ARMY AVIATION

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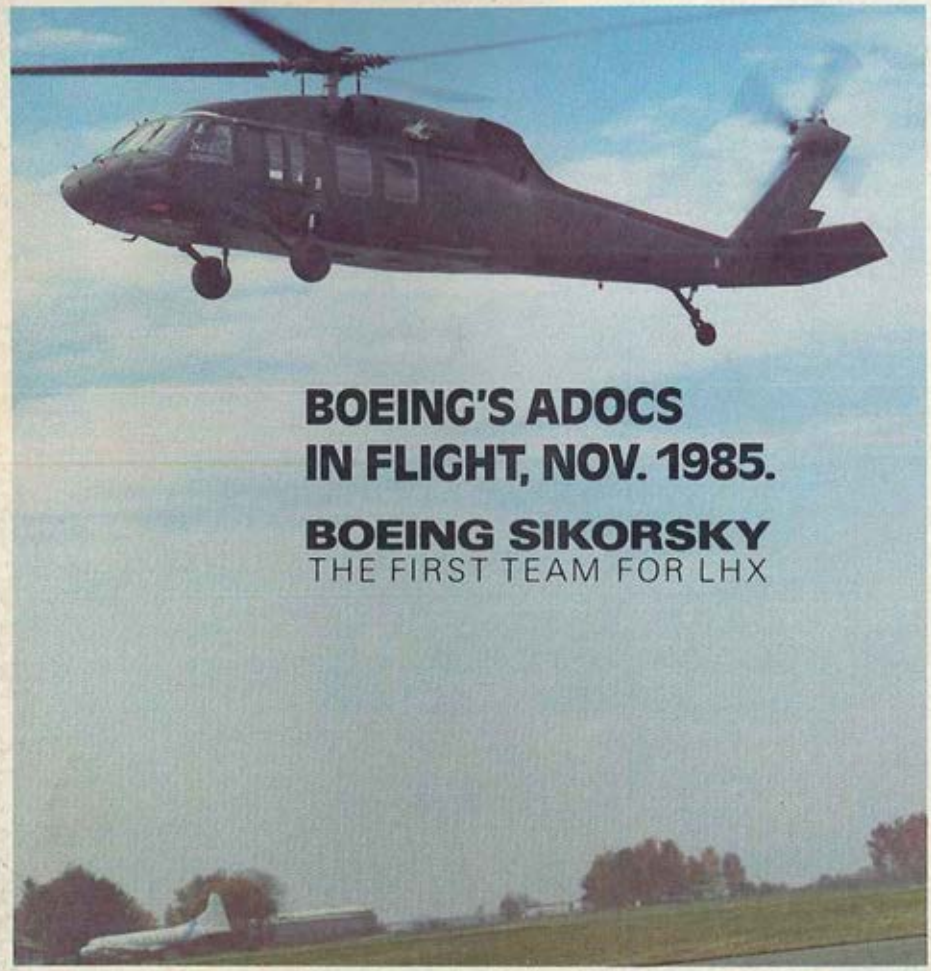

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FORTHCOMING ISSUES
February 28, 1986—Full 1986 AAAA National Convention Programming Details and the announcement of the 1985 National Award Winners.

March-April 1986—A combined issue that serves as the Program for the April, 1986 AAAA National Convention in Atlanta.

May 31, 1986—A General News Issue featuring a Post-Convention Report on the 1986 AAAA National Convention.

FRONT COVER
The Boeing-Sikorsky Advanced Digital Optical Flight Control System (ADOCS).

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Army Aviation

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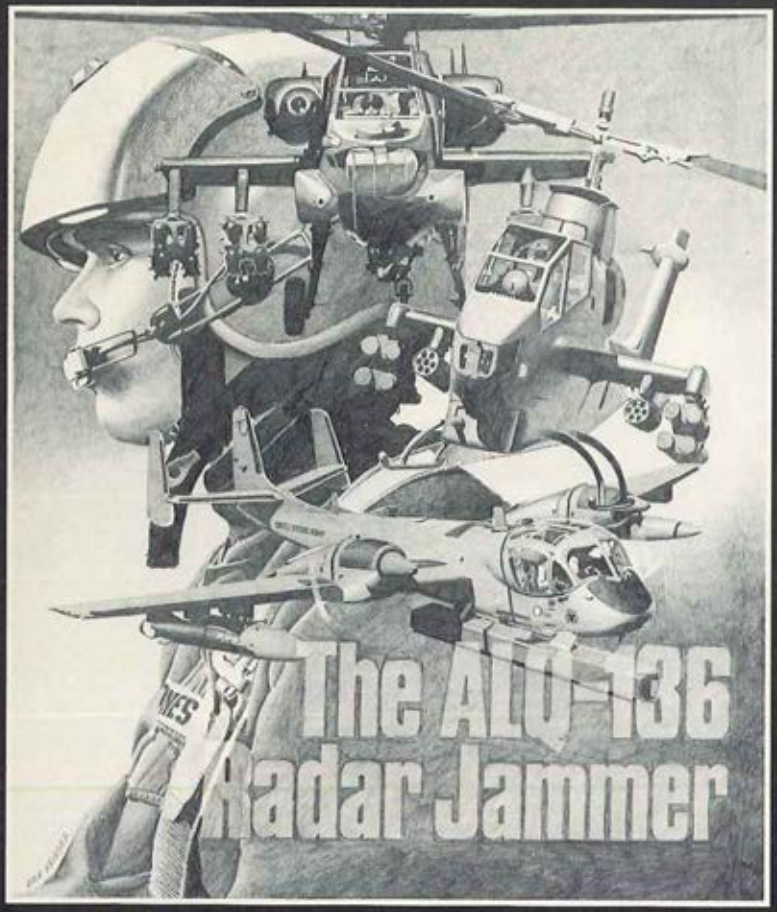

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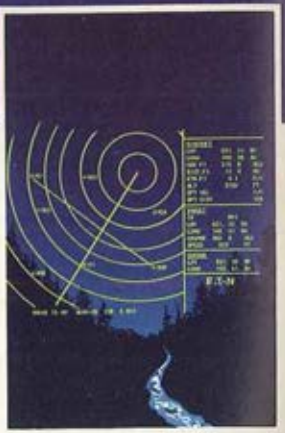

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1986 AAAA National Scholarship Award Winners

The 1986 AAAA National Scholarship—$8,000 ($2,000 a year for four years) Mary G. Herrick, daughter of COL Curtis L. Herrick, Chesterfield, MO. (AAAA Interviewer: COL Wayne W. Wright).

Robert M. Leich Memorial Scholarship—$4,000 ($1,000 year for four years) Rebecca L. Drake, daughter of LTC Van T. Drake, Alamogordo, NM (2nd Teacher's Report utilized)

O. Glenn Goodhand Memorial Scholarship—$4,000 ($1,000 year for four years) Lisa M. Knudson, daughter of BG Wayne Knudson, Annandale, VA (AAAA Interviewer: MG Francis J. Toner)

Joseph E. McDonald Memorial Scholarship—$4,000 ($1,000 year for four years) Richard A. Erich, son of Richard W. Erich, Binghamton, NY (AAAA Interviewer: Rolland Quick)

William B. Bunker Memorial Scholarship—$4,000 ($1,000 year for four years to an Engineering School applicant) Jema Marie Gonzales, daughter of MG Orlando E. Gonzales, Granite City, IL (No AAAA interview; 2nd Teacher's Report used in lieu of the AAAA Interview)

B. Howard Dean Memorial Scholarship $2,000 ($1,000 a year for two years) (Sponsored by the Monmouth Chapter and limited to the sons and daughters of Chapter members) Christine M. Stuppi, daughter of Charles Stuppi, Iselin, NJ (AAAA Interviewer: COL David S. Grieshop).

Delbert L. Bristol Memorial Scholarship—$2,000 ($1,000 a year for two years) Mark L. Watson, son of Clinton Watson, Florissant, MO. (AAAA Interviewer: LTC James R. Hoefener, Ret.)

Rudolph Kahl-Winter Memorial Scholarship—$2,000 ($1,000 a year for two years) Paul L. Howe, son of CPT Paul F. Howe, APO NY 09182 (AAAA Interviewer: MAJ Glen A. Panning)

Jane Phillips Memorial Scholarship—$2,000 ($1,000 a year for two years) Sheila L. Bonnett, daughter of COL William B. Bonnett, Tacoma, WA (A second Teacher's Report utilized.)

The Monmouth Chapter Scholarship—$2,000 ($1,000 a year for two years) (Sponsored by the Monmouth Chapter and limited to the sons and daughters of Chapter members) Susan P. Duffy, daughter of John P. Duffy, Colts Neck, NJ (AAAA Interviewer: MAJ Stanley R. Chrzanowski)

Washington, D.C. Chapter Scholarship $2,000 ($1,000 a year for two years) (Sponsored by the Washington, D.C. Chapter and limited to the sons and daughters of Chapter members) Allen P. Born, son of COL Howard P. Born, Burke, Virginia (AAAA Interviewer: COL Pierre V. Brunelle)

Jack H. Dibrell Memorial Scholarship $1,000—Laura A. Schlicht, daughter of SFC Erwin W. Schlicht, Jr., Ft. Campbell, KY (AAAA Interviewer: LTC Richard R. Walker)

John C. Geary Memorial Scholarship—$1,000—Susan C. Baldwin, daughter of CW4 Franklin D. Baldwin, Ret., Troy, MO (AAAA Interviewer: LTC William L. McCabe)

Billy R. Hawkins Memorial Scholarship $1,000—William M. Brandt, son of MAJ William M. Brandt, Natchitoches, LA (A second Teacher's Report was used in lieu of the AAAA Interview)

The Kenneth K. Kelly Memorial Scholarship—$1,000; (Sponsored by the Monmouth Chapter and limited to the sons and daughters of Chapter members) Jeanne Marie Burke, daughter of John J. Burke, Neptune, NJ (AAAA Interviewer: Leonard T. Donnelly)

The Austin F. Epsaro Memorial Award $1,000—Ann Marie Griffiths, daughter of Thomas H. Griffths, Conklin, NY (AAAA Interviewer: Clyde W. Kennedy)

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Vigorous Progress Toward LHX

by MG Ellis D. Parker
Commanding General, U.S. Army Aviation Center and Fort Rucker

THIS January issue of *Army Aviation Magazine* is devoted to providing an overview and update of the entire Light Helicopter Family (LHX) program. Much was accomplished during 1985, and the development of the LHX continues to vigorously progress toward the acquisition decision.

Covering all bases

In this issue, **General Thompson**, AMC Commander, discusses the innovations in Acquisition Management that are being planned. **BG Andreson**, the LHX Project Manager, provides a program update. **BG Ostovich**, Director of the LHX Special Study Group, describes the ongoing analysis and concept formulation efforts being conducted by several TRADOC agencies.

An overview of the innovative two-level maintenance concept is provided by **COL Bellows**, Assistant Commandant of the Aviation Logistics School.

One key goal of the LHX program is for the scout-attack (SCAT) version to be operated by a single pilot. The Advanced Rotorcraft Technology Integration (ARTI) is designed to prove that thesis. Details of the integration program are provided by **COL Cass**, Special Assistant for ARTI at the Aviation Applied Technology Directorate (AATD).

Power requirements for the LHX vehicle are to be supplied by two T-800 engines, development of which is underway. An overview of engine development is provided by **LTC Lawson**, Assistant LHX Project Manager for the T-800 engine.

Significant improvement in Reliability, Availability, and Maintainability (RAM) is expected in the LHX program due to the new technology being designed into the system. Key areas are presented by **Mr. Hunthausen**, Chief of the RAM and Subsystems Division, AATD.

Manpower Personnel Integration (MANPRINT) is an important aspect of the development program. This feature requires a long lead time as plans are developed to qualify the people (pilots, trainers and maintainers, etc.) to support the LHX. The summary of the MANPRINT for the LHX is provided by **Mr. Reading**, Chief of the Integrated Logistics Support Management Division in the LHX Project Manager's Office.

The need for LHX

With all the emphasis on technical data and the acquisition of the LHX, it is important for us to remember the reasons for the LHX effort. Simply stated, LHX is a necessary response to the threat. In addition to superior numbers in every category of equipment, the Soviets have made significant advances in the quality of their equipment.

Of particular concern are recent indications that the MI-24 Hind attack helicopter fleet is grow-

ing. Of equal concern are projections regarding the fielding of new, more capable helicopters and directed energy weapons such as lasers, electromagnetic pulse (EMP), microwave and particle beam weapons.

The major question now facing Army long-range planners is how do we fight in this type environment? If technology and recent mid-intensity conflicts provide any clues at all, we can expect 24-hour-a-day operations to be the rule rather than the exception. The battle does not have to be confined to marginal or better weather conditions, but can take place in all but the most extreme weather.

Explosive growth in the number of threat anti-tank helicopters makes air-to-air helicopter combat inevitable. The forecast pertaining to threat forces is for continued growth in technology and in the size of their fleet. Such continued growth requires us to think of ways and means to maximize the attrition of threat second-echelon forces before they can deploy.

Sobering facts

Given some idea of what the future battlefield will be like, planners have turned their attention to the aviation equipment we now have on hand and how it will fare on a battlefield. As a result, the following rather sobering facts have surfaced concerning the UH-1 HUEY, AH-1 COBRA, and OH-58 KIOWA:

- All are vulnerable to small arms and air defense.
- All are easily detectable.
- None have NBC protection.
- All have poor or no night and adverse weather capabilities.
- All are manpower intensive.

For these reasons, we've determined that either a high-risk product improvement program or a new technology aircraft is required to enable aviation units to fight and win in the 21st century. That's why the idea of a family of light vertical takeoff and landing (VTOL) aircraft was born and quickly christened the LHX.

The LHX will take advantage of emerging technological gains in weapons, structures, counter-measures, aviation electronics, aeromechanics, systems integration and mission support equipment. The continued development of the LHX program will pull together these products and help us maintain the edge over any future threat.

Further, the vigorous progress in the LHX program shows that our senior leadership continues to place great emphasis on modernizing the aviation force. As I have stated before, we are moving closer to our goal of placing the safest and most advanced aviation systems on the battlefield. IIIII

WAR COLLEGE — Army Aviators and Flight Surgeons in the Class of 1986 at the U.S Army War College gathered recently for this group photo. Shown above in the FRONT ROW, from left to right, are: LTC Theodore T. Sendak; COL Ronald N. Williams; LTC Michael M. Rosenfeld; LTC Jorge Torres-Cartagena; LTC William Huff; COL Wes Beal; LTC Harold Timboe; and LTC Gerald D. Poe. BACK ROW: LTC George Francioni; LTC (P) Joshua L. Kiser; COL Timothy C. Scoble; LTC Stuart W. Gerald; LTC Theodore S. Orvold; and LTC William L. Nash.

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The AAAA TRACK RECORD: 1983—A downpour in Atlanta between the Convention Center and the Hall of Fame Luncheon; 1984—A rainstorm in DC just prior to and during the Awards Banquet that made the parking lot-to-hotel trek a pure joy! April,1985—April showers (What else?) and then some on the night of the Awards Banquet and a 75-yard open field run in the rain between the hotel and the Banquet Hall across the street. Yes, an "A-Brella" is certain to be welcomed as an AAAA giveaway by the spouse of each '86 Advance Registrant.

* * *

We'll have busses for the six block trip between the Atlanta Marriott Marquis Hotel and the Convention Center, but don't get caught in the rain again! Get yourself a dandy A-Brella! Complete and submit the tearout Advance Registration Form on the following pages and do so prior to March 10, 1986.

1986 AAAA National Convention Professional and Social Program
April 9-13 — Atlanta, Georgia

(Specific functions and presentations are subject to change.)

TUESDAY, 8 APRIL 1986

1200.....Registration and Ticket Sales

WEDNESDAY, 9 APRIL 1986

0800.....Registration and Ticket Sales
1215.....Nat'l Exec Board Luncheon
1400.....Nat'l Exec Board Meeting
1500....Hall of Fame Trustees Meeting
1800.....AAAA Early Birds Reception

THURSDAY, 10 APRIL 1986

0700.....Registration and Ticket Sales
0745.....Chapter Pres/Secs Breakfast
0845.....Panelists/Speakers Breakfast
0900.....AAAA Membership Meeting

PROFESSIONAL PROGRAMMING

1000..President's Welcome to Atlanta
1005.....Branch Chief's Welcome
1010.....Keynote Address
1040.....Aviation Branch Update
1110.....Aviation Branch Update/NCO
1130.....Luncheon Reception
1215.....1986 Membership Luncheon
(Introduction of US Helicopter Team)

PROFESSIONAL PROGRAMMING

1430.....USAALS Update
1450.....U.S. Helicopter Team Update
1510.....AH-64 Tactical Fielding Plan
1530.....Aviation Safety Today
1550.....Panel—Questions & Answers
1630.....AAAA Exhibitors Reception and Exhibit Hall Opening
2100.....AAAA Chapter Receptions

FRIDAY, 11 APRIL 1986

0700.....Registration and Ticket Sales
0715.....Panelists/Speakers Breakfast
0900.....Spouses Breakfast

PROFESSIONAL PROGRAMMING

0830.....ODCSRDA Update
0850.....ODCSLOG Update
0910.....Current ODCSPER Policies
0930.....Aviation as a Maneuver Force

0950.....Panel—Questions & Answers

1030.....AAAA Exhibit Hall Displays and Awards Luncheon Reception
1200.....1986 AAAA Awards Luncheon

1430.....Combat w/Heavy Forces (Avn)
1450.....Combat w/Light Forces (Avn)
1510.....Combat w/Special Opns (Avn)
1530.....Panel—Questions & Answers

NCO PROFESSIONAL PROGRAMMING

1430.....Update on CMF 28
1445.....Update on CMF 93
1500.....Update on MOS 93B
1515...Update on Aviation in USAREUR
1535.....Update on Aviation in Korea
1555.....Closing Remarks

SPOUSES' PROGRAMMING

1430.....Importance of the family structure to the Army
1455.....Stress Management
1520.....Women in the Army; A historical perspective
1545.....Panel—Questions & Answers

1630.....1986 Cub Club Reunion
1830.....AAAA President's Reception
2000.....20 Year Reunion Dinner of the 1st Aviation Brigade
2100.....AAAA Chapter Receptions

SATURDAY, 12 APRIL 1986

0700.....Registration and Ticket Sales
0715.....First Light Breakfast
0830.....NCO Panel — Q & A
0830....Spouses' Visit to High Museum and Shopping Tour
0900.....Exhibit Hall Displays

PROFESSIONAL PROGRAMMING

0830.....Weapons—LHX Armament
0850.....Air-to-Air Today; Ties to LHX
0910.....New aviation simulators
0930.....T-120 (Air-to-Air)
0950.....Stand-in-Place Stretch Break
1000.....UH-60A BLACK HAWK Update
1010.....CH-47D Mod Program Update
1020.....AHIP Update
1030.....ASE Program Update
1040.....AAH Program Update
1050.....LHX Program Update
1110.....Panel—Questions & Answers
1145.....Closing Remarks

1200.....Refreshments—Exhibit Hall
1300.....Saturday Sitdown Luncheon
1400.....Dessert and Coffee at the Exhibit Hall "Social"
1700.....Exhibit Hall closes
1830....'86 Awards Banquet Reception
1930....1986 National Awards Banquet
2200.....AAAA Chapter Receptions

SUNDAY, 13 APRIL 1986

0830.....Nat'l Exec Board Meeting
0930.....The "Aviation Brunch"

1986 AAAA National Convention
Advance Registration Form—Hotel Registration Form

MARRIOTT MARQUIS HOTEL AND GEORGIA WORLD CONGRESS CENTER, ATLANTA, GA — APRIL 9 -13, 1986

I plan to attend the 1986 AAAA NATIONAL CONVENTION. I understand I must return this form by **MONDAY, MARCH 10, 1986,** and that I may receive a full refund of my function fees by phone call made to the AAAA on or before **WEDNESDAY, APRIL 2, 1986,** or by written notification to AAAA that is received not later than **APRIL 2.** Please **print** or **type** all information. **NOTE:** Military fees and room rates apply only to Active Army and DAC personnel and to those Reserve Component and retired AAAA members who are not in the current employ of defense contractors or suppliers on a full-time, part-time, or consulting basis.

