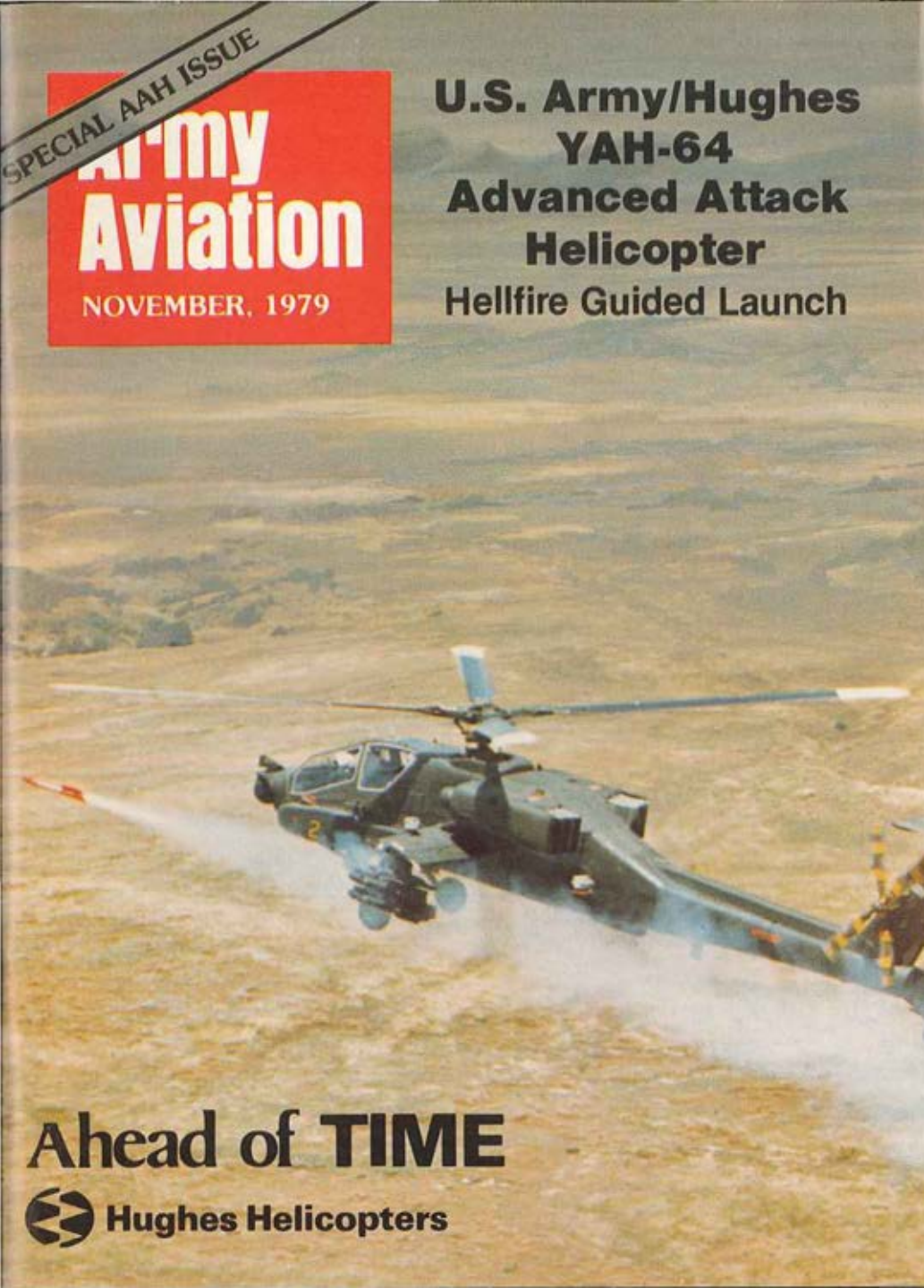
SPECIAL AAH ISSUE

Army Aviation

NOVEMBER, 1979

U.S. Army/Hughes YAH-64 Advanced Attack Helicopter

Hellfire Guided Launch



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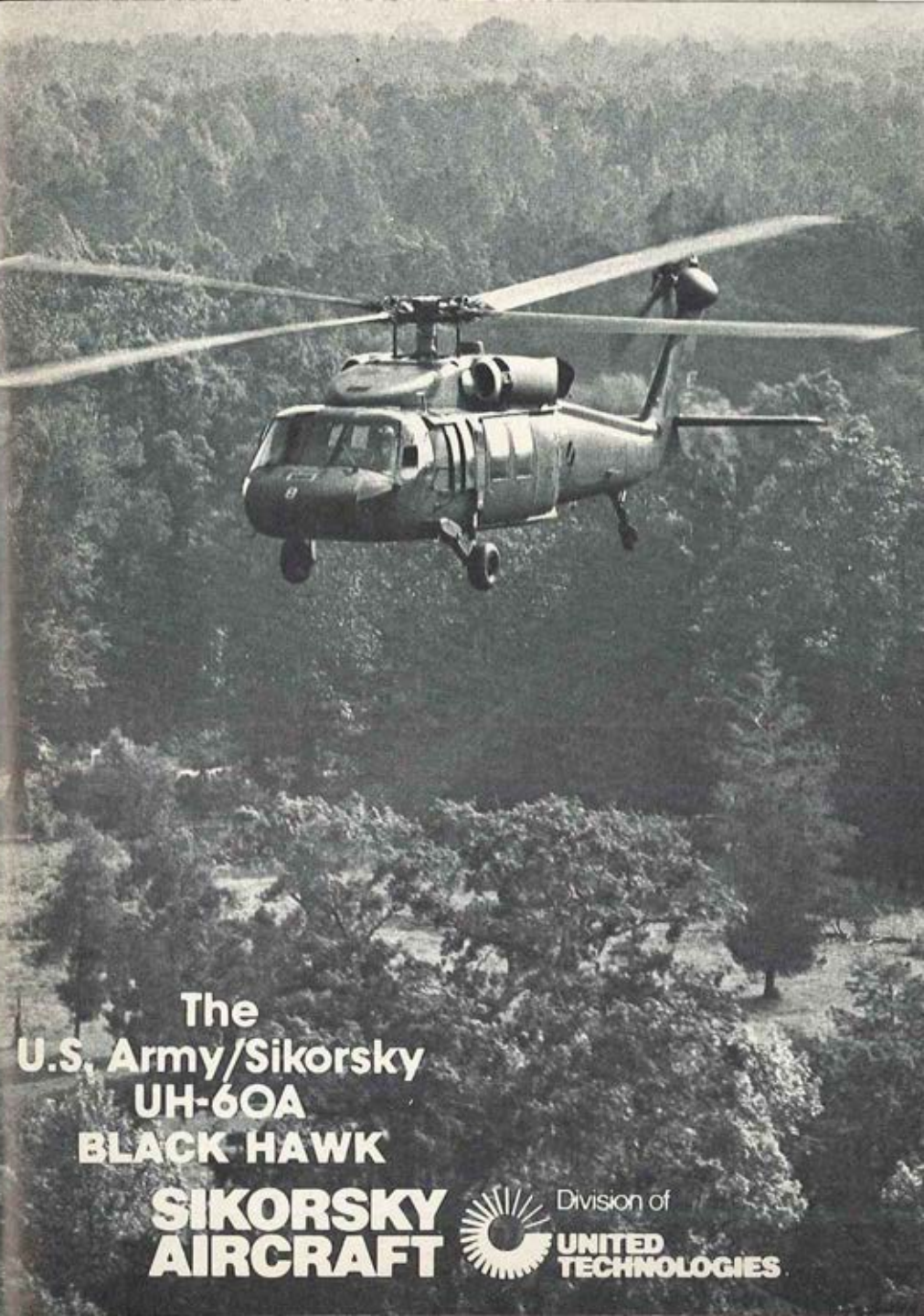
RCA Government Systems Division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ARMY AVIATION

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A professional journal endorsed by the Army Aviation Association of America (AAAA).

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ARMY AVIATION (ISSN 0004-248X) is published monthly, except February and December by Army Aviation Publications, Inc., Westport, CT 06880. Editorial and Business Offices: 1 Crestwood Road, Westport, CT 06880. Phone: (203) 226-8184 or 226-8185. Subscription rates for non-AAAA members: $10, one year; $19, two years; add $7.50 per year for foreign addresses other than military APO's. The views expressed in the publication are not necessarily those of the Department of the Army or of the staff of the publication. Display and classified advertising rates are listed in SRDS Business Publications, Classification 90. Second class postage paid at Westport, CT.

