only are the LHX prime contractors pursuing TQM, but the same is true of their subcontractors. Due to the highly competitive aspect of the program and the thrust throughout the defense industry on TQM, most companies have seen the need for change. It also stands to reason that with important components being purchased by the primes for use on the LHX, subcontractors must also take part if TQM is to succeed.

Teaming Arrangements

The application of TQM in the LHX program is happening despite the complexities inherent with teaming arrangements. Both contractor teams are composed of three separate companies each with specific responsibilities of design and manufacture. They have overcome the unique arrangement of each of their organizations to make TQM work. For the team of Boeing Sikorsky, this is done at each of the team's sites in Philadelphia, Trumbull and Wichita. The team of McDonnell/Bell has elected to co-locate the design functions at the McDonnell facilities in Mesa, AZ. While the administrative aspects of the program may not be of particular importance, the fact that all involved parties at all locations are placing emphasis and management commitment on TQM is very significant.

The attention and commitment given to TQM by the LHX participants bodes well for the program. It holds the promise of a payoff that benefits both the Government and the contractors. With it the LHX can be developed, manufactured, and fielded in the shortest possible time, at a lower cost, and with the highest levels of quality possible. That, in turn, can only help to draw future business to the manufacturer. IIIII

LHX Test and Evaluation — Past, Present and Future

by Lieutenant Colonel Ralph M. Buie

The LHX weapons system presents a unique and unrivaled challenge to the Army's development and operational test community to design and execute an innovative, yet comprehensive test program. The test community has answered this challenge with an exemplary Test and Evaluation Master Plan (TEMP) which details an aggressive, focused test program based on a "building block" strategy that will result in a fully tested LHX system for Army fielding. The LHX TEMP was approved by OSD in June 1988 and the Army-approved 1989 annual update has been forwarded to OSD. The test program is structured to minimize program risk and test and evaluation costs while ensuring that the multifaceted aspects and interests of the test community are adequately addressed in program test planning and resourcing.

From the onset of the Concept Exploration Phase, the LHX test and evaluation community has made a concerted effort to economize and maximize all test efforts associated with the program. Beginning with the Advanced Rotorcraft Technology Integration (ARTI) program, all disciplines of the test community have been brought to bear for test planning and coordination. This continues into the Demonstration/Validation (DEM/VAL) phase with the chartering of the Simulation Assessment Team (SAT) to conduct a simulation assessment of both contractor teams' flight/handling qualities, part-task, and full mission simulations. Using the ARTI and SAT experience as a base, a solid Full Scale Development (FSD) test program has been structured. Through the means of the Coordinated Test Team (CTT), which includes both Government and contractor testers working together to adequately test the LHX, the overall FSD test program can be planned and executed in the most efficient manner to date. The CTT will be tailored to effectively meet the test objectives of each development phase and the Test Integration Working Group

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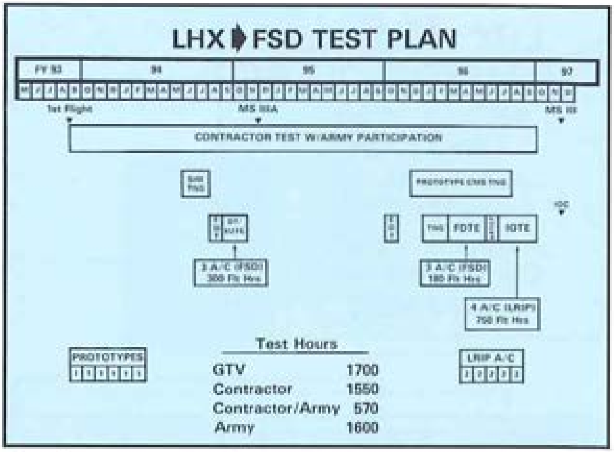
The Threat — The Soviet Mi-28 HAVOC Attack Helicopter

(TIWG) will provide the core CTT Government membership. The CTT will participate both early-on and actively in the contractor's FSD test program from the LHX's first flight in August 1993. This will ensure test and evaluation objectives are being accomplished and will avoid duplication of contractor and Government test requirements and data. Only through the use of this "team effort" philosophy can the LHX test program be completely successful.



Another critical element of the LHX test effort has been the early user participation that is being maximized to the greatest extent possible. This user participation has been a trademark of the LHX effort from the ARTI and Risk Reduction programs, continues into the DEM/VAL phase with active participation in the SAT effort, and will be sustained throughout the formal test schedule in the FSD phase. Starting in 1992, a Training and Doctrine Command (TRADOC) sponsored Early Operational Capability (EOC) unit will be the user's focal point concerning all LHX operational test and evaluation.

EOC Unit Testing

The employment of an EOC unit will strengthen the LHX acquisition process, provide a vehicle for developing and maturing tactics, organization, and assist in the integration of the training system for LHX. During FY92-94, the EOC unit will be an air cavalry troop (+) assigned to TRADOC, based at Fort Rucker, AL, and under the operational control of the U.S. Army Test and Experimentation Command (TEXCOM) during Force Development Test and Experimentation (FDT&E). The unit will expand to an air cavalry squadron (-) structure during FY95-96 to participate in the formal training validation FDT&E and operational test and evaluation. The EOC unit will use OH-58D (Armed) aircraft until LHX aircraft become available.

The LHX TEMP has been designed to ensure that a comprehensive test program is planned, coordinated, resourced, and executed. The overall LHX test program is shown above. Key elements of the program include the SAT effort in DEM/VAL and the Development Test/Early User Test and Experimentation (DT/EUT&E), Live Fire Test and Evaluation (LFT&E), and the Initial Operational Test and Evaluation (IOT&E) in FSD. A brief description of each is in order.

Flight Handling Tests

In June-July 1990, the SAT will assess the contractor teams' LHX FSD design through flight/handling qualities, part-task, and full mission simulation providing valuable insights into potential systems integration challenges, and thoroughly exercising the test and evaluation structure and coordination necessary for a successful FSD test phase. The SAT results will be provided to the Source Selection Evaluation Board (SSEB) as substantiating data.

Scheduled for September-October 1994, DT/EUT&E is a limited, coordinated effort (60 days/300 test flight hours) between the U.S. Army Test and Evaluation Command (TECOM) and TEXCOM designed to support the Milestone IIIA Low Rate Initial Production (LRIP) decision. This early test period will provide excellent test experience and "lessons learned" from which a strong Initial Operational Test and Evaluation (IOT&E) plan can be written and executed.

During LHX development, a detailed LFT&E program will be conducted including iterative survivability and vulnerability analyses. During FSD and LRIP phases, all LHX critical components will be challenged by both threat-level

(LHX Testing — cont. on page 53)

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Army Aviation Training System Sc

FIRST TEAM 148 SUP

	UH-1	CH-47D	UH-60A	AH-1S	AH-64	MH-47E
SUPER TEAM	0	0	0	0	0	0
FIRST TEAM	22	6	18	9	8	1
	88 cockpits			18 cockpits	16 cockpits	

reboard

LHX INTEGRATED TRAINING SYSTEM
THE FIRST TEAM: BOEING·SIKORSKY·LINK

H-60K	AIRCRAFT SIMULATED	SIMULATOR SYSTEMS	TOTAL COCKPITS
0	0	0	0
1	7	65	148

The U.S. Army Space Command

by Colonel Ronan I. Ellis

The U.S. Army Space Command (USARSPACE) is located in Colorado Springs, CO, and is the Army component to the U.S. Space Command (USSPACECOM). The Army effort in space started at the end of World War II, but the USARSPACE did not arrive until April 1988. Much of the early Army effort was done in the development of ballistic missiles, and organizations such as the National Aeronautic and Space Administration (NASA) and the U.S. Army Strategic Defense Command (USASDC) evolved from those early Army space efforts.

The USARSPACE is one of three service components of USSPACECOM and as such supports CINCSPACE as his Army component. The Army is interested in space for a number of reasons. The Army's concept for space is to use space to enhance the execution of Army missions across the spectrum of conflict. The USARSPACE supports this concept by developing and executing a number of space demonstrations to support Army units. These demonstrations provide non-line of sight communications, geopositioning, environmental observations and surveillance.

The USARSPACE as an operating command also plans for the fielding and operation of strategic defense system elements which are ground based. Pending a national decision concerning the Strategic Defense Initiative Program these elements could include a ground based interceptor, a ground based surveillance and tracking system, a ground based radar and the associated system command and control. Should the near term kinetic energy antisatellite (ASAT) Weapon be a ground based weapon system, the USARSPACE would also be responsible for that strategic weapon.

The USARSPACE over the next year will be assuming the responsibility from the U.S. Army Information Systems Command for the operation of the Defense Satellite Communications System (DSCS) Operations Centers. Currently the USARSPACE manages the joint tactical use of the DSCS system satellites through its Regional Space Support Centers located in Europe, CONUS and Hawaii.

In addition to its HQs in Colorado Springs, CO, the USARSPACE has detachments at the Consolidated Space Operations Center, Falcon AFB, CO, and NASA at Johnson Space Center, Houston, TX. The NASA detachment consists of highly trained Army officers who perform functions as: Astronauts, Vehicle Integration Officers, Geologic Science Officer and Space Flight Planning Officers (a subsequent article will describe this mission in more detail).

"Line of sight has been critical for command and control. Space gives 'the high ground' new meaning."

As I look to the future, I believe space will become increasingly important to Army operations. In the strategic arena as we look at the strategic defense initiative and the new kinetic energy ASAT program, the Army is on the verge of major changes in terms of missions and operations. Both of those programs could add significant strategic missions to our current capabilities. However, today's Army is a strategic Army with overseas deployed and CONUS based deploying forces. We are required to protect national

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interest worldwide. With the threats to these interests becoming more global and multi-faceted, there will be an increased requirement for Army forces to deploy in responses to crises worldwide. Space will be an important force multiplier to these operations. By definition, space is global. Space systems orbit the earth in 90 minutes or view 1/3 of the earth in a single snapshot. Army systems have been traditionally terrestrially based and horizontally distributed and line of sight has been critical for command and control. Space gives 'the high ground' new meaning.

Vertical Communications

Vertical communications can carry vital information from the United States to multiple points around the globe instantaneously. Many support functions done in theater will be easily accomplished by space platforms much like today's TV "eyewitness news." Communication, weather, position and navigation, surveillance, terrain analysis and management can all be enhanced by using space platforms that exist today.

Space based systems bring tremendous capabilities to Army commanders worldwide. What is required is that the Army ensure that its access to these platforms be available through all spectrums of conflict. It is only when commanders become confident that these systems will be available from training to war will they be willing to include them in their contingency plans. While strategic defense initiatives will be vigorously pursued by Army developers, space support for the Strategic Army can be implemented now.

The Potential of Space

Through a series of demonstrations to units deploying in CONUS to training sites and overseas for major exercises, over the next 18 months, Army commanders will become more familiar with the combat enhancement potential available from platforms orbiting our planet. The USARSPACE is a new and growing command in the United States Army whose vision and mission is to support the USSPACECOM and to ensure Army forces worldwide get the support they need from space to accomplish their landpower mission. IIIII

USARSPACE: NASA JSC Detachment

by Major Jan Drabczuk

Since the birth of Army Aviation, aviation has evolved to meet the growing needs of the ground combat commander. Today, Army Aviation is poised before a new frontier and is expanding its contribution to the role of soldiers in space.

Most people consider the military's space role a U.S. Air Force mission. However, quite contrary to this perception, space operations are truly a joint service effort. Department of Defense directives give the overall executive management of space projects to the Department of the Air Force, but Navy, Marine, Coast Guard and Army involvement has been, and is, ever present.

"First in Space"

A logo found on the U.S. Army Space Command emblem is "First in Space." It was a U.S. Army modified Redstone rocket that launced Explorer I, the first U.S. satellite, in January 1958. As astronauts, Army Aviators BG Bob Stewart, COL Woody Spring and, most recently, LTC Jim Adamson have continued to support Army space involvement through their manned space flights.

Exploiting the need for space expertise, the Army, through a memorandum of understanding with NASA, became a full partner in the Manned Space Program. This partnership has evolved into the U.S. Army Space Command (USARSPACE) officially designating a subordinate detachment at the Johnson Space Center, Houston, TX. It is here at JSC that shuttle program management, space station engineering, mission operations and flight crew training are accomplished.