FULL NAME, INCLUDING RANK _____

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NICKNAME FOR BADGE _____ SPOUSE'S NAME, IF ATTENDING _____

UNIT OR FIRM NAME FOR BADGE _____ OFF. PHONE ( ) _____

UNIT OR FIRM CITY AND STATE FOR BADGE _____

ARE YOU A MEMBER OF YOUR UNIT OR FIRM'S EXHIBIT HALL STAFF? ☐ YES; ☐ NO

ARE YOU A CHAPTER DELEGATE? ☐ YES; ☐ NO; IF SO, WHAT CHAPTER? _____

1986 AAAA Convention Registration Form

SPECIFIC FUNCTION HELD AT THE 1986 NATIONAL CONVENTION OF AAAA	NOTE—Keynote Address and Prof'l Program begin at 10 a.m, April 10	MIL/DAC MEMB. OR SPOUSE*	CIVILIAN MEMB. OR SPOUSE*	ITEM LINE TOTAL	OFFICE USE
REGISTRATION (Needed to attend Professional Sessions.)		☐ $10	☐ $55	$ _____	_____
MEMBERSHIP LUNCHEON, Congress Center, Thurs., April 10		☐ $7	☐ $14	$ _____	2 _____
SPOUSE'S BREAKFAST, Marriott Marquis, Friday, April 11		☐ $6	☐ $6	$ _____	3 _____
AWARDS LUNCHEON, Congress Center, Friday, April 11		☐ $8	☐ $16	$ _____	4 _____
PRESIDENT'S RECEPTION, Marriott Marquis, Friday April 11		☐ $9	☐ $17	$ _____	5 _____
►1ST AVN BRIGADE DINNER, Marriott Marquis, Friday, April 11		☐ $25	☐ $25	$ _____	6 _____
SPOUSES' TOUR—HIGH MUSEUM & SHOPPING, Sat. April 12		☐ $10	☐ $10	$ _____	9 _____
LUNCHEON (Sitdown), Congress Center, Saturday, April 12		☐ $6	☐ $12	$ _____	10 _____
● RECEPTION & AWARDS BANQUET, Marriott Marquis, Sat., Apr.12		☐ $25	☐ $50	$ _____	11 _____
AVIATION BRUNCH, Marriott Marquis, Sunday, April 13		☐ $6	☐ $12	$ _____	12 _____
★ MEMBERSHIP FEE FOR NON-MEMBERS		☐ $15	☐ $15	$ _____	_____

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★ AAAA membership is required to attend the Professional Sessions. ● Formal/Black Tie, Dark Business Suit; Military Blues/Mess Jacket. *Spouses are not required to register. ■ Mastercard & Visa credit cards only; no others accepted for function fees. ►Limited to 1st Aviation Brigade members and their spouses.

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Headquarters Hotel Reservation Form
1986 AAAA National Convention — Atlanta, Ga.

HEADQUARTERS HOTEL — ATLANTA MARRIOTT MARQUIS HOTEL — APRIL 9-13, 1986

NOTE: THE 1986 CONVENTION KEYNOTE ADDRESS AND PROFESSIONAL PROGRAM START AT 10 A.M., THURSDAY, APRIL 10

PLEASE CHECK THE ROOM RATE DESIRED:

( ) MILITARY RATE, SINGLE BEDROOM, $51 ( ) CIVILIAN RATE, SINGLE BEDROOM, $80

( ) MILITARY RATE, DOUBLE BEDROOM, $51 ( ) CIVILIAN RATE, DOUBLE BEDROOM, $80

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Reservations will be held until 6:00 p.m., then released for sale to the general public, unless guaranteed or covered by deposit equal to one night's stay. Guaranteed hotel reservations must be cancelled before 6 p.m. destination time on the day of arrival. Cancellation or change of hotel reservations may be directed to AAAA by phone up to WEDNESDAY, APRIL 2, 1986. Failure to notify the hotel of a change in the arrival date may result in full cancellation.

Room charges are subject to applicable local and city taxes. Check-in time is 4:00 p.m. and check-out time is 1:00 p.m. for the Marriott Marquis. If a room at the hotel you prefer is not available, one at the nearest rate will be reserved at a nearby AAAA-designated overflow hotel.

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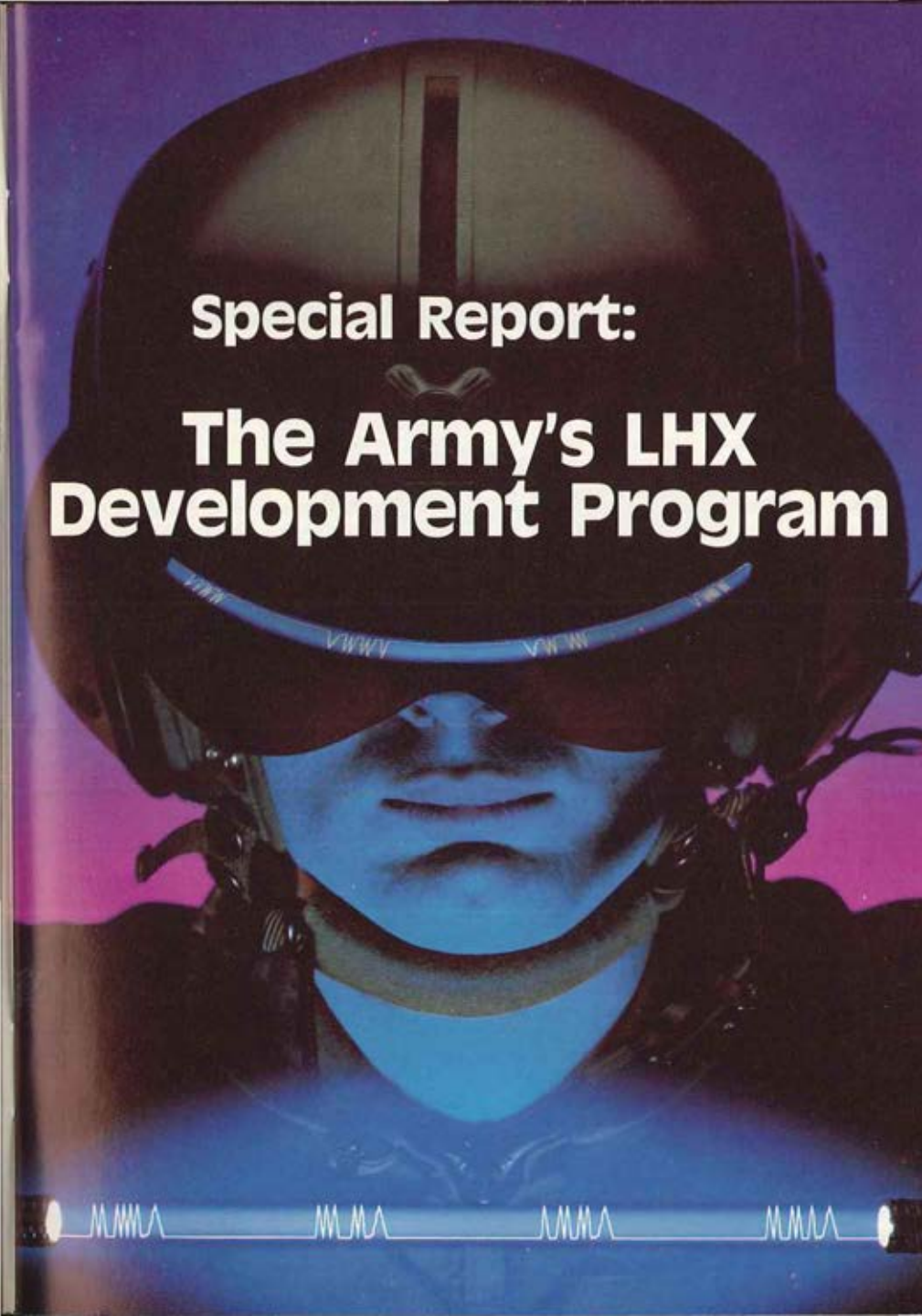
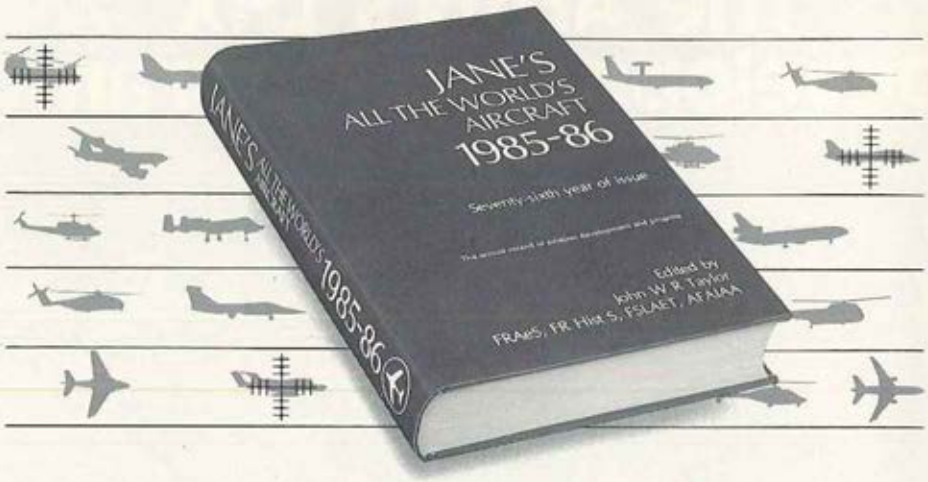


Special Report:

The Army's LHX Development Program

If Your Aircraft is in This Book, Sanders Knows How to Protect it Against IR Missiles.



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LHX: A New Way of Doing Business

by HON James R. Ambrose

I welcome the opportunity to introduce again a series of articles addressing the development status of the Light Helicopter Family (LHX), potentially the largest acquisition program ever undertaken by the Army.

I am a strong advocate of the need for the Army to change the way it does business, of the need to get ahead of the Soviet challenge, and of the need to get on top of the accumulated shortfalls of current materiel, doctrine, force structure, and operating costs.

Breaking with the past

In the LHX program, we have attempted to break with the past in an effort to find improved approaches to large Army development and procurement programs. Most assuredly, LHX will revolutionize both our ability to capitalize on battlefield maneuverability and firepower with a greatly improved, new generation of helicopters, and the way we field future weapons systems.

The past year has witnessed increasing momentum as the LHX concept exploration phase nears completion. Because I think it's essential that the entire Army Aviation community stay abreast of these activities, I've asked key Army program participants to share an update of LHX activities with you. *Army Aviation Magazine* has offered to feature an LHX update annually from now on in the January issue, so this edition provides the transition from the LHX special issue published in June, 1985.

Clearly we have a compelling need to replace our tactically obsolescing UH-1H, OH-58A/C, and AH-1S fleet of light helicopters. Operational and support costs of the current fleet are approaching a level of unacceptable burden. The fleet's ability to survive the threat today is marginal at best and it surely would be incapable of surviving the threat enhancements of the next decade.

Emerging results of detailed analysis currently underway indicate LHX technology innovations are achievable and capable of providing appropriate levels of threat protection while still remaining affordable and field supportable.

ABOUT THE AUTHOR
The Honorable James R. Ambrose serves as the Under Secretary of the Army in Washington, DC.

Making the case

1986 will be a benchmark year for the LHX program. The up-front work on the basic Advanced Rotorcraft Technology Integration (ARTI) contracts and the detailed investigations of alternatives in the Cost and Operational Effectiveness Analysis (COEA) will be concluded. This effort is necessary to establish the case for LHX prior to seeking approval for entry into Full Scale Development (FSD) through the ASARC/DSARC process.

The LHX program must successfully pass this rigorous analysis and decision process to gain the required commitment from the Army, DOD, and the Congress.

The sheer magnitude of the LHX program will rightfully draw close scrutiny from numerous sources, including the media. The Army welcomes that assistance in assuring that we arrive at the correct decision for replacing our obsolescing fleet.

I encourage all of you to read the series of LHX articles in this issue. As we forge our way ahead, LHX should allow Army Aviation to play an ever increasing role in projecting and synchronizing combat power on the Airland Battlefield of the future. IIIII

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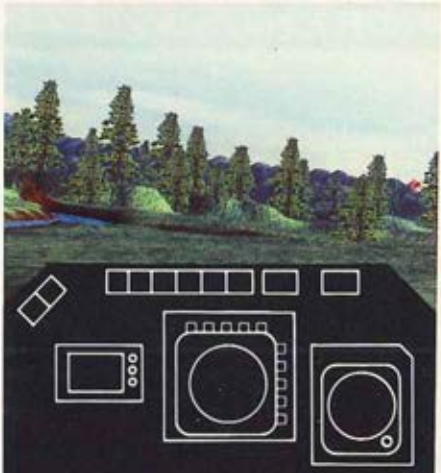

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LHX: Innovations in Acquisition Management

by GEN Richard H. Thompson

IN the June issue, I reported on the Army Materiel Command's innovative approaches to the LHX acquisition strategy and management. I pledged an AMC full court press on technological challenges and issues affecting the established program goals of developing and fielding a system that will be reliable, affordable, field supportable, and survivable against the threat of 1995 and beyond.

I'd like to take this opportunity to expand further on our efforts and progress of recent months.

Working together

AMC is continuing to work in close harmony with the TRADOC community to assure that we meet the user requirements and urgency of need schedule. Program magnitude and priority has led us to take exception to "business as usual" by applying innovative procedures in the LHX development, production, fielding, and follow-on support.

It is imperative that we thoroughly address up front, and in detail, those factors which have been prime cost drivers on previous programs so as to minimize production, fielding, and operating and support (O&S) costs. A formidable task indeed, but one that is well underway within AMC and TRADOC organizations.

The overriding objective of AMC is to deliver to the aviation soldier the most cost-effective and a field-supportable, advanced light helicopter systems which will meet the Army's demanding operational requirements.

General Richard H. Thompson serves as Commanding General of the U.S. Army Materiel Command headquartered in Alexandria, Virginia.

I can't overemphasize the importance that AMC is placing on Reliability, Availability, Maintainability (RAM) and Integrated Logistics Support (ILS) up front in the LHX airframe and LHX T-800 engine development efforts.

I can report that RAM considerations are already making a dramatic impact on the preliminary designs of the LHX. On every occasion of reviewing LHX progress with contractors, I require a presentation of their RAM/ILS initiatives that will assure our LHX supportability goals are receiving the attention they deserve.

Driving down costs

It's our aim to drive down the O&S costs of the LHX by at least 40% over the existing UH-1/AH-1 systems in the current light fleet. Reliability gains are a must and are being sought through the use of composite structures, improved drive train components, fault-tolerant designs, and self-healing architecture.

Automated diagnostics (artificial intelligence) and an on-board maintenance data recorder will reduce unnecessary troubleshooting techniques and erroneous removals/adjustments of fully operable components.

We're placing RAM/ILS, and Manpower Personnel Integration (MANPRINT) on an equal basis with cost and technical performance in the full-scale development (FSD) effort. For the first time, contractors will be contractually bound to guarantee minimum acceptable values in RAM/ILS performance — a requirement never before incorporated in major development contracts.

The competing contractor teams are fully aware that supportability is a major scoring

area in the LHX competition and that they must focus the necessary attention in their designs now to be a winner later.

Efforts are well underway to develop a detailed LHX training system acquisition strategy. Major aspects of this strategy are: prime contractors will develop and deliver both aircraft and its supporting training system; also, aircraft and training system will be designed and developed concurrently; and, moreover, the aircraft and training system will be tested at DT/OT II; and a point of particular interest is that the training system will be fieded to support First Unit Equipped (FUE).

Our objective for training equipment is that SCAT crew training (single seat) will utilize flight simulators, part task trainers, the basic utility and single seat SCAT aircraft. Lastly, our commitment at AMC to have training equipment available at or before the fielding of the aircraft is firm, and we will back that position up by heavily weighing training in the source selection evaluation process.

Single pilot operation

To meet force structure manning constraints and to further contribute to the O&S cost reductions, LHX is pursuing a single crewmember scout-attack (SCAT) system and a single crewmember operable utility aircraft. Single pilot operation is the most challenging aspect of the LHX program requiring AMC to combine in-house expertise with industry in determining how best to simulate and evaluate single pilot feasibility.

A highly automated and fully integrated cockpit with high speed data processing is key to the success of the LHX single pilot capability and tactical survivability. The single pilot study and evaluation in our concept exploration is captured within the Advanced Rotorcraft Technology Integration (ARTI) program which is ongoing at five major contractors.

The principal objectives of ARTI are design of an integrated/automated cockpit and demonstration of the technical feasibility of single pilot operation through detailed engineering simulation. ARTI results will provide insight in the feasibility of a single pilot and will reduce the risk levels prior to entering FSD.

Our effort has progressed sufficiently to lead us to believe we are on the right track and give us enough information to make a logical decision by mid-FY 86. It is fair to say that LHX is truly the most formidable engineering and integration challenge for the helicopter industry since initial powered vertical flight.

For helicopters to help us win the battles of tomorrow, they must first be able to survive on the battlefield. The ability of the Army's current light fleet of helicopters to survive on the mid-to-high intensity battlefield is marginal even at today's threat levels. The environment of future battlefields will be characterized by sophisticated combat systems, interacting computerized command and control systems, integrated battle (nuclear, biological, chemical, and electronic warfare), and ever-increasing threat levels.

Tactical obsolescence of the current light fleet has passed the point where modification and technology insertion can provide the means to upgrade the OH-6/OH-58/UH-1/AH-1 fleet to meet operational needs of the Army in the 21st Century.

A total system

I have stressed innovative management techniques throughout the LHX program to streamline the acquisition process, thereby leading to a shorter development cycle, lower acquisition and operating costs, and a smoother transition to production compared to prior weapon system programs. The LHX is the Army's first system designed and procured as a total weapon system — that is to say — an air vehicle with integrated mission equipment, training devices, and combat mission training simulators under the contractual responsibility of a single prime contractor team.

Program management innovations include competitive development and production with firm fixed-priced (FFP) contracts, pilot production of prototypes during FSD, simplified performance-oriented Request for Proposals (RFP), and significant MANPRINT influence on system design, and probable incorporation of two-level maintenance support. Throughout the LHX development process, we will employ continuous and comprehensive test and evaluation to assure that program goals are being achieved.

I'm pleased to report that the program achieved a key milestone last July when competitive FSD contracts were awarded to two

(Innovations — Continued on Page 52)

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LHX Program Overview

by BG Ronald K. Andreson

SINCE I last addressed the status of the Light Helicopter Family (LHX) program in the June 1985 issue, significant progress has been made toward fulfilling the Army's future light rotorcraft tactical requirements of the 1990's and beyond.

Cost and Operational Effectiveness Analysis (COEA) efforts, initially started in the Spring, are now at full speed. In July, 1985, Full-Scale Development (FSD) contracts were awarded for the LHX T800 turboshaft engine; in August the LHX Letter of Agreement (LOA) — which will serve as the basis for the LHX Required Operational Capability (ROC) in FSD — was approved by the Department of the Army (DA); and in October preparation of the Request for Proposal (RFP) for the LHX air vehicle system began.

From concept to reality

In the mid-1970's the LHX concept was incorporated in the Army Aviation Research, Development, Test, and Evaluation (RDT&E) Plan as a potential 1980's development. In the late 1970's and early 1980's, many of Army Aviation's technology demonstrator programs were initiated to mature technologies perceived as critical for integration into the Army's next generation rotorcraft.

Programs — including advanced composite airframe program (ACAP), advanced digital/optical flight control system (ADOCS), integrated communication, navigation, identification, and avionics (ICNIA), and advanced technology demonstrator engine (ATDE) — focused the development of the technology base toward a common objective.

These programs, and dozens more, laid the foundation for the next generation rotorcraft and ensured that these technologies would be sufficiently mature for transition into FSD.

In January, 1982, the Army completed its first Army Aviation Mission Area Analysis (AAMAA), which identified 77 major deficiencies of the current light fleet (of which 56 were exclusively related to hardware improvements) and documented the need for a new family of light rotorcraft to replace the aging and obsolescing AH-1, OH-58 A/C, OH-6, and UH-1 fleets, while complementing the BLACK HAWK, APACHE, and AHIP.

During the Army Aviation Systems Program Review in March 1982, the Army's senior leadership endorsed the recommendations presented in the AAMAA to replace the Vietnam-vintage light fleet with the LHX.

The LHX concept

The LHX will be an advanced technology helicopter with two variants — scout/attack (SCAT) and utility (U). The LHX will encompass a high degree of commonality; be operable in adverse weather; be capable of single crew member operation (SCAT); and, over its life cycle, will achieve significant savings in terms of cost and manpower when compared to the current light fleet.

To accomplish this aggressive goal, the LHX will probably incorporate emerging technologies such as advanced composite airframe, advanced technology rotor systems, high-efficiency engine, lightweight drive trains, Very High

Brigadier General Ronald K. Andreson serves as the LHX Project Manager for the U.S. Army Aviation Systems Command, St. Louis, Missouri.

Speed Integrated Circuits (VHSIC) processors, advanced displays, voice interactive subsystems, integrated aircraft survivability equipment, digital avionics, fly-by-light/fly-by-wire flight control system, and cockpit integration/automation.

The currently planned procurement of 5,023 LHX aircraft represents the largest aircraft acquisition in the history of the Army.

Current program status

The LHX program is currently in concept exploration. During this phase of the acquisition life cycle, the feasibility and benefits of certain critical program goals must be verified prior to beginning FSD of the LHX air vehicle system in Fiscal Year 1987.

Concept exploration will culminate in mid-1986 with the Army System Acquisition Review Council/Defense System Acquisition Review Council (ASARC/DSARC) milestone review, followed by issuance of the LHX aircraft system RFP to industry.

Key program goals are:

a. Single-pilot SCAT.
b. Significant combat capability and survivability improvement.
c. 8,000 ±500 lbs. primary mission gross weight for the SCAT.
d. Unit flyaway cost not to exceed $6 million for the SCAT and $4 million for the Utility aircraft (in constant 1984 dollars).
e. 70% commonality between the SCAT and Utility versions (common engine and dynamic systems).
f. 40-50% reduction in operating and support costs compared to the current light fleet.