Volume 28 — November, 1979 — Number 11

AAH SPECIAL ISSUE

OTHER FEATURES

NEXT MONTH

The December, 1979 issue of **ARMY AVIATION** will carry the **"1979 Who's Who in Army Aviation"** as a detachable centerfold insert.

The Chinook D...more for less.

The U.S. Army CH-47D prototypes are flying now, completed ahead of schedule and on budget. When the U.S. Army's Chinook helicopter fleet is fully converted to the new Delta Model, the Defense Department and the American taxpayer will be getting full value for their dollar...one and a half times the current fleet productivity to match the demands of modern combat forces and a 21 percent reduction in operating costs to meet stringent budget limitations.

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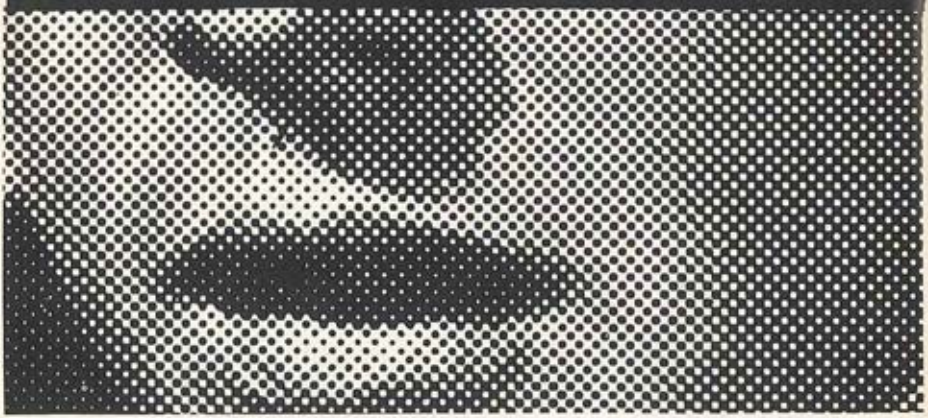
SPEAKING OUT



Is commissioned officer specialty 15A00 a competitive field of endeavor?

THE purpose of this letter is to bring to your attention the extremely low selection rate of Army Aviators for Major (AUS) by the last promotion board, and solicit AAAA's guidance and help in exerting a positive influence at the Department of the Army level.

My reason? I'd like to insure that the commissioned officer specialty (15A00) becomes and remains a competitive field of endeavor.

Selection rate inequity

The first time selection rate for aviators with aviation as a primary or alternate specialty was 59%, compared to:

. . 80% for Infantry,
. . 82% for Armor, and
. . 83% for Field Artillery specialties.

An Open Letter from Captain James R. Anderson, Enterprise, Alabama

This is as published in the recommended list for temporary promotion to Major, dated 30 May 1979.

Board guidance indicates that quotas should not be established for specialties; however, those officers who are in the underaligned specialties — Infantry, Armor, and Field Artillery, to list a few — were to be carefully reviewed to "make OPMS work."

It's hoped that officers are promoted based on their ability and duty performance on a competitive basis with all their contemporaries, and not be penalized for being in an overaligned specialty.

"Less than equitable"

The percentages indicate that Army Aviators received a less than equitable consideration for promotion.

The precedent set by this promotion board, unless rectified, will certainly have a tremendously adverse and long-term effect on Army Aviation and, hence, possibly on the national defense posture of the United States.

This top-ranking military jetprop is volunteering for a few more special missions.

Beechcraft's rugged C-12 jetprop has earned its military stripes as a hard-working military transport. Its turboprop economy has been saving money for the Army and Air Force all over the world. In addition, the C-12 has gained an enviable reputation for reliability.

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And because many of these special equipment packages can be quickly removed or converted, one C-12 airframe can be used to fill the roles of several special missions aircraft.

In addition, the comprehensive Beech logistics support program now assumes total responsibility for all on-site maintenance, crew training, parts inventory, and worldwide technical service. As a result, the C-12 continues to deliver operational readiness rates well in excess of 90%.

If your command could use a special mission support system with this kind of multi-role capability, get complete information by contacting Beech Aircraft Corporation, Aerospace Programs, Wichita, Kansas 67201.

Beechcraft

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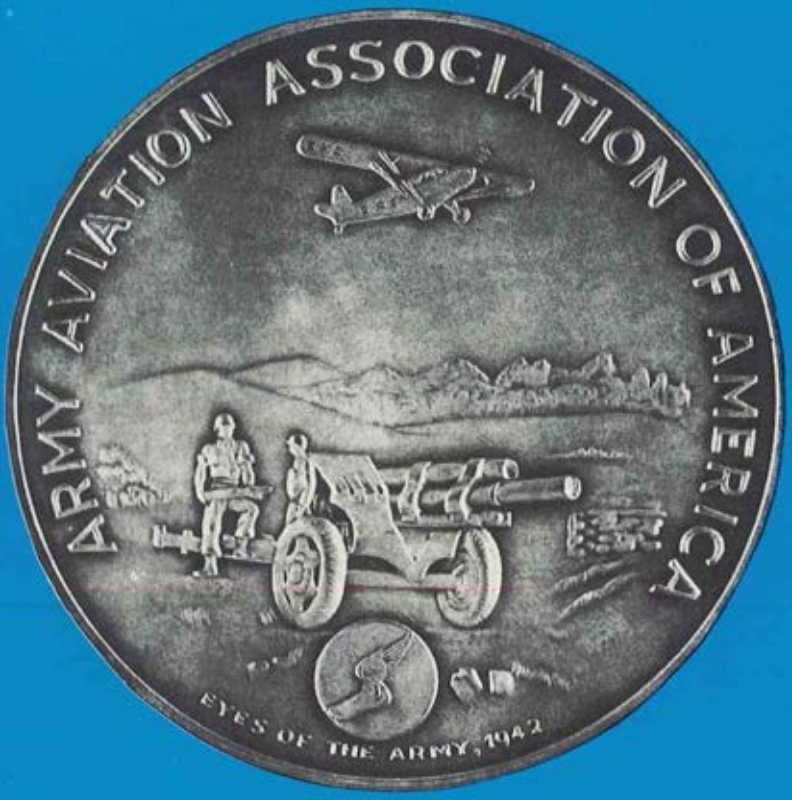
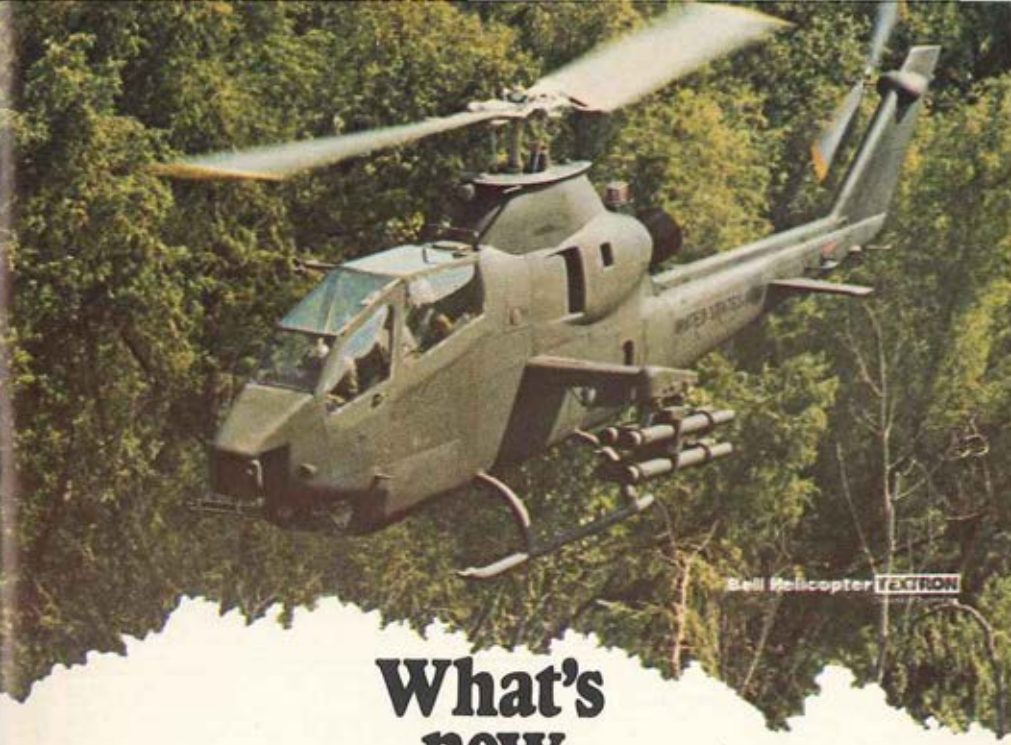


CALENDAR YEAR 1979 NOMINEES ARE SOUGHT FOR AAAA'S NATIONAL AWARDS

(FOR ADDITIONAL DETAILS, TURN TO PAGE 103.)