USARSPACE has the mission to assure Army access to space capabilities to enhance mission accomplishment for all levels of war across the spectrum of conflict in joint and combined operations and AirLand Battle execution.

MAJ Drabczuk is a crew/vehicle Integration Officer, USARSPACE NASA Detachment, Johnson Space Center, Houston, TX.

The NASA detachment provides mission specialists to serve as shuttle flight crew members. The detachment also provides engineering expertise for human interface of Manned Flight Systems, an Army focus on NASA in the area of "Military Man in Space Operations," and Army requirements for DoD space shuttle programs.

The JSC Detachment is made up of a small cadre of Army astronauts and space operations officers. Army astronauts have the responsibility to participate as mission specialists for both DoD and NASA space flights. Presently three operational astronauts are assigned to the JSC detachment. They also perform other duties like mission control communication officers (CAPCOMs) during shuttle flight operations, and function as the Army's ambassadors for space.

The rest of the detachment is comprised of space operations officers, whose jobs involve joint space support to both NASA and Army activities. These positions include a geologist, two vehicle integration officers, a crew integration officer, a mission development officer, and a flight simulation officer.

The Geologist

The geologist is the geologic science advisor to the Astronaut Office. He has the responsibility to plan and coordinate manned space observations of the earth as well as provide geologic, geotechnical and terrain analysis advice to NASA and DoD.

Positions for vehicle integration officers have been with the detachment since its earliest formation. These positions have been the backbone of Army real-time support to NASA. The vehicle integration officers are responsible for the engineering interface between shuttle crew members,

"It was a U.S. Army modified Redstone rocket that launched Explorer I, the first U.S. satellite."

NASA management and shuttle launch site personnel. Vehicle integration officers follow the processing and checkout of the space shuttle vehicle and its mission payload from mission manifest, prelaunch, launch and landing.

Integration & Operations Officers

The newest jobs in the detachment are the crew integration officer and the operations development officer. The crew integration officer has the responsibility for providing flight crew operations engineering support for R&D and the preparation of primary and secondary flight payloads. Through this position an interface is accomplished between NASA, DoD, and the commercial contractors on payload experiment design and unique flight support integration in order to obtain proper management flow to support the NASA manifest. The operations development officer functions in parallel with the crew integration officer, except that his emphasis is placed on the shuttle/space station vehicle. Support includes work with flight software, shuttle hardware design and flight operations support.

Flight Simulation Officer

The last member of the Johnson Space Center team is the flight simulation officer. This job entails crewing a NASA G-2 aircraft. A highly technical job in support of shuttle training, the position of flight simulation officer has provided the detachment an Army officer with expertise in NASA flight operations.

The NASA-JSC detachment has supported, and will continue to support, the Army and NASA in space operations. It is a unique duty and a rewarding one. The NASA-JSC detachment, comprised of predominantly Army Aviators, has been the focal point from which Army manned space activities have grown. It will continue to support NASA and the Army to achieve the ultimate high-ground, "SPACE". IIIII

Air Traffic Control:

Guardians, SIR!

by Captain Deborah J. Chase

APO SAN FRANCISCO — U.S. Army air traffic services history is being made in the Republic of Korea. In November, 4th Battalion, 58th Aviation will open a new, state-of-the-art Flight Operations Center (FOC) in Yongsan and close an era for air traffic controllers who have served tours in the Republic for the last quarter century.

The names Evenreach, Warrior, FOC North, and FOC South elicit a variety of responses from soldiers who have worked and lived at these Flight Coordination Centers (FCC) and FOCs. If you polled them — from the ones at Evenreach who have a love/hate relationship with the 4,800 foot mountain on which they live, to those at South high atop Namsan mountain in the center of Seoul — they would all claim that *their* facility, *their* home, is the Army's best kept secret.

Air Traffic Services Network

FCC Evenreach, FCC Warrior, FOC North, and FOC South comprise the air traffic services network by which soldiers of the battalion currently perform flight following for U.S. Army aircraft flying in Korea. FCC Evenreach and FCC Warrior are collocated with Republic of Korea (ROK) Army early warning radar sites. Together, they provide flight following in the northern portion of the country from the east coast to the west coast. Their areas of responsibility include the vital and highly sensitive Demilitarized Zone (DMZ) flight corridors.

CPT Chase is ATC Liaison Officer, 4th Battalion, 58th Aviation, APO SF.

Controlling Facility

FOC North is the controlling facility for FCCs Evenreach and Warrior. Its mission includes providing DMZ corridor clearances in coordination with the appropriate airspace management elements, flight following, and assisting in air rescue operations. FOC South is FOC North's counterpart and performs a similar mission south of Seoul. It does not have subordinate FCCs.

All four sites will be deactivated in November when U.S. Army flight following in the Republic is consolidated at Flight Operations Center — Korea, (AKA Guardian Control). The consolidation will result in all flight following being conducted from the Yongsan district of Seoul with radio transmissions remoted to and from outlying sites to provide coverage to aircraft flying below 600' AGL throughout the peninsula. This will be accomplished with both microwave radio and landline communication links.

It is reported that this consolidation was conceptualized as early as 1972 and actually initiated in 1981. A number of setbacks delayed the implementation of the project including the most recent: a flooding problem in the FOC's basement location in an antiquated Japanese Army bunker on Yongsan's South Post. The setbacks were overcome, the new drainage system passed the test of the monsoon season, and the consolidation project has been progressing by leaps and bounds.

Since January 1989, an energetic and highly motivated team of communications-electronics equipment installers from Ft. Huachuca, AZ, has been hard at work installing new equipment and reconfiguring old. It is largely through their efforts and because of their support system, both in Korea and in the States, that the new facility will open five months ahead of the originally projected completion date of March 1990.

During the consolidation, air traffic controllers of the 4/58th have continued providing uninterrupted flight following coverage by using some of their tactical training and a lot of ingenuity. They connected their fixed-base FSW-8 consoles to the radios in their tactical flight following vans, AN/TSQ-61B, and continued their mission without missing a beat. With its implementation, Guardian Control will become the hub to which the tactical air traffic services elements will be electronically connected in order to provide for the integration of tactical and peacetime flight following service. Future developments may include upgrades with space age technology such as fiber optic communications links and automated flight following capability.

Rumors abound that the South Post bunker is haunted with the ghosts of its former Japanese occupants. There is no doubt that on a clear night atop four mountains in the ROK, one can hear the distinct sound of: "Guardians, SIR!" IIIII

Hardware:

Propulsion Directorate Responses to Problems

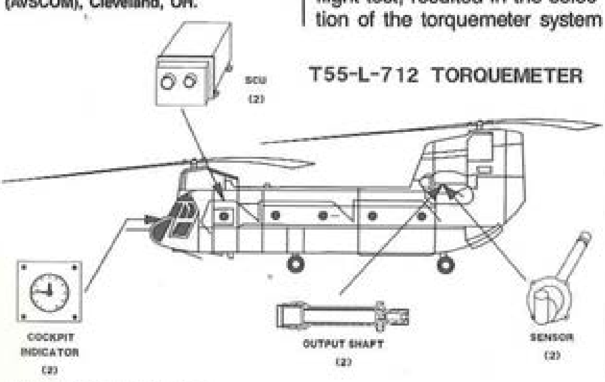
by Peter L. Meitner & Joseph Flowers

CLEVELAND, OH — The U.S. Army Propulsion Directorate is located in Cleveland, Ohio and operates as a tenant-partner of the NASA-Lewis Research Center. The two organizations pursue joint programs directed toward small turboshaft engines and toward drive train systems for rotorcraft. The overall goal of this joint activity is to keep the next generation of U.S.-developed rotorcraft at the technological forefront. The work is performed both in house and under contract, and consists primarily of Research (6.1) and Exploratory Development (6.2). While the results of these Propulsion Directorate (PD) efforts receive widespread dissemination via reports and/or presentations at technical society meetings, there is another important aspect of the activity which is not well known and is seldom reported — solutions to chronic problems. This article highlights some of the past and ongoing efforts to use the Propulsion Directorate expertise in developing solutions to chronic problems.

Mr. Meitner is a Lead Aerospace Engineer, and Mr. Flowers is an Engineering Technician for the U.S. Army Research & Technology Activity, Propulsion Directorate, (AVSCOM), Cleveland, OH.

T55 Torquemeter

AVSCOM requested that the PD develop an advanced torque meter system for the T55-L-712 engine powering the CH-47D aircraft. PD personnel designed a new engine output shaft and Simmons Precision was the electronics contractor for the new torquemeter system which consisted of a phase shift engine output shaft, a monopole sensor, an airframe mounted signal conditioning unit, and a new cockpit indicator. The successful completion of a 150 hour engine qualification test, a ten hour emergency power test, and a 200 hour flight test, resulted in the selection of the torquemeter system for the T55-L-714 engine used in the MH-47E aircraft.



Compressor Housing

Corpus Christi Army Depot (CCAD) requested that the PD develop a material addition process to repair and reclaim used T55-L-712 engine compressor housings. PD developed a plasma spray process using a silicon aluminum alloy powder. A restored compressor case survived a 150 hour endurance test and a 200 hour flight test. The developed spray procedure is soon expected to become part of the overhaul process for T55 compressor housings and should allow approximately 100 units to be reclaimed per year.

Flow Rig Inlets

At CCAD, rebuilt turbine engine stator rings are assembled and flow checked using a Fleming flow rig to determine the stator Effective Flow Area (EFA). While CCAD and the engine builders use the same type of flow rig, they use different inlets, which give different values of EFA for the same test hardwar At CCAD's request, PD persor nel developed a design prc cedure for low loss inlets, witl the inlet shape dictated by tes hardware geometry. The desigr procedure was developed foı both elliptical and circular section inlets. Testing of the inlets is in progress, and it is expected that

(Propulsion — cont. on p. 54)

Research & Development:

Overview of Research Efforts at the USAARL

by Colonel David H. Karney

FORT RUCKER, AL — The U.S. Army Aeromedical Research Laboratory (USAARL), one of 11 research laboratories and development activities of the U.S. Army Medical Research and Development Command, researches occupational medicine in the military setting and Army Aviation's distinct concerns. While our mission is to deal with Army Aviation's unique occupational problems, our specialized research disciplines are applied throughout most military systems and operations.

USAARL's mission is geared to reducing or solving important problems associated with aviation, tactical combat vehicles, selected weapons systems, and airborne operations. Our research efforts have two objectives: the prevention or minimization of health hazards in the military operational environment and the enhancement of soldier performance. The six major research areas: acoustics, vision, crew workload and stress, life support technology, impact, and vibration, are studied by three research divisions: Sensory Research (SRD), Biomedical Applications Research (BAR), and Biodynamics Research (BRD).

Sensory Research Division

The Sensory Research Division investigates hearing protection, visual enhancement and protection, and visual neuroscience applications. SRD conducts research on noise hazard assessments of Army weapons; medical, human factors, and physical properties of night vision devices and helmet displays; and visual effects of chemical battlefield threats.

Biomedical Applications

Biomedical Applications Research Division confronts the problems of workload stress and fatigue and physiological life support. BAR researches sustained aviator performance, assessment of aviation motion sickness, and the effects of military operations in the NBC environment.

The Biodynamics Research Division studies protective life support systems, impact injury, vibration hazards, and test and evaluation of aeromedical equipment. BRD conducts research on correlation of injuries and injury producing mechanisms with aviation life support equipment damage, anthropometric dummies in crash simulations, exposure to whole-body vibration and repeated impact, and electromagnetic interference chamber testing.

OH-58 Crashworthy Seat

Through a contract with Bell Helicopter Textron, the major development of the OH-58 Crashworthy Seat to help prevent spinal column injuries in crashes has evolved at USAARL. The energy-attenuating capabilities of the new OH-58 seat are a result of the seat pan being fixed at the forward-edge hinge point. The hinge directs the impact energy away from the aviator's spinal column and towards the bulkhead. A polycarbonate sheet connects the seat back to the seat pan to prevent the buttocks from contacting the bulkhead structure.

The crashworthy seat prevents injury caused by excessive vertical forces up to 26.5 ft/sec. This level of crash energy is approximately four times that prevented by the existing seat installation. This recent success has not yet been fielded.