ARTI

In December, 1983 firm fixed-price contracts were awarded to Bell Helicopter Textron, Boeing Vertol, McDonnell Douglas Helicopter Company, IBM, and Sikorsky Aircraft for advanced development effort under the Advanced Rotorcraft Technology Integration (ARTI) Program. The principal objectives of the ARTI program are to demonstrate the technical feasibility of the single-pilot SCAT aircraft and reduce the risk of FSD through design of the integrated/automated cockpit. The goal of ARTI is to prove that the co-pilot can be eliminated by incorporating such technologies as an integrated cockpit, automated navigation, digital map, automatic targeting, interactive voice controls, sensor fusion, wide-field-of-view displays, and a workload-relieving automated flight control system. Modifications to the ARTI contracts have been issued to incorporate two additional tasks — preliminary design of the VHSIC-based LHX computer system, the Electro-Optical Target Acquisition Designation System (EOTADS), and the Night Vision Pilot Sensor (NVPS). Coincident with ARTI is a cooperative program between the U.S. Army Aviation Systems Command (AVSCOM) and the U.S. Air Force Aerospace Medical Research Laboratory (AFAMRl) to demonstrate the virtual cockpit display technology, with the core effort focusing on the helmet-mounted display (HMD).

Wind tunnel simulation

Pre-FSD wind tunnel testing and engineering simulation contracts have been executed with all major helicopter manufacturers: Sikorsky Aircraft, Bell Helicopter Textron, McDonnell Douglas Helicopter Co., and Boeing Vertol.

The objectives of the wind tunnel/simulation program are to reduce aircraft FSD risk, verify each contractor's best technical approach design, provide evaluation data for the air vehicle system source selection evaluation board (SSEB), and supplement the ARTI simulation tasks by providing accurate aircraft aerodynamic and dynamic representation.

Both SCAT and Utility LHX configurations will be tested. The wind tunnel efforts include airfoil, unpowered airframe, powered model, anti-torque/directional control system, engine installation, and aeromechanical stability tests.

As in the ARTI program, contractors plan to supplement Government-sponsored testing with independent research and development (IR&D) risk reduction activities. The wind tunnel program represents a significant pre-FSD risk reduction effort and is representative of the acquisition life cycle of the LHX.

COEA

The LHX Cost and Operational Effectiveness Analysis (COEA) is being conducted by the Directorate for Combat Development (DCD) at Ft. Rucker, Ala., as part of the Concept Formulation Package (CFP), under the auspices of the LHX Special Study Group.

The purpose of the COEA is to conduct a comprehensive, comparative evaluation of alternative systems as to cost, performance, and tactical effectiveness, to ensure the best approach is pursued. Cost and Training Effectiveness Analysis (CTEA), a Hardware vs. Manpower (HARDMAN) analysis, and logisitics, as well as maintenance analyses, will be included in the evaluation. Preliminary results will be completed in February, 1986.

LHX COEA alternatives are described in detail by **BG Ostovich** in his article on the work of the LHX Special Study Group.

T800 engine program

On 19 July 1985, the Army signed competitive, firm fixed-price FSD contracts with two engine manufacturing teams: AVCO Lycoming and Pratt & Whitney (known as AVCO/United) and Garrett Turbine Engine Company teamed with the Allison Gas Turbine Division of General Motors Corporation — known as LHTEC. With the award of these contracts, the Army significantly departed from a "business as usual" approach in contracting.

Since contract award, both teams have implemented refinements in support of reliability, availability, maintainability/integrated logistic support (RAM/ILS) goals, engine weight, performance, and cost. Producibility, Engineering and Planning (PEP) activities are proceeding in parallel with coordination meetings held, as required, to transfer production technology, thereby ensuring producibility by both engine manufacturers for each team's design. Both teams have completed their Logistic Support analysis Guidance Conference and initial mockup review.

The T800-XX-800 engine program is moving at a rapid pace. The contractual guarantees contained in the program underscore both team's schedule commitments in the FSD program. This departure from "business as usual" is working and is indicative of how streamlining initiatives and competition are being applied. The Army expects to choose the winning engine design in FY 88, following completion of preliminary flight rating testing.

Program innovations

Innovation has been stressed throughout LHX program planning to streamline the acquisition process, thereby leading to a shorter development cycle, lower acquisition and operating costs, and a smoother transition from development to production compared to prior weapon systems programs.

The LHX aircraft system is the first weapon system to be designed and procured as a total system — i.e., air vehicle with integrated mission equipment, engine, training devices, and combat mission simulators. LHX is the first Army system to have the prime contractors develop and produce the training systems.

Engines — the first hard metric engine produced for the Army utilizing the International Standard Organization (ISO) standard — will be Government-furnished equipment (GFE).

Other major program innovations include competitive development and production, utilization of pilot production tooling in FSD, industry participation in the requirements process, power and growth margins (engine and air vehicle), MANPRINT integrated up front, two-level maintenance, integrated fault detection, monitoring, recording systems, and continuous comprehensive evaluation (C^2E).

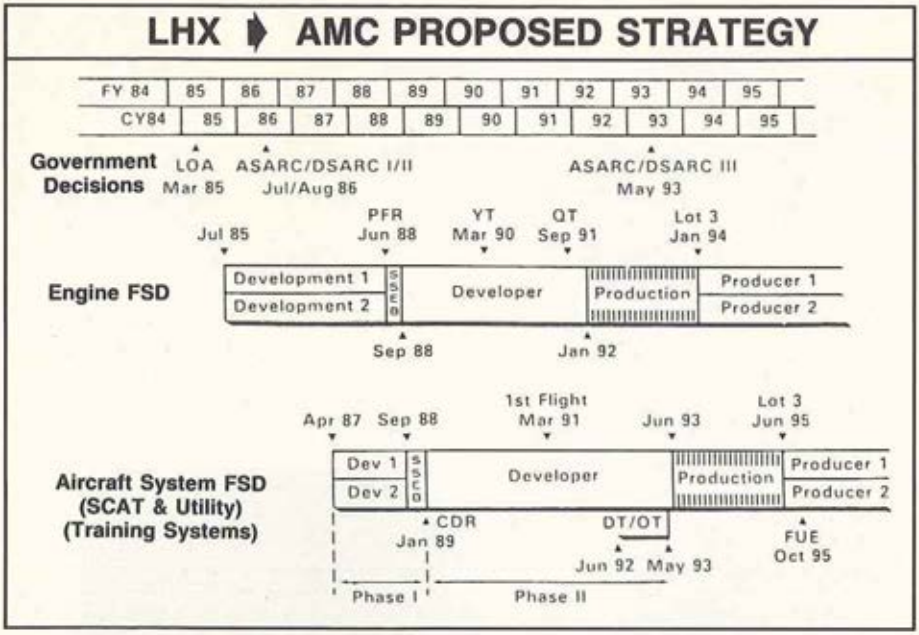
The program incorporates performance-oriented RFPs structured to be simple, concise, very readable and easily understood as to what is needed.

Acquisition strategy

Competition is the central focus of the LHX acquisition strategy. The T800 engine acquisition strategy is predicated on competitive development and procurement. A fundamental requirement for acquisition is a competitive procurement of the total engine end item by the Lot 3 production contract award.

In the RFP, bidders were required to propose and justify their method of accomplishing this competitive procurement requirement. Facilitization, including brick and mortar, production tools, production test equipment, and other related items as used in the production process will be contractor, not Government, funded.

PEP funds will be provided, but this will not be construed as justification for detailed Army involvement in innovative industrial planning. The intent is to permit maximum flexibility and latitude in exercising corporate initiatives. Qualified (QT) engines will be manufactured using pilot production tooling; no maturity phase is planned. RAM requirements will be demonstrated during FSD without follow-on RAM



growth programs.

Competitive development and procurement is also integral to the LHX air vehicle acquisition strategy. Competition is sustained in development with firm fixed-price contracts to two contractor teams through Critical Design Review (CDR) (Phase I).

Following CDR, down selection to one team will be made. The Phase I scope will include detailed hardware and software design, brassboard demonstrations of key mission equipment package (MEP) components, and development of detailed plans to achieve RAM/ILS, MANPRINT/training, pilot production, and production competition goals.

This competitive effort reduces overall program risk and significantly enhances industry's ability to provide meaningful unit production cost and operating cost guarantees with their Phase II proposals. Furthermore, this should provide the Government leverage to attain a firm fixed-price contract for FSD Phase II.

As is the case for the T800 engine, the Government will not fund for facilitization; and competitive procurement of the end item is required by the Lot 3 production contract award.

Summary

The Army's light fleet of helicopters is becoming tactically obsolete. Within the next decade, these Vietnam-vintage aircraft will have an average age of approximately 25 years. The physical and technological state of the current fleet has passed the point where modification and technology insertion can provide the means to upgrade the fleet to meet the demanding requirements of the future battlefield.

The LHX solution is a comprehensive fleet modernization focused on the development and deployment of a family of lightweight, highly survivable, and supportable — yet affordable — SCAT and Utility aircraft, incorporating state-of-the-art technology of the 1980's.

With the advent of the LHX, Army Aviation is moving toward a new dimension. Sound business sense decisions and a cooperative "team" effort between Government and Industry will ensure the Army's fighting posture is achieved in the most cost-effective and efficient manner. IIIII

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The LHX Special Study Group

by BG Rudolph Ostovich, III

THE LHX Special Study Group was formally established in June, 1985 to conduct the LHX Cost and Operational Effectiveness Analysis (COEA), which is the fourth and final step in the LHX concept formulation process.

Since 1983, however, the same nucleus of professionals has been involved as a **de facto** special study group in the first three steps — the trade-off determination (TOD), the trade-off analysis (TOA), and the best technical approach (BTA).

The TOD, which was completed in the spring of 1984, surveyed the technology available for an aircraft like the LHX and assigned risk, cost, and weight penalties to possible trade-off areas of performance and operational capability such as speed and weapon load.

The TOA, in turn, provided for the selection, by means of trade-offs among the capabilities, of the optimum parameters needed to accomplish the LHX mission. For the BTA, the output of the TOA was taken and an aircraft designed to conform to that output. This aircraft, the LHX BTA, will then be evaluated in the COEA, the purpose of which is to identify the best of available systems to do the job.

Goals

Obviously, the scope of this effort could have been unmanageably large. To help bound the problem, HQDA established program design goals. These goals have not changed substantially since their inception in 2QFY84.

Brigadier General Rudolph Ostovich III, Assistant Commandant, USAAVNC, Ft. Rucker, Alabama, serves as Director of the LHX Special Study Group.

- Scout/attack (SCAT) primary mission gross weight: 8,000 ±500 pounds.
- Unit flyaway cost (FY 84$): Utility — $4M; SCAT — $6M.
- Significant combat capability and survivability improvement.
- Single-pilot SCAT; two-crew, single-pilot-operable utility.
- Common engine and dynamic systems for SCAT and utility.
- Reduction of 40 to 50 percent in operation and support (O&S) costs.
- Preplanned product improvement to capture emerging technologies and capabilities.

We believe these goals are achievable given appropriate resourcing and time.

Alternatives

In July, 1985 the Under Secretary of the Army helped define the study by identifying the following aircraft as alternatives for the LHX mission. These alternatives will be analyzed in the COEA:

Alternative 1 (base case) — AH-1S, OH-58 A/C, UH-1H enhanced with reliability, availability, and maintainability (RAM) and safety product improvement programs (PIP).

Alternative 2 — AH-64A, OH-58D, UH-60A with RAM, safety, and operational enhancement PIPs for 1995.

Alternative 3 — BTA LHX-SCAT and LHX-Utility helicopters.

Alternative 4 — Tilt-rotor LHX-SCAT and LHX-Utility (including commercial utility option).

The PIPs for Alternatives 1 and 2 do not remove all the deficiencies, nor do they give the aircraft the full capability to meet the 1995

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threat. However, they do represent reasonable weight, cost, and risk modifications which would be expected to be applied regardless of the decision on LHX.

Analysis

The COEA is currently underway at the U.S. Army Aviation Center where the Special Study Group is processing these four alternatives through 10 subanalyses as required by TRADOC Pamphlet 11-8:

a. Mission needs, deficiencies, and opportunities.
b. Threat and operational environments.
c. Constraints.
d. Organizational and operational plan.
e. Specific functional objectives.
f. System alternatives.
g. System characteristics, performance, and effectiveness.
h. Costs.
i. Uncertainties.
j. Preferred alternative.

Deficiencies

Most studies build on a foundation laid by earlier groups and studies. The LHX COEA is no exception. The study group started with the Army Aviation Mission Area Analysis (AAMAA), a massive 1982 study that identified 77 major aviation deficiencies within the context of AirLand Battle doctrine and Army 21 concepts.

During the course of the COEA, the study group will specifically address the following needs and deficiencies. The resultant alternatives will be rated as to their capability to fulfill the need or correct the deficiency.

- Aging and obsolescing fleet (OH-58, UH-1, AH-1, OH-6).
- Limited night operations.
- Ability to conduct AirLand Battle doctrine operations.
- Battlefield survivability.
- Standoff range detection/engagement.
- Strategic deployment capability.
- Air-to-air capability.
- Multitarget engagement capability.
- Operation and support burden.
- High/hot environment capability.
- Command, control, and communication (C^3) tactical support.
- Nuclear, biological, and chemical (NBC) environment.

In recent years, the threat has improved their doctrine and advanced the quality and quantity of their weapons systems. These facts can not be ignored. In addition, the requisite potential to fight anywhere in the world at any time of the year establishes a large array of environmental conditions in which the U.S. Army must operate.

Though the technological potential to meet extreme threat or environmental conditions exists, the extreme will not often happen. The capability incorporated in LHX must therefore be tempered to reflect a reasonable capability to fight the battles of the future while considering the cost of doing business. The complexity of this decision requires careful study and sound judgment.

Scenario

To avoid bias, the study group is using TRADOC approved, standard scenarios for Europe and the Mideast. Analysis of both Europe and Mideast scenarios is important because of the differences in operational distances and environments.

In Europe, a battalion task force defends against regiments of a Soviet Motorized Rifle Division in an operational area 30 kilometers (km) wide x 40 km deep. In the Mideast, a brigade task force defends against regiments of a Soviet Motorized Rifle Division over a much larger, 300 km square area.

The AirLand Battle doctrine developed to meet the threat of the 1990s and beyond divides operational combat requirements into three areas of interest: close-in, deep, and rear area.

Army Aviation conducts tactical operations as a member of the combined arms team in each of these areas of interest through combat, combat support, and combat service support during offensive and defensive operations.

Of importance to the ground commander's scheme of maneuver is the anti-armor mission, aviation's contribution to the close-in battle, while both anti-armor and anti-personnel/materiel missions during cross-FLOT operations form part of the Corps Commander's deep battle plan. In this operation, aviation and other members of the combined arms team attack second echelon forces.

Finally, aviation will contribute significantly to the rear area battle by intercepting the

threat's deep strike into our own rear area. This mission will involve air-to-air engagements countering the threat's airmobile assault.

Even though the TRADOC standard scenarios are defensive in nature, it's clear to see that these operations capitalize on Army Aviation's strength — offensive maneuver.

The study group will analyze the capability of each LHX alternative to accomplish these missions. During the COEA, the study group will compare the capabilities of each system and determine the most cost and operationally effective alternative.

Effectiveness

The COEA is structured around three echelons of effectiveness for each alternative: strategic (fleet), operational (corps), and tactical (battalion and squadron).

Fleet operational costs in peace and war will be determined by the Concepts Analysis Agency (CAA). The study group will determine the composition of best aviation structure for corps operations using CORBAN, a low-to-medium resolution corps combat simulation. Combat performance of aircraft alternatives in typical missions will be evaluated using CARMONETTE, JANUS, and T-ARMS II, which are all tactical or system-level, medium-to-high resolution computer combat simulations.

The study group will be working closely with the CAA, the Combined Arms Center (CAC), and the Systems Analysis Activities from TRADOC (TRASANA) and AMC (AMSAA) in this effort.

The use of LHX-Utility aircraft in the medical evacuation role will also be analysed. Analysts from the study group are coordinating with representatives from the Academy of Health Sciences to jointly perform this analysis.

Cost

In order to correlate effectiveness and cost, the study group will use both life cycle and force costs. AMC is developing life cycle costs to allow comparison of total costs of acquiring and owning each alternative. Costs will reflect constant FY 86 dollars and current year dollars by appropriation.

A 20-year life is assumed for each alternative with a phase-in and phase-out period. These AMC-generated costs will be validated by the Office of the Comptroller of the Army.

TRASANA will conduct a force cost analysis that will compare the costs of a combat aviation brigade in both heavy and light divisions for each alternative. This analysis will provide one-time non-recurring and annual recurring costs for each alternative in FY 86 dollars.

As noted earlier, CAA will generate both peacetime and wartime operational fleet costs for each alternative.

Summary

The LHX concept calls for development of an affordable, high-technology family of light helicopters where the attributes of scout and attack helicopters are combined into a single SCAT airframe and where commonality of major components exists between SCAT and utility versions.

Although this concept appears to have merit, it must be exposed to critical review in light of other possible alternatives. This is the task set before the LHX Special Study Group. Their effort will assist the Army in determining how best to employ its resources to produce the greatest effectiveness. They will accomplish their mission by conducting a disciplined cost and operational effectiveness analysis to identify which alternative is best.

Although many tough questions remain to be answered, the objective has been adequately prepared, the course well defined, and resources marshalled in order to successfully accomplish the mission. IIIII

MUSEUM GIFT — GE has presented a T-700 engine, which powers the AH-64 and UH-60, for display at the Army Aviation Museum at Ft. Rucker. Attending the ceremony were (l to r) COL Ralph Lauder, BLACK HAWK PM; Thomas Sabiston, Museum Curator, GE's Louis Bevilacqua, and MG Ellis Parker, CG-Aviation Center.

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LN 29539 MATERIAL: .....CRES 17-4 PH
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The LHX Logistics Program

by COL Ronald L. Bellows

THE LHX logistics program is continuing at a furious pace. Most important is the fact that Reliability, Availability, and Maintainability/Integrated Logistics Support (RAM/ILS) are on equal footing with technical and cost considerations.

The reality of the existing light fleet is that we will not be able to afford the light fleet support system into the 21st century, so we are extremely serious about achieving a 40-50% reduction in operation and support costs in LHX while achieving the highest system readiness rate possible.

To achieve these aggressive goals, the U.S. Army Aviation Logistics School has been working with the U.S. Army Aviation School and the LHX Project Manager on the development of a viable maintenance concept which will influence the design and take advantage of technological advances to improve supportability.

This article will provide an overview of how we can reduce costs and increase readiness through design, maintenance, supply, and soldier support initiatives to make these new concepts a reality.

Supportability by design

To realize the operational and support goal, we need many things. Among them is an aircraft that is highly reliable, warns of impending failures, and — once failure occurs — is easily fixed and supported by a streamlined logistics support system. In other words, we need to minimize the time between failures, the time required to make repairs, and decrease administrative and logistics delay time.

A basic tenet of the LHX Program is to use emerging technology to design an aircraft and components that fail infrequently. The Aviation Logistics School has already been working with the new concepts of Predictive Aircraft Maintenance System, Progressive Phased Maintenance, and Aircraft Combat Maintenance/Battle Damage Repair which look at onboard recording of maintenance trend data, electronic links for remote diagnostics, rapid repair of battle damage, replace rather than repair procedures, and electronic maintenance.

These new technologies will be incorporated in the LHX and will contribute to increased mission capability by one man with a few **common** tools.

Two-level maintenance

A design goal of the LHX includes the development of a streamlined two-level maintenance system which incorporates only user and depot level maintenance tasks. The LHX must include previously mentioned simplification of replacement actions, a limit on the amount of tools and test equipment, and a built in diagnostic and prognostic fault isolation system to accomplish this goal.

The Aviation Logistics School has initiated a study, with the help of the Aviation Center and the LHX Project Manager, to answer the many questions that naturally arise as we begin to take a hard look at what two-level maintenance for the LHX really involves and how it impacts on our present MOS structure, training, and career progression for the aviation soldier. We expect preliminary results to be available in

Colonel Ronald L. Bellows serves as the Assistant Commmandant of the U.S. Army Aviation Logistics School located at Fort Eustis. Virginia.

February, 1986.

Since the design is not yet finalized, it isn't possible to list depot maintenance tasks. However, current planning for depot functions include component or LRU repair and the more complex structural repairs. These tasks will be performed at depot activities located so as to provide the necessary support.

This depot capability will run the gamut in size from the current fixed CONUS depots to small contact teams capable of performing repairs at the owning unit.

Geography does not distinguish between maintenance levels. Depot tasks may be performed far forward if necessary to sustain mission capability and user maintenance may be performed by activities other than the owning aviation unit.

The user maintenance activities are to be much smaller as a result of the elimination of component repair and the simplification of the remaining tasks. The tasks associated with the LHX system will be consolidated to require the least number of MOS's.

The owning aviation unit will have the maintenance skill mix and density necessary to sustain unit aircraft based on combat workloads. That is, it will have the capability to perform all user tasks.