What's new on the Cobra? Everything that moves.

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There's been a powerful 29% increase in engine SHP, plus a boost in transmission capacity providing excellent hot day performance.

There's a new composite main rotor blade that improves performance as well as survivability.

There's a significant increase in tail rotor thrust enhancing NOE agility.

But that's only part of what's new on the Cobra.

Weapon systems, fire control, cockpit layout, active/passive defense systems: all designed to strengthen our anti-armor forces. Now, and for the next 20 years.

Bell's AH-1S Cobra: Everything's new but the name.

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Title of Publication: Army Aviation (032400). Date of filing: September 27, 1979. Frequency of issue: 10 times a year. Location of known office of publication: 1 Crestwood Road, Westport, CT 06880. Location of headquarters or general business offices of the publisher: Same. Publisher: Arthur H. Kesten, 1 Crestwood Road, Westport, CT 06880. Editor: Same. Managing Editor: Dorothy Dorothy Kesten, same. Owner: Army Aviation Publications, Inc., 1 Crestwood Road, Westport, CT 06880; Arthur H. Kesten, same; Dorothy Kesten, same. Known bondholders, mortgagees, and other security holders owning or holding 1% or more of the total amount of bonds, mortgages, or other securities: None.

The average number of copies of each issue during the preceding 12 months, and the actual number of copies of the single issue filed nearest to the filing date (latter appears in parentheses) were:

a. Total number of copies printed: 10,610 (14,500); b. Paid Circulation: tion: 1. Sales through dealers, carriers, counter sales: 1,250 (3,500); 2. Mail Subscriptions: 9,053 (8,638); c. Total Paid Circulation: 9,303 (12,138); d. Free distribution by mail, carrier, or other means: Samples, complimentary, and other free copies: 1,083 (1,292); e. Total Distribution (Sum of c. and d.): 10,386 (13,430); f. Copies not distributed: 1. Office use, left over, unaccounted, spoiled after printing: 224 (1,070); 2. Returns from news agents: None (None); g. Total (Sum of e, f1, and f2 should equal net press run shown in a): 10,610 (14,500).

I certify that the statements made by me in this statement dated September 9, 1979 are correct and complete.

Dorothy Kesten, Managing Editor

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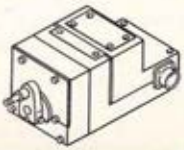
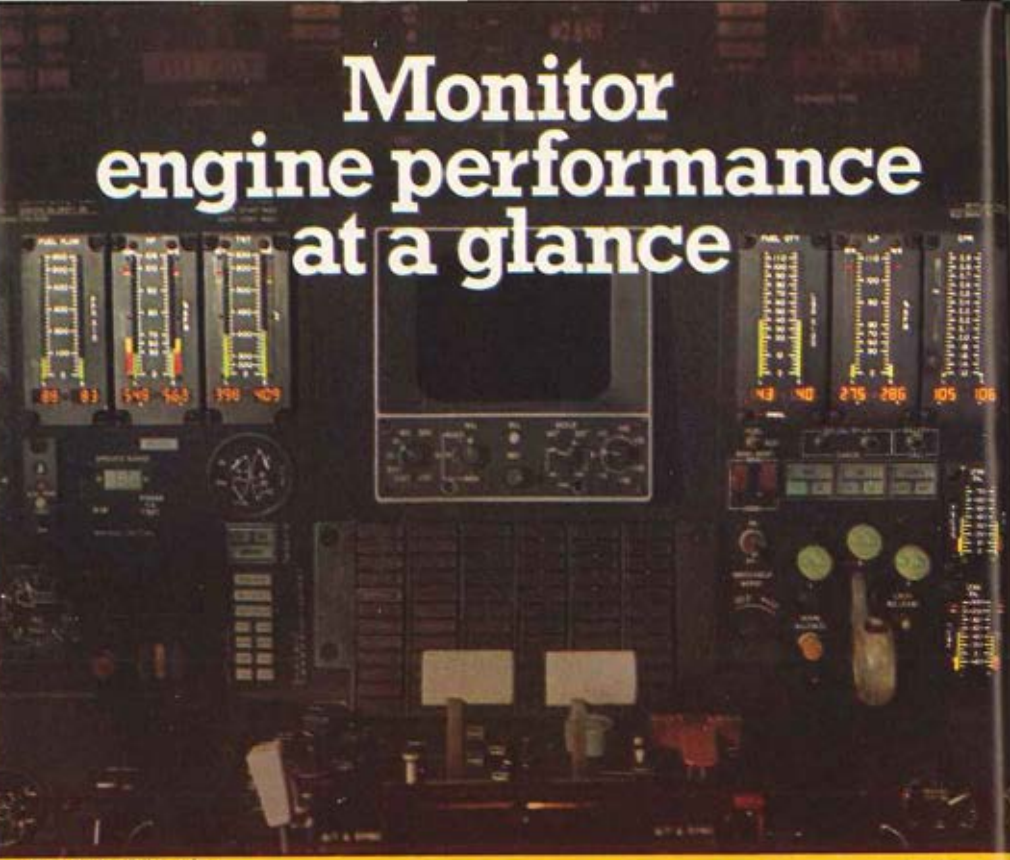


Electromechanical Actuator

Bearing-Distance Heading Indicator

Attitude Indicator

Monitor engine performance at a glance



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Nominees sought for 1980 induction to the "Army Aviation Hall of Fame"

BACKGROUND: An AAAA-sponsored "Army Aviation Hall of Fame" honors those persons who have made an outstanding contribution to Army Aviation, and records the excellence of their achievements for posterity. The "Hall of Fame" is located at Fort Rucker in the Army Aviation Museum where the portraits and narratives of the Inductees are displayed in a distinctive location. The costs of the program — selection, induction, portraiture, etc. are underwritten by the AAAA. ELIGIBILITY: Anyone may nominate a candidate for the "Hall of Fame." All persons are eligible for induction, except AD military personnel Civilian personnel are eligible prior to their retirement.

★★★★★

Nominations should be submitted on or before 1 December 1979 to AAAA, 1 Crestwood Road, Westport, CT 06880, and should include:

(1) The nominee's full name and address.

(2) A 40-50 word summary of the achievement(s) for which the candidate is being nominated to the "Army Aviation Hall of Fame."

(3) A current photograph of the nominee, if living, or information as to where such a photo or photos may be obtained.

TO: AAAA, 1 Crestwood Road, Westport, CT 06880

I'd like to nominate the following persons as candidates for induction into the "Army Aviation Hall of Fame" in April, 1980. On separate sheets, I've enclosed their full names and addresses (where known), a brief 40-50 word description of each of their accomplishments, and a photograph of each, where available. (Please print).

Nominee.....

Nominee.....

Nominee.....

Your signature.....

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HELLFIRE is a total anti-armor weapon system. It is totally effective. It is totally responsive.

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HELLFIRE is being developed with the combined capabilities of the U.S. Army Missile Research and Development Command at Redstone Arsenal, Ala., and Rockwell's Missile Systems Div., Columbus, Ohio. For more information write: Missile Systems Division, Avionics & Missiles Group, Rockwell International, 4300 E. Fifth Ave., Columbus, OH 43216.

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The Army's AAH

AN UPDATE

A Total System for Battle

UNITED STATES ARMY
THE CHIEF OF STAFF

The most significant battlefield threat that the Army faces today is the impressive Warsaw Pact ground offensive capability, made up primarily of armored forces. Our challenge is to maintain a quality, highly mobile force capable of defeating this threat.

The U.S. Army ground commander as well as his NATO counterpart requires a weapon system which will permit the rapid massing of anti-armor firepower at the decisive time and place. The Advanced Attack Helicopter provides such a capability. It can operate and survive in the forward battle area, fight at night and in bad weather, maneuver in the soldier's domain, and recycle firepower rapidly thus providing the combat balance necessary to fight and win.

The Army looks forward to providing to the combined arms team the unique dimension of anti-armor firepower and mobility which the AH-64 possesses.