UH-60 Simulator

Another major accomplishment that has occurred at USAARL is the procurement, installation, testing, and acceptance of the UH-60 BLACK HAWK research flight simulator in fiscal year 1989. The unique capabilities of the UH-60 simulator (AEROMED) can be described under three categories: environmental control system, bioinstrumentation, and flight performance.

The environmental control system provides for environmental extremes within the cockpit of 105° Fahrenheit (F) to 68° F ± 3° F and for 90% Relative Humidity (RH) to 25% RH ± 3% RH.

The bioinstrumentation system consists of signal conditioning and monitoring units to collect continuous physiological information such as electrocardiograms (EKG), electroencephalograms (EEG), respiration, blood pressure, eye movement, core temperature, and many others. **(USAARL — cont. on pg. 54)**

COL Karney is Commander, U.S. Army Aeromedical Research Laboratory (USAARL), Ft. Rucker, AL.

Operations:

Task Force SKYHAWK

by Colonel Richard M. Adams

APO NEW YORK — The last two years have passed quickly here in SKYHAWK country. The Brigade has had many successes and has matured into a combat ready member of the 8th Infantry Division (Mech). During these two years we have participated in numerous field training exercises including two CARAVAN GUARDS and REFORGER 88. The two attack helicopter battalions completed very successful ARTEPS as members of the Division's combined arms team at the Hohenfels Training Area in December of last year. We organized the Brigade's separate companies into an effective fighting force called TF SKYHAWK. The Task Force demonstrated its skills during REFORGER 88 as well as on its ARTEP in February 88.

COL Adams was Commander, 4th Brigade, 8th Infantry Division (Mechanized), at the time this article was written.

In May, the Brigade had the opportunity to be the first Aviation Brigade to participate in a combined arms, MILES-AGES scenario at the Combat Maneuver Training Center (CMTC) at Hohenfels. The Brigade deployed on "APACHE" with one attack helicopter battalion, elements of TF SKYHAWK, an ATC platoon and the Brigade TOC. Since this was the first employment of Combat Aviation at CMTC, the Brigade S3 worked closely with the CMTC staff to develop and implement an aviation model designed to ensure all facets of aviation were doctrinally employed and done so in a safe manner.

The attack battalion was primarily employed in the close-in battle and as part of a counterattacking force. Task Force SKYHAWK employed UH-60s to conduct resupply missions from the Division Support Area forward to the Brigade's field trains.

The Divarty Support Platoon supported the operation by providing the Division with both aerial fire support and very effective night time surveillance. The OH-58Ds were OPCONed to the attack battalion during the day and worked under Division control at night. On several occasions they were placed OPCON to the maneuver brigade. The EH-60 QUICKFIX platoon also was integrated into the scenario under the operational control of the Division's Military Intelligence Battalion.

In addition to the blue force support, the Brigade employed four OPFOR "HINDS" using AH-1F aircraft. The aircraft carried orange tow tubes and red stars in the windows to distinguish them. The crews were trained in Soviet tactics and flew Soviet mission profiles.

The exercise was conducted using MILES-AGES and lasted 25 days. The Brigade was able to maximize the training opportunities by rotating the attack battalions and the aircrews from the task force at the mid point of the exercise.

Observer/controllers were provided by the attack battalions and trained by CMTC personnel. Their integration into the exercise provided a link to the chief controller, a mechanism for effective feedback to the aircrews and most importantly, an additional safety factor.

The Brigade flew over 1,200 hours and drove 150,000 miles, both accident free. APACHE was an outstanding training opportunity for this Brigade and provided commanders an accurate Mission Essential Task Lift (METL) assessment.

SKYHAWK! IIIII

Engineering:

AVSCOM Directorate for Engineering

by James A. Ray

ST. LOUIS, MO — The Directorate for Engineering provides for life cycle engineering support for all Army aircraft systems and related aviation materiel. In this role, support is provided for R&D projects, developmental projects, aviation materiel production, and operational fielded systems. The Directorate is also part of the AVSCOM Research, Development, and Engineering Center which ties together AVSCOM's externally located laboratory and testing activities along with other technical Directorates within St. Louis to meet the overall technical support mission of AVSCOM. The RD&E center also provides for a combined effort to address solutions to field related readiness and operational problems.

Flight Safety Parts Program

With the implementation of the Flight Safety Parts Program within the Army, there are several issues where enhancement could be made to improve the overall procedures. Contact was made with the Aerospace Industries Association Rotary Aircraft Group to review AVSCOM's procedures. As a result of their initial review, it was determined an AVSCOM/Industry Working Group would be appropriate to work out details on improving specific areas of the program. This industry working group was expanded to include the American Helicopter Society as well as an open invitation to other companies. An interim report of the status of the efforts was briefed at the AAAA Joseph P. Cribbins Product Support Symposium in February with the final report being targeted for later this year. The result has been improved consistency in implementation with each company's parts as well as an improved working relationship with industry.

Mr. Ray is Deputy Director of Engineering, U.S. Army Aviation Systems Command, St. Louis, MO.

EEE Policy

Army systems are continually being upgraded to include state-of-the-art features in electronics. Operations have similarly required more resistance to electromagnetic emitter sources. In order to ensure Army Aviation has addressed the needs and provided for proper protection, an Electromagnetic Environmental Effects (EEE) Policy Board was established with the Director of Engineering as chairman. EEE design requirements are being defined through an Aeronautical Design Standard and being implemented on current and new models of Army aircraft. Pending implementation of design features, any needed restrictions and operating instructions have been provided to the field.

Stratford Engine Plant

The Stratford Army Engine Plant is a Government owned facility managed by AVSCOM. Through the Industrial Modernization Incentives Program a major modernization of this facility has been on-going over the last few years.

This year represented a culmination of a major effort in this process in improving the productivity for aviation (and tank) engine production as well as added mobilization surge capability. Involved in this process were:

- changes/additions in factory design;
- manufacturing planning and control systems;
- plant maintenance information systems;
- tooling inventory management systems and
- plant automated material handling systems.

The results included an overall computer integrated manufacturing facility with enhanced capabilities and reduced manufacturing costs.

Total Quality Management

One aspect in the implementation of the DoD Total Quality Management Program has been the formal establishment of concurrent engineering teams. Following the precepts of TQM, these teams include engineers with specialties in systems, functional expertise (structures, electronics, propulsion, etc.), production, quality, maintenance, logistics, quality and safety. Each team is led by the System Engineer for a given aircraft model and works together during the development process to ensure all elements of design are coordinated concurrently. The first major efforts where these concurrent engineering teams will be involved is the LHX and the LONGBOW APACHE.

This spring a series of sepa-

(Engineering — cont. on p. 54)

Hardware:

T800 Engine Program: Smart Contracting

by LTC Arnold E. (Sandy) Weand, Jr.

ST. LOUIS, MO — This is the third of a five part series on the development and acquisition of the T800 engine. The last issue covered the history of the T800 program beginning with the contractor teams' proposals for the T800 Full Scale Development (FSD) program, and how the Government downselected to the two contractor teams of AVCO-Lycoming/Pratt & Whitney (APW) and the Light Helicopter Turbine Engine Company (LHTEC).

SUMMARY OF TECHNICAL REQUIREMENTS

POWER RATINGS		
	INTERMEDIATE RATED POWER (IRP) (30 MINUTE RATING)	1200 SHAFT HORSEPOWER (SHP)
	FUEL CONSUMPTION AT IRP	358 LBS/HOUR
	CONTINGENCY POWER (2.5 MINUTE RATING)	1300 SHP
	MAXIMUM POWER (10 MIN RATING)	1320 SHP
	50% IRP	600 SHP
	FUEL CONSUMPTION AT 50% IRP	330 LBS/HR DESIRED, 335 LBS/HR MAX
OPERATIONAL ENVELOPE		
	ATTITUDE RANGE	-45 TO 105 DEGREES
	ALTITUDE	SURFACE TO 25,000 FEET
	TEMPERATURE	-65 TO +130 DEGREES F AT SEA LEVEL

Contracts

Each team signed a five year FSD contract. These contracts specified selecting one team approximately three years into the program, at the end of the Preliminary Flight Rating (PFR) phase, to finish the engine development through the Qualification Phase (QT) and to produce the engine for the Government. At the time of contract award in 1985, the Army announced the final source selection at the end of the PFR phase was to be based on demonstrated progress through PFR and the proposed go-forward plans/commitments. Both contracts contained a clause stating the non-selected team's contract would be terminated at the end of the PFR phase. The Governments termination liability with the non-selected team was contractually limited to the Government's contract price for the first three years, or PFR phase, ending 31 October 1988.

LTC Weand is Assistant Program Manager for T800 Engine, St. Louis, MO.

Termed a new way of doing business, the government (largely due to competition), was able to contractually obtain unprecedented contract performance guarantees in the areas of engine performance, reliability, maintainability, produceability, cost, and numerous program plans. The FSD contract was fixed-price. The Government paid only the amount negotiated prior to the contract award. The contractor team was required to accomplish the contract performance requirements, regardless of his cost. Additionally, the contract paved the way for these guarantees and commitments to become binding in the final portion (QT) of the FSD contract and in new or post QT contract modifications.

Contract Commitment

Each team contractually committed to achieving at least 500 hours mean time between failures, and 2,000 hours between removal. The teams also agreed to a maximum time to repair (by remove and replace) of less than 15 minutes for line replaceable units, and 60 minutes for the four engine modules. Both teams agreed to design and develop the engine for two levels of maintenance, apply the principles of MANPRINT to their design, and develop and tailor a real time logistics support analysis record with terminals in AVSCOM maintenance directorate and the Light Helicopter Program Manager's Office. More significant was that each team had to demonstrate maintainability during two maintainability demonstrations during the PFR phase, one for user tasks, the second for depot tasks.

(T800 — cont. on page 54)

Maintenance:

A European AVCRAD: Now a Reality

by LTC Eric Braman

APO NEW YORK — AVSCOM's commitment to readiness extends from mid-America to Brussels, Belgium, where a new AVCRAD has recently opened.

AVSCOM has pre-positioned aviation maintenance equipment — configured as it would be in war time — so that in the event of hostilities ARNG National Guard units from CONUS could immediately upon arrival in theatre begin classifying and repairing material.

To assure that the AVCRAD really works, the National Guard Bureau, in conjunction with AMC, periodically deploys groups of guardsmen from several aviation depot maintenance roundout units from the states to Brussels so they can become familiar with the facilities as well as provide extra manpower to perform back up AVIM and depot level maintenance in support of the USAREUR aviation program.

Operational control of the AVCRAD falls under the jurisdiction of the Depot Division in the AVSCOM Directorate for Maintenance. The European AVCRAD is a special repair activity with a mission to classify, repair, and return critical aviation material to the theater supply system.

AVSCOM has contracted DynCorp, a Reston, VA aerospace firm to perform cadre and base operations functions. This small group of contractor personnel in conjunction with the deploying guardsmen are responsible for the requisitioning, installation, maintenance of equipment and tools as well as the calibration of special tools and Test Measure Diagnostic Equipment. The continuing challenge is to insure the AVCRAD is equipped to meet the dynamic maintenance requirements of a fleet that is ever changing through modernization.

LTC Braman is Commander of the Aviation Classification Repair Depot, APO NY.

The support received in establishing this facility has been superb in every detail from Herculean efforts of the deploying guardsmen, cadre workforce provided by DynCorp, to the Belgian Army who billet and feed our Guardsmen.

The AVCRAD in Brussels — an outgrowth of the four in the states — began operating in September 1987 and was the result of a study that predicted the need for a forward deployed depot-level maintenance capability in the event of mobilization.

In fiscal '90 our capability to support the theatre will be expanded with the receipt of a C-23 Sherpa. This aircraft will expedite the movement of critical aviation materiel and maintenance teams between Aviation Intermediate Maintenance units, European Redistribution Facilities, Reserve Storage Activities and Special Repair Activities.

Working with AVSCOM, we have positioned technical inspectors at each of the European Redistribution Facilities to insure the timely evacuation of unserviceable aviation material to the appropriate general support or depot level repair activity.

During the past two years the European AVCRAD has progressed from a concept to a reality. The appropriate TDA/CTA equipment and special tools have been identified, requisitioned, received, installed, and calibrated. European AVCRAD personnel (both ARNG soldiers in ODT and DynCorp CET) have classified, repaired and returned to the supply system in excess of 1100 components, resulting in a cost avoidance of over one million dollars.