In addition, there will probably be a backup user maintenance activity at division or higher level. The mission of that unit will include maintaining the float account, providing surge capability to prepare for and recover from combat operations, holding, and ultimately repairing Not Mission Capable Supply (NMCS) aircraft, aircraft recovery, and evacuation to depot, operating cannabilization points, and providing user level maintenance for non-divisional units.

Again, this organization will have the same capabilities found in the owning unit. It will, however, be in a different location to provide an additional user maintenance capacity and will serve primarily to preserve the mobility of the owning unit.

Supply support

Two-Level Maintenance is theoretically the best way to support the LHX. It does, however, make the repair parts pipeline more critical than current maintenance doctrine. Combat units will not have piece part repair or fabrication capability. This means that once a failure occurs it can't be repaired until the part is on hand. For mobility, manpower, and cost reasons, it isn't feasible for units to solve the problem by increasing their stock of repair parts.

The solution is to do everything possible to reduce the supply and transportation burden. Modern materiels and manufacturing techniques will be used to keep the weight and cube down and high reliability and survivability will cause low demand. Prognostic equipment will reduce LRU stockage and careful placement of depot capability will reduce pipeline length.

Our LHX supply support options are almost infinite. In the final analysis, the solution must be affordable in dollars and must not require a larger slice of the strategic and tactical supply and transportation capabilities than is devoted to the current fleet. Ideally, the LHX supply support will cost substantially less.

The soldier

We are giving a great deal of care to designing the LHX to reduce operational and support costs while achieving higher availability, reliability, and maintainability. Since training and sustaining personnel is an expensive procedure, we must be equally diligent to ensure MANPRINT goals are accomplished.

We expect to reduce the numbers of mechanics through simplified design and increased reliability and maintainability. The two-level concept will further reduce numbers, consolidate skills into new specialties, and, in all likelihood, require a new philosophy of career progression.

Furthermore, if active forces are required to fill depot maintenance positions, the existing aviation maintenance training will require realignment. Historically, with technological advances, more and more high level tasks are pushed lower in the organizations. This phenomenon — known as skill creep — creates a problem since lower level personnel frequently lack the training and experience to accomplish the tasks. Either the school trains for a longer period of time or only accepts personnel of a higher mental capacity. This trend is being reversed with the LHX.

At this stage, it isn't possible to provide complete answers for the training and personnel issues. The major constraints, however, are

(Logistics — Continued on Page 52)

T-800: Breaking the Barriers to Competition

by LTC Willie A. Lawson

THE Army — with the award of two firm fixed-price Full Scale Development (FSD) contracts on July 19, 1985, to the AVCO Lycoming and Pratt & Whitney (APW) team and to the Garrett/Allison Light Helicopter Turbine Engine Company (LHTEC) — incorporated many new initiatives and exposed the rest of DOD to a "New Way of Doing Business".

Our efforts resulted in two excellent contracts for development and production of the T800 engine which include provisions that cover the Army in virtually every area. They are firm fixed-price contracts and include unprecedented guarantees for acquisition, operation, and support costs.

Breaking new ground

The contracts provide for production competition and guaranteed supportability in a manner that is unparalleled in the history of Government procurement. The comprehensive guarantees are evidence of the contractor's commitment to develop an engine which provides for a step improvement in overall cost of ownership.

Each contractor team has signed up for significant improvement in engine manpower and personnel integration (MANPRINT) as an integral part of the design and development process.

The evolutionary process that took place in the early stages of the T800 program resulted in many briefings and agonizing working sessions. Many meetings were conducted with the Commander of the Army Materiel Command, and the Under Secretary of the Army, in order to implement their guidance concerning the streamlining principles and initiatives.

Our first draft Request for Proposal (RFP) was 750 pages. This draft was reduced through a number of comprehensive meetings and data calls down to 571 pages. We thought this was a very impressive and acceptable piece of work. However, senior Army leadership thought differently and seven drafts later (four of which were coordinated with industry for comments) we finally provided the contractors with a RFP that was end product oriented and identified only the basic fundamental requirements. The total number of pages, including System Specification and Data Requirements, was 156.

This "performance-oriented" approach addressed three major program initatives: Competition, Performance, and Cost with the objective to transfer as much risk as possible for program success to the contractor.

Competition

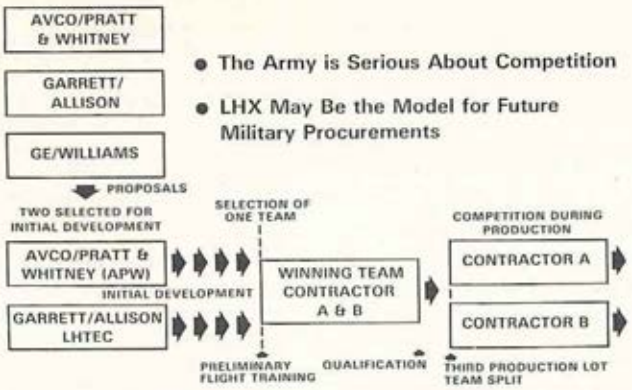
The contractors and the Army made commitments at the outset of this development to maximize competition at all levels for the life of the T800 program. Two contracts were awarded for FSD, with team competition ongoing for a period of approximately three years.

This competition has forced contractors to pursue design and development vigorously and activate the required organizations to implement the Reliability, Availability, Maintainability/Integrated Logistics Support (RAM/ILS) and production competition requirements at the outset of the program.

The significant advances represented by the

Lieutenant Colonel Willie A. Lawson is the Assistant LHX Project Manager for the T-800 Engine, U.S. Army Aviation Systems Command, St. Louis, MO.

LHX ▸ T800 ENGINE PROGRAM ACQUISITION STRATEGY



T800 contracts in the areas of competition, reliability, fielded cost, and contractor financial sharing have been gained through the application of competitive pressure throughout the acquisition process. This is the first instance in which such comprehensive steps have been taken in a major system development.

Each engine team has made significant contribution to the program in the way of cost sharing. This only came about through the benefits of competition.

A major requirlement of the T800 engine program is establishment and maintenance of two sources for manufacture of an engine to the same design. The two sources will then compete for production beginning not later than the third production lot. Contractors have contractually agreed to exchange the necessary technology and "know how" between the team members during development and during production to ensure maintenance of a single design. This includes Class I design changes, Class II design changes, tooling data bases and Materiel Review Board (MRB) actions.

To accomplish the Government requirement for end item competition each contractor established a different teaming arrangement.

The Government evaluation of the teaming agreements concentrated on two areas: first, did the agreement "fit" the contractors and their individual organizations so the management of the program will not be adversely impacted? Second, do the terms of the agreement conflict with or limit the contract requirements and program goals?

Several key clauses were established and incorporated into the contract to assure the teaming arrangements complement or enhance the program goals. These provisions include a "Joint and Several Liability" clause, and a "Technology Transfer/Licensing Fee" clause.

Parts competition and breakout were also key areas of competition which received major emphasis during the evaluation and subsequent contract. The contract teams have committed to qualify a minimum of two sources for each part of the engine down to a certain level and have established procedures whereby they will maintain two sources throughout the program.

In addition, should any form of breakout and parts management be required (because of high cost parts) the contracts contain priced options to buy Technical Data Packages and/or to qualify alternate vendors.

As stated earlier, competition during the T800 program is not limited to the prime sources; each contractor team has guaranteed to

broaden the supplier base, increase the use of socio-economic suppliers, and provide data rights to support direct component purchase of the Army.

Contractual provisions for continued technology transfer and configuration management ensure a common engine configuration throughout the life of the fielded system. This emphasis on and commitment to competition will enable the Government to control program cost through maximum use of competition and will provide a production base down to the vendor/subvendor level to support surge and mobilization.

Performance

From the inception of T800 program planning, it was recognized that there were only four milestones upon which to base a full, accurate, and fair downselect — namely, Source Selection, Preliminary Flight Rating (PFR), Qualified Testing (QT), or Development Testing/Operational Testing (DT/OT).

Source selection at the start of FSD would provide little competition. Competition to QT or DT/OT would be prohibitively expensive. PFR is a technical milestone in any engine development program which signifies sufficient maturity to allow experimental flight testing of the engine. At this point, demonstration of the critical issues will have been accomplished.

PFR, therefore, is the first meaningful hardware performance demonstration milestone and was selected as the most cost effective point at which to "downselect" to a single contractor team to complete FSD.

Although many technical risks were reduced through prior Army funded development efforts such as the Advanced Technology Demonstrator Engine (ATDE) program, significant untested issues remain to determine if this "New Way of Doing Business" truly works. These include:

- Demonstration of performance and durability requirements.
- Demonstration of the reliability and maintainability requirements.
- Proof of the teaming concept, including technology transfer and common configuration management.
- Verification of the concept of competition during production.
- Adherence to the development schedule.
- Cost growth control outside the boundaries of the fixed price contract.
- Credibility of engine price and operational and support guarantees.

Each of these factors have been guaranteed by both contractor teams. However, it is well known that outside influences often allow modification of such guarantees during the course of development program. Continued competition is the assured method to exert effective leverage over the critical portion (the next three years) of the development process.

The T800 contracts establish challenging RAM requirements which must be demonstrated during FSD. This forces the contractor to integrate RAM into the design — beginning early in FSD — so as to have an engine that can be less costly to operate and one that will meet the contractor Operational and Support (O&S) cost guarantee.

Requiring the contractor to meet RAM requirements during FSD decreases the expensive additional testing and production changes encountered during a post development maturity phase which has occurred on previous programs.

Competition will force the contractor teams to develop the best performing design including maximization of output power, fuel consumption, and other technical and physical characteristics. Contractors will strive to conduct early substantiating tests of critical items which provide time for corrective measures during development and allows the Government to select on the basis of demonstrated success.

By identifying basic pass/fail criteria for each of the technical performance tests, contractors have agreed to accomplish any redesign, retest, requalification, and retrofit during FSD that is necessary to demonstrate the requirements of the System specification.

Cost

The Government, in formulating the acquisition strategy and requirements of the contracts, attempted to establish the basis for the life cycle cost of the program early on. This philosophy of approaching the elements of fielding cost as a designed-in rather than added-on function will be proven out during the competition development phase.

The R&D portion of the contract, except for support of flight testing, was contracted on a

LHX ➧ T800 ENGINE PROGRAM DEVELOPMENT COST

	APW	LHTEC
• Total Contract Price	$240 M	$264 M
• Contract through PFR	$120 M	$147 M

- **Minimum Gov't Cost for T800 Development $384 M**
- **Maximum Gov't Cost for T800 Development $387 M**

Government Estimate for Single Contractor Development
$350 M Without Contractor Cost Share
Competing Two for Approximately the Price of One
Benefit of Competition

firm fixed price basis which poses a substantial risk to the contractors. In addition, the contractors have signed extensive Design-to-Cost (DTC) and O&S cost guarantees. These guarantees are contractually binding provisions negotiated into the FSD contract which will carry over into production.

On previous programs, DTC and O&S "goals" were established in FSD and the contractors were required to exert their best effort to accomplish these "goals." During development then, trade-offs were conducted and these cost goals would many times take a back seat to the technical requirements. Projected life cycle costs as a result would often increase dramatically.

Contractors have now signed up to a not-to-exceed price for production and have committed that the operating costs will not exceed a specified dollar amount and will pay damages if operating costs exceed that guaranteed amount. Cost becomes a major factor in trade-off determinations.

In addition, to including firm numbers — in lieu of goals — the DTC and O&S provisions are flexible enough to account for potential program changes. For instance, the DTC prices are based on a Planned Production Schedule. However, the clause contains a method for determining the price if a quantity less than the planned quantity is procured.

Also, the provisions establish that each of the members of the team will have the capacity and will agree to bid on other than a 50/50 split for each production year. This was necessary because if an approximate 50/50 split is required to maintain DTC agreement, a competitive environment does not exist.

Summary

The contracts signed for the T800 engine FSD contain many commitments and guarantees by the contractors to ensure program success. RAM/ILS has been made an integral part of the engine detail design process. Subcontractor specifications are also being written to include RAM/ILS requirements consistent with each team's program goals. Air Vehicle/Engine Integration (AV/EI) activities are continuing steadily with each potential LHX air vehicle manufacturer (AVM's).

Current T800 engine installation information as well as proposed interface agreements and documentation are being coordinated. AVM's participated in each team's engineering mock-up review of the T800 engine. During the next few months, as the T800 design evolves, numerous trade studies will be conducted to incorporate improved integrated logistics support, producibility, cost and MANPRINT considerations in the design.

The contractors have assumed a great deal of risk for contract performance. Some of these have been briefly discussed in this article. Many other innovations, guarantees, and special contract requirements have not been described. An after action report detailing the entire process — including RFP preparation, Source Selection Evaluation Board (SSEB) preparation, evaluation, and lessons learned — has been written and is available upon request. IIIII

While Others Are Still Working On Preliminary Design,

We're Building The Power Of LHX.

We completed the Preliminary Design Review of our T800 engine nine months ahead of schedule. Giving the Army its first real look at the power of LHX. The only engine designed exclusively to meet the needs of tomorrow's Army.

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The Single Pilot Issue

by COL Stanley D. Cass

THE Army decision to develop the LHX based on single pilot operation may well be the most significant change made yet in Army Aviation doctrine. But now we need to validate not only the technical feasibility of the decision, but we must also satisfactorily resolve many other questions pertaining to the total operational suitability of the concept.

The Advanced Rotorcraft Technology Integration (ARTI) program — see the June 30, 1985 issue for more details — is designed to answer the technical question by developing architecture for a mission equipment package, flight controls, and an integrated/automated cockpit to facilitate single-pilot operation in a combat environment.

Seeking early answers

The more operational concerns — such as survivability, psychological factors, training, and so on — are being addressed to some extent in ARTI, but more fully in other on-going efforts and in activities under consideration.

Ideally, these questions could be satisfied by the use of a surrogate aircraft, flown by one pilot, under realistic testing conditions. However, since there's no apparent way to provide surrogate aircraft sufficiently representative of a production-ready LHX, this solution doesn't presently appear viable.

Likewise, the alternative to delay a final suitability acceptance until the DT/OT phase — though also ideal — is apt to have unacceptable cost and schedule implications. So, the Army must, and will, continue to evaluate the true significance of the issues with a goal of resolving them as early as possible in the development phase.

There is no doubt that total operational suitability must be proven in the LHX, whether it is flown with one or two pilots. However, our demographic and personnel inventory predictions strongly indicate that within our personnel strength ceiling we won't even have enough qualified pilots available in the 1990's to put two rated crewmen in each LHX required.

Meanwhile, a careful analysis of the cost effectiveness of a one-pilot LHX with its improved maintainability must be compared to its operational effectiveness, to see if the total savings in life cycle cost offset any potential degradation of mission capability.

And, finally, we hope to learn from our ongoing ARTI program if the cognitive skills required by a sophisticated single-pilot LHX will demand more experienced aviators with more flight hours and years of maturity than recent flight school graduates. If so, our training base will need to be scrutinized for adequacy.

Now let's look briefly at each of these efforts to see how they contribute to our decision validation process:

ARTI

At this writing, the five ARTI contractors have completed Task III of their contracts, which calls for detailed designs and architecture layout for the cockpit and the simulation hardware. Some have moved on to Tasks IV and V which call for fabrication and checkout of their experimental systems, and initiation of simulation experiments.

Colonel Stanley D. Cass serves as Special Assistant for ARTI at the Aviation Applied Technology Directorate located at Fort Eustis, Virginia.

On the present schedule, they will be simulating various mission scenarios starting in January, 1986 and will be evaluated by the Army Simulation Evaluation Team (SET) in the March-April, 1986 time frame.

Task VI calls for flight experiments, utilizing a vehicle of their choice. A purpose of this Task is to validate the simulations by actually flying critical functions. The vehicle is actually being used primarily to gain data on part tasks, subcomponent testing and assessment of flight control effectiveness.

The contractor reports, in all cases, have recommended that single-pilot operation is technically feasible with the integrated/automated functions included in their designs. These reports have generally included very extensive analyses on the influence of battlefield factors such as stress and fatigue on an aircraft crew regardless of size or complement.

They suggest — among other things — that combat stress may be independent of crew complement whereas fatigue may not.

User aviation support

A vital element of the ARTI program has been the contribution of Army "user" flying personnel and experience to the total effort. This contribution includes a team of four FORSCOM pilots available at specific times to each of the five ARTI contractors to support their simulation and flight testing.

This effort was initiated as a result of a request in early 1985 from one of the ARTI contractors for aviators to evaluate their work, and USAAVNC subsequently coordinated with TRADOC and FORSCOM to make a team available to each contractor. Aviators were selected to participate based on flying time and aircraft qualifications, so that each team has a range of experience.

The second, and very important, segment of the user participation effort is the Simulation Evaluation Team. This concept evolved from the realization that the contractors' simulations would have to be evaluated against a common standard and by a group of suitably qualified personnel.

Accordingly, a Government Composite Mission Scenario (GCMS) was designed under the auspices of the Director of Combat Developments (DCD) at Fort Rucker and provided to the ARTI contractors in June, 1985.

At about the same time, the SET was organized with five FORSCOM aviators, one from USAAVNC, and an engineering test pilot from the Aeromechanics Research Laboratory, that again represented a broad range of experience in both scout and attack helicopters.

This SET is scheduled to go to each of the contractor facilities and evaluate how well their simulation using the GCMS validates the single pilot thesis from Tasks I, II, and III. The GCMS is the common standard, and must be evaluated to eliminate the differences between contractors in mission content and emphasis. However, most of the contractors will have at least one of their own scenarios available for evaluation as well.

These evaluations are not designed to make comparisons between contractors, and no order of merit will be made. The intent — again — is to determine if his simulation can indeed validate his single-pilot concept. It is apparent that these evaluations, and the debriefings from the SET members, will play the key role in the methodology for validating the technical feasibility part of the single-pilot decision. It is considered critical to the credible resolution of this question to have these operational pilots available to us.

Crew Station Research

During the same time frame that saw the SET organized and the GCMS designed, it became obvious that all five ARTI contractors — based on their Task Analysis and Workload Projection — were concluding that single-pilot LHX operation was feasible. Since these conclusions were being made based on somewhat inexact methods, and did not include similar projections of two-pilot missions, a need was identified for an in-house program to look at the total picture of crew complement for the LHX. This realization led to the creation of the Crew Station Research and Development Program (CSRDP).

This "non-contaminated" investigation of the crew size issue was to be conducted by AVSCOM's Aeromechanics Research Laboratory (now the ARTA Aeroflightdynamics Directorate) at the NASA-Ames Research Center, Moffett Field, California. They have the necessary simulation facilities and software available, and, using the GCMS identical to the ARTI contrac-

tors, they began conducting part-task simulations beginning in December, 1985.

The program is scheduled to complete full mission simulation in December, 1986 and will have evaluated all the most difficult LHX tasks during various battlefield conditions against both one and two pilot cockpit configurations. If meaningful answers are to be expected, then the simulation must be able to replicate an entire mission of the LHX Battle Commander as closely as possible with all the weather, visibility, threats, and communication problems expected.

That is what CSRDP is designed to do, and this program should give valuable reinforcement to our validation of the operational aspects of the crew size decision.

ADOCS

Another source of data that can contribute to a final assessment of workload pertaining to an LHX crew is the Advanced Digital/Optical Flight Control System (ADOCS) program ongoing at the Aviation Applied Technology Directorate at Fort Eustis.

This system consists of advanced digital control laws, optical technology, and advanced multi-axis controllers, and is installed in a UH-60A helicopter for flight evaluation. It has now started early flight testing, with 100 hours to be flown by contractor pilots and 15 by the Army. These tests will collect handling qualities information using various modes of the flight control system, which can be tailored to provide four, three, or two functions to the pilot side-arm controller.

The Army testing will include a phase that evaluates the handling qualities of both the Primary Flight Control System and the Automatic Flight Control System, and a phase at Indiantown Gap Military Reservation, Pennsylvania, to evaluate ADOCS for the Scout/attack mission.

Following these formal tests, the aircraft will be made available at several operational aviation sites to allow unit pilots to fly and evaluate the system.

Throughout the testing and evaluation process we intend to collect data on acceptability and suitability of these advanced flight controls to include in the LHX decision process.

Making the decision

At the beginning of this article I stressed that ARTI was designed to validate the technical feasibility of single-pilot LHX operation, and would contribute many answers to other operational questions, but that we would be relying on several other sources for final and total validation.

The "trick" is how to judge the validity of each input; how to weight each criteria; and how to total up the results to make sure we have the correct answers. We are defining a methodology that is both quantitative and qualitative, and that puts the right emphasis on both time and accuracy in the accomplishment of the various tasks involved in a mission.

That is our charge, and it's going to take the best collective efforts of all agencies involved in the process to make a timely and iron-clad recommendation on the validity of our decision.

We are truly embarking on a new and exciting era in Army Aviation. If we can prove that a single pilot can accomplish all of the missions designated for the LHX scout/attack helicopter — while fully utilizing the elegant suite of equipment available to him and returning safely time after time — we will, indeed, have done our job. IIIII

TOP RECRUITER — 1LT Walt Stiehm, (left) of the 56th Aviation Company, presents the membership application for the 83rd new AAAA member he has personally recruited to Rhine Valley Chapter President LTC Julian A. Sullivan. A new AAAA member himself, Stiehm began actively recruiting members in August, 1985. In addition to his membership work, he helped establish the highly popular Rhine Valley AAAA Bowling League.