E. C. MEYER
General, United States Army
Chief of Staff

The AAH is a Team Player!

AN UPDATE BY BG EDWARD M. BROWNE, PROGRAM MANAGER—AAH, USA DARCOM

IT'S been over two years since the first issue of the **Army Aviation Magazine** devoted to the AAH program. I again thank **Art Kesten**, the editor, for the opportunity to acquaint interested personnel with the Army's **Number 1 aviation program** and now for dedicating this "update" November 1979 issue to the **Advanced Attack Helicopter.**

Although credits to other team members, and the background and description of the **AAH** have not changed significantly since the August/ September 1977 issue, I repeat part of this information here for newcomers, and for those who did not save the article or who do not have a file copy available.

First and foremost, the AAH is a team player — a lethal member of the combined arms team. Bringing major weapons systems through development also requires a concerted team effort, and I cannot speak too highly of the tremendous support given me in managing this program by the Chief and his staff, and the Commanders of DARCOM, FORSCOM, TRADOC, and the United States Army, Europe.

Elements of each of these commands have joined me to bring you this composite overview and update of the **AAH Program** from the materiel development scenario through the development of training and tactics for its employment.

BACKGROUND

In June 1973, the Deputy Secretary of Defense authorized the Army to initiate a two-phase development of the **Advanced Attack Helicopter,** Phase I to be a competitive development for selecting the best helicopter airframe to enter Phase II full scale engineering development. Bell and Hughes were selected to compete in a three-year development culminating in a fly-off. Hughes was selected the winner in December 1976. Phase II is focusing on completing subsystems (missile, cannon, rocket, target acquisition and night vision) development and their integration into the winning helicopter, the Hughes YAH-64.

The Phase II full scale engineering development program encompasses 56 months. It includes the fabrication of three additional flying prototypes, the development and integration of a target acquisition-designation system, a pilot's night vision system, and the fire control essential to integrate the **HELLFIRE** anti-tank missile, and the 2.75 rocket and 30mm cannon (area weapons) subsystems.

SYSTEM DESCRIPTION

The AAH is a twin engine helicopter with two T-700 (1,560 shp each) engines. It is equipped with a four-bladed, fully articulated main rotor and a four-bladed tail rotor. It uses a three-point landing gear. The pilot is located in the rear of the tandem cockpit arrangement, with the co-pilot-gunner in the front crew station. Four stores stations are mounted under the wings to obtain a variety of armament options. A photograph of the Hughes YAH-64 AAH prototype aircraft is shown below.

The YAH-64 is the first Army Attack Helicopter to be developed specifically for day, night, adverse weather anti-armor missions with emphasis on the ability to fight, survive, and live with the troops in the "Front Line" battlefield environment.

To achieve this objective, emphasis was placed on designing and development of a weapons

The AAH is a Team Player

platform with superior flight performance. The best measures of performance for a helicopter, at a prescribed atmosphere, mission weight, and endurance, are **vertical rate of climb (VROC)**, cruise speed, and agile maneuverability (the ability to avoid obstacles at high speed).

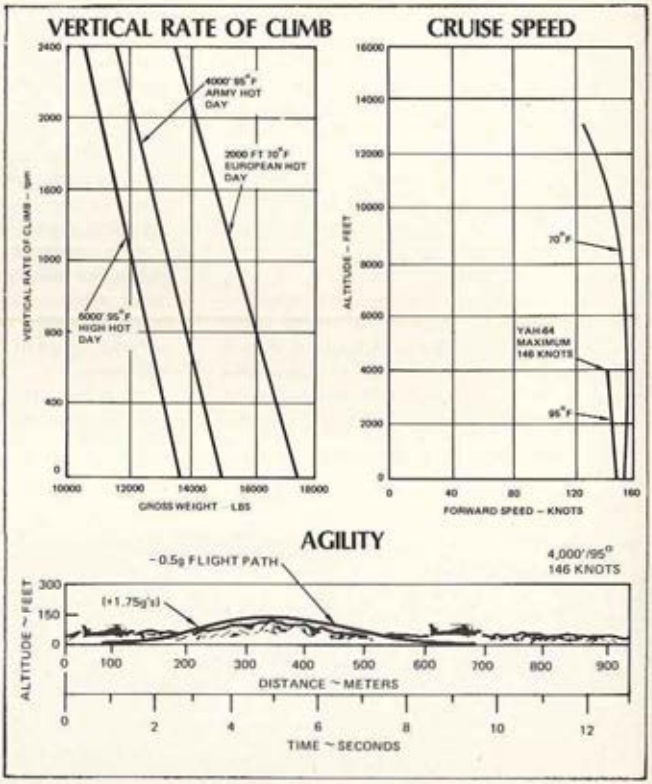
The charts on this page present the expected flight performance of the production AH-64 while carrying sufficient fuel for 1.83 hours endurance.

All of our design efforts to date have been focused to make the AAH a superb tank killer. The primary weapon is the laser-guided **HELLFIRE** anti-tank missile (SEE A). Its lethality against tanks at long stand-off range has been demonstrated repeatedly in the direct and indirect fire modes throughout the separate missile development program. **Colonel Ben Pellegrini's** article on his **HELLFIRE** development clearly points to the dramatic combat firepower effects you will be gaining.

The area suppression weapons are — first — the old standby 2.75 inch rockets (SEE B), of which the AAH carries 76 in four 19-tube pods, and the new XM-230E1, 30mm "Chain Gun" cannon (SEE C), developed by Hughes specially for the AAH. The AAH will carry 1,200 rounds of XM789 (30mm) **high explosive dual purpose ammunition (HEDP)**. The 30mm PMO has done an amazing job of developing this small caliber round that literally knocks the hell out of light armored vehicles. The outstanding weapons have been coupled through a new fire control system that now provides excellent accuracy of all weapons for air-to-ground engagements, and we have included, for the future, provisions for an air-to-air engagement capability. All armament systems can be operated by both the co-pilot-gunner and/or the pilot through the use of the **integrated helmet and display sight system (IHADSS)**. (See **Page 77.**)

NEW ADEN-DEFA AMMO

On 29 September 1976, OSD directed the AAH Program Manager to develop a new 30mm ADEN-DEFA class of ammunition for the Army's Advanced Attack Helicopter that could also be used in the USMC's **Harrier,** and is interoperable in the ADEN and DEFA guns of our NATO allies. This was the AAH's first contribution to NATO **Rationalization, Standardization, and Interoperability.**



Elastomeric Design Decisions

Safeguarding the flight stability of the world's most survivable attack helicopter

The Hughes YAH-64 Attack Helicopter was designed to fight and survive under the toughest combat conditions. Inflight stability, reliability, ease of maintenance, and the capability to withstand abuse were critical criteria in the decision to use elastomeric lead/lag rotor dampers from Lord Kinematics.

The results speak for themselves. After endurance tests equivalent to 4,500 flight hours, the damper system displays ample capability to damp small or large amplitude vibrations and maintain maximum flight stability in the face of potentially destructive ground resonance. Equally important, it has no fluid to leak, no sliding surfaces to wear, and no need for maintenance, adjustment, or lubrication. And, it is not affected by dirt, grit, or other environmental hazards. Even ballistic damage produces only a proportional loss of damping efficiency.

The future looks bright. The YAH-64 Rotor Damper System is a refinement of the elastomeric dampers proven on the Hughes Model 500D helicopter. It now becomes a foundation for research into new elastomers and lightweight composite substrate materials to meet future needs.

For more information on this system or assistance with your next elastomeric design decision, contact Lord Kinematics, 1635 West 12th Street, P. O. Box 2051, Erie, Pennsylvania 16512. Telephone: 814:456-8511. Telex: 914-438.

LORD Lord Kinematics

TADS/PNVS

Northrop's TADS/PNVS for U.S. Army's Advanced Attack Helicopter (AAH) permits AAH to attack and survive at extended standoff ranges, day or night, under adverse weather conditions.

TADS (Target Acquisition Designation System) allows direct view target detection and tracking. Night and long-range target recognition. Laser tracking and range finding.

PNVS (Pilot Night Vision System) provides forward-looking infra-red imagery allowing nighttime nap-of-the-earth flight.

Northrop TADS/PNVS designed specifically for Army AAH. Proven technology derived from Northrop's broad range of electro-optical experience. More than 500 Target Identification Systems delivered to U.S. Air Force for F-4 Phantom. Northrop producing Television Sight Unit for U.S. Navy F-14 Tomcat. Developing electro-optics for Seafire fire control system for Navy surface ships.