The AVCRAD, as an agent for AVSCOM, 200th TAMMC and NGB, has been tasked with the following missions:

- Manage ARNG Aviation ODT Program
- Operate an Aviation Maintenance Facility Capable of Classification and Depot Level of Selected Aviation Material
- Operate a Below Depot Level Repair Program for all Aviation Material (200th TAMMC GSRP)
- Operate a Redistribution Facility for Theatre Controlled Aviation Material (200th TAMMC ABF)
- Operate an AVSCOM Special Repair Activity (SRA)
    - Displaced Equipment
    - New Equipment Fielding
    - FMS
    - PBD-731
- Operate an ARNG/Theatre Aircraft Storage Facility
- Operate a War Reserve Storage Site for Aviation Material
- Operate an Aviation Support Activity for
    - AVCRAD
    - ARNG Storage Facility
    - TAMP II

(AVCRAD - cont. on page 63)

AAAA Gifts for the Holidays!

As a service to active AAAA members, the AAAA National Office maintains an inventory of souvenir and gift items. To place your order, please complete and return this request to the AAAA National Office at 49 Richmondville Avenue, Westport, CT 06880-2000. Please print clearly or type all information. All orders must be prepaid. Please do not send cash. Please allow six to eight weeks for delivery. If you have any questions or require additional information, please feel free to call the AAAA National Office at (203) 226-8184.

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Decal 12 inch	______	$5.00	$4.50	$4.00	$ ______
Coin	______	$2.50	$2.25	$2.00	$ ______
Coffee Mug	______	$5.50	$5.00	$4.50	$ ______
Patch w/4-color AAAA logo	______	$3.50	$3.00	$2.75	$ ______
Cap w/silk-screen AAAA logo	______	$7.50	$6.00	$5.00	$ ______
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$20.00—39.99	$4.75	$12.00
$40.00—59.99	$6.00	$15.00
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To the Editor: During the 1988 Armor Conference at Fort Knox the 3rd Armored Cavalry Regimental Commander, COL Jarret Robertson, heralded a warning while praising his Aviation Squadron's performance at the National Training Center. He stated that "Aviation must remain well grounded."

These five words foreshadow a concern that may cripple our maturing branch. COL Robertson's statement is a flickering caution light that will become more serious if the Aviation community does not react promptly.

I believe the expanded version of this might read:

"Attention aviation captains and lieutenants! You are experiencing an unprecedented period in the history of your branch. As time passes so do those with experience in ground operations. The days of company grade aviators with Armor, Infantry, and Artillery backgrounds will soon come to an end. Combined arms exercises, non-aviation service schools, and individual study may be your only source of interaction and professional development with your ground counterparts".

I'd like to discuss the future implications of this situation. The first concern to consider is the effect of time. The loss of field grade and general officers with an air/ground background will follow the extinction of company grade 'well grounded' aviators. Senior ground commanders with aviation roots, such as LTG John Woodmansee of the V Corps, will become a thing of the past. Future ground commanders with limited aviation experience and exposure may only allow for limited employment of aviation assets. The opportunities for aviators to command on the ground will cease to exist.

Left alone, the effects of time will erode the bonds of trust and cooperation between ground and air maneuver. Regardless of their future roles, two colonels who slept in the same foxhole or rode in the same track as lieutenants will maintain mutual trust and respect throughout their careers. How will a future ground colonel perceive his aviation counterpart? Will the ground colonel's experience be that aviators never showed up during bad weather, were late, at the wrong location, and not in radio contact? How will trust develop under these circumstances? We must terminate this growing perception.

Some may say that today's perceptions of aviation will not continue indefinitely, the branch is still maturing. However, the future problems we face will make the perception issue a minor one. The maturation process must be healthy from the combined arms perspective. Aviation leaders cannot narrowly focus on their own needs. Aviators must be team players who carry more than their own weight. A one-branch mentality, rather than a combined arms attitude will cause a growing child to mature into an arrogant, unpopular adult. The branch must focus on its future credibility while still in its youth.

Establishing credibility starts and ends with the individual aviator. It does not require restructuring TO&Es or making sweeping changes in doctrine. Rather, it requires aviators to master air and ground operations and demonstrate it at every opportunity. Aviation commanders at all levels must be physically present during war gaming and mission planning. They must teach ground maneuver leaders through professional development programs that actively highlight aviation's capability to enhance combined arms operations. Fort Rucker will continue to educate non-aviation students. More importantly, aviators must experience the same formal education offered by the basic and advanced courses of other branches. Lastly — quality, branch qualified officers must represent aviation. Imaginative incentives could link liaison positions with sought after flying jobs.

The final analysis always seems to rest on the individual. In this case, the 'well grounded' aviator: the man or woman who makes a personal goal of self-development as a combined arms team player; and, who vows never to miss an opportunity to demonstrate his or her abilities. What will be the results? Aviation survivability, lethality, and operational efficiency will all increase as well as the credibility of all those who proudly wear the wings of Army Aviation.

— James J. Galvin, Jr., Captain, USA
Monterey, CA

USPHT
(continued from page 11)

But in the end, it was the Commander's decision. This was the selection made:

Representing the USA: CW2 George Egbert and CW2 Paul Hendricks, Arizona NG; CW3 Jon Iseminger and CW3 Rudy Hobbs, Ft. Rucker; CW3 Ed Jones and CW3 Neil Whigham, Texas NG; CW4 John Loftice and CW2 Ken Wright, USAREUR; CW3 Howard Fancher & SGT Lonnie Rash, Hawaii and Ft. Rucker.

Competing for Individual Honors: CW3 Rick Church & SGT Scott Harbarger, Ft. Campbell & Ft. Bragg; CW4 Maris Stipneiks & 1LT Brian Dickens, Arizona NG. And Demonstration Crew: CW3 David White and 1LT Jae Collins, MDW.

Perfect Scores!

Our arrival to Chantilly gave us concern because of the lack of organization, but we got through it. The focus for the entire five days was on only one thing: win it and be sure to win it. On day one, the five out of the seven crews scored 200 points, a perfect score.

On Day two, during the Timed Arrival with Load Drop-off, our flexibility was tested for the first time. CW3 Howard Fancher and SGT Lonnie Rash (Crew 55) had just completed an out-of-ground-effect hover check when they got an engine chip light. They signaled trouble, left the aircraft and someone else shut it down. SSG Ricardo Manuel raced off to alert another group (two of those legendary National Guard crew chiefs, SSG Wayne Henderson of Scottsdale, AZ and Danny Balderrama of San Antonio, TX) to START MARKING the proper tail number on a spare aircraft, and another U.S. aircraft moved up to take their place. 300 seconds after touchdown, Crew 55 pulled pitch enroute to the start line, and took their place directly behind the aircraft who moved up for them. They went on to fly a score of 198 out of 200 points, something no one else in the world could have done. The organizer was impressed. Heck, *we were impressed!*

On Day three, the Demonstration Crew, White and Collins, and the Time Judge (MSG James Sutton) had to deal with a particularly difficult Chief judge who was determined to disqualify all co-pilots sitting in a manner he felt inappropriate. The organizer had to settle this problem, which caused the competition to be stopped for three hours. And it was settled favorably to our Team training, much to the credit of these outstanding behind-the-scenes personnel.

Scoring

Day four was scheduled so that the leaders flew last. The USA took the balance of the competition by storm. How well did we do? The first seven places. The Team score bettered the next highest score (Russians) by 171 out of 2400 points. The scores were unbelievable. Team average score was higher than the winning 1986 WHC score. Who won? The 1986 World Champion! Jon Iseminger and his hand-picked co-pilot Rudy Hobbs.

And they did it the hard way. The day before the last event, Jon had been penalized by a judge for a double set, costing 25 points. We had filmed it, and the Team Commander had filed a protest (legal jargon for a move to regain those points), but the decision had not been made when he went out on the course. So he had to do the best he could and mentally shut out the protest. He won the Championship by three points. He only lost four points himself out of 800 total possible, an unbelievable effort!

The closing note was taken from a comment the Commander left on the chalkboard in the briefing room for all to see. It was early July and we all knew he must have written it, because it was *him* just the way it was written.

"We did not come to qualify. We came to dominate." That pretty well says it all. IIIII

Team Scores

Place	Country	Points
1	United States	2,373
2	Soviet Union	2,202
3	Great Britain	1,746
4	France	1,598
5	West Germany	1,581

Individual Crew Scores

#	Place	Score	Name
77	1	796	CW3 Jon Iseminger and CW3 Rudy Hobbs
22	2	793	CW4 John Loftice and CW2 Ken Wright
44	3	786	CW3 Rick Church and SGT Scott Harbarger
33	4	784	CW2 George Egbert and CW2 Paul Hendricks
55	5	781	CW3 Howard Fancher and SGT Lonnie Rash
88	5	781	CW3 Ed Jones and CW3 Neil Whigham
99	7	771	CW4 Maris Stipneiks and 1LT Brian Dickens

Challenges of LHX
(continued from page 4)

tractors are realistically incorporating Total Quality Management initiatives into their disciplined approach to designing, testing and producing the LHX to ensure that the challenging technical issues will be successfully overcome.

As the centerpiece of the Army's Aviation Modernization Plan and as the Army's number one R&D program, the LHX is poised to become one of the free world's most advanced weapons system. The LHX is the future of Army Aviation and will play a significant part in Army Aviation's role in the AirLand Battle concept of the 21st Century.

Continued support of the program by the Army, OSD, Congress and our industry partners will ensure that the LHX matures into the Army's combat aircraft of the future. IIIII

Training
(continued from page 25)

quisition systems. Finally the LHX MILES/AGES system will provide the ability to demonstrate and score aviation's contribution to the warfighting capability of the combined arms team. We also are considering built-in air-to-air and air-to-ground engagements, and on-board ASE training features that will enable warfighting scenario practice using on-board systems, with a post-training performance feedback capability.

In conclusion, our objective is to field a training system concurrent with the weapons system which trains operators, maintainers, and support personnel effectively, realistically, and safely. Additionally, this system will sustain those skills necessary to maintain combat ready LHX units. Since the training system is an integral part of the weapon system, it is being developed and produced by the LHX prime contractors. Concurrent development of the weapon system and its training system will eliminate aircraft/training system configuration inconsistencies and will ensure the training system receives equal priority with the weapons system throughout the life cycle of LHX. The successful integration of training with advances in technology and science will truly make LHX the future of Army Aviation. IIIII

LHX MEP
(continued from page 27)

16-Bit which had been the previous baselines. This will provide a threefold increase in processor throughput without increasing cost or weight.

As a result of Congressional and Office of the Secretary of Defense (OSD) directives, the Army, Air Force, and Navy have formed the Tri-Service Joint Integrated Avionics Working Group (JIAWG) to develop "common avionics" for use in the Services' newest aircraft programs: the Army's LHX, Air Force's Advanced Tactical Fighter (ATF), and Navy's A-12. The JIAWG has selected SEM-E as the standard format for the "common modules", and is preparing specifications for the "common modules" and other common items which will be used by the three aircraft programs in their FSD efforts, actually a Preplanned Product Improvement (P^3I) for A-12 which is now in Full Scale Development.

Common Service Avionics

The JIAWG has precipitated a major continuing effort between the LHX, ATF, and A-12 program offices and their contractor teams to ensure these new development aircraft will share common electronics components. This means that when the LHX is fielded, the Army will have an aircraft that is the technological equal of the newest and best Air Force and Navy aircraft, which could be a first for Army Aviation.

The "common avionics" goal is to reduce development, procurement, and operations and support costs for the three Services by competitively procuring a reduced number of module types that constitute avionics hardware. These "common modules" can then be maintained at reduced costs within each of the Services' logistics support systems. This would allow an Army LHX to land at an Air Force or Navy base and replace a defective or battle damaged electronics module. Other areas in which commonality is being pursued include software (i.e.: Ada Higher Order Language which is the DoD and JIAWG standard) and a common software development environment which includes the host computer and all the "tools" that are used to develop the software.

Army pilots are now assisting both LHX teams in developing their cockpits/crewstations. The Army pilots will provide early user feedback on control and display issues, placement of switches and functional workload allocation. The crewstations are installed in full mission simulators that provide day and night mission simulation with a real time interactive threat. The simulators will allow the Army crews to operate the LHX just as they would in actual tactical conditions.