LHX R&M Design Test and Assessment

by Mr. Roger Hunthausen

THE family of light helicopters — LHX — has brought to the forefront a series of new and innovative concepts for Army Aviation: single-pilot cockpit, all composite fuselage, fly-by-light flight control systems, degraded mode operations, two-level maintenance.

Degraded mode operation? Two-level maintenance? These terms and concepts are certainly new to some in Army Aviation, yet they have become household words to many involved in the development of the LHX.

This is the first aircraft development program where mission reliability, maintainability, and logistics have taken a seat up front in the list of priorities along with performance, weight and cost. In fact, the improvements in R&M and logistics over the existing fleet are absolutely essential for successful achievement of LHX fielding.

R&M objectives

The overall objective of LHX R&M can be stated simply — to achieve greater availability through improved supportability. LHX development will emphasize R&M through the drive to achieve a 50% improvement in mission reliability and a 60-70% reduction in maintenance burdens. This article will describe the design attributes that are required for the achievements of these ambitious objectives and the unique requirements for test and assessment.

When a designer is tasked to improve system reliability, he has various options from which to choose. Among the options available are to increase the strength of the materials, reduce the number of parts, and/or lessen the environment that accelerates component failure, i.e. temperature and vibration.

However, an LHX design utilizing all of these options will still fall short of the goals mentioned above. Why? Because the above options all address hardware reliability and miss another important ingredient — the diagnostic software.

The diagnostic software for our LHX should be considered extremely critical because of the key objective to increase mission productivity. This objective drives a design to be multifunctional and therefore, unfortunately, very complex, especially when one considers the degree of integration required of the mission equipment packages (MEP's).

Fewer false alarms

Inadequate condition monitoring and fault isolation often tend to generate false alarms or incorrect failure indications that are all too prevalent in any current weapon systems. So the designer can't consider only the hardware reliability in his design, but must also provide a design for diagnostics, or as it is usually termed: "design for testability."

This will become increasingly important if we realize that the drive for two level maintenance will push more tasks to the field level. Accurate diagnostics are essential to decrease the burden on the maintainer and reduce the requirement for specific trouble shooting skills and special test equipment.

The R&M improvement to the aerial vehicle components includes reduction of parts, im-

Mr. Roger Hunthausen serves as Chief of the RAM and Subsystems Division at the Aviation Applied Technology Directorate, Fort Eustis, Virginia.

proved design for the environment, emphasized modularity for maintenance, emphasized on-condition maintenance designs, improved built-in monitoring/diagnostic capabilities, etc.

Such technologies as composite structures will greatly reduce the unscheduled maintenance rates due to their improved impact resistance and design for low fatigue stresses. These structures allow a greater amount of maintenance to be deferred thus increasing aircraft availability.

Unfortunately, composite structure repair techniques are still in their infancy and need further development in order not to burden the logistic system. However, the advantages in ballistic tolerance, durability, and weight reduction far outweigh this present disadvantage.

Vibration problems

A primary cause of accelerated failures is due to the inherent vibratory nature of the helicopter. Vibration reduction in the main rotor system will play a key part in the reduction of these types of failure modes, and will also reduce pilot fatigue, which is a pilot failure mode.

Advanced rotor and hub designs, a total main rotor isolation system, and higher harmonic control offer the potential for significant vibration reduction. For example, the higher harmonic control concept, currently being demonstrated, has the potential of reducing a helicopter vibration level by greater than 50%. Such rotor systems may include automatic tracking and a total on-condition maintenance design.

The LHX engine and drive train components can also be expected to have dramatic increases in R&M. Integral lube systems, inlet protection systems, design for low stresses, fine filtration, high temperature materials, etc., all play key roles in the reduction of component failure rates.

Improved seal designs should help reduce the constant annoyance of maintenance checks due to leaks. Modular design should ease the logistic burden as well as facilitate accessibility for inspection and repair. Improved diagnostics through improved chip detectors and flight data recording of parameters exceeded should greatly reduce the false alarm rates that we currently see on the existing light helicopter fleet.

Mission equipment package

Although the above sampling of advancing technologies that will improve LHX R&M is impressive, the design that really excites the imagination is the integrated cockpit with all the advanced displays, automation, and semiautomatic functions. It's nice to look at and fun to operate, but what happens when it breaks? No, it can't be designed not to break, but here is where the LHX can really show some improvement over current aircraft.

The primary causes of avionic failures are vibration, temperature, and contamination (not necessarily in that order). A major cause of false and repetitive maintenance is due to inaccurate designs for testability. The drive to improve the MEP reliability is thus directed toward those demonic elements.

I've already mentioned some rotor design improvements to reduce vibration. Preliminary design analysis for MEP modularity and packaging indicates that a greater control of contamination and temperature can be achieved. MEP cooling and packaging design will play an essential role in the overall improvement of these components' reliability.

However, testability design is a different sort of problem. The MEP design for single-pilot operation is such an integrated, complex, multifunctional, semiautomatic system that continuous monitoring of component status is essential. But one can't simply overload a card or box design for testability. Past experience has shown that as more testability is added, more failure modes occur and, heaven forbid, false alarms proliferate.

However, this does not have to happen in the LHX. The key to avoiding such pitfalls is to incorporate testability and diagnostic design right at the start of component design with the same level of emphasis as performance cost.

New technologies

Other attributes of the MEP to improve R&M include such technologies as very high speed integrated circuits (VHSIC) and integrated communication/navigation systems which will have increased reliability through inherent design improvements, plus the reduction of parts (switches, connectors, cabling, etc.).

Fly-by-light flight controls will also show an increase in reliability over existing systems.

However, their main attribute is in the area of aircraft survivability. This technology also falls into the same category as composite structures where the failure rate is low, but the maintenance tasks, skill levels, and support equipment required are not yet established or developed.

A key design attribute for the LHX will be the integrated diagnostic and subsystem management concept. This concept involves on-aircraft displays for pilot advisories that keep him apprised of subsystem status and mission capability.

A maintenance computer will be dedicated for fault detection/isolation, categorization/prioritization of maintenance based on mission needs, airframe and dynamic subsystem monitoring for on-condition maintenance/inspections/repair, maintenance record keeping, and interface with ground-based displays for advanced troubleshooting functions and logistic information.

The ground-based equipment will function as an advanced diagnostic tester, an aid for inspections, trending, combat damage assessment, and as interface for other logistic equipment such as trainers, paperless manuals, and automated parts requisitioning systems. This concept should greatly ease the manpower requirements in skill levels and quantity of personnel required for LHX support.

Combat power

One final comment about the integrated MEP design is needed, and that is the tremendous increase in combat productivity that can be achieved for the LHX. Such a design allows continued operation in combat with failures, although in a somewhat degraded mode.

Degraded mode operation is not as bad as it may sound. A key design attribute of the LHX MEP is the amount of functional redundancy that can occur with different pieces of hardware. Sensors used for target acquisition and tracking can be triply redundant for some missions with only a slight degradation in accuracy, depending upon climatic conditions.

A description of all these potential redundancies is beyond the scope of this article. However, such capabilities allow the Company Commander better utilization of his multimission aircraft before he is forced to down an aircraft for maintenance.

Before leaving this R&M design section, it should be pointed out that not all of the problems are solved. Advanced wiring and connector designs need to be pursued for the LHX to significantly improve upon the R&M problems we have with our current aircraft. Also, more R&D is needed in the area of aircraft survivability equipment (ASE) if a high degree of reliability is to be maintained with the increase of complex ASE now planned for the LHX.

Test and assessment

Now that the design has been put into place, all that's left is to perform the engineering development, test, and go to production. Right? Unfortunately, the process will not be this simple for the LHX program, which will break new ground in this area also.

Previous aircraft development programs allowed a gradual reliability growth curve to guide the program with the demonstrated reliability during test and evaluation to be somewhat lower than the minimum value as stated by the user in the requirement document. Not so for the LHX!

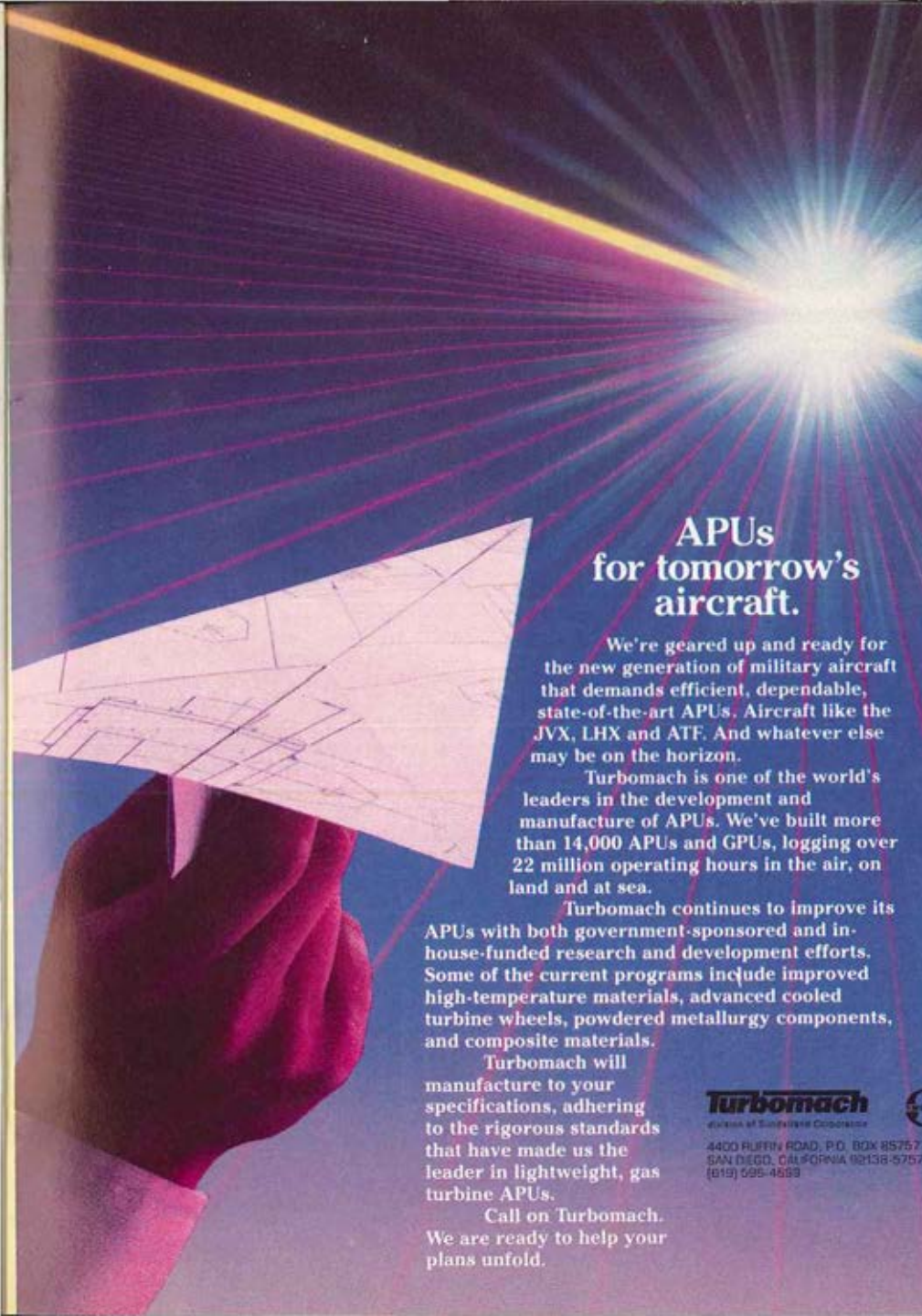
Specific direction from the Department of the Army requires R&M values to be demonstrated during the test and evaluation phase prior to production. The user can't lower his requirement and the developer can't artificially raise his estimate of best technical achievement values.

Therefore, a test and evaluation program must be designed to rapidly mature the various subsystems for final assessment following the development test phase, which presents a unique problem for LHX development. The key to its success is twofold: (1) extensive "upfront" laboratory and hot bench testing to provide improved inherent reliability prior to flight testing, and (2) getting to flight testing as early as possible to identify the field failure modes and allow time for fix and retest.

It is the fix and retest that is the unanswerable design for the test program. Without sufficient test articles and aircraft test time to correct problems, the user's minimum requirements will be difficult, at best, to demonstrate.

The testing of the MEP components presents an interesting challenge. The LHX SCAT MEP will have more complex components and soft-

(R&M — Continued on Page 52)



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LHX Manpower and Personnel Integration

by Mr. Charles J. Reading, Jr.

MANY people have asked, "What is this thing called MANPRINT, and how is it done?" Officially, MANPRINT is an Army initiative to impose the full range of Human Factors Engineering (HFE); Manpower, Personnel Training (MPT); system safety; and health hazard considerations over the entire weapon system acquisition process, from concept exploration to system fielding and support.

Stripped of all the official jargon, the intent of the LHX MANPRINT Program is to ensure people considerations are included in the acquisition and design process early and in a meaningful manner. The Project Office, in partnership with our TRADOC counterparts, has been aggressively pursuing LHX MANPRINT goals in the light of the overall Operation and Support O&S cost decreases which are the cornerstone of the LHX program.

What are we doing?

What have we been doing to accomplish MANPRINT? What remains to be done? All good questions! This article will address those questions by outlining the LHX approach for optimizing soldier-machine interface, and system performance at an affordable MPT cost.

The LHX MANPRINT process began when the Army Aviation Mission Area Analysis determined the need for a new aircraft to replace the current aging and tactically obsolete light fleet. At this point, people considerations became paramount. We asked questions concerning how many pilots will be required to perform the mission; who will maintain the aircraft; and do we, or will we, have the quantity and quality of soldiers required to operate and maintain this new weapon system.

Mr. Charles J. Reading, Jr., is Chief of the Integrated Logistics Support Division in the LHX Project Manager's Office, USA AVSCOM, St. Louis, MO.

The answers to those and many other MANPRINT related questions are being developed through an in-depth series of studies and analyses.

The first, and probably the most technically challenging question deals with the single pilot issue. Can a single pilot accomplish the mission in a wartime environment? The ongoing analysis to help answer this critical question is the Advanced Rotorcraft Technology Integration (ARTI) program. This program includes mission time-line analysis, analytical simulations (including workload analysis), and the use of modified aircraft and simulators.

I won't expand on ARTI here, as it is covered in-depth in other articles in this issue. I will, however, expand on others: MPT, maintenance and supportability analysis efforts.

HARDMAN

We here in the LHX Integrated Logistics Support Division are absolutely dedicated to ensuring that this aircraft can and will be supported in the most cost effective manner consistent with the highest mission capability rate possible. The Hardware vs. Manpower (HARDMAN) methodology is one of the tools being used to ensure success in this effort.

HARDMAN is composed of a series of interrelated steps designed to provide early estimates of MPT requirements for the proposed LHX system. The initial step in LHX HARDMAN application was to develop a "paper" LHX by compiling and integrating both existing and

emerging technology from all available sources.

This proposed "paper" LHX was then analyzed in order to determine the resultant MPT resource requirements. We are now beginning to perform the impact and trade-off analysis necessary to identify maintenance high drivers, other potential MPT problem areas and alternate solutions.

Armed with this information, we will ensure that maintenance problems are designed away and that MPT considerations and limitations drive LHX design.

A good start

HARDMAN is a good first step in determining the optimum design in terms of MPT resources. However, it does not address the full range of maintenance and logistic support issues, particularly those at user level. Furthermore, the current HARDMAN analysis does not provide a complete framework for assessing the impact of Reliability, Availability and Maintainability (RAM) characteristics on either system MPT requirements or mission capability.

To overcome this deficiency, we are utilizing an enhanced version of the modeling technique known as the Analysis of Military Organizational Effectiveness (AMORE). AMORE is directed at assessing the relationship between available personnel and materiel resources, system operational characteristics (e.g., mission requirements, RAM), and mission capability in terms of flying hour rates.

The focus of AMORE is organization-wide. The analysis considers all of the organizational components (e.g., operational, integrated logistics support, command and control), required to meet mission objectives. Exercising the AMORE model will identify the effect of combat losses, equipment failure, non-availability of personnel, administrative and logistics downtimes and other such factors on maximum unit effectiveness.

This information will enable us to determine the correct mix of human and materiel resources and thus the optimum organizational structure, and will also provide insight into ways in which capability levels may be increased.

In addition to utilizing sophisticated modeling techniques, we are also performing numerous studies to ensure that system goals (e.g., two level maintenance) do not have an adverse effect on manpower and that good career progression is possible within the LHX force structure.

The conventional Human Factors Engineering Analysis (HFEA) is also being expanded to include more "people" related issues and concerns. A System Safety Advisory Group has been established to ensure that the LHX design and deployment scenarios provide the safest possible working environment for operators and maintainers.

So far we've reviewed what the Government is doing about LHX MANPRINT, but that's only half the story. The other half is LHX contractor participation. We have encouraged contractors, both at the prime and sub levels, to establish dedicated MANPRINT personnel. These personnel are required to ensure that MANPRINT goals are achieved by considering man/machine issues from the piece-part level through total development of the aircraft and support systems.

The training system

One of the more challenging aspects of contractor involvement is the development of the LHX training system. For the LHX, the contractor will design, develop, and field the entire training system consistent with aircraft design. This includes all software, hardware, programs of instruction and appropriate combat mission simulators. The contractor proposed training system will be fielded and available to support Development Test (DT) and Operational Test (OT) training requirements. This concept will ensure that a total, comprehensive and verified training system is available prior to aircraft production and deployment.

To oversee Government and Contractor MANPRINT applications and to ensure MANPRINT issues are integrated with all aspects of the LHX program (e.g., ILS and Systems Engineering), we have established a MANPRINT Management Team. This team is chaired by the LHX ILS Manager and co-chaired by the TRADOC System Manager and has developed the first-ever system specific MANPRINT Management Plan.

This plan provides a road-map for effectively accomplishing MANPRINT related goals. It is a living document for both recording past MANPRINT activities and their results and for

(MANPRINT — Continued on Page 52)

Innovations
(Continued from Page 22)

engine manufacturing teams for the T800-XX-800 turboshaft engine. The winning contractor teams of AVCO Lycoming/Pratt Whitney (AVCO/United) and Garrett Turbine Engine Company/Allison Gas Turbine Division, GMC (LHTEC) have signed up for competitive development through Preliminary Flight Rating (PFR) in June, 1988.

Following PFR a down selection to one contractor team will be made based on their progress in fulfilling contract requirements. The two contractors on the final team will then compete for successive production contracts beginning not later than the third year of production.

The RFP for the LHX air vehicle, scheduled for release in FY 86, is currently being prepared by a select group of experts to achieve similar objectives. It is our strategy not to provide detailed specifications but to incorporate the best minds of industry to develop a system that best meets the Army's performance specifications.

LHX is well on its way to becoming a model program that will conserve valuable fiscal resources while providing a significant capability to defeat the future threat. AMC will do its utmost to keep this effort on track. IIIII

MANPRINT
(Continued from Page 51)

outlining future analysis efforts.

To verify that the MANPRINT goals derived from these analyses and planning efforts have been achieved, performance oriented testing will be accomplished. MANPRINT test issues, to include human performance criteria, are currently being incorporated into the Test and Evaluation Master Plan (TEMP).

During DT/OT, data concerning equipment/human performance and the adequacy of the MPT support structure will be collected and analyzed. Test results will then be used to drive the design and/or MPT support structure modifications required to optimize system performance.

The total commitment of the LHX Team has made it a leader in MANPRINT implementation. We have laid the proper groundwork for MANPRINT success via the analysis and planning efforts previously discussed. However, much remains to be done.

MANPRINT is an evolutionary and iterative process that requires constant vigilance and support. We must always remember that system performance is a combination of both equipment and human performance. IIIII

Logistics
(Continued from Page 35)

definable. Skills must be consolidated in such a way that the individual is fully employed, performing tasks with sufficient correlation to achieve and sustain mastery.

The overall training effort must be substantially less than that devoted to the current light fleet. This must be an aggregate reduction, not just a per student or per aircraft reduction. Finally, the individual must have a career progression opportunity at least equal to the current CMF 67 opportunities.

The goals of the LHX program are ambitious with potentially high payoffs. The Aviation Logistics School will continue to refine design, maintenance, supply, and soldier training concepts which stand to increase LHX reliability, availability, and maintainability. IIIII

R&M
(Continued from Page 48)

ware than any previous Army aircraft. Testing of an extensive MEP during engineering development will create new and unusual problems for R&M assessment.

As a minimum, it must be assumed that a separate MEP integration facility will have to be dedicated to mature the reliability of the components and to verify diagnostic software before installation in the LHX air vehicle.

The R&M objectives of the LHX are very ambitious but they're necessary if we're going to achieve the combat productivity required for the Army's new weapon systems. This article only touches on some of the main characteristics and problem areas — and only in a very superficial manner.