Northrop Corporation, Electro-Mechanical Division, 500 East Orangethorpe Avenue, Anaheim, California 92801.

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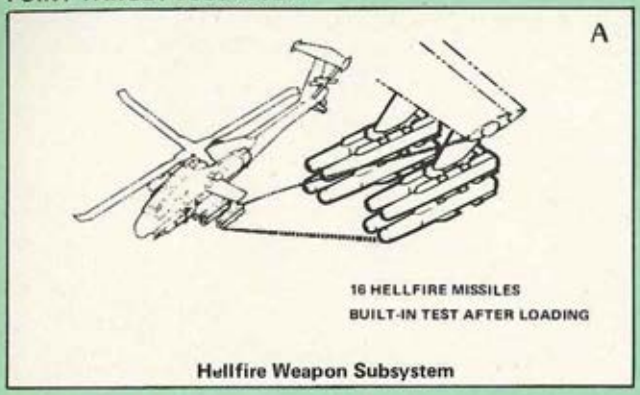
POINT TARGET SUBSYSTEM

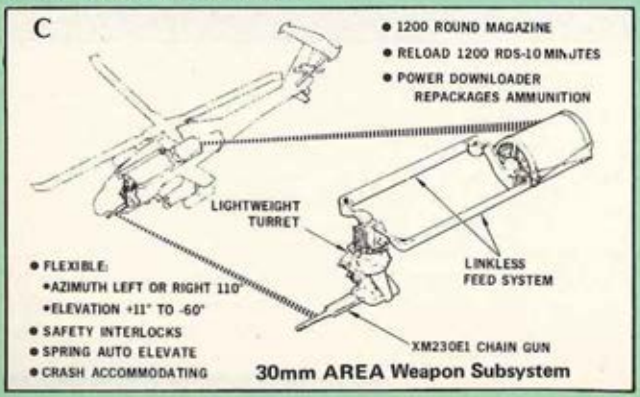


Hellfire Weapon Subsystem

2.75 ROCKET SUBSYSTEM

76 FFAR Rockets
Weapon/Stores Management

AREA WEAPON SUBSYSTEM



30mm AREA Weapon Subsystem

Today, 30mm ADEN/DEFA ammunition is used in many NATO and third country aircraft. Basically three automatic cannons, the British MK IV ADEN gun, the French 552 and 553 DEFA guns fire this standard ammunition.

Multi-use weapon

Over 14 combinations of 30mm weapons systems and aircraft (from the **Mirage III** to the **Gnat F Mark I**) are deployed in active forces in most of the Free World. Our task is to assure interoperability of this new ammunition in these systems.

The AAH-developed 30mm ammunition consists of three cartridges: the XM788, **Target Practice (TP)** round, the XM799, HEI round, and the XM 789, a **high explosive dual purpose (HEDP)** round, having both anti-personnel fragmentation features and excellent penetration against lightly armored vehicles. Hughes was awarded a contract on 2 March 1977 for the development of this ammunition The XM788 round has been type-classified as Standard; the XM799 round has completed all firing tests; and the XM789 is being readied for qualification testing.

The characteristics of this ammunition are shown in the adjoining **D** table.

Because of the capability and rapid development of the 30mm ADEN/DEFA configuration **HEDP** cartridge, it is also being evaluated for additional ap-

plication to include the U.S. Army's AH-1S Cobra and the High Mobility Vehicle XR-311 for the Military Police, the Marines' AV-8B Harrier, and the Navy LVTP-7 landing craft.

ARMAMENT PAYLOAD

Varying altitude conditions and temperature will dictate finite mission loads. However, the AAH requirement is a minimum of 450 feet per minute vertical rate of climb with eight HELLFIRE missiles and 320 rounds of 30mm ammunition and with 1.83 hours' endurance at the Army hot day (95°, 4,000 feet, 95% IPR). The production AH-64 is expected to exceed that minimum. There are many representative options, and an informative pictorial presentation of these appears in COL "Bob" Molinelli's article on Page 68.

SURVIVABILITY

I still believe helicopter survivability on the modern battlefield is directly related to three elements:

1. The inherent ballistic "toughness" incorporated into the basic design of the airframe.

2. The optimization of weapons lethality and fire control during integration, giving the ability to acquire, shoot and kill first, and

3. The doctrine, tactics, and training developed for employment.

We have already discussed the weaponry and its integration. MG Tom Lynch, Commander of the Armor Center; MG Jim Merryman, Commander of the Aviation Center; COL Bob Molinelli, Commander of the 6th ACCB; and COL Cecil Shrader, our new

Cartridge Characteristics

Cartridge Weight	3.54 kg (approx.)
Case Material	Aluminum
Projectile Weight	.240 kg (approx.)
Muzzle Velocity	760 m/s to 800 m/s
Peak Pressure	290 MPa
Impulse	260 N.s.
Cartridge Length	200mm
Cartridge XM788	TP
Cartridge XM789	HEDP

D

AAH—TSM, will — in separate articles in this issue — walk you through their efforts and views on doctrine, tactics, and training for employment. So for now, let's focus on the hardware survivability features designed into the AAH.

DETECTABILITY

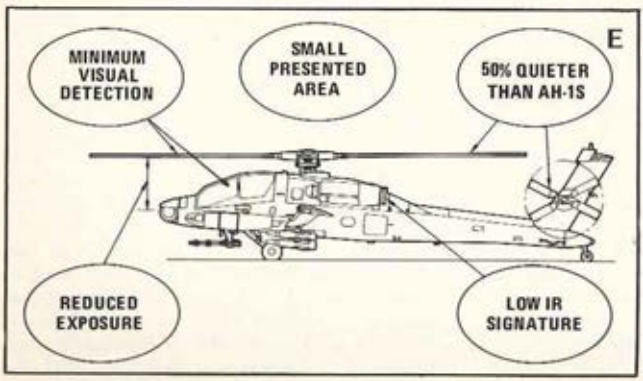
A low flicker rotor, low glint canopy, composite materials, "scissor" tail rotor, overall compact design, and a new approach to engine plume suppression have resulted in a low signature across the aural, visual, radar, and infrared spectrums. (SEE Chart E below).

BALLISTIC TOLERANCE

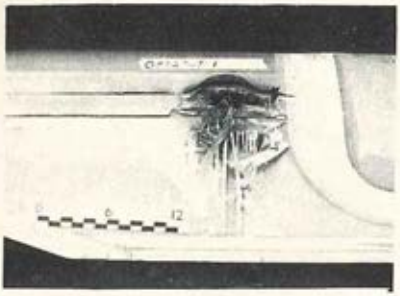
The vulnerability assessment of the YAH-64 indicates low vulnerability to 12.7mm fires and to 23mm HEI rounds. Added features, such as the requirement for the main gearbox to operate one hour without oil, further enhance mission accomplishment.

While new metals and materials already used in the AAH have resulted in the ability to take multiple hits of 12.7mm and 23mm HEI and still fly home, we are now looking at more advanced materials which will do even better. Protection of the crew is provided by the transparent shield between cockpits, against a lone 23mm HEI getting both the pilot and the co-pilot, and a blast shield below the transprent cockpit areas to protect the lower torso. (A G photo presentation appears on the next page.)

The current metal main



F



MAIN ROTOR SPAR HIT – HEI
Operated 5.2 Hours After Hit – No Failure

HEI CREW PROTECTION BLAST SHIELDS

Transparent Shield
Between Cockpits

Below Seat Shield

rotor blades, which incorporate five overlapping—but independent—spars, can withstand a worse case of HEI hit and still let you fly home. (SEE F photos just above).

Using this technology we have launched a "composite" blade development program that will give greater life and added vulnerability features. We expect it to be available for our first production AH-64.

The fuel cell system and structure has demonstrated taking a direct HEI hit without exploding or catching fire, and the tank self-sealed! Now that's what I call ballistic toughness!

CRASHWORTHINESS

Rugged construction and innovative design features maximize low system attrition. Additionally, 95% probability of crew survival at a crash impact rate of 42 feet per second is engineered into the YAH-64. Our goal — save the crew and repair the helicopter so both will fight again.

In sum, the **AAH** is the most survivable helicopter known. Its survivability is achieved by the synergistic effects of high maneuverability, a rugged, twin engine airframe highly tolerant of high-caliber HEI and invulnerable to mid-caliber projectiles. Redundant flight control systems, self-sealing fuel cells — all make the AAH an exceedingly "hard" helicopter. (SEE Chart G on Page 28).