FY90 promises to be an exciting year in which the pre-FSD activities will culminate in subsystem level hardware demonstrations of the key MEP items that will provide LHX the superior operational capabilities it will need to be the dominant rotary wing aircraft on the future battlefield. IIIII

LHX Support
(continued from page 29)

In addition, the LHX will be field recoverable by Army truck or by CH-47. All transportability requirements will be verified through actual testing during FSD.

Facilities

It is envisioned that the LHX will require no additional facilities other than those currently available to support the existing light fleet. However, during DEM/VAL, the contractors are conducting facilities surveys to ensure adequate space is available for the LHX Combat Mission Simulators.

In this article I have touched on each element of the Supportability program for LHX. Several in-depth analyses and studies are on-going to determine the best and most cost effective method of support. As the system matures, concepts will change and even better support concepts will be discovered. You can be assured that this office is totally dedicated to fielding the most cost effective, operationally suitable, and totally supportable aircraft ever developed. IIIII

LHX Testing
(continued from page 33)

fire (specification caliber requirement) and one level of overmatching fire (one larger caliber beyond specification desired). A full-up LFT&E will be conducted if the test data from previous tests prove insufficient.

The FSD test program culminates with the IOT&E in July-September 1996 which supports the Milestone III Full Production decision with a comprehensive operational test (90 days/750 test flight hours) of the production LHX. This "final exam" of the LHX will fully exercise the weapons system in a realistic operational environment with Army pilot and maintenance support personnel.

The Mission Profile

In each of the development and operational test events, the test and evaluation emphasis will be on the two primary missions of armed reconnaissance and attack with air combat operations integrated into each mission profile. The test baseline will be an OH-58C and AH-1F-equipped scout-weapons platoon or team. This unit will be a light or heavy scout-weapons team based upon the test scenario and enemy situation. The EOC unit will be the operational test unit throughout the FSD phase.

Individual test objectives, scope, resourcing, and instrumentation have been planned in detail in order to support the overall LHX development. Test schedules and supporting resources have been tailored to the specific objectives of each development phase and provide for an efficient and orderly approach to required testing. LHX instrumentation planning has been closely examined to ensure required test data are collected accurately and with maximum commonality, flexibility, and ground station compatibility. The Instrumentation Working Group (IWG) is currently coordinating the LHX instrumentation requirements with the test community to include the OSD Common Airborne Instrumentation System (CAIS) initiative, the Mobile Automatic Field Instrumentation System (MAFIS), and both contractor and Government development test requirements.

From start to finish, the LHX test program has been planned, coordinated, and scheduled so as to systematically test and evaluate the LHX weapons system throughout the development process. Each LHX assessment, test, and evaluation has been scoped to accurately define and report the LHX system's technical performance and operational effectiveness and suitability. Through the use of an innovative, flexible, and comprehensive test program, the LHX TEMP has set the testing standard for both current and future development programs. IIIII

Propulsion
(continued from page 43)

these inlet designs will be adopted by both CCAD and the engine manufacturers.

Clutch Investigation

As a result of a number of unexplainable helicopter transmission shaft failures, AVSCOM requested that the PD look into the possibility that random sprag clutch disengagement/engagement was causing the failures. In response, PD personnel have developed a comprehensive sprag/raceway engagement model, and have determined the low frequency axial threshold vibration levels above which clutch slippage occurs. A test rig is being designed to expand these tests to higher frequency levels and work is underway to verify the clutch engagement model.

While the above examples are not a comprehensive list, they do illustrate one important point: the solution of chronic problems has been, and will continue to be, an important aspect of the AVSCOM's Propulsion Directorate technical effort. IIIII

USAARL
(continued from page 44)

The flight performance data acquisition system provides the capability to sample data from up to 64 sources simultaneously consisting of the 16 bioinstrumentation channels and all of the digital variables in the simulator computer memory which change dynamically with flight simulation.

USAARL's accomplishments have resulted in significant improvements in aircraft systems and life support equipment over nearly three decades. Researchers remain steadfast in their mission to provide better safety and comfort for today's and tomorrow's soldiers. IIIII

Engineering
(continued from page 46)

rate storms caused significant aircraft damage at three locations in the southern U.S. As an effort to expedite recovery, a series of engineering teams were deployed to the sites (and contractor facilities) to provide for inspection, repair, and additional spares sources. The result has been for a significant recovery of aircraft parts/repairs, schedule improvements, and dollars saved. Parallel to this effort was another team to review all existing tiedown procedures and equipment to provide for improvements. Interim guidance was provided to the field with additional long range improvements still being pursued. IIIII

T800
(continued from page 47)

To ensure a readily available competitive parts supply, each team agreed to expand their vendor base to a minimum of at least two suppliers for each part. Included in this requirement were set asides for small business, and small, disadvantaged/women owned businesses. Tech data packages prices were agreed to, as were the Government's rights and contractor responsibilities, if the Government were to buy the packages. To ensure each team member within a team was, in fact, building the same engine, interchangeability demonstrations were required where the engines would have to be built and successfully pass certain tests using the other team member's parts.

As reported in an article in the August-September issue of ARMY AVIATION, the Army did not dictate specific engine performance requirements but rather bands of acceptable performance. Under competition each team was willing to sign up for specific requirements.

Perhaps the most far reaching and unprecedented agreement obtained with the two contractor teams was the guaranteed not-to-exceed average design-to-cost of $245,000 for the intended 10,000 engine buy, and a guarantee that these engines would operate for less than $120 per engine operating hour. This operation and support guarantee included all POL, parts, materials, and labor for both levels of maintenance.

Looking Ahead

Next month I will explain some of the LHX program changes that affected the two contractor teams during the competitive phase, explain that impact on the final source selection and describe the parameters of the current contract. IIIII

MG Ostovich (continued from page 6)

Annual closeouts are simplified through an automatic birthday scan at the end of each month. On the last day of the month, when all data entry is completed, the program lists the individuals for whom record closeouts are in order. All closeouts for the month are then computed and printed automatically.

The software provides an accurate transfer of files. While all data are stored on a hard disk, the main menu has an option that permits individual records to be transferred to and from a floppy disk. Thus, when aviators leave a unit, all of their flight hour data can be transferred to a receiving unit's computer.

One feature that I find especially appealing is that the program does not require the purchase of any supportive applications software. It is completely "stand alone". As a result, units are spared the difficulty and expense often associated with commercial software procurement.

The Automated Flight Record System package consists of three five-inch diskettes. The program itself is contained on two of the diskettes. The third disk contains the User Manual with complete instructions for printing to hard copy.

System Requirements

The software is designed to run on microcomputer systems using DOS 2.1 or higher. A full complement of core memory (640 kilobytes) is necessary, as well as a hard disk drive. The hard drive must be able to provide at least 2.5 Megabytes of storage space for the AFRS subdirectory. The software also supports a wide range of printers through a printer menu.

Evolution

Distribution of the present version of the software represents the first phase of an effort aimed at establishing an Armywide flight record network. At this stage of the effort, the software is being distributed only to units with the appropriate computer systems who volunteer to participate.

This first stage of flight record automation is providing clear evidence of the advantages of the software. Comments received through the Automated 759 Help Line (phone #: 205-255-4208) are also helping to identify features of the package that can be enhanced or added in subsequent stages.

A more comprehensive version of the software is already on the drawing board. Features are planned that will accommodate still more of the flight record needs of the units. By next summer, distribution of this expanded version of the software will begin. For this and any other upgrade of the software, the user can rest assured that flight data already in their computer will not have to be reentered.

"We have today an acknowledged military requirement for the war on drugs."

Ultimately, a centralized data base and an Army-wide flight records network are envisioned. We want to establish a network that would give every Army Aviation unit and detachment access to a central computer for data inquiries. Moreover, with all flying hour data neatly stored in a central location, we will be able to conduct timely and cost-effective analyses of flying hour data. This capability will allow us to gain a greater understanding of the components of our flying hour program and their interrelationship with performance and safety.

Conclusions

No one can argue against the requirement for a good flight record keeping program. We all know that it is necessary to track individuals on flight status for pay purposes. More importantly though, commanders must monitor their unit flying hour programs to stay abreast of the readiness and training requirements for their aviation personnel.

For our forces to maintain the competitive edge, it is imperative that the decision maker be able to access the full expanse of such information in the shortest possible time. I believe we have established a solid foundation for a standardized system that will do just that. IIIII

Last call for CY89 AAAA National Awards: Jan. 15, 1990 suspense date set

"Award Presentations"

Up to eight AAAA National Awards for accomplishments made during Calendar Year 1989 will be presented at the 1990 AAAA National Convention in Orlando, FL. The individual AAAA National Awards will be made on Friday; the unit AAAA National Awards will be made on Saturday. Senior members of the U.S. Army will be invited to present the AAAA's top awards on both occasions.

"Outstanding Aviation Unit Award"

Sponsored by the McDonnell Douglas Helicopter Company, this award is presented annually by AAAA "to the Active Army aviation unit that has made an outstanding contribution to or innovation in the employment of Army Aviation over and above the normal mission assigned to the unit during the awards period encompassing the previous calendar year." Any Active Army Aviation unit that has met the foregoing criteria is eligible for consideration.

"ARNG Aviation Unit of the Year Award"

Sponsored by Textron Lycoming, this award is presented annually by the AAAA "to the Army National Guard aviation unit that has made an outstanding contribution to or innovation in the employment of Army Aviation over and above the normal mission assigned to the unit during the awards period encompassing the previous calendar year." Any Army National Guard aviation unit or organization that has met the foregoing criteria is eligible for consideration.

"USAR Aviation Unit of the Year Award"

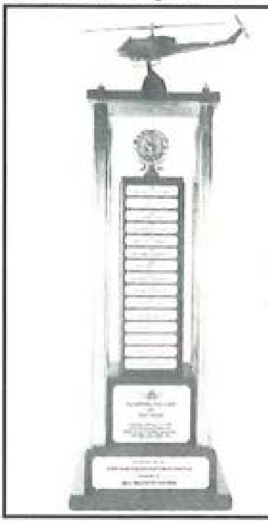
Sponsored by Textron Lycoming, this award is presented annually by the AAAA "to the U.S. Army Reserve aviation unit that has made an outstanding contribution to or innovation in the employment of Army Aviation over and above the normal mission assigned to the unit during the awards period encompassing the previous calendar year." Any U.S. Army Reserve aviation unit or organization that has met the foregoing criteria is eligible for this award.

"The Robert M. Leich Award"

Sponsored by the Grumman Corporation, this award is named in memory of Brigadier General Robert M. Leich, USAR, the AAAA's first president (1957-1959) and its Awards Committee Chairman for 23 years. It is presented periodically to a unit for sustained contributions to Army Aviation, or to a unit or an individual for a unique, one-time outstanding performance.

"Army Aviator of the Year Award"

Sponsored by the Sikorsky Aircraft Division of United Technologies Corporation, this award is presented annually through the AAAA "to the Army Aviator who has made an outstanding individual contribution to Army Aviation during the Awards period encompassing the previous calendar year." Membership in AAAA is not a requirement for consideration. A candidate for this award must be a rated Army Aviator in the Active U.S. Army or Reserve Components, and must have made an outstanding individual achievement.



"Aviation Soldier of the Year Award"

Sponsored by Bell Helicopter Textron, this award is presented annually by AAAA "to the enlisted man serving in an Army Aviation assignment who has made an outstanding individual contribution to Army Aviation during the awards period encompassing the previous calendar year." Membership in AAAA is not a requirement. A candidate for this award must be serving in an Army Aviation assignment in the Active U.S. Army or the Reserve Components, and must have made an outstanding individual achievement.

"James H. McClellan Aviation Safety Award"

Sponsored by General Electric Aircraft Engines in memory of James H. McClellan, a former Army Aviator who was killed in a civil aviation accident in 1958, this award is presented annually to an individual who has made an outstanding individual contribution to Army Aviation safety in the previous calendar year. The award is NOT intended to be given for the accumulation of operational hours without accidents by any aviation unit.

"Outstanding DAC of the Year Award"

Sponsored by the Boeing Helicopter Company, this award is presented annually by AAAA "to the DAC who has made an outstanding individual contribution to Army Aviation in the awards period encompassing the previous CY." Membership in AAAA is not a requirement. A candidate for this award must be a current Department of the Army Civilian.