The LHX will have unique capabilities above and beyond the existing fleet: it will be lighter, faster, smaller, and more software intensive. Software? Software R&M will have to wait for another article! IIIII

LHX-CALIBER SYSTEMS

Being "point man" on the forward edge of the AirLand Battle Fleet of the '90s, that lone LHX scout/attack pilot will have his hands full. Not only must he fly perilous nap-of-earth routes, he must, at the same time, detect threats while avoiding detection. And he will have to make appropriate responses to those threats whether they are air-to-air or from ground-to-air.

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For complete information about integration of these low-risk LHX-Caliber Systems into larger systems and a free poster of this LHX illustration: In the U.S., call 612/853-5000, or write Government Systems Resource Center, P.O. Box O, Minneapolis, MN 55440. In Europe, telephone 06373-4304; or write Government Systems, P.O. Box 1, Newquay, TR7 3AP, Cornwall, United Kingdom; or Telex 45224.

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Mr. Jeffrey A. Olson
Chief, Power & Propulsion Branch (AMC-PM-LHX-TP)

Awards and Honors

Creative Informal Rewarding is a vital part of effective leadership

FT. RUCKER, ALA. — The current U.S. Army awards system seems to adequately serve its purpose of recognizing whole units or their individual members, but it definitely has its limitations.

The program is certainly not known for its timeliness, it tends to lack personal sincerity, and it's difficult to use to reward seemingly small but essential accomplishments. The civilian employer is afforded the luxury of giving immediate monetary bonuses, but the military leader does not have that option.

One of the most effective ways for a military leader to successfully conquer the inadequacies of the formal awards program is through the use of creative informal rewards.

In simple terms, creative informal rewarding is innovative recognition by a leader for significant contributions from his subordinates.

These rewards can be anything from an excused absence from duty to a simple plaque, as long as the reward adequately recognizes the performance.

The most notable characteristic of creative informal rewarding is its overall applicability. When used in conjunction with the authorized awards program, it can spontaneously reward the soldier on the spot, can serve as personal recognition from the leader, and can reward any soldier for the outstanding performance of any task.

A fundamental concept is that rewards are most effective when given immediately. An example of this immediate responsiveness was exhibited in a small reward given by a brigade S-3 during a cited field exercise. A group of soldiers was given a mission which included a lengthy road march to and from an objective.

The S-3 happened to find the soldiers on their return trip to the command post. They had performed marvelously but were fatigued and morale was low. The S-3 very promptly told the soldiers what a magnificent job they had done and how much they had helped the mission of the brigade, and he passed out cigars from his personal stock to every man.

As a result of that quick response, the soldiers immediately felt the appreciation of the S-3 and they were able to complete their mission with renewed vitality and enthusiasm.

The underlying principle, as phrased by that S-3, is: "Give flowers to the living." Creative informal rewarding is one of the few methods available to accomplish the fundamental leadership objective of rewarding personnel as quickly as possible, not after they've been reassigned from the unit.

Another advantage of this practice is that it tends to exhibit more personal appreciation and recognition from the direct leader than the formal awards.

Sincere gratitude is extremely important to the soldier. One of the best ways to provide that personal touch is through the use of a simple handshake. A handshake or similar physical touch (a pat on the back) helps confirm to the soldier the leader's personal appreciation.

When performed at a unit gathering, parade, or formation, the leader further reinforces his appreciation by personally recognizing the soldier in front of his peers or subordinates.

EXTRAORDINARY PERFORMANCE — James M. Hudson (right), a DAC assigned as a maintenance test pilot with the 120th Army Reserve Command, Ft. Jackson, SC, receives the prestigious Broken Wing Aviation Safety Award from LTG Johnny J. Johnston, CG of the Second U.S. Army, for his display of extraordinary skill in landing his T-42A aircraft safely after one of its engines exploded and caught on fire on 2 November 1984.

An excellent example of personal appreciation and recognition was provided by a battalion commander's creation of the "Rambo" awards. Inspired by the recent screen production, the award is presented at the end of a special training day to the soldier from each platoon who exhibited the most motivation and leadership throughout the day.

Simple, but effective, the award consists of a cloth name tape with the name "RAMBO" situated vertically on it, and is attached to a pocket with a brigade crest. The award is personally presented to the selectees by the battalion commander in front of the entire training company.

It's often very difficult for a leader to find an appropriate reward for soldiers whose performance is outstanding when the task to be rewarded is minor, but essential.

Certainly the soldier deserves a reward of some type, but perhaps he doesn't merit a recognized award. Here, numerous creative, informal options are available to resolve the leader's dilemma.

He could reward the soldier with a letter of commendation or appreciation, send the soldier to a military school which he desires, or give the soldier additional time off. Other alternatives include the presentation of a unit T-shirt or brigade coin or even tickets to a sports event.

Probably the easiest yet most effective way to reward that type of performance is through the use of verbal praise. This form of creative informal rewarding can be applied to any situation and, when performance merits, should be used liberally.

When the soldier puts forth his best effort but still falls short, it is imperative that the leader recognize his attempt and encourage him to continue to try. Soldiers need to be rewarded for outstanding achievement and they thrive on personal recognition from their leader.

Napoleon once said if he had enough ribon, he could conquer the world. Although the military awards program is striving to meet the needs of the soldier, it is creative informal rewarding which fills the voids in the current system.

When used in conjunction with authorized awards, creative rewards allow the leader to recognize achievement immediately, with more personal sincerity, and at any level of accomplishment, and the types of rewards and their applications are limited only by the imagination of the creator.

—CPT Jeffrey L. Presnal
Aviation Training Brigade,
USAAVNC

CLASS PHOTO — The Army Aviators in the Class of 1986 at the Air Command and Staff College at Maxwell AFB, Alabama, gathered recently for this photo. FRONT ROW (l to r): MAJ (P) Rodger Tunnell (ACSC Faculty), MAJ Tom Wills, LTC Charlie Watkins (Army Class Leader), MAJ Bruce Umstaedter, MAJ Carl Kropf, MAJ Mike Whitaker. BACK ROW: MAJ Lyn Boylston, MAJ John Buchanan, MAJ (P) Dave Swank, MAJ Chuck Shelton, MAJ Robert Combs (ACSC Faculty), MAJ Andrew Chatam. MISSING: MAJ (P) Don Cumbie.

AWARDS

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Small Business
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COBRO Corporation
Team, Group, or Special Unit Industry Award :
Sikorsky Support Services, Inc.
United Technologies Corporation

AAAA MONTEREY BAY CHAPTER

1985 Unit of the Year :
206th Assault Helicopter Company
1985 Aviator of the Year :
CW3 (P) Craig R. Nixon
1985 Air Crewmember of the Year :
SGT Wan Napper

USAALS, FT. EUSTIS, VIRGINIA

1985 NCO of the Year :
SSG Stephen A. Clarke

AAAA CHAPTER-SELECTED "AVIATION SOLDIER / NCO OF THE MONTH"

DEC — Schwaebish Hall Chapter
SP4 Stephen L. Spector
DEC — Taunus Chapter
SGT Bruce Hudson
JAN — Army Aviation Center Chapter
SSG Margaret M. Kluchonic
SP4 Stephen J. Isleib
JAN — Taunus Chapter
SSG Jeffrey Bezore

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JAN. 10, 1986 — Guest Speaker: MG Richard D. Kenyon, Chief of Legislative Liaison, Department of the Army.
Initial Entry Rotary Wing Class 25: ★ WO1 Charles E. Wittges; + WO1's Donald K. Shivers, Steven M. Shoemaker, Scott A. Beiler, Bart J. Krull.
Initial Entry Rotary Wing Class 26: ★ 2LT John C. Miller; + 1LT's Dale N. Jorgenson, Jr., Glen G. Deevaert, 2LT's Perry L. Hagaman, Bradley A. Dunning.

JAN. 14, 1986 — Guest Speaker: LTG Robert R. Williams, Ret, former DCSOPS, HQDA, and CG, USAAVNC.
Aviation Officers Advanced Course 85-4: ★ CPT Michael A. Zonfrelli; + CPT's Wayne T. Yamato, Eric S. Dean, Stephen Skowronski, James J. Budney, Jr.

ATC AWARDS — Shown above at a Ft. Huachuca awards dinner are: (l to r) Mr. Robert Hamby, representing the 1985 ATC Facility of the Year, Lawson AAF Control Tower, Ft. Benning, GA; SGT Derrick Dempsey, the Air Traffic Controller of the Year; SGT James Miller, 1985's top ATC Maintenance Technician; CW2 Terry Van Steenbergen, the ATC Manager of the Year; and CPT Mitchel McCoy, representing the 1985 ATC Combat Support Platoon of the Year, 5th Platoon, 68th ATC Company, 16th ATC Battalion, Ft. Sill, OK.

POLICE WORK — SSG Margaret Kluchonic (right), Aviation Center NCO of the Month for January, shows SP4 Stephen Ilseib, the month's top soldier, how to use radar to check for speeding vehicles. She is an MP squad leader at Ft. Rucker. He is a computer programmer/analyst.

Hardware

The AH-64 APACHE Attack Helicopter: Killer on the loose!

ST. LOUIS, MO. — The AH-64 APACHE is the most awesome airborne attack helicopter to be fielded anywhere in the world today. With fielding the First Unit Equipped (FUE) in April, 1986 Army Attack Units will take a quantum leap ahead in combat capabilities.

Day, night, and adverse weather are no challenge for the APACHE target acquisition and pilotage sensors. In fact, night is the best time of day for the APACHE. The full stand-off range to engage and kill targets to the maximum range of missiles and rockets is now a reality. No longer is an Army attack helicopter required to operate within the kill zones of enemy air defense systems.

The APACHE has a new and unrivaled performance capability to carry a full complement of assorted weapons to defeat any threat and still have unprecedented agility and evasive flight performance under the most demanding world-wide atmospheric temperature and altitude conditions.

Never before has the Attack Helicopter Battalion (AHB) commander had such effective, responsive, and flexible fire power. APACHE will rewrite the AHB combat tactics and doctrine.

The AH-64 maintenance concept of "Remove and Replace" at the AVUM level and the full time monitoring on-board Fault Detection and Location System (FD/LS) will identify failures to the flight crew and enable maintenance to correct the majority of failures within minutes; enabling quick turnaround and length availability for enemy re-engagement.

The realiability of the AH-64 is growing ahead of its projections. Greatly assisting in this growth is the extensive flying accumulated during Ft. Rucker Aircraft Qualification Courses (AQC) and the identification and correction of user shortcomings.

As a result of the extensive production verification efforts and training experience, the AH-64 will be fielded in fighting condition — battle ready.

A Report by Mr. John P. Clarke

A first for aviation — Total Package/Unit Materiel Fielding (TP/UMF) — is well in hand to support the FUE. The complete AHB fielding package will be delivered to Ft. Hood beginning in January, 1986, so it is available at least 30 days before FUE.

Now, the AHB commander will have **one** point of contact to deal with for any TOE equipment — the AVSCOM Materiel Fielding Team, located at Ft. Hood.

LTC Kenneth McIntyre, formerly of the AH-64 Program Manager's Office, played a key role in establishing the TP/UMF and has moved on to direct the overall AHB TP/UMF effort for AVSCOM.

COL Dave Keating, formerly the AH-64 Assistant Program Manager for Logistics, has been designated as the Army's Project Manager for Remotely Piloted Vehicles. **LTC Cecil Scalf** continued Dave's fine work and FUE implementation on a temporary basis through late December, 1985 when **COL John Henry Dick** came on board as the APM for Logisitics.

John comes from a recent assignment in USAEUR and he brings a strong background of field experience to strengthen the supportability of the APACHE. He, along with **Mr. Craig Breder,** APACHE Integrated Lostics Support Chief, will have the APACHE PMO responsibility to support the APACHE logistically when it is fielded. All AMC major subordinate commands have functional log support requirements.

—Mr. John P. Clarke
Deputy Program Manager
Advanced Attack Helicopter

HELPING HAND — AAAAs "Old Ironsides" Chapter presented a VCR and four children's videotapes to the Nuremburg Hospital's Pediatric Ward last Christmas. MAJ William Bryan and COL Robert Claypool, the Hospital Commander, (seated) are shown at left with pediatrician CPT Merlin Robb, CW2 Ed Petrow, and some happy kids.

HELLFIRE Modular Missile System: Present and Future

REDSTONE ARSENAL, AL. — HELLFIRE's dual source production competition is working. FY85 missile unit procurement costs were down considerably from original estimates — a savings of over $25 million.

This reduction in cost coupled with laser HELLFIRE's excellent performance track record — high lethality, pinpoint accuracy, short time of flight and superior standoff range — render HELLFIRE a truly cost effective antiarmor missile.

Current Performance Attributes: Today's HELLFIRE Modular Missile System provides the users with a degree of engagement flexibility, target lethality, and launch crew survivability not heretofore achievable with any other antiarmor system. HELLFIRE's enhanced firepower/lethality is due to:

- a large, highly lethal, shaped charge warhead;
- low circular error probable;
- high probability of kill at short range;
- short time of flight; and
- high rate of fire.

The launch crew will survive because:

- the crew may launch from defilade positions;
- at long standoff ranges;
- with minimal launch signature; and
- nonballistic missile flight paths (negating the effectiveness of counterbattery radars).

Applications Programs: The HELLFIRE Modular Missile System is being integrated onto several aerial and ground launch platforms. These HELLFIRE applications programs are in various phases of the materiel acquisition cycle. The status of these application programs is summarized below:

- Navy/Marine Corps HELLFIRE (on AH-1J & AH-1T Sea COBRAs) — The AH-1J completed OPEVAL July, 1985 (12 direct hits/12 launches). AH-1T completed Navy Technical Evaluation in June, 1985, and approval for full production is pending.
- UH-60 BLACK HAWK ("Bolt on - Bolt Off" HELLFIRE with remote laser designation) — Began Development Test (DT) missile flight tests December, 1985. Operational Test (OT) scheduled for late Spring, 1986.

A Report by Lt. Colonel Emmett E. Hughes

- Ground Launched HELLFIRE (on HMMWV/Trailer or on a ground tripod — Swedish concept) — The U.S. Army program is pending DA approval of the requirement document while the Swedish Program is currently under engineering development; OPEVAL is scheduled for September, 1986.

The Future of HELLFIRE: Whereas HELLFIRE's evolution has brought a magnificent capability against the current threat, additional improvements in the near term are necessary in order to stay ahead of the Warsaw Pact forces.

In the FY86-FY88 timeframe:

- A digital autopilot will replace the current analog autopilot to simplify trajectory shaping, improve minimum range performance, and upgrade HELLFIRE's air-to-air capability.
- The current laser seeker will be hardened against potential electro-optical countermeasures.
- HELLFIRE's current single stage motor will potentially be replaced by a two pulse motor which will increase the missile's maximum range and reduce its time of flight.
- The warhead will be enhanced as necessary to defeat ever-increasing threat armor protection levels.

In FY88-FY91:

- A fire and forget seeker will likey be developed to operationally complement today's laser seekng missile. This new seeker will improve HELLFIRE's performance in adverse weather/obscurants; increase its fire power; reduce the effects of target masking in undulating terrain; reduce launch crew exposure times; and enhance HELLFIRE's air-to-air capability.

Conclusion: As the AH-64 APACHE approaches its first unit equipped date early this year, HELLFIRE will bring to the attack helicopter force an incomparable, long-range antiarmor capability, a missile capable of defeating all armor on today's battlefield.

As threat armor evolves, HELLFIRE will continue to overmatch its armor protection levels and countermeasures and do so in the most cost effective manner possible, with minimal redevelopment and requalification of existing missile hardware.

—LTC Emmett E. Hughes
Ass't PM, HELLFIRE
Adv Planning & Applications

JACK ELLIOTT PYLER

CW2 Jack Elliott Pyler of Port Arthur, Texas, has passed away as a result of injuries sustained in an automobile accident on 7 December 1985. Last assigned to the 187th ATC Company (FWD) in Wiesbaden, FRG, he is survied by his wife, Sandra, and children, Crystal, 16, and Jack Jr., 10.

Historical

New Army Aviation Museum building is nearing construction

FT. RUCKER, ALA. — The Army Aviation Museum Foundation is moving steadily ahead toward a long-awaited groundbreaking ceremony for a modern museum facility here on a site adjacent to the present museum buildings and grounds on the Main Post.

The Museum has amassed a truly magnificent collection of aircraft, documents, and memorabilia which reflect the proud history of Army Aviation but it has no place to properly preserve or display much of it.

The Foundation's Board of Directors remains committed to it's 1984 decision to begin construction of a permanent home for the Army Aviation Museum at Ft. Rucker in phases with the funds presently available rather than waiting to begin until the fund-raising drive for a new museum building has reached its original goal of $2.5 million.

Foundation Board Chairman LTG **Jack Tolson, Ret,** told the AAAA National Executive Board at it's Atlanta meeting on 11 January that the Foundation has thus far raised $1.5 million in cash and $305,000 in pledges in addition to $110,000 already expended for development costs such as architectural services, site survey, and soil tesing.

COL Ed Brown, Ret, the Museum's Director of Development, reports that the 46th Engineer Battalion has been authorized to do the necessary site preparation work for the new facility as a domestic action project. The Museum Foundation will reimburse the Engineer's for costs such as fuel and materials which are not directly attributable to normal training.

Site preparation is scheduled to take 60 days and is expected to begin this April, pending final approval of the building plans by the Secretary of the Army. Ground-breaking and construction would begin as soon as the site is prepared — perhaps as early as June.

The cost of the first construction increment — which will include the museum's main entrance, 40,000 feet of aircraft display area, a gift shop, and a new parking lot — is estimated at $1.5 million. The completed $2.5 million museum structure will include approximately 74,800 feet of usable area and the fund-raising effort for the second phase of construction is continuing under full steam.

Several major contributions to the building fund have been received since the last in-depth report on the museum's progress in the June, 1985 issue of *Army Aviation*:

- **General Electric**, through the VP and General Manager of its Engine Projects Division, **William J. Crawford, III**, has pledged $100,000 over the the next five years — in addition to $55,000 already donated — and has presented a check for $20,000 as a first installment.
- **General Motors**, through the General Manager of its Allison Gas Turbine Division, **F. Blake Wallace**, has pledged $50,000 to the fund and made an initial donation of $16,666.
- **Garrett**, through its Vice President, **Thomas F. Bennett**, has made an initial contribution of $10,000 to the museum fund.
- **Grumman** has made a $2,000 donation and **Canadian Marconi** has given $1,500 in addition to their previous contributions.

The new Army Aviation Museum building will be an impressive, functional structure which will do justice to the proud heritage of the Army's Aviation Branch.

We're all looking forward eagerly to the ground-breaking ceremonies at Ft. Rucker.

PRESERVING ARMY AVIATION HISTORY — Jeff Miles (left) of the Government Programs Office of GM's Allison Gas Turbine Division points out features of an Allison engine on an OH-6 CAYUSE at the Army Aviation Museum to COL F.M. McCullar, Ret, of the Museum Foundation's Board of Directors. Miles presented a $16,666 gift to the Museum's building fund as part of a $50,000 pledge from the General Motors Foundation.

Genesis - Day 1 - Or how hard it was for the first Grasshoppers to do their thing!

IN 1941, Army Aviation—as we know it today—hadn't yet gotten off the ground. Several lightplane manufacturers, aided by a handful of military visionaries, were pressing the War Department to evaluate the aircraft in operational use. At this point, we extract from *"Mr. Piper and His Cubs,"* written by **Devon Francis.**

"In June, **(John E.P.) Morgan,** a Piper marketing representative, got a break. The Second Army was about to embark on maneuvers at Camp Forrest, Tenn., and the Air Corps was asked to supply some observation aircraft. It had none to spare. Assistant Secretary of the Army **(Robert) Lovett** wrote **Morgan,** suggesting the use of lightplanes.

At their own expense Piper supplied eight airplanes; Taylorcraft and Aeronca, two each. All were fitted with two-way RCA radios for communication. All had sixty-five h.p. Continental engines.

The experiment at Camp Forrest was hardly an unqualified success. Someone had failed to pass along the word. The Army was puzzled by the presence of civilian pilots flying outsize kites. The utility of the things was too simple for the military mind to grasp.

Lightplanes were not in the table of organization and, ipso facto, did not exist. Their pilots were given few orders. They slept under the wings of their planes. They scrounged their food.

Some messenger, reconnaissance, and spotter flights did get flown. In the fourth and last week of the maneuvers the umpires discovered that they could find out what was going on only if they covered the terrain from the backseat of the civilian planes. That helped.

Okay, the puddle jumpers would try again, still at their own expense. This time it was the Third Army maneuvers at Fort Bliss, near El Paso, for two weeks dating from the middle of July.

Two more Cubs were added to the liaison fleet. West Texas blistered under a copper sun. The orders cut for the signature of **Major General Henry H. Arnold,** Chief of the Air Corps, specified that the lightplanes were to report to Biggs Field, Laredo, for assignment to the 1st Cavalry under command of **Major General Innis P. Swift.**

The pilots would be billeted by the Air Corps and eat in the officers' mess. But **Arnold's** orders meant nothing to the post commanding officer, a National Guardsman called up to active duty. What were civilians doing on his post?