PROGRAM SCHEDULE

Having provided an overview of the system, a look at the current program is now in order. Since the last report, the **AAH** Program was provided increased FY 78 funds by Congress over those requested by the Department of Defense; thereby permitting the **AAH** to accelerate development from a 60-month to a 56-month Phase II program.

The Phase II contractual effort with Hughes Helicopters requires the modification of the two Phase I aircraft (AV02 and 03), and the **Ground Test Vehicle (GTV)**, the fabrication of three new aircraft (AV04, 05, and 06), the integration of subsystems into the aircraft, support of the TADS/PNVS fly-off and operational testing to obtain a production decision.

During this time, the **HELLFIRE** missile subsystem, the TADS/PNVS and the 30mm cannon with ammunition are completing development for subsystem integration by Hughes. The on-going competitive TADS/PNVS development will complete in April 1980 with the selection of a single TADS/PNVS contractor to complete the balance of engineering development (maturity phase).

Current planning is to complete the 56-month development phase by the end of August 1981 when a three-month operational test II (OTII) is completed. Prior to completion of development, Long Lead Time Item funding will be placed on contract in February 1981 for

On the AAH:

We're a three-time winner.

On the AH-64 Advanced Attack Helicopter, Hughes Helicopters is taking three-way advantage of Sperry Flight Systems expertise. Flight controls, display symbology and digital data handling are just some of the areas where we excel.

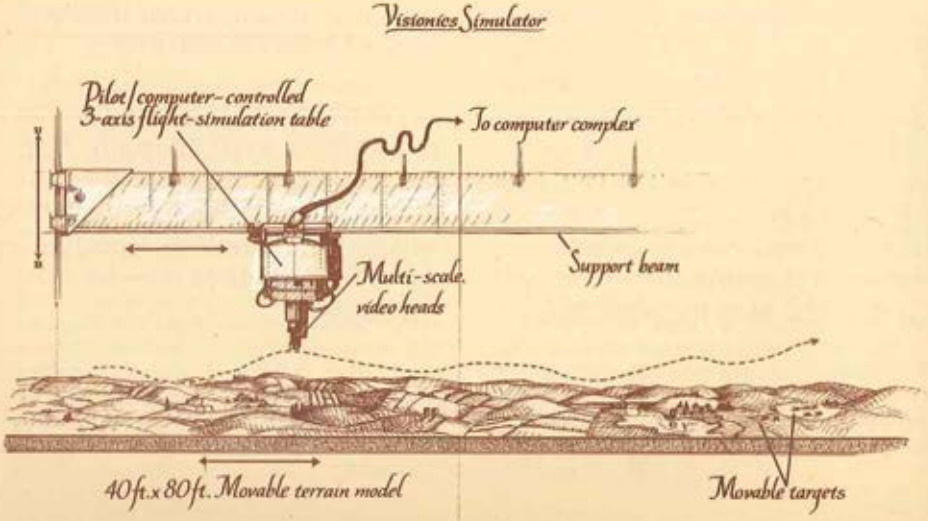
The AAH will have a Sperry digital automatic stabilization equipment system (DASE) operating on the MIL STD 1553 digital data bus providing stability and control augmentation and autopilot functions. The DASE also includes the AH-64's backup fly-by-wire control system (BUCS). Sperry's cockpit display symbology generator and Multiplex Remote Terminal Units (based on our space shuttle multiplexer-demultiplexer technology) are optimized for the AAH role.

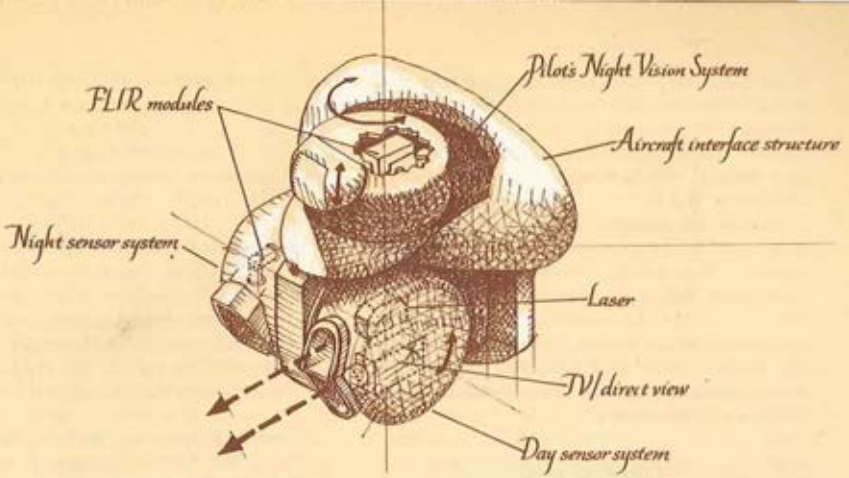
When the AAH goes into production, we'll be ready. For the Army's front-line anti-armor system, only the best will be good enough. Sperry will be doing its part — in triplicate.

SPERRY
FLIGHT SYSTEMS

How do you develop more effective defense systems?

You start with vision.





TADS PNVS

For three decades we have placed great emphasis on a continuous program of analysis and study to help us foresee the future course of world military strategy.

This vision for projecting military needs, and the development of technical resources to meet them, has significantly contributed to many of the country's first line defense systems.

In fact, a number of systems with vision of their own have grown out of this analytical approach. Paveway, an airborne laser designator, Pave Penny, an airborne laser tracker, and a Target Acquisition and Detection System known as TADS, for example, all required advanced electro-optics in order to search out, mark, and track targets day or night. Our Pilot's Night Vision System (PNVS) required new developments in forward-looking infrared technology.

When analyses also revealed a greater need for first-round accuracy, the military services called for weapons that could "see." Two such are Copperhead, a laser-guided artillery projectile, and Pershing II, a tactical missile that uses radar correlation, terminal guidance to point of impact.

To test systems with advanced technologies we've invested in some of the most sophisticated facilities in the industry. A unique and spectacular one is our multi-million dollar Simulation and Test Laboratory. Its electro-optical simulator includes a mammoth terrain model over which such systems can be "flown" by a pilot or missile.

Through vision, innovation and testing we've helped keep our country abreast of its defense needs. Without question, we're eminently qualified to help analyze and develop our country's future defense systems.

MARTIN MARIETTA

Martin Marietta Aerospace
6801 Rockledge Drive, Bethesda, Maryland 20034

those items requiring extensive leadtimes. An ASARC/DSARC will be held in October/November 1981 subsequent to OT II and a production decision obtained in November 1981 and initial production contract award in December 1981.

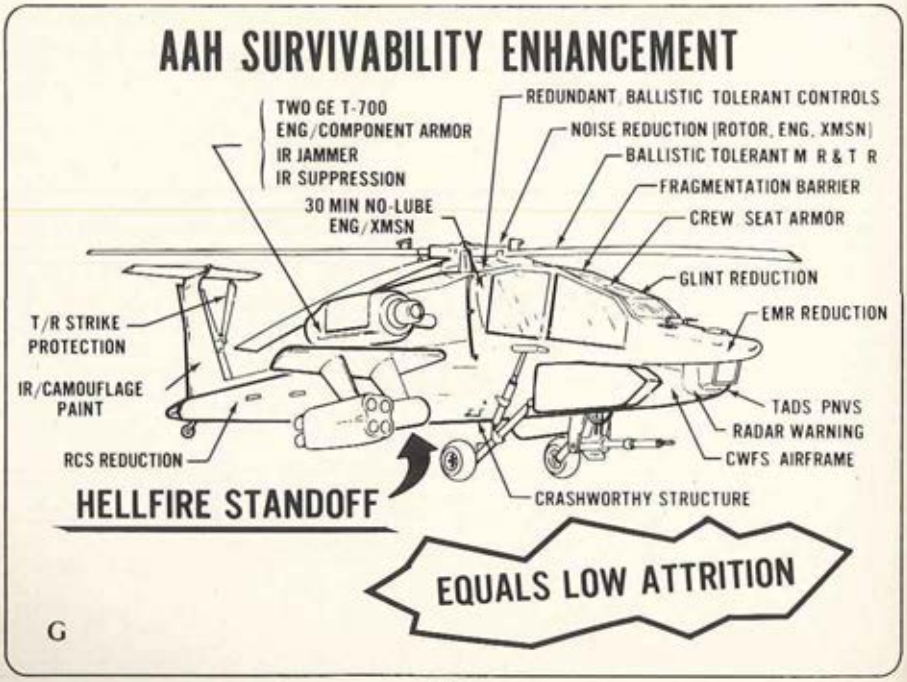
Current production planning indicates a lead time of 34 months from date of LLTI contract award to first delivery, which would make the first AH-64 delivery in November 1983. We are currently reviewing additional approaches to production which would permit us to increase the initial production build-up with a view towards an improvement in economic and force posture considerations.