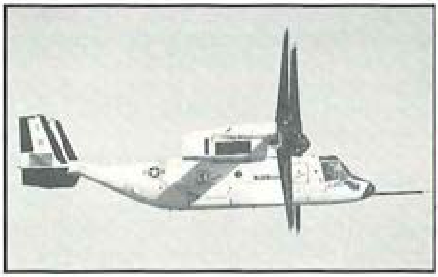
Administrative Details

ACCOMPANYING DATA FOR INDIVIDUAL AWARDS: A standardized **"Nomination Form for Submission of All AAAA National Awards"** is the sole form utilized by the Awards Committee in its selection of annual AAAA National Awards Winners. Copies may be obtained directly from any Chapter Secretary or by writing to AAAA, 49 Richmondville Avenue, Westport, CT 06880-2000. The form should be accompanied by a recent photo and biographical sketch of the nominee. Photos of the commander and the senior NCO must accompany each unit nomination. The **"Nomination Form for Submission of All AAAA National Awards"** and the accompanying photo(s) should be mailed ON OR BEFORE the January 15 suspense date. Please use stiffeners to protect the photo(s) being submitted. While "nomination" material cannot be returned, photos may be returned on request. The receipt of each nomination will be acknowledged by the Awards Committee Chairman.

BRIEFINGS

An **anti-helicopter mine** is to be developed by **Ferranti Instrumentation Ltd.** for the U.S. Army Materiel Command and the Defense Advanced Research Projects Agency (DARPA). The mine, which can be scatterable or hand-laid, will incorporate a passive identification system to distinguish between friendly and enemy helicopters.

The **U.S. Coast Guard** and **U.S. Army** will contract with **LHTEC** (Light Helicopter Turbine Engine Company) to integrate and demonstrate through a flight test, T800 powerplants in a Coast Guard HH-65 helicopter. The flight test program will evaluate the capability of the T800 engine to enhance the HH-65's future readiness, availability, and capability. The 1,200 shp T800 engine has demonstrated fuel economies which make it competitive in the 600-1300 shp range.



The **Bell-Boeing V-22 Osprey** has accomplished full conversion from helicopter mode to airplane mode while in flight. The aircraft flew at an altitude of 6,000 feet while making the transition into the airplane mode. Top speed was held to 155 knots.

AWARDS AND HONORS

The following information is provided by the U.S. Army Aviation Center at Ft. Rucker, AL:

Initial Entry Rotary Wing Aviator Course Class 89-1 UH-1 Track (07/07/89): WO Arthur D. Barnard, Distinguished Graduate; WOs Brian C. Wilson, Edward E. Loscar, and William O. Fountain, Honor Graduates.

Initial Entry Rotary Wing Aviator Course Class 89-1 OH-58 Track (07/07/89): 2LT Mark O. Gackle, Distinguished Graduate; 2LT Richard K. Jardine, Honor Graduate.

Initial Entry Rotary Wing Aviator Course Class 89-1 OH-58 Track (07/07/89): WO Michael W. Tucker, Dist. Graduate.

Initial Entry Rotary Wing Aviator Course Class 88-24 UH-60 Track (07/07/89): 2LT James R. Schenck, Distinguished Graduate.

Initial Entry Rotary Wing Aviator Course Class 88-23 AH-1 Track (07/07/89): 2LT Mark D. Morelli, Distinguished Graduate; 2LT Patrick D. Marburger, Honor Graduate.

Initial Entry Rotary Wing Aviator Course Class 88-23 AH-1 Track (07/07/89): WO Robert Gonnella, Jr., Distinguished Graduate; WO Mitchell S. Kilby, Honor Graduate.

Initial Entry Rotary Wing Aviator Course Class 89-2 UH-1 Track (07/21/89): 2LT Garth Conner, Dist. Graduate; 2LTs Lawrence M. Iwanski and Judith R. Kress, Honor Grads.

Initial Entry Rotary Wing Aviator Course Class 89-2 UH-1 Track (07/21/89): WO Stephen D. Middaugh, Distinguished Graduate; WOs Jeffrey A. Marler and George E. Searles, Honor Graduates.

Initial Entry Rotary Wing Aviator Course Class 89-2 OH-58 Track (07/21/89): 2LT Keith E. Olson, Distinguished Graduate; 2LTs William K. Gayler and James H. Bradley, Jr., Honor Graduates.

Initial Entry Rotary Wing Aviator Course Class 89-2 OH-58 Track (07/21/89): WO Jerry N. Blackwell, Distinguished Graduate.

Initial Entry Rotary Wing Aviator Course Class 89-1 UH-60 Track (07/21/89): 2LT James D. Hutton, Dist. Graduate.

Initial Entry Rotary Wing Aviator Course Class 89-1 UH-60 Track (07/21/89): WO Damon E. Bostick, Dist. Graduate.

Initial Entry Rotary Wing Aviator Course Class 88-24 AH-1 Track (07/21/89): 2LT Kevin P. Klutz, Dist. Graduate.

Initial Entry Rotary Wing Aviator Course Class 88-24 AH-1 Track (07/21/89): WO Robert J. Augugliaro, Dist. Graduate.

Master Warrant Officer Training Course Class 89-2 (07/25/89): MWO Michael A. Brickner, Class Leader.

Air Traffic Control Operator Advanced NCO Course Class 89-2 (07/28/89): SSG Lori A. Nieman, Dist. Graduate.

Flight Opns Coordinator Advanced NCO Course Class 89-3 (07/28/89): SFC Zenon Cardenas, Jr., Dist. Graduate.

Avionics Equip. Maintenance Supervisor Advanced NCO Course Class 89-3 (07/28/89): SSG William Rodriguez, Distinguished Graduate.

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HHC 17TH AVIATION BDE
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2706 CHAMELEON DRIVE
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DESPRES, BRENDON J.
413 RAMONA DRIVE
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FREEBORN, VINCENT L.
298 DIXIE DRIVE
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BLANK, JOHN J. JR.
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SMITH, CHRISTOPHER
2461-B PALMER LANE
FORT LEWIS, WA 98433
SPEAL, JOSEPH F.
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107 BRIAN COURT
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WO1 Todd A. Weiler
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CPT Kyle D. Campbell
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CPT Ronald L. Landers
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2LT David K. Payne
SGT Victor G. Richter
1LT Gary W. Shulenberger
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2LT Brian K. Sperling
2LT Charles K. Tanner
2LT Timothy T. Thompson
2LT Norman M. Wade
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CW3 H. Terry Mart

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CDT Scott A. Harmon
CDT Robert K. Meek
CDT James W. Montgomery, II

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COL Philip W. Handley
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WO1 Gary E. Miller
1SG Frank J. Mitchell
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2LT Ledley L. Yaussy
1LT Hong S. You

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SSG Mickey E. Mittag
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SFC Leroy A. Phelps
SSG Homero Reyes
MSG Walter D. Smith
1SG Howard Soileau
SFC Dumrong Tonkphontong
SFC Fred C. Von Gortler
SFC Michael L. Ward
SSG Lawrence F. Werline
SSG Jonathan P. Young

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CPT Arnold B. Coley
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CPT James E. Hinnant
1LT Keith J. Lafrance
CW2 Carl R. Martin
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1LT Gary R. Mcmeen
CPT Stephen D. Montgomery
SSG Craig H. Rinde
2LT John D. Savage

GR. CHICAGO AREA CHAP.
CHICAGO, IL

SGT Scott J. Breslin
SSG Earl-nelson L. Guir
WO1 David W. Johnson
CW2 Donn R. Proven
Mr. Timothy G. Quinn
CW4 William P. Rosenthal
Mr. Armando Tobar
CW4 Lenny Van Dorp
1LT William W. Whitecotton

HANAU CHAPTER
GERMANY

1LT Todd L. Smith
SPC Arnold T. Turner

LINDBERGH CHAPTER
ST. LOUIS, MO

Mr. David J. Allton
Mr. H. Mike Benefield
Mr. Barry N. Corona
CW4 James F. Cronin, Ret.
Ms. Nancy L. Faller
Mr. Alan D. Gibson
Mr. Michael E. Henricks
Ms. Candace L. Holcomb
Ms. Cindy A. Hustedde
Mr. Stanley J. Isbell
Mr. Rodolfo Lopez
CW4 James E. Minninger
Mr. Kirk S. Pinson
Mr. Glen F. Rizzie
Mr. Kenneth D. Sampson
MAJ Craig G. Searfoss
CPT Vitello N. Silva
Mr. Willie A. Travis, Jr.
Mr. Gerald Ward

MONMOUTH CHAPTER
FORT MONMOUTH, NJ

Mr. Richard D. Brady
Mr. Clifton E. Newsom
Mr. Allen R. Ponsini

MAINZ CHAPTER
MAINZ, GERMANY

WO1 Phillip S. McCoy

MONTEREY BAY CHAPTER
FORT ORD, CA

CPT Phillip A. Merritt
CPT Thomas O. Moneymaker

MORNING CALM CHAPTER
SEOUL, KOREA

LTC James E. Clay, Ret.
CW2 Michael A. Greenwood

MOUNT RAINIER CHAPTER
FORT LEWIS, WA

PV2 Clay Hockman
CPT Calvin J. Owens

NORTH COUNTRY CHAPTER
FORT DRUM, NY

CPT Daniel J. Shanahan

NORTH TEXAS CHAPTER
DALLAS/FORT WORTH

Mr. Tim V. Bogard
Mr. John J. Buehrle
Mr. George L. Cefoldo
Mr. Cal Coolidge
Mr. Jay Corry
Dr. Jerry E. Crain
Mr. Lloyd C. Cregor
Mr. Trent Edmondson
Mr. Harry Elledge
Mr. Jim G. Gentry
Mr. Ted C. Hall
Mr. Ford Hawkins
Mr. Don A. Hill
Mr. Thomas E. Kilgo
LTC Harry M. Mack
Mr. Ulli R. Munroe
Mr. David Nickleberry
Mr. Raul Perez
Mr. Ralph H. Snow
Mr. David P. Spencer
Mr. David O. Turner

NORTHERN LIGHTS CHAPTER
FT WAINWRIGHT/F'BANKS AK

SGT Robert E. Stout

OLD IRONSIDES CHAPTER
ANSBACH, GERMANY

1LT Kenneth J. Biland
SPC Sean P. Collins
CPT Jeffrey A. Crabb
WO1 Jeffrey J. Fitzgerald
1LT Leonard A. Kortekaas
1LT Darryl L. Long
1LT John D. Murphy
CW2 John P. Sondag
BG Wesley B. Taylor, Jr.

PHANTOM CORPS CHAPTER
FORT HOOD, TX

SPC Carl J. Benton
SSG Donald D. Bowles
SSG Dougals W. Campbell
CSM Wesley Campbell, Jr.
SGT Gerald P. Carpenello
CSM Peter L. Cloutier
SPC Richard J. Dalrymple
SSG Arlene M. Graham
SPC Jeffrey L. Haney
PFC Timothy P. Herkenhoff
1SG(P) Stacy L. Hunt
CW2 Paul D. Hutchinson
SGT Edward James
1LT James E. Larsen
WO1 David M. Metz
SFC William Grady Mitchell
1LT Mark A. Moser
MAJ Kent S. Nabarrete
MSG Joseph L. Pattberg

CPT Michael D. Shepherd
WO1 David W. Smith
SPC Duane E. Smith
CW2 Michael E. Smith
SPC Brett A. Stewart
CPT Mark E. Swanson
SSG William A. Tartaglia
CW2 James S. Tolman
CW2 Frank C. Vincent
PV2 James E. Voisin
Ms. Eva J. Walker
SFC Paul Whittle, Ret.