"I know nothing about you," he snapped, "or why you're here."

The lightplane pilots, hot, tired, dirty, and nettled — **(William D.) Strohmeier** and **Tony Piper** among them — flew to the Laredo civil airport and checked into a downtown hotel.

For two days **Ted Weld** and **John Morgan,** who had come down to oversee the operation,

Extracted from *"Mr. Piper and His Cubs"* by Devon Francis. Published by the Iowa State University Press, Ames, Iowa 50010. 1973, $7.95.

PIPER L- 4's — The proud tradition of today's Army Aviation began with the 19 students in Class One at Ft. Sill, Oklahoma, on 1 August 1942. The Piper L- 4 CUB was the first plane used by this first class of Army aviators.

argued with the Biggs commandant.

"What do you have to have," demanded **Morgan,** "a verbal command from a big shot?"

"Yes, if you dot the 'o'."

In desperation **Morgan** telephoned **Lovett** in Washington. "Be in the CO's office at 10 a.m. tomorrow," said **Lovett.**

Morgan and **Weld** were there when the telephone rang.

"Yes, sir," responded the CO. "Yes, sir! Yes, SIR!"

Whereupon the lightplane contingent moved into Biggs Field and into the officers' mess.

The Texas maneuvers proved to be the payoff. In the biggest desert operations ever undertaken by the U.S. Army, in temperatures ranging up to 115 degrees, the little airplanes bounced in and out on blistering runways hastily scraped by Army engineers on dry lake beds, on the slopes of hills, and through cactus with spikes that left festering sores if a man brushed against them.

The lightplanes not only were durable, they were easily repaired as well.

In one instance three of them were ordered to land on an unprepared field. The first two pilots stubbed their toes on landing and spread their gears. The third got down without damage. He radioed the base for repair parts. In one hour and twenty minutes both the damaged airplanes were flying again.

The Air Corps fly boys crash-landed their big Consolidated Vultee "O" (for Observation) Ones so consistently that orders were finally issued that no military aircraft was to use a newly-prepared field until the light planes had been in and out of it for 48 hours.

Any damaged Air Corps observation plane had to be trucked to a main base for repair.

General Swift was impressed by the ease with which the small planes carried out their courier duties. At his headquarters 50 miles north of El Paso he growled about the delay in getting radio messages through.

"Send a Grasshopper down to Biggs Field," he told an aide.

"What's a Grasshopper?" asked the aide.

"They'll know when you tell them."

The name stuck.

Within a month Grasshopper lapel pins had been struck and distributed.

GRASSHOPPER REUNION — 25 World War II era Army pilots gathered at Ft. Sill for a three-day reunion last October organized by BG William W. Ford, Ret, first Commander of the Department of Flight Training. The group visited Post Field, site of their initial flight training, and were fascinated during a private dinner by COL Robert Stewart's description of his free flight in space as an Army - NASA astronaut.

Industry

The Army's Bell Plant Rep Office: A major player in systems acquisition

FT. WORTH, TX — In today's acquisition arena, many dynamic organizations facilitate acquisition of major weapons systems — one organization involved concurrently in all acquisition phases (concept, design, development, production, modification, fielding, and support) is the Army Plant Representative Office (ARPRO) located at the Bell Helicopter Textron manufacturing facility in Ft. Worth, Texas.

Our mission, as with the other two ARPROs in AVSCOM — Boeing Vertol and McDonnell-Douglas Helicopter — is to perform Contract Administration functions prescribed or delegated in the Federal Acquisition Regulation (FAR) for contracts awarded by DOD services, other Government agencies, and foreign governments.

The ARPRO's objective is to obtain on time, at the lowest possible cost, a product with a high level of quality and reliability. Although not a buying activity, we perform on-site administration for all Government contracts awarded to Bell and provide efficient, minimal cost services to procurement agencies and contractors.

The services we provide include facility surveys, quality assurance, production, contract administration, engineering (design through logistical support), price/cost analysis, cost/schedule monitoring, security, contract settlements, subcontract evaluation, proper contractor utilization of Government property, and flight/quality acceptance for buying agencies.

This requires interface with various Government/Program Management Offices, some of which are: UH-1 (all services), LHX, OH58D-AHIP & COBRA (Army), Super COBRA (USMC), TH-57 (Navy), and the V-22-JVX Tiltrotor.

A Report by Major (P) Fred V. Carpenter

We maintain a close working relationship with DOD Competition Advocacy/Spares Management Offices since "spares" purchased from Bell total over $150 million annually. In this area we provide another valuable service — pricing and negotiating the majority of spares purchased for the military/Government from Bell.

Additionally, our mission requires close interaction with the resident office of the Defense Contract Audit Agency (DCAA).

The ARPRO's environment involves an everchanging situation, especially in technology breakthrough areas such as: "Tiltrotor" aircraft of the future, increased use of composites, fly by wire components, and advanced automated flight systems.

Staying abreast of this environment requires staffing that mirrors major commands with divisions in: Procurement and Production, Quality Assurance, Engineering, Flight Test/Acceptance and Administration.

We must remain current with increased use of high technology in design/manufacturing, and constantly seek to improve our productivity by enhancements in areas such as "ADP".

Bell's diverse operations requires ARPRO interface with their major rebuild/overhaul and production facility in Amarillo, Texas, with seven different plants in the Fort Worth area and with numerous global subcontractors.

We are staffed with only 12 military and 128 civil service personnel and this demands the utmost in management capabilities if we are to accomplish the overwhelming workload and keep up with the daily changes in priorities.

Commissioned Officers assigned to ARPRO must have a strong Program Management background. Therefore, these TDA positions are coded 6T (Materiel Acquisition Management) which represents the dedication AVSCOM has to improving DOD acquisition of major weapons systems.

This is just a small portion of what a Army Plant Representative Office does to ensure that the end result is "to provide the customer with a quality, relaible product, on time, and at the lowest possible cost" — this is our reason for existing.

—MAJ (P) Fred V. Carpenter
Deputy Commander
ARPRO, Bell

International

Keeping the World Helicopter Championship where it belongs!

FT. RUCKER, ALA. — In 1981, the United States Precision Helicopter Team (USPHT) won the World Helicopter Championship (WHC) in Piotrkow Trybunalski, Poland.

Under the auspices of the Helicopter Club of America — a private organization — the support group for the 1986 U.S. team is already organized under the leadership of **LTC Robert E. Harry** at Fort Rucker, Alabama, and is moving to lay the groundwork for another World Championship.

The support group has three objectives:

1. Design and organize a fair and unbiased national competition to select a U.S. team to compete against the best aviators in the world.
2. Develop and supervise a training program designed to win the 1986 World Helicopter Championship.
3. Provide support which will allow the U.S. team to demonstrate American leadership in the development of helicopter:
   - Hardware
   - Technology
   - Flight Training Programs
   - Navigator Procedures
   - Crew Coordination Techniques

The coordination and preparation for the National Championship (to be held here on 9-14 February) is nearly completed. The competition, which is open to any helicopter team in the United States, boasts 27 teams from six MACOM's and one civilian team — Hynes Aviation, Inc. from Frederick, OK.

The courses and schedule for the winning teams' training have been planned, and final details are being worked out. Teams selected will begin intensive

DEDICATED TO WINNING — Members of the Support Group for the 1986 U.S. Precision Helicopter Team gathered outside Team Headquarters at Ft. Rucker recently for this photo. Shown from left to right are: SGT Ricardo R. Manuel, S-4 NCO; SP4 Cedric C. Tate, Driver; Ms. Sara Berkeypile, Secretary; CW3 (P) George "A.K." Adkinson, Maintenance Officer; CW4 Charles "Pappy" Proctor, Training Cell; PFC Patricia A. Connell, Administrative Supervisor; CW3 E. Daniel Kingsley, Safety Officer; SGT James H. Milliner, Driver; LTC Robert E. Harry, Team Commander; CPT Wendy R. Lageman, S-4; CW2 Robert E. McConnell, Training Cell; CPT Bobby G. Hanna, Jr, S-1; CW3 Nick P. Walters, Training Cell; CPT Wesley F. Walters, S-3; SSG Joseph D. Harris, S-3 NCO. MISSING: CPT W. Keith Martin, MD, Team Flight Surgeon.

training until the World Championship competition in England (22-28 June 1986).

The competition events this year are changed somewhat from those in 1981. Safety is in a much more prominent spotlight, and the manuevers are more orthodox. The events in 1981 heavily emphasized perfection of the individual efforts of the pilot and co-pilot, whereas the 1986 events place a much greater weight on crew coordination than ever before.

A Report by CW3 E. Daniel Kingsley

Several of the 1981 World Champion team members have been called into the support group (Training Cell) to add the benefit of their experience to the group effort. **CW3 Nick P. Walters, CW4 Charles L. (Pappy) Proctor,** and **CW2 Robert E. McConnell** have added imeasurable depth to the support group, bringing knowledge and information only the experience in Poland could have provided them.

There is a very special camaraderie here which is a little more difficult to describe than the finite, black and white things. It's the attitude. Every member of the support team is looking beyond the national championships to the World Championship.

This attitude can be seen in the attention even the most mundane chore gets if it will help to select the best crews; in the pride every individual feels in assisting someone else who may need a helping hand; in the whole spirit of things. It has infected everyone associated with the support group.

The United States Precision Helicopter Team will be a winner. Every member of the support group is dedicated to the mission of selecting and training the best eight crews in the United States to keep the World Helicopter Championship where we feel it belongs.

— CW3 E. Daniel Kingsley
Aviation Safety Officer, U.S. Precision Helicopter Team

LATE NEWS — We've just received the names of the six winning teams in the Ft. Rucker Precision Helicopter competition who will go on to participate in the U.S Precision Helicopter Team competition against the best helicopter crews in the country, military and civilian. They are:

1. **CW3 James A. Maddox**
   CW2 Howard H. Fancher
   547 points — OH-58
2. **CW2 Noel C. Seale**
   CW2 Michael C. Pacalar
   455 points — OH-58
3. **CW2 Raymond D. Kent**
   CW2 Patrick L. King
   391 points — OH-58
4. **CW2 Jimmy Green**
   CW2 John A. Iseminger
   315 points — OH-58
5. **CW2 Thomas P. Reynard**
   David J. Clark
   313 points — UH-1
6. **CW2 Donald G. Andera**
   CW3 Michael Spradling
   312 points — UH-1

1986 World Helicopter Championships

USA BOOSTER TRIP

Castle Ashby, England
June 22-28, 1986

11 DAYS — 10 NIGHTS
DEPART: Friday, June 20
RETURN: Tuesday, July 1
TOTAL PRICE: $1,111
(Double occupancy)

THE TRIP INCLUDES:

- **Special USA departure.**
- **Round trip commercial air carrier New York to London.**
- **One week at the Angel Hotel. All rooms have a private bath. Full English Breakfast daily. Complete Table'hote Dinner (six nights).**
- **Transportation to and from the Hotel and Aerodome daily.**
- **Lunches and beverages available at Castle Ashby, the Championship site.**
- **Transportation to London Hotel.**
- **Four days and three nights in London.**
- **One half day sightseeing.**
- **Transportation to the airport on the day of departure.**
- **Complimentary $100,000 flight insurance.**

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($20 membership required - except for Team members, news media, friends and relatives of HCA members)

Membership Application and Tour Application forms are available from:

Helicopter Club of America
One Crestwood Road
Westport, CT 06880
(203) 226-0487

A $150 deposit is required with the Tour Application and final payment is due by May 1.

Operations

The 12th Aviation Group is prepared to fight and win!

APO NY 09457 — 1985 has been an exciting year for the 12th Aviation Group. Our training mission was to fully integrate the 12th Aviation Group as a true member of the combined arms team.

To do this, we developed a comprehensive program that started at the individual soldier level and then culminated with several collective level evaluations that included the employment of the 12th Aviation Group as a task force and a true combat maneuver unit.

A Report by Colonel Robert S. Frix

Our individual training program went far beyond the normal training requirements of the Army's ITEP and ATM programs. We developed an extension to these programs by requiring our young soldiers to learn the ways of Armor, Artillery, and Infantry.

We periodically sent teams of two or three officers to perform the duties of platoon leaders and operations officers in these other combat arms units. Their hands-on experiences taught them employment considerations and gave them the opportunity to learn more than any textbook or classroom instruction could have taught them.

All these training experiences took place during field training exercises where the young officer not only learned how to employ the unit he was assigned to, but also had the opportunity to train the leadership of that unit on the integration and employment of Army Aviation as a member of the combined arms team.

Our collective training program not only included company, battalion, and group externally evaluated ARTEPS, but also included integrating Armor, Artillery, Infantry, our German partnership units, and CONUS National Guard units into our task organization.

We aggressively pursued every opportunity to go to the field and participate in every major field exercise we could. On numerous occasions we participated with the 8th Infantry Division (Mechanized) during CPX's, CFX's, and FTX's.

Our missions included economy of force, screen, and reconnaissance in the main battle area; the tactical maneuver force in the rear area; and raids, diversions, and deliberate attacks for the cross FLOT battle.

During REFORGER '85, the 12th Aviation Group was task organized as a true combat maneuver unit. In addition to our normal organization, we had a National Guard infantry battalion and artillery battery attached for employment as well as German lift and attack assets.

During the defensive phase, the Group provided the tactical maneuver force for rear combat operations. During the offensive phase, the Group performed offensive combat operations deep in the rear of the enemy in concert with the ground maneuver plan. The 12th Aviation Group had become a true member of the combined arms team!

Today, the 12th Aviation Group continues to improve on those lessons learned to refine the employment of Army Aviation as a true member of the combined arms team. Our challenge is to insure that we continue to develop combat leaders, commissioned and non-commissioned, who are prepared to fight and win any future conflict, particularly here in the European Theater.

—COL Robert S. Frix
Commander, 12th Combat Aviation Group

The outstanding soldiers of the 501st Aviation Battalion had a very busy year

KATTERBACH, FRG — The mission of the 501st Aviation Battalion is to support mobile armored warfare in the 1st Armored Division. The battalion has enjoyed a busy, prosperous and safe year.

It all began in January '85 when the battalion prepared to go to Northern Germany for REFORGER (FTX Central Guardian) where the battalion served as the aviation controller for the other three USAREUR Divisional Aviation Battalions.

This exercise took place in

adverse weather conditions, but the benefits highly out weighed the adversities. In observing the other three Battalions, we had the opportunity to observe some outstanding aviation operations; many of which we have incorporated into our Battalion SOP's.

Right after REFORGER our Echo Company (UH-60) deployed to Denmark to support the International Long Range Reconnaissance Training Exercise "Viking 85". This exercise was a NATO special operations exercise which supported teams from over seven countries throughout Europe.

Conducting over 90 special operation missions, of which half were under NVG conditions, proved to be challenging in the minimal weather conditions. This exercise proved valuable in our interoperability training and coordination with our European neighbors.

During March the battalion deployed on Division FTX Certain Iron for nine days — which proved to be the training event of the year. With over eight inches of snow on the ground and the road conditions being red, the Division Commander gave the order to deploy to the GDP.

AIR WAR COLLEGE — The four Army aviators currently attending the Air War College at Maxwell AFB, Alabama, are pictured above. FRONT: COL George C. Hollwedel, Jr. REAR: LTC Herbert G. Stocking. LEFT: LTC Billy J. Miller. RIGHT: LTC Billy G. Murphy.

Again, our aircrews were given the mission to operate in extreme adverse weather conditions but, by massing our combat power in company size operations, we defeated the OPFOR aggressors and had a highly successful and safe operation, flying over 2,300 hours. All facets of the battalion were thoroughly tested.

In April, (with the UH-60 grounding) the UH-1s of our General Support Company deployed on Flint Lock 85 which was interoperability training between one of the 1st Armored Division's Infantry Battalions, a German Infantry Battalion, and the U.S. Special Forces located in USAREUR.

A Report by Lt. Colonel Immanuel C. Sieving III

Meanwhile, B Company (Attack) was out conducting interoperability training with the 4th Canadian Mechanized Brigade in Exercise Snakebite 85, particularly with the 444th Squadron which is their partnership unit.

They conducted a highly successful offensive operations, practicing attack helicopter operations employment and exchanging information on how both forces operate, since the Canadians do not have attack aircraft.

The interoperability training between our COBRA pilots and 444th Squadron scouts proved invaluable. In fact, these two units won the USAREUR Partnership Unit of the Year for 1985.

As August rolled around, the Battalion deployed to Hohenfels, Germany where it conducted a successful Annual gunnery exercise firing all tables in established mission type scenarios.

Concurrently, Charlie Company (Attack) was preparing to deploy to the southern tip of Spain to participate in operation TESEO. The enroute flight planning proved to be challenging in crossing two international borders and, working with the Spanish in their exercise gave our aircrews a better understanding of how air mobility is employed in the Spanish Army.

As the battalion nears the end of another calendar year, we can only say it has been an outstanding year, not only in operability training, but also in safety. As we look forward to 1986, it will probably be one of the biggest years for Aviation in the 1st Armored Division.

In January, the battalion is the major Aviation Player Unit in USAREUR (FTX Certain Sentinal). Immediately after REFORGER, the battalion will go provisional as we form the 4th Maneuver Brigade in the 1st Amored Division on 16 February, with 17 April being the activation day for the new brigade.

We also have a 7.8 million dollar airfield construction program going on which involves the installation of new parking pads, a new refueling operation, and the construction of a new hanger.

In closing, all these accomplishments would not have been possible without the outstanding soldiers we have in the Aviation Branch today. Because of them, the 501st AB(C) is a fighting force in the 1st Armored Division and a full fledged member of the Combined Arms Team.

— LTC Immanuel C. Sieving, III
Commander, 501st Combat Aviation Battalion

Briefs

The AAAA members in the Greater Indianapolis Area have activated an **Indiana Chapter,** the Association's 49th. **MAJ Samuel H. Mowery** (Pres), **CPT Thomas K. Beaty** (SrVP), **Dale G. Mohlenhoff** (Sec), **Norm Egbert** (Trea), **1LT Talmadge G. Pope** (VP-Memb), and **1LT Dale J. Voitus** (VP-Prog) serve on the Chapter's initial Executive Board.

The AAAA's 50th Chapter has been activated at Ft. Leonard Wood as the **Ozark Mountain Chapter.** Sikorsky VP **William A. Minter** was guest speaker at its activation meeting. **COL James E. Brayboy** (Pres), **Stan Gregory** (SrVP), **CW4 Robert J. Hawkins** (Sec), **CW2 Okey L. George** (Trea), **LTC Clarence A. Smith** (VP-Memb), **SP4 Dean A. Oliveri** (VP-Prog), and **COL Robert H. Smith** (VP-Publ) are the Chapter's Charter Officers.

The Ft. Polk, La., area was the site of the activation of AAAA's 51st Chapter with the **Wings of the Devil Chapter** getting off the ground in early December. Serving on the Charter slate of officers are **MAJ Richard L. Gill** (Pres), **MAJ Fred E. Brown** (SrVP), **CPT Eugene W. Reaves, Jr.** (Sec), **CPT Joseph L. Bradley, Jr.** (Trea), **1LT Thomas E. Van Fechtmann** (VP-Memb), and **MAJ Lloyd R. Dobbins** (VP-Prog).

On Dec. 17, the **Wright Brothers Chapter** was activated in Columbus, Ohio, to commemorate the 82nd Anniversary of the first flight of powered aircraft by the Wright Brothers, according to **Carl E. Bobo, Jr.** The officer slate and full activation details will follow.

Arizona members have a Chapter once again with the activation of the **Arizona Chapter** in Mesa in December. (A Ft. Huachuca-**Grand Canyon Chapter** had deactivated several years ago). The initial Executive Board includes **MAJ Lyle D. Monson, Sr.** (Pres), **Randall L. Taylor** (SrVP), **LaVerne R. Foreman** (Sec), **Dave Olney** (Trea), **Joe Hovorka** (VP-Memb), **CW4 Roger K. Gould, Ret.** (VP-Prog), and **MAJ Joseph F. Pullano, Ret.** (VP-Publ).

AAAA Overview

MG Molinelli

COL Gilbert

CW4 Helton

■■ Nominations Committee proposes five

There are ten elective offices on the Nat'l Executive Board with annual elections staggered so that three to five members are elected to the Board each year. Composed of the AAAA's Past Presidents, incumbent President, and the Executive Vice President (who serves without vote), the Nominations Committee will propose five members to fill the National Board elective three-year offices to be vacated at the time of the April, 1986 Convention. They include **John J. Stanko, MG George W. Putnam, Jr., CW4 David E. Helton, MG Robert F. Molinelli,** and **Leslie H. Gilbert.** The latter two AAAA members have served on the Board as appointed National Members-at-Large, and will be nominated to fill the elective offices being vacated by **Paul L. Hendrickson** and **Leonard D. Kulik.** The actual election of National Officers will take place during the AAAA's General Membership Meeting on Thursday morning, April 10, in Atlanta, Ga.