Contractors

Hughes Helicopters as the prime airframe contractor and systems integrator has developed a **"Team"** effort with a number of major subcontractors. These subcontractors and their respective products are:

Advanced Structures—Main & Tail Rotor
Aircraft Gear Corporation—Gearboxes
Bendix—Drive Shafts & Couplings
Bertea—Hydraulic Control Subsystem
Garrett AirResearch—APU
Grumman Aerospace—Boresight Kit
Hamilton Standard—Flight Controls
Honeywell—IHADSS
Litton Precision Gear—Main Transmission, Engine Nose Gearboxes, and HARS
Lockheed Air Services—Hardware Trainers
Menasco—Landing Gear
RCA—Automatic Test Equipment (ATE)
Rockwell MSD—HELLFIRE Msl Equipment
Science Applications—Fixed Base Data Acquisition System
Sperry Flt Systems—Multiplex, Automatic Stabilization Equipment, and Symbology Generator
Teledyne Ryan—Airframe Structure
Teledyne Systems—Fire Control Computer

In addition to the above **Team Members,** the **TADS/PNVS** competing contractors, Martin Marietta and Northrop, are also associates and team members for Hughes' integration effort.



Production & Procurement Goals

Over a seven-year period, the Army currently plans to procure 536 AH-64's. Production will continue through FY 90 with the last aircraft delivered in March 1990. (SEE the **AAH Phase II Schedule** below).

TECHNICAL STATUS:

During the past year, we ran into some technical snags in developing the air vehicle. Difficulties in the areas of high dynamic loads, vibrations, and handling qualities have caused us to reexamine our technical approaches to their solution. Although no single problem we have experienced is a "show stopper," in combination they slowed down our development progress. Attempts to fix each problem, as an entity within itself, were not yielding satisfactory results.

So we set in motion a complete design review that concluded in the decision to change the tail design to incorporate a movable horizontal stabilizer (stabilator). The stabilator approach will provide improvement to meet requirements in each of the problem areas cited. First flight of the prototype stabilator is scheduled for October 1979 and we expect to fly the final design with all the automatic in-flight programming electronics incorporated in the aircraft in early spring.

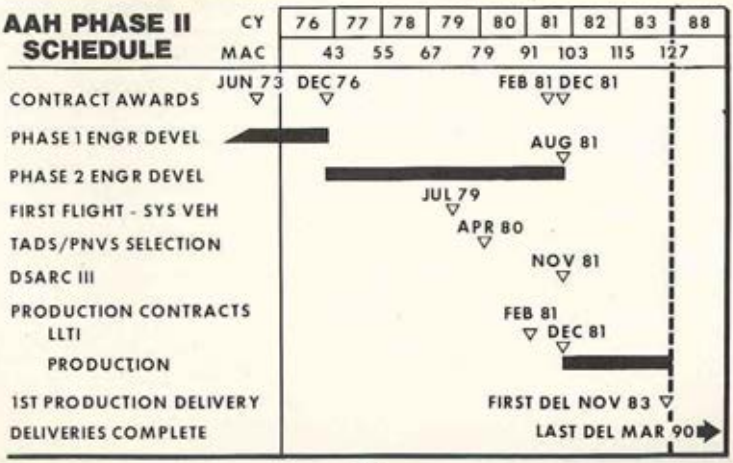
One of the most challenging aspects of the YAH-64 development program is the systems integration and test of the HELLFIRE, 2.75" rocket, and 30mm weapons systems elements. In many cases we are plowing new ground, particularly as pertains to helicopters. To gain high confidence of successful integration prior to aircraft installation, we built a laboratory with a "hot mock-up" of the actual AH-64 to interface all the subsystems. The process employed is shown in Chart "H" on the next page.)

As can be seen, all systems flow through the **MEDL** where the systems "play" on a bench-type set-up and then get installed into the **MSS**. The **MSS** is a full scale YAH-64 airframe with complete cockpit instrumentation and aircraft wiring. Computer simulated inputs are fed into the **MSS** systems so that systems responses can be observed and measured. When this aspect of testing is complete, the systems, as a total package, are removed and reinstalled on the actual flight vehicle.

The tempo is accelerating

While the integration thus achieved is not foolproof, this concept reduces the overall time required for systems checkout at the flight test site. As the date for the **TADS/PNVS** competitive fly-off approaches, the tempo of the on-aircraft integration and test is accelerating. Today, two aircraft with all subsystems integrated are undergoing flight testing and armament fire control work at the test facility.

By the time you read this article, both air-



craft, equipped with competitive **TADS/PNVS**, will have achieved a significant amount of in-flight systems testing. **HELLFIRE** missiles (guided) will have been fired and night operations, including **PNVS** flight at low level, will have been accomplished.

In short, the program is flying along.

AAH COMMONALITY PROGRAM

The AAH Commonality Program is centered around the DOD Standardization Program to enhance system reliability, maintainability, and cost effectiveness by minimizing the number of new parts, materials, processes, repairable components, tools, and **Ground Support Equipment (GSE)** and to use parts with Federal Stock Numbers (Standardized) whenever feasible. In short, don't load the combat unit down with more things to carry around and keep track of than absolutely essential!

The Hughes Helicopters' contract requires that a company-wide standardization committee review and resolve all related commonality problems as well as approve all proposed non-standard part application requests. Hughes Helicopters is also required to impose a **Preferred Parts List (PPL)** on all their subcontractors, both major and minor, to minimize the number of individual items used on the AAH. The contractors are required to submit to the Government all non-standard item requests for evaluation. If a similar item is in the DOD inventory that may fulfill the need without adding another item to the inventory, that item becomes a preferred part.

This same process is also used for tools and ground support equipment. As of July 1979 the Government has recommended that 2,702 of the proposed non-standard parts be replaced with a current item in the DOD inventory of which 2,442 of the items have been accepted by Hughes and their subcontractors/vendors.

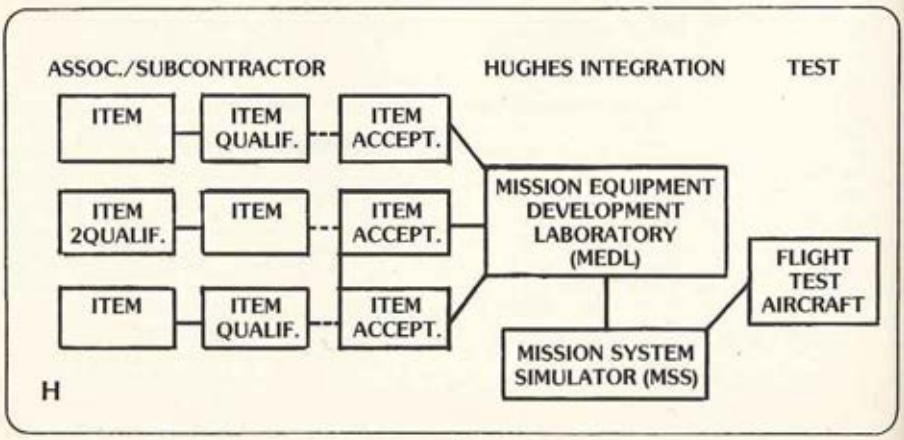
While this amounts to a substantial cost avoidance in the supply system when you consider that each item is normally stocked, stored and issued for at least a ten year operating period, more importantly we have reduced what the combat user has to cart along with him in battle.

LOGISTICS SUPPORT

Support for the AAH is being developed under the **Integrated Logistics Support (ILS)** concept; that is, the AAH is being designed for logistics support. The **Logistics Support Analysis Program (LSAP)** is the tool being used to design for support. This program identifies each specific part, maintenance level, piece of support equipment, publications, training, and training device requirement.

The AAH **LSAP** uses the Review Team concept of logisticians and maintainability engineers working together analyzing the design and documenting the concept that will be presented for operational testing.

The **LSAP** Review consists of logisti-



cians and engineers from the four Readiness Commands, Training and Doctrine Command (TRADOC Systems Manager, schools and the Log Center), the Logistics Evaluation Agency, and the Materiel Readiness Support Activity. This collective team has been successful in reducing the support equipment requirements and utilizing common TO&E equipment wherever possible.