PIKES PEAK CHAPTER
FORT CARSON, CO

MAJ John E. Redfearn, III

RHINE VALLEY CHAPTER
GERMANY

SGT Roger A. Roussell

SCHWAEBISCH HALL CHAPTER
GERMANY

SGT Matthew S. Chamberlin

SO. CALIFORNIA CHAPTER
LOS ANGELES, CA

Mr. David K. Dratwa
Mr. Mel Gee
CPT Michael R. Myers
Mr. John D. Ryan
MAJ Thomas C. Wallace

STUTTGART CHAPTER
STUTTGART, GERMANY

CPT James C. Cook

TAUNUS CHAPTER
GERMANY

CW4 Louie Guerrero Davila
CPT Rodney E. Godemann

THUNDERHORSE CHAPTER
FULDA, GERMANY

CW3 Wayne L. Alford
2LT James A. Moffatt

WASHINGTON DC CHAPTER
WASHINGTON, DC

MSG Matthew H. Dailey, Ret.
Mr. David L. Laird
1LT Bruce V. Sones

WINGS OF THE DEVIL CHAP.
FORT POLK, LA

Mr. Rudy Park

WINGS OF THE MARNE CHAP.
GERMANY

LTC Albert E. Bryant
SGT Daniel G. Ramsey

MEMBERS WITHOUT
CHAPTER AFFILIATION

LTC Milton Baugh
SGT Scott A. Bell
2LT Charles T. Brown, III
1LT Mark J. Collins
MSG David I. Cowan
2LT Christopher J. Dziubek
SP4 Paul J. Gracia
Mr. H. Mark Grove
CW3 Ralph M. Hardy, Jr.
Mr. James E. Holcomb
CPT Calvin G. Kelly, III
Mr. Joseph A. Micali
SPC Michael D. Morgan
Dr. Stephen B. O'brien
1LT Jonathan T. Reinebold
CW2 Leland W. Swanson
Mr. Frank Verbeke
CW4 Dan P. Welberg

AVCRAD
(continued from page 48)

• Provide Aviation Material Classification Capability at ERF's and RSA (K-Town)

• Operate an Aviation Log Air Support Program with a C-23 Sherpa.

The conceptual objective of an OCONUS AVCRAD was to establish a depot level warm base, recognizing this would require up front resourcing for the facility, TDA/CTA equipment, special tools and bench/shop stock. No appreciable return on the investment was expected until mobilization. The success of the European AVCRAD in executing the aforementioned missions clearly demonstrates a cost benefit that can be accrued through warm basing. AVSCOM and the Theatre have realized a significant peacetime capability as an adjunct to preparation for the mobilization mission. The European AVCRAD is performing as a highly responsive and cost effective special repair activity in support of the total Army Aviation maintenance program. IIIII

The Mission
(continued from page 17)

guns and sequentially engages the HINDS. The cavalry crew's relief reports *"on station."* The new cavalry crew requests a situation report. The pilot transmits an updated tactical display to the new air mission commander and returns to the FARP.

During the dash to the rear, the copilot runs a diagnostic check on their LHX. He reports to the pilot that the aircraft is damaged, but that there is no apparent degradation of the mission equipment. The pilot decides to return to the forward assembly area instead of to the FARP.

The troop commander orders the LHX crew to proceed to decontamination point prior to going to the forward assembly area. Upon arrival at the decontamination point, the LHX and crew move through the stations with ease. The overpressure system for the crew and other compartments on the aircraft did its job. With their aircraft decontaminated, the crew unmasks and continues to the forward assembly area.

Home again

At the forward assembly area, the pilot starts the APU and shuts down the engines. Three men reload and refuel the aircraft in 15 minutes. The crewchief plugs in a hand-held troubleshooting computer. Reading the display, he finds he needs two common modules for the right bay mission computer. The crewchief changes these modules as a mechanic pulls the maintenance DTD and the tactical DTD to give to the operations officer and the maintenance officer for the post mission debrief. The mechanic hands another two DTDs to the crew, and with a smile says *"Kick the pants off of that bear."* IIIII

CAREER TRACK

Active AAAA members may have a 30-word classified employment ad published in two consecutive issues of ARMY AVIATION MAGAZINE free of charge. Write to the AAAA National Office, 49 Richmondville Avenue, Westport, CT 06880-2000, or call (203) 226-8184 for Career Track applications. Inquiring organizations, please contact the National Office.

Captain, USMA 1981, BSME, seeks R & D program management/engineer position with Defense Industry. Three years experience Aviation R & D Staff Officer, Combat Developments/Test & Evaluation section and Platoon leader, Operations Officer, available February 1990. 11-01

CHAMPUS SUPPLEMENT AVAILABLE TO AAAA MEMBERS

CommandCare, the superior CHAMPUS health supplement, is now available to members of the Army Aviation Association of America. As a member of AAAA, you may now apply for CommandCare — the CHAMPUS supplement that offers 100% coverage to retired military personnel and their dependents, as well as to the dependents of active duty personnel. It will be administered by Membership Services, Inc., 1304 Vincent Place, McLean, VA 22101, a company specializing in providing services to leading associations.

To receive more details about this new benefit to AAAA members, simply call Membership Services toll free 1-800-234-1304 (or, in the Washington, D.C. metro area, at 821-0555) and ask for CommandCare information.

Army Aviation Hall of Fame Selection Criteria changed

The AAAA National Executive Board recently enacted changes in the criteria for nomination to the Army Aviation Hall of Fame.

The old criteria stated that the nominee had to have "made an outstanding contribution over an extended period".

The new criteria states that the nominee shall have "made an outstanding performance or contributions to Army Aviation over an extended period, **or** made a doctrinal or technical contribution, **or** made an innovation with an identifiable impact on Army Aviation, **or** whose efforts were an inspiration to others, **or** any combination of the foregoing."

The Board also voted to remove the limitation that active military personnel are ineligible for nomination or selection and must be retired to be eligible for nomination, with the exception that active Colonels and Generals will still be ineligible.

The Board also opened the voting on Hall of Fame candidates from all AAAA members who have been members for **seven** years or more to all AAAA members who have been members for **two** or more years.

The Hall of Fame Trustees emphasized that they were especially desirous of receiving nominations of persons in the enlisted, DAC and warrant officer ranks. Members are encouraged to submit Hall of Fame nominations to the AAAA National Office, 49 Richmondville Avenue, Westport, CT 06880 now, even though the nomination process will take place in 1991 for induction in April 1992.

WESTPORT, CT — On Saturday, October 14, 1989, the staff members of the AAAA National Office had the honor of attending the wedding of William R. Harris and Nancy Jo Childs. Mr. Harris is the Editor of ARMY AVIATION, while Mrs. Harris serves as a Circulation Assistant for the magazine. The staff of the National Office would like to extend heartfelt congratulations and best wishes for a future filled with much happiness! Bill and Nancy Jo are pictured above, leaving the reception to prepare for their honeymoon trip to Paris, France.

AVIATION OFFICER HI-TIMERS

(Due to a computer error, the Aviation-Officer Directory published in July, 1989, incorrectly listed the flight times of the 'High-Timers'. The corrections listed below are as of 15 October 1989.)

CPT (P) Paul T. Keil	6,900
CPT Darrell P. Allman	6,500
CPT (P) R. J. Callahan	5,500
CPT Andrew L. Neill	5,300
1LT Jack T. Ogle	5,000
CPT (P) Frank H. Zahrt	5,000
CPT (P) Chris A. Acker	4,900
CPT (P) Neal E. Lang	4,800
CPT Michael E. Hassel	4,500
CPT Michael E. White	4,500
CPT (P) J. W. McKnight, Jr.	4,050
CPT Kiell Martinsen	4,000
CPT (P) Wilfred F. Brown	3,975
CPT (P) Michael N. Lehman	3,900
CPT (P) E. W. Reaves, IV	3,900
CPT Michael A. Fant	3,800
CPT Cortney J. Stratman	3,800
CPT Alvin A. Abejon	3,500
CPT (P) Michael O. Grant	3,500
CPT Timothy C. Hartnett	3,315
CPT Michael J. Hartman	3,250
CPT David K. Parker	3,250
CPT Kenneth S. Jones	3,200
CPT Timothy P. Souder	3,000
CPT Glenn T. Tetreault	3,000
CPT Samuel E. Blake, Jr.	2,900
CPT Ronald E. Wilson	2,900
CPT Benjamin F. Adams, III	2,700
CPT Bradley G. Peterson	2,700
CPT Thomas J. Kee	2,604
CPT Michael G. Evans	2,556
CPT David B. Cripps	2,500
CPT (P) Mark A. Grablin	2,500
CPT William D. Harrell	2,300
CPT Nancy J. Sherlock	2,300
1LT Michael P. Slattery	2,300
CPT John W. Sovine, Jr.	2,300
2LT Ken W. Collins	2,200
CPT Patrick Harp	2,200
CPT Mark E. Larrabee	2,200
CPT Craig P. McCurdy	2,200
CPT John E. Valentine	2,200
CPT Randy C. Nelson	2,100
CPT (P) Philip M. Smith	2,100
CPT Robert S. Saunders	2,040
CPT Stephen Saflin	2,010
CPT (P) Paul L. Barnard	2,000
CPT Bryan E. Campbell	2,000
CPT George V. Dimitrov	2,000
CPT Thorwald E. Eide	2,000
CPT (P) David L. Lawrence	2,000
CPT Michael A. Lozano	2,000
CPT Harlow W. Norvell	2,000
CPT Mark A. Smith	2,000
CPT David F. Swafford	2,000

Chapter News

ARMY AVIATION CENTER CHAPTER, FT. RUCKER, AL — To culminate the summer program, SPC Randall L. Kirks and SGT Van T. Ezell, received Aviation Center Soldier and NCO of the year honors, respectively. Also during the summer the Chapter held a BBQ picnic and 5K run, hosted by 1-10 Aviation; and a marathon softball tournament hosted by the 1-11th Aviation, which featured 15 teams playing 21 hours of continuous softball, until one winning team remained! Capping the summer program was a golf tournament.

CHESAPEAKE BAY CHAPTER, FT. MEADE, MD — On 15 July 1989, members attended the dedication of the Edgewood Army National Guard Armory, which will house all aviation units in Maryland. The Chesapeake Bay Chapter dedicated a picnic table with a brass plaque (shown above with Ann Marie Thomas, VP Membership), for use by the aviators housed in the Armory.

GREATER CHICAGO AREA CHAPTER, CHICAGO, IL — The Chapter convened a general membership meeting at the O'Hare Officer's Club, after a program presented by Mr. Armand L. Coppe, President, Litton Precision Gear Company. Members viewed tapes of current Army aircraft utilizing gears produced by Litton in Chicago, and about new capabilities of the LHX. The program for the next meeting will be presented by Rockwell Inc., and will cover the use of lasers in Army aircraft.

HANAU CHAPTER, GERMANY — On 7 September 1989, a luncheon and professional development meeting was held at the Hanau Officer's Club. COL David H. Hicks, Chapter President, recognized CWO Wilson and 1LT Acton as the Division Top Gun winners.

OLD IRONSIDES CHAPTER, ANSBACH, GERMANY — A General Membership meeting was held in conjunction with the 1-1 Cavalry Country Western Barbeque on 25 August 1989. The main purpose of the event was to gain new members and welcome the newly arrived members of the 3-1 Aviation. Over 500 people attended the dinner, while another 350 came for the dancing portion with entertainment provided by the Montana Band and several Clogger and Square Dance Groups from the local area.

CORRECTION

In the August-September issue, the newly established CW3 Stephen A. Hansen Scholarship was incorrectly listed as the CW3 Stephen E. Hansen Scholarship.

New AAAA Officers

Janice E. Wolfe, (Treas.), **Arizona Chapter.**

LTC Paul M. Severance, (Senior VP), **CPT Lesli L. DeVeau,** (Secretary), **1LT Todd L. Smith,** (Treas.), **CSM John J. Beck,** (VP Enlisted Affairs), **Hanau Chapter.**

MAJ Thomas L. Schatte, (Secretary), **CW2 William S. Nagle,** (Treas.), **Monterey Bay Chapter.**

Honorary Members

The following person has been selected by his respective Chapter as an Honorary Member. He will receive a complimentary one year membership, citation in these pages, and a "Certificate of Honorary Membership."

OLD IRONSIDES CHAPTER

BG Wesley B. Taylor, Jr., Assistant Division Commander (N), 1st Armored Division.

Aviation Soldiers of the Month

SSG Douglas N. Addington, Colonial Virginia Chapter (July)

SSG Homero Reyes, Colonial Virginia Chapter (August)

SSG Lawrence F. Werline, Colonial Virginia Chapter (Sept.)

Aces

The following members have been declared Aces in recognition of their signing up of five new members each.