■■ National Board adds five new members

Four additional Chapters reached the "150-member or better" plateau recently, their Presidents assuming a January-March, 1986 seat on AAAA's Nat' Board. The Presidents are **MAJ John L. Hamlin** (Hanau), **LTC Immanuel C. Sieving** (Old Ironside Chapter), **COL Raymond G. Boland** (Wings of the Marne Chapter), and **Cadet Michael T. May** (Citadel Chapter). The latter is the youngest member to ever serve on AAAA's 63-member Board. Also, **Ward Hemenway,** newly-elected **Connecticut Chapter** President, replaced **LTC "Vince" Bailey,** as that Chapter's representative on the National Board.

■■ Chapter Refunds increased substantially

Promptness pays! Under a new program, a Chapter that submits a draft meeting notice to the National Office in an envelope that's postmarked at least one month prior to the actual meeting date will receive a "$0.40 per member" bonus once in each membership quarter in which it conducts a Chapter professional, social, or professional-social meeting. This "bonus" would be in addition to the normal $0.20 per member refund provided to the Chapter.

■■ Paris Air Show Videotapes

Six CONUS Chapters have already signed up for "loan" of the "1985 Paris Air Show" two-volume videocassette package by the editors of *Aviation Week & Space Technology.* Purchased by AAAA, the VHS videotapes are offered for CONUS Chapter viewing on a "first come, first served" basis through Thursday, August 7. The **Citadel Chapter** (Feb.20), **Chicago Area Chapter** (Mar. 5), **Corpus Christi Chapter** (Mar. 20), **Pikes Peak Chapter** (Mar. 31-Apr. 3), and **Indianapolis Chapter** (Apr. 14-18) have all planned Chapter screenings in the near future.

Largest Membership Gain

(Membership Competition Standings as at 15 January 1986)

The 16 Master Chapters
$1,200 to Winner—$600 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Memb Gain
1	Army Aviation Center Chapter	+111
2	Morning Calm Chapter	+94
3	Delaware Valley Chapter	+60
4	North Texas Chapter	+55
*5	Corpus Christi Chapter	+48
*5	Washington, DC Chapter	+48
7	Lindbergh Chapter	+34
8	Colonial Virginia Chapter	+24
9	Monmouth Chapter	+6
10	Connecticut Chapter	−3
11	Southern California Chapter	−4
12	Fort Hood Chapter	−9
13	Mount Rainier Chapter	−16
14	Fort Bragg Chapter	−26
15	Monterey Bay Chapter	−145
16	Air Assault Chapter	−185

The 18 Senior Chapters
$600 to Winner—$300 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Memb Gain
1	Rhine Valley Chapter	+194
2	Old Ironside Chapter	+186
3	Thunderhorse Chapter	+115
4	Hanau Chapter	+80
5	Stuttgart Chapter	+63
6	The Citadel Chapter	+40
7	Greater-Atlanta Chapter	+34
8	Suncoast Chapter	+14
9	Combined Arms Chapter	+2
10	Chesapeake Bay	+1
11	Bonn Area Chapter	−9
12	Wings of the Marne Chapter	−12
*13	Jack H. Dibrell (Alamo) Chapter	−15
*13	Coastal Empire Chapter	−15
15	Indiantown Gap Chapter	−20
16	"Follow Me"	−46
17	Mainz Chapter	−57
18	Aloha Chapter	−65

The 18 AAAA Chapters
$300 to Winner—$150 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Memb Gain
1	Schwaebisch Hall Chapter	+123
**2	Arizona Chapter	+101
**3	Indianapolis Chapter	+95
4	Taunus Chapter	+79
**5	Wings of the Devil Chapter	+71
**6	Tar Heel Chapter	+67
7	Tu-Can Chapter	+54
8	Edwin A. Link Memorial Chapter	+48
**9	Ozark Mountain Chapter	+45
10	Chicago Area Chapter	+24
11	Mid-America Chapter	+14
12	Tennessee Valley Chapter	+12
*13	Nurnburg Chapter	+9
*13	Checkpoint Charlie Chapter	+9
15	Lone Star Chapter	+1
16	Pikes Peak Chapter	−3
17	Northern Lights Chapter	−7
18	Cedar Rapids Chapter	−14

*Tie; **Ineligible in this competition

Largest Percentage Gain

(Membership Competition Standings as at 15 January 1986)

The 16 Master Chapters
$800 to Winner—$400 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Perc Gain
1	Delaware Valley Chapter	+28%
2	Morning Calm Chapter	+26%
3	North Texas Chapter	+23%
4	Colonial Virginia Chapter	+8%
5	Washington, DC Chapter	+7%
6	Army Aviation Center Chapter	+6%
*7	Lindbergh Chapter	+4%
*7	Corpus Christi Chapter	+4%
9	Monmouth Chapter	+2%
*10	Southern California Chapter	−1%
*10	Connecticut Chapter	−1%
12	Fort Hood Chapter	−2%
13	Fort Bragg Chapter	−7%
14	Mount Rainier Chapter	−8%
15	Air Assault Chapter	−12%
16	Monterey Bay Chapter	−40%

The 18 Senior Chapters
$400 to Winner—$200 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Perc Gain
1	Old Ironside Chapter	+150%
2	Rhine Valley Chapter	+98%
3	Thunderhorse Chapter	+94%
4	Hanau Chapter	+57%
5	Stuttgart Chapter	+47%
6	The Citadel Chapter	+35%
7	Greater-Atlanta Chapter	+22%
8	Suncoast Chapter	+11%
9	Combined Arms Chapter	+2%
10	Chesapeake Bay	+1%
11	Wings of the Marne Chapter	−7%
12	Bonn Area Chapter	−8%
13	Coastal Empire Chapter	−10%
14	Jack H. Dibrell (Alamo) Chapter	−11%
15	Indiantown Gap Chapter	−14%
16	"Follow Me"	−28%
17	Mainz Chapter	−36%
18	Aloha Chapter	−38%

The 18 AAAA Chapters
$200 to Winner—$100 to Runner-Up

Curr Rank	Name of AAAA Chapter in this Competition	Perc Gain
1	Schwaebisch Hall Chapter	+138%
2	Tu-Can Chapter	+100%
3	Taunus Chapter	+87%
4	Edwin A. Link Memorial Chapter	+48%
5	Checkpoint Charlie Chapter	+28%
6	Mid-America Chapter	+26%
7	Chicago Area Chapter	+25%
8	Tennessee Valley Chapter	+19%
9	Nurnburg Chapter	+13%
10	Lone Star Chapter	+1%
**11	Arizona Chapter	0%
**11	Indianapolis Chapter	0%
**11	Wings of the Devil Chapter	0%
**11	Tar Heel Chapter	0%
**11	Ozark Mountain Chapter	0%
16	Pikes Peak Chapter	−4%
17	Cedar Rapids Chapter	−16%
18	Northern Lights Chapter	−20%

*Tie; **Ineligible in this competition

Overseas Chapters win 10 of 12 Membership Contest Cash Prizes

While the Army Aviation Center Chapter won the **big prize** — the $1,200 cash award tied to the Largest Membership Gain during the CY ending January 15, 1986, it was AAAA's overseas Chapters that swept a majority of the honors — and cash — associated with the year-long **Membership Enrollment Competition.**

Korea's **Morning Calm Chapter,** with runner-up finishes in both Membership Gain and Percentage Gain, was a big winner, and is to pocket $1,000 at the forthcoming AAAA Membership Luncheon at this April's Nat'l Convention in Atlanta.

USAREUR's Chapters made out like bandits — the **Rhine Valley Chapter** won Membership Gain honors in the Senior Chapter class (and the runner-up cash award in the Percentage Gain competition). The **Old Ironside Chapter** will net a $400 Cash Prize in winning the Senior Chapters' Percentage Contest and was runner-up (worth $300) to the **Rhine Valley Chapter** with a net gain of 186 members.

In the AAAA Chapter class (25-99 members as at contest start), overseas Chapters again won all four cash awards . . The **Schwaebisch Hall Chapter** took all the marbles . . winning both the Membership Gain $ with a 123 member net gain and the Percentage Gain cash award with a solid 138% gain.

The runner-up cash awards went to the **Tu-Can Chapter** (Panama) with its 100% gain, and USAREUR's **Taunus Chapter** with a 79-member net gain during the competition.

In the Master Chapter category (150 or more members at contest start), the **Delaware Valley Chapter** (Philadelphia area) won $800 with its substantial 28% membership gain, just two percentage points above the **Morning Calm Chapter.**

The latter also gave the **Army Aviation Center Chapter** a good run for its money ($1,200), in being only 17 members behind at contest end. The consolation: a $600 runner-up cash award.

During the contest year, 34 Chapters posted net gains; and 18 Chapters ended the year with less membership. The biggest gainer was the **Rhine Valley Chapter** with a 194-member net gain while the **Air Assault Chapter** suffered the largest loss, some 185 members.

1st CAVALRY DIVISION REUNION

The 1st Cavalry Division Association will hold its 39th Annual Reunion August 7-10 in Las Vegas, NV. Reunion Headquarters will be in the Riviera Hotel. For additional information, please write or call: COL Bob Litle, Ret., Executive Director, 1st Cavalry Division Ass'n, 302 North Main, Copperas Cove, TX 76522-1799. (817) 547-6537.

281st ASSAULT HELICOPTER COMPANY

Anyone who served with the 281st Assault Helicopter Company in Nha Trang, South Vietnam and would like to attend a unit reunion, please contact: Duane Brudvig, 8208 Sumter Avenue North, Brooklyn Park, MN 55445.

DO YOU KNOW MY NAME?

If you can locate MAJ Bruce F. Crandall, SGT Steve M. Northern (USAF), CPT Daniel A. Nicholson (USAF), WO Mark M. Feinberg, or MAJ Kenneth E. Ernest (Vietnam era winners of the AVCO-AWA Helicopter Herosim Award) please contact: Richard M. Berman, Marketing Communications, AVCO Lycoming Textron, 550 South Main Street, Stratford, CT 06497. (203) 385-2000.

January-May, 1986 Calendar of AAAA Chapter Activities

January, 1986

■■Jan. 10. Monterey Bay Chapter. Mid-afternoon General Membership Meeting-Elections. Ft. Ord Officers' Club.

■■Jan. 16. Colonial Virginia Chapter. Professional Luncheon Meeting. Kirk Daniels, Test Pilot, guest speaker. "The SH-2 LAMPS Program". Ft. Eustis NCO Club.

■■Jan. 16. Edwin A. Link Chapter. Professional Dinner Meeting. MG August Ciancolo, guest speaker. "Army Aviation and Training". Holiday Inn Arena, Binghamton, NY.

■■Jan. 21. Ft. Hood Chapter. Mid-afternoon Professional-Social Meeting. Space Shuttle Atlantis Astronauts Sherwood Spring and Mary Cleave, guest speakers. Soldiers' Dome.

■■Jan. 21. Cedar Rapids Chapter. Mid-afternoon Professional Dinner Meeting. COL David S. Grieshop, Commander, USA AVRADA, guest speaker. Stouffer's Five Seasons Hotel.

■■Jan. 22. Citadel Chapter. Evening Professional Meeting. MAJ Rhett, guest speaker."Flight School: Before & After" Jenkins Hall Auditorium.

■■Jan. 22. Lindbergh Chapter. Late afternoon Wine & Cheese Party-Membership Drive. St. Louis Area Support Center Community Club.

■■Jan. 31. Pike's Peak Chapter. Late afternoon Professional Meeting. BG Rudolph Ostovich III, Asst Commandant, USAAVNC, guest speaker. Raider's Den NCO Club.

■■Jan. 31. Leavenworth Chapter. Late afternoon Membership Rally & Election of Officers. Ft. Leavenworth NCO Club.

February, 1986

■■Feb. 6. Lindbergh Chapter. Late afternoon Happy Hour Welcome to AIMI Conferees. King Henry VIII Inn.

■■Feb. 10. Schwaebisch Hall Chapter. Professional Luncheon Meeting. MG Edwin M. Aguanno, guest speaker. "Future Aviation Equipment". Schwaebisch Hall Community Club.

■■Feb. 11. Washington, D.C. Chapter. Professional Luncheon Meeting. MG Robert F. Molinelli, guest speaker. "Army Acquisition '86: Leadership in Army Aviation". Pentagon Quality Inn.

■■Feb. 13. Connecticut Chapter. Professional Dinner Meeting. LTG Charles D. Franklin, guest speaker. Three Doors Restaurant.

■■Feb. 13. Thunderhorse Chapter. Late afternoon General Membership Meeting. Fulda Community Club.

■■Feb. 13. Tu-Can Chapter. Late afternoon Professional Meeting. COL Harold E. Watson (USAF), guest speaker. Howard AFB NCO Club.

■■Feb. 13. Stuttgart Chapter. Late afternoon Professional Meeting. Eugene Buckley, Sikorsky-UTC, guest speaker. "Update on the LHX". Nellingen Officers' Club.

■■Feb. 19. Colonial Virginia Chapter. Late afternoon film: "Aircraft Development". Delayed presentation to AAAA's 1985 "Trainer of the Year". Ft. Eustis Officers' Club.

■■Feb. 20. The Citadel Chapter. AvWeek videotape: "The 1985 Paris Air Show". Evening Professional Meeting. Jenkins Hall Auditorium.

■■Feb. 21. Taunus Chapter. Mid-afternoon General Membership Meeting. Wiesbaden Air Base Club.

■■Feb. 21. Corpus Christi Chapter. Mid-afternoon General Membership Meeting. CCAD Officers' Club.

■■Feb. 25. Ft. Hood Chapter. Mid-afternoon Professional-Social Meeting: "AH-64A APACHE Arrival and Logbook Ceremony". Ft. Hood Army Airfield.

■■Feb. 27. Checkpoint Charlie Chapter. Late afternoon Business-Social Meeting. Elections-Planning for '86 AAAA Convention. Aviation Detachment.

■■Feb. 27. Mainz Chapter. Late afternoon Business Meeting. Chapter Election; Planning for '86 USAREUR Convention. Finthen Community Club.

■■Feb. 27-Mar. 3. Monterey Bay Chapter. AAAA Ski Trip. Alpine Meadow, Heavenly Valley & Sierra Ski Ranch.

March, 1986

■■Mar. 4. Delaware Valley Chapter. Professional Dinner Meeting. Dr. John Zuk, NASA Ames Research Center, guest speaker. Media Towne House, Media, PA.

■■Mar. 5. Lindbergh Chapter. Be-Bop '50's Bash. Contests, Prizes "The Bunker".

■■Mar. 5. Chicago Area Chapter. Late afternoon AvWeek videotape: "1985 Paris Air Show". Ft. Sheridan Community Club.

■■Mar. 20 - 23. 26th USAREUR Region—AAAA Convention, AFRC, Garmisch-Partenkirchen, Germany. (Ski Week starts Mar. 19).

April, 1986

■■Apr. 5. Ft. Hood Chapter. Professional Dinner Meeting. "2nd Annual AAAA Aviation Ball." LTG Crosbie E. Saint, Commander, III Corps, guest speaker. Soldiers' Dome.

■■Apr. 9-13. AAAA National Convention. Atlanta Marriott Marquis Hotel and the Georgia World Congress Center (Exhibit Hall-Professional Sessions), Atlanta, Georgia.

■■Apr. 15. Washington D.C., Chapter. Professional Dinner Meeting. MG John W. Woodmansee, Jr., guest speaker. "Force Structure & Army Materiel Requirements". Ft. McNair Officers' Club.

May, 1986

■■May 5-7. Ft. Monmouth Chapter. "1986 AAAA Electronics Symposium". Berkeley Carteret Hotel, Asbury Park, N.J.

QUITE A TRIP — AAAA Morning Calm Chapter Korean Sustaining Member President Mr. Rhee Min Hee (right) presents a round trip air ticket to SP4 Jeffrey Vierow, one of 15 young soldiers selected by the Chapter for a weekend trip to Cheju Do — a scenic island located off the southwest coast of Korea. Sustaining Members have underwritten four Cheju Island tours with great success. The weekend includes a tour of the island's Folk Museum, a visit deep into one of the world's largest caves, and a breathtaking view from Mt. Ilchool-Bong.

ARIZONA CHAPTER — Offficers of the new Arizona Chapter are (L to R): Joseph Pullano, VP Programs; Vern Forman, Secretary; Lyle Monson, President; Randall Taylor, Vice President; Roger Gould, VP Publicity; Joseph Hovorka, VP Membership. MISSING: Dave Olney, Treasurer.

OZARK MOUNTAINS — Officers of this new Chapter are FRONT: COL Robert Smith, Publicity; SP4 Dean Oliveri, Programs; CW2 Okey George, Treasurer. BACK: CW4 Robert Hawkins, Secretary; COL James Brayboy, President; MAJ Stan Gregory, Ret, SR VP; LTC Clarence Smith, Membership.

INDIANA AAAA — Officers for a newly formed Indianapolis Chapter are (L to R): 1LT Talmadge Pope, VP Membership; Norm Egbert, Treasurer; 1LT Dale Voitus, VP Programs; MAJ Samuel Mowery, President; Dale Mohlenhoff, Secretary; and CPT Thomas Beaty, Senior VP.

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Not receiving your issues? Did you send in a change of address? — Page 78

1st Aviation Brigade's 20-Year Reunion Dinner draws a crowd!!

More than 110 members of the **1st Aviation Brigade** and their wives have already indicated they'll attend the unit's **20 Year Reunion Dinner** in Atlanta, Ga., on Friday evening, April 11, and many more persons are expected to "Count me in!" in the weeks to come.

The **Reunion Dinner**, the first such gathering of the **Golden Hawks** since the unit's activation in Vietnam in 1966, will feature—in the words of Tri-Chairman John Marr — "great food, great fun, and great entertainment." COLs John Todd and Terry Rosser, the Brigade's current commander, are also Tri-Chairmen, and promise a memorable evening.

Get in touch with your former **1st Aviation Brigade** contemporaries, and tell them to "Come on down!" (See the AAAA Registration Form elsewhere in this issue).

A mid-March mailing will update the attendee list, and poll you on the seating plans of your listed unit.

Lastly, you'll be asked to bring some personal memorabilia of your Brigade service for exhibit hall display — photos, banners, uniforms, etc.

PRELIMINARY LIST OF REUNION DINNER ATTENDEES

COL Bobby R. Adams, VA
Ron Alto, AZ
LTC John H. Anderson*, AL
COL Richard C. Antross, CA
LTC Gary S. Beck, KS
COL Norman M. Bissell, VA
LTC Patrick J. Bodelson, RI
COL George S. Bosan*, PA
Danon L. Brantley, OK
LTC Joe D. Calhoun, IL
COL Jos R. Campbell, CA
COL R. Potter Campbell, NH
LTC Lee R. Cantlebary*, GA
MAJ Edw. S. Chambers, GA
COL Jerry W. Childers, CA
BG Sam Cockerham*, VA
LTC Terry J. Coker, GA
MAJ Chris L. Cole, AL
COL Eugene B Conrad*, AL
LTC G. Kirk Curran, VA
Robert L. Daboub, OH
LTC Robert P. Fallis, AL
COL B.H. Freeman*, KY
MG Orlando E Gonzales, MO
LTC (P) W.D. Gram, AL
MAJ David L. Grieger*, GA
COL David S. Grieshop, NJ
COL Daniel G. Gust*, AL
CW4 Walter W. Gutsche, KY
MG Ben Harrison*, TX
BG Jack Hemingway*, TX
COL Terence M. Henry, AL
COL James E. Hyers, TX
MG Claude T. Ivey, NC
LTC Cliff Johnson*, GA
Tom Kilgo, VA
COL John A. Lasch, III, VA
COL Edw. K Lawson, III, SC
MAJ (P) Richard Leister, GA
LTC Dwight L. Lorenz, VT
MG Robert Mackinnon*, TX
LTG Jack V. Mackmull*, SC
COL N.A. Mahone, Jr*, FL
COL Robt. A. Mangum*, VA
SGM Arthur McGehee*, MS
LTC Ronald Merritt*, NY
LTG James Merryman*, VA
Thomas W. O'Connor, VA
CW4 William C. Ogle, MO
MG Ellis D. Parker, AL
COL N.I. Patla, MO
LTC Geo. E. Patterson*, GA
LTC Richard L. Peters, KS
COL Wayne N. Phillips*, CA
CW3 Joseph L. Pisano, KY
MG Alton G. Post*, CA
MG Geo W Putnam, Jr*, VA
COL Harold M Ramey*, CA
LTC Lawrence R. Retta, AL
COL Terry Rosser, AL
LTG G.P. Seneff, Jr*, HI
MAJ Matt Serletic*, GA
COL Gerald H. Shea*, FL
MG James C. Smith*, FL
COL Lee C. Smith, Jr*, AL
COL Robert H. Smith, MO
BG Dick Stephenson, MO
MG Story C. Stevens*, SC
LTC William W. Stuck*, CT
COL Selmer A Sundby*, VA
Gene Svoboda, OH
CW4 Dale Swafford, WA
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COL John Todd*, VA
COL Harry Townsend*, MD
COL Dennis P Vasey, AL
LTC Roger Waddell*, GA
COL Jerry T. Wagner, AL
COL Charles C. Walts*, FL
Charles V. Warren, KS
CW4 C.J. Williams, Jr*, VA
LTG Robert R Williams*, TX
COL John Zugschwert*, VA
*Retired
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