MAJ Rodney A. Adams, Ret.
LTC George S. Eyster
Joann Henderson
Juri Koern
Mark A. McCormick
E7 Larry W. Mitchell
CW2 Lawrence L. Smith
MAJ Joe Weatherly

Top Chapters

The September 30 Membership Enrollment Competition standings have the following chapters ahead with three months left in the CY89 contest ending December 31. The rankings are based on **CY89 net membership gain.**

Master Chapters
(231 or more members)

Rank		Net gain
1	Army Aviation Center	532
2	Washington DC	134
3	Phantom Corps	99
4	Arizona	44
5	North Texas	25
6	Corpus Christi	2

(The otner Master Chapters show a current net loss during January-September period.)

Senior Chapters
(115-230 members)

Rank		Net gain
1	Greater-Atlanta	43
2	Fort Bragg	41
3	Chesapeake Bay	27
4	Coastal Empire	21
5	Wings of the Marne	9
6	Stuttgart	7
7	Delaware Valley	2

(The other Senior Chapters show a current net loss during January-September period.)

AAAA Chapters
(25-114 members)

Rank		Net gain
1	Wings of the Devil	41
2	Pike's Peak	35
3	Mid-America	24
4	Citadel	20
5	Tennessee Valley	20
6	Indiantown Gap	18
7	Cedar Rapids	10
8	Benelux	4
9	Northern Lights	4

(The other AAAA Chapters show a current net loss during January-September period).

The year-end membership totals of each of AAAA's 53 chapters for CY89 contest will appear in Jan. 31 issue.

The AAAA Joseph P. Cribbins Product Support Symposium

The AAAA's Lindbergh Chapter's annual Joseph P. Cribbins Product Support Symposium will be held in St. Louis on February 14-16, 1990. The symposium will continue to emphasize readiness and support of the U.S. Army aircraft fleet. LTG John M. Loh, USAF, Commander of the Aeronautical Systems Division, U.S. Air Force Systems Command, will kick off the symposium as the Keynote DoD speaker. He will be followed by Mr. Bryan H. Rowe, Vice President, General Electric Engine Group as the Keynoter for Industry. Awards to industry for support of the Army's fleet of aircraft and to the Army's Outstanding Aviation Logistics Support Unit will be made at a luncheon on February 15, with Mr. Don Fuqua, President, Aerospace Industries Association, as the speaker. A panel composed of both industry and DoD personnel is planned for February 16, where Product Support issues and solutions will be presented.

New Scholarship Banquet

The evening banquet on February 15 is a new appproach for 1990. The Lindbergh Chapter in the past has contributed proceeds from the symposium to the AAAA Scholarship Foundation and will continue to do so in 1990. To put added emphasis on AAAA Scholarships, a banquet for the benefit of the AAAA Scholarship Foundation is scheduled. Since the inception of the program in 1963, the AAAA Scholarship Foundation has provided over $285,000 to more than 360 qualified applicants.

CASL Workshop

The 1990 AVSCOM Competition Advocate Shopping List (CASL) Workshops and Parts Symposium will precede the AAAA Product Support Symposium at the Stouffer's Concourse Hotel in St. Louis. There will be an opportunity to obtain information about AVSCOM's CASL Program, Technical Data Packages, Overhaul, Source Approval Requests and many related subjects. Approximately 300 aviation parts will be on display for review.

The CASL Workshops and Parts Symposium will commence at 7:00 am, February 13, 1990 and conclude at 4:00 pm, February 14, 1990. AAAA Product Support Symposium attendees are encouraged to attend. For more information, please call Roger Boeckman at (314) 263-1712 or Judy McCullough at (314) 263-1046.

WEDNESDAY, FEBRUARY 14, 1990

1600-2000	Registration and Ticket Sales
1800-2000	Early Birds Reception

THURSDAY, FEBRUARY 15, 1990

Morning Session

0730-1600	Registration
0830-0915	Keynote Address By Senior DoD Official
0915-0945	Keynote Address by Senior Industry Official
0945-1030	Army Aviation Modernization Plan Update
1030-1115	PEO/PM Business Opportunities
1115-1330	Lunch and Awards Presentation

Afternoon Session

1330-1415	Readiness/Product Support from an AVSCOM Perspective
1415-1500	AVSCOM Business Opportunities
1500-1530	Contractor Performance
1530-1630	Panel Presentation by Thursday Speakers

Evening Session

1800-1930	Reception
1930-2100	AAAA Scholarship Banquet

FRIDAY, FEBRUARY 16, 1990

0700-0800	Continental Breakfast
0800-1000	Government and Industry Product Support Panel
1000-1030	New Procurement Law
1030-1100	LHX Update
1100-1145	Panel Presentation by Friday Speakers
1145-1200	Closing Remarks

1990 AAAA Joseph P. Cribbins Annual Product Support Symposium Advance Registration Form

STOUFFER CONCOURSE HOTEL — ST. LOUIS, MO — FEBRUARY 14-16, 1990

SPONSORED BY THE LINDBERGH CHAPTER OF THE ARMY AVIATION ASSOCIATION

I plan to attend the 1990 AAAA PRODUCT SUPPORT SYMPOSIUM. **Advance Registration Deadline Wednesday, January 31, 1990.** Government fees apply only to Active Army, DAC Personnel, Reserve Component and Retired AAAA members who are not in current employ of Defense Contractors or Suppliers on a full-time, part-time or consulting basis. **PRINT OR TYPE ALL INFORMATION.**

FULL NAME ______________________

RANK/TITLE ______________________

UNIT/FIRM NAME ______________________

UNIT/FIRM ADDRESS ______________________

CITY ______________ STATE ________ ZIP CODE ________

OFFICE PHONE # (   ) ______________ NICKNAME FOR BADGE ______________

	GOV'T FEES	INDUSTRY FEES	ITEM TOTAL
REGISTRATION FEE	☐ $10	☐ $175	$______
MEMBERSHIP FEE (NON-AAAA MEMBERS)	☐ $15	☐ $15	$______
LUNCHEON TICKET (Thursday, February 15)	☐ $10		$______
AAAA SCHOLARSHIP BANQUET TICKET (Thursday, February 15)	☐ $20		$______
COPY OF PROCEEDINGS	☐ $10		$______

CIRCLE METHOD OF PAYMENT: Cash Personal Check Business Check Total: $______

MAKE CHECK PAYABLE TO: AAAA PRODUCT SUPPORT SYMPOSIUM

Must be a member of Army Aviation Association of America, Inc. to attend AAAA PRODUCT SUPPORT SYMPOSIUM. If Non-AAAA member, $15 membership fee applied to one year's membership in AAAA. Industry Registration Fee includes one Luncheon ticket, Banquet ticket and copy of proceedings. Government Registration fee does not include Luncheon ticket, Banquet ticket or copy of proceedings. Must be purchased separately. Spouses must purchase individual tickets for Luncheon and/or Banquet. This form & fees listed do not cover the CASL Workshop 13-14 February 1990.

HOTEL RESERVATIONS

Must make your own hotel reservations **NLT JANUARY 31, 1990** at **STOUFFER CONCOURSE HOTEL,** 9801 Natural Bridge Road, St. Louis, Missouri 63134. Phone: 1-800-468-3571 or 314 429-1100. To receive reduced rates, identify that you are attending AAAA Product Support Symposium.

MAILING INSTRUCTIONS

Mail this Advance Registration Form to: Susan Werkmeister, 500 Northwest Plaza, Suite 813, St. Ann, MO 63074. Phone: 314 298-2786. **ADVANCE REGISTRATION DEADLINE: JANUARY 31, 1990.**

AAAA Calendar

A listing of recent past AAAA Chapter Events and upcoming National dates

October, 1989

■ ■ **Oct. 13.** Monmouth Chapter. Combined Professional Association Luncheon Meeting. Gibbs Hall, Ft. Monmouth. Guest Speaker: MG Billy M. Thomas.

■ ■ **Oct. 14.** Lindbergh Chapter. President's Dinner Dance. Park Terrace Hilton (At Airport).

■ ■ **Oct. 17.** Ft. Leavenworth Chapter. Professional-Social Meeting. Ft. Leavenworth Officer's Club, Hearth Room. Guest Speaker: LTC(P) Mike Dallas.

■ ■ **Oct. 20.** Connecticut Chapter. Professional Dinner Meeting and Welcome for BG(P) Dave Robinson and Wife. Pinecrest Country Club, The Greenery, Shelton. Guest Speaker: BG(P) Robinson.

■ ■ **Oct. 27.** Checkpoint Charlie Chapter. General Membership Meeting. Templehof Air Base, Hanger #3, Avn Det BBDE Classroom. Guest Speaker: MAJ Douglas Powell.

■ ■ **Oct. 27-29.** Lindbergh Chapter. Get-Away Weekend. Breckenridge on the Lake, Osage Beach, MO. Lake Road 54-30A.

■ ■ **Oct. 28.** Air Assault Chapter. AAAA 10km Road Race. Clarksville Base Recreation Center.

■ ■ **Oct. 30.** Ft. Bragg Chapter. Professional Luncheon Meeting & Officer Elections. Ft. Bragg Officer's Club, Lafayette Room. Guest Speaker: COL Billy J. Miller.

November, 1989

■ ■ **Nov. 1.** Lindbergh Chapter. Professional Social Meeting. Duffy's at Henry VIII, Lindbergh Boulevard & Interstate 70.

■ ■ **Nov. 7-8.** 7th Annual AAAA Aircraft Survivability Equipment (ASE) Symposium, Tracor Aerospace, Austin, TX. Contact Nat'l Office. (203) 226-8184.

■ ■ **Nov. 7.** AAAA ASE Award Presentation, Marriot at the Capitol, Austin, TX.

■ ■ **Nov. 28-30.** AAAA USAREUR Region Annual Convention & Exhibit/Display, Der Sauerland Stein Hotel, Willingen, Hochsauerland, West Germany.

December, 1989

■ ■ **Dec. 7.** AAAA Aviation Trainer of the Year Award Presentation & AAAA ROTC Award Presentation, Fort Rucker, AL.

■ ■ **Dec. 8.** AAAA NEB Meeting, Fort Rucker, AL.

February, 1990

■ ■ **Feb. 3.** AAAA National Awards Committee Meeting to select CY89 National Award Winners.

■ ■ **Feb. 14-16.** 16th Annual Joseph P. Cribbins Product Support Symposium sponsored by the AAAA Lindbergh Chapter. Stouffer Concourse Hotel, St. Louis, MO.

■ ■ **Feb. 15.** AAAA Outstanding Aviation Logistics Support Unit of the Year Award Presentation & AAAA Industry Award Presentations, Stouffer Concourse Hotel, St. Louis, MO.

■ ■ **Feb 15.** 1st Annual AAAA Scholarship Found'n Banquet, Stouffer Concourse Hotel, St. Louis, MO.

April, 1990

■ ■ **April 11-15.** AAAA Annual Convention, Orange County Convention Center, Orlando, Florida.

■ ■ **April 11.** AAAA NEB Meeting, Orange County Convention Center, Orlando, FL.

July, 1990

■ ■ **July 14.** AAAA National Awards Committee Meeting to select CY90 National Scholarship Award Winners.

September, 1990

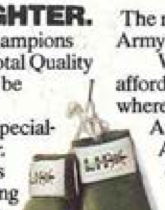
■ ■ **Sept. 11-13.** AAAA Army Aviation Electronics Symposium. Sponsored by the Monmouth Chapter of AAAA. Berkeley Carteret Hotel, Asbury Park, NJ.

TQM: MANAGING THE CHAMP

LHX. THE ARMY'S NEW FIGHTER.

From the beginning, it's had the stuff champions are made of. A product of the SuperTeam's Total Quality Management (TQM) system, this LHX will be built right.

Working at a single site, our SuperTeam specialists are responding to the voice of the soldier. With concurrent engineering—simultaneous product and process design—we're developing a producible, supportable, high-performance aircraft. Experts in engineering, manufacturing, MANPRINT, design-to-cost, training and supportability are working as a team to prepare this fighter for the championship.



The result: an aircraft that will deliver precisely what Army pilots, commanders and maintainers need.

With SuperTeam TQM, we're creating an effective, affordable combat weapon system with *no equal* anywhere in the world. A system which will meet the Army's goals for weight, flyaway *and* lifecycle costs. A winner that will provide our nation with the decisive edge—from the opening round to the final bell.

LHX
MCDONNELL DOUGLAS
SUPERTEAM
BELL HELICOPTER TEXTRON

WE PUT THE FIGHT INTO LHX.