Built-in detector

Unique features that will insure the AAH is supportable within the existing MOS structure and with approximately the same numbers of personnel required to support existing Army aircraft are the **Fault Detection Location Subsystem (FD/LS), Automatic Test Equipment (ATE),** and Boresight Technique. **FD/LS** built into the airplane identifies defective **Line Replaceable Units (LRU).** Replacement at the AVUM of the defective **LRU** will allow the vehicles to remain in an operational status. The ATE at AVIM will diagnose the **LRU** and determine the defective module.

Replacement of the defective module at the AVIM unit will allow the **LRU** to be returned to service, thus never leaving the field activity location.

The AAH captive boresight technique employs a kit installed solely on the aircraft, thus freeing the operation from influence of terrain, wind, and aircraft attitude, and movement during optical checks. The boresight operation can, therefore, be performed in an area no larger than that occupied by the aircraft. Errors between sighting systems and the ordnance delivery points (within given tolerances) are detected and measured by the optical units and corrected by keying in changes to the fire control computer in lieu of the normal time consuming mechanical adjustments.

Boresighting the ordnance attachment points and the area weapon (30mm Chain Gun) can be accomplished in 30 minutes with two men. Design success of these three features will give the Army an AAH that is operationally ready with minimum "hands on" maintenance, thus reducing operating and support costs while maximizing "Availability to Fight!"

THE AAH'S CONTRIBUTION

Validation of the value of attack helicopters in combined arms operations is being carried out through series of new tactical testing programs. These tests are designed to collect measured data from field exercises that simulate the most modern threat weapons in mechanized assault forces. The tests are expected to prove the effectiveness of attack helicopters in countering the threat of numerically superior armored forces.

The Army also expects to validate the tactics employed for attack helicopters and determine

improvements that can be made in tactics and hardware in order to enhance their future survivability on the modern battlefield. OSD is supervising the planning of these tests to insure that the results obtained are based on the most realistic conditions and combined arms tactics possible.

Previous tests such as **Air Combat Engagement-Tactics Deployment and Evaluation (ACE-TD&E)**, and **Joint Attack Weapons System (JAWS)** demonstrated that gaps existed in the portrayal of the tactics. The new series of tests of tactical aircraft effectiveness in anti-armor operation was initiated in Sept. 1977. These tests have since been named **TASVAL** for **Tactical Aircraft Survivability Evaluation.**

TASVAL's Objectives

1. Determine loss rates of friendly ground attack aircraft during anti-armor attack missions in moderately to heavily defended areas. Determine which threat weapons or combinations of weapons are most effective in destroying friendly aircraft.

2. Determine threat armored target destroyed/damaged rates. Determine which attack/weapons and tactics or combinations result in maximum target kill rates.

3. Determine friendly aircraft losses vs. armored target killed, considering effectiveness of tactics and combinations of friendly aircraft, i.e., type and mix of aircraft in attack force, size of attack force, etc.

4. Evaluate synergistic effects of AH-1S and A-10 aircraft operating in concert on kill and survivability rates.

5. Evaluate effect of weather (assumed ceiling and visibility restriction) and EW countermeasures on friendly aircraft vs. armored target kill exchange ratios.

At this time the A-10 and AH-1S aircraft are the only types of close air support planned to participate in the tests. None of the tests or evaluations will use the AH-64 because we need the few prototypes to complete the development program. The battle scenarios employ A-10's only, attack helicopters only, and combined A-10 and attack helicopter forces.

Red and Blue Forces

The **RED FORCES** will consist of 31 tanks, six self-propelled artillery pieces, and 11 armored personnel carriers. Threat air defense will be simulated by two improved **Hawk** batteries with four transporter erectors each, **Redeye**, and **Chapparal** (four batteries). Four truck-mounted units simulate four ZSU-23-4 air defense guns.

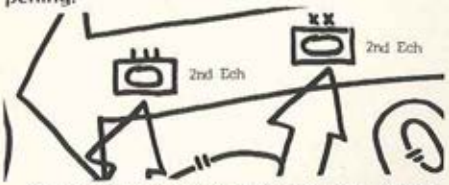
The **BLUE FORCES** are equipped with ten tanks and two **TOW** launchers. The A-10 is armed with GAU-8 30mm cannon and **Maverick** missiles. The AH-1S is armed with

* * * * *

An Army AH-1S Cobra moves into firing position as a USAF A-10 begins a firing run during the TASVAL test at Fort Hunter Liggett, Calif.

20mm cannon and TOW missiles. When A-10 is employed, four aircraft are utilized; when the AH-1S is employed, five are utilized.

Lasers and laser sensors are used to take the place of real projectiles hitting real targets. These sensors are linked to a mini-compute. network that performs near real time casualty assessment allowing a rough score of the battle progress to be maintained while it is still happening.



Due to the complexity of assessing aircraft kills the system is unable to report aircraft kills during the battle. Firing data from all the players is processed by computer after the battle to determine targets killed and final exchange ratios.

Full electronic warfare tactics will be used in TASVAL. BLUE FORCES will attempt when possible to jam ZSU-23 radar and SA-8 radar. Chaff, flares, and standoff jamming will be employed or simulated. RED FORCES will employ jamming of BLUE's communications.

Joint countering

Air-to-air engagements between helicopters is being examined in the J-CATCH program. These involve the joint countering of attack helicopters, both A-10's and the AH-1S being employed. The synergistic effects of combining the A-10 and the AH-1S in operations against hostile helicopters are being investigated.

The Army and Air Force will use the results of these tests to develop their combined air-to-air tactics against armed helicopters and determine the requirements for any modifications to increase effectiveness. Out of all this we expect to learn how best to optimize the AAH to contribute the most in the anti-armor mission.

From what is learned, the AAH OT-II will be structured to test the AAH's ability to make such a contribution to the Combined Arms Team.

The AAH is a Team Player

MANAGEMENT

The AAH is one of the Army's highest priority programs and is the No. 1 aviation priority. The **Advanced Attack Helicopter Program Manager (AAH—PM)** is chartered by the Secretary and reports to the CG, USADARCOM.

The **Program Manager** is delegated full line authority for the management and the technical direction of his program, and is responsible and accountable for total program planning and direction, and controlling the allocation and the use of all resources authorized for the execution of the approved program.

The **AAH Program Office** is structured under the multi-level project concept. The **Project Managers** of the **TADS/PNVS** and **30mm Ammunition** developments report to the **AAH—PM**, and use certain elements of the **AAH** staff to assist their respective project offices in their development efforts.

The faces that go with the names and titles are shown on the **AAH—PM** Management Team photochart in the centerfold of this issue. Since the AAH program development is a joint effort of both the Army and industry, an organization chart of the prime contractor, Hughes Helicopters, follows immediately after the **AAH—PM** photochart. The Hughes Helicopters' team is adeptly translating the Army's AAH requirements into a most outstanding weapons system.

Program Manager's Comment

The **Target Acquisition Designation System (TADS)** and the **Pilot's Night Vision System (PNVS)** with fire control integration make up the heart of the AAH. These equipments integrated into the YAH-64 enable us to find, fix, and kill targets in adverse weather, both day and night.

In the next article, **Colonel "Bud" Patnode**, the PM for **TADS/PNVS**, discusses these super AAH subsystems.

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND
5001 EISENHOWER AVE., ALEXANDRIA, VA. 22333

Helicopter operations in Vietnam and field tests confirmed the essential fire support, immediate availability, and responsiveness to the ground commander provided by attack helicopters. The Cobra has done a fine job for us and is presently undergoing modernization, but it does have limitations. It is for these reasons that the Advanced Attack Helicopter (AAH) Program was initiated to increase our airborne weapons platform and anti-tank capability of the combined arms team.

The Advanced Attack Helicopter is one of the Army's Big Five development programs today, and is the Number 1 Army Aviation Program. To accomplish the tough tasks of developing, producing, deploying and supporting the Advanced Attack Helicopter, the Army has no less than seven Program/Project Managers playing important roles in managing this total effort. In addition, the systems contractor, Hughes Helicopters, uses eighteen major subcontractors and associated industrial concerns to assist in the contractual effort. The integration of advanced weapons into a state-of-the-art helicopter is now and has been a challenge to US industry. The Program Manager for the AAH is responsible for the total program. Assisting him within the Army are the Project Managers for HELLFIRE/Ground Laser Locator Designators (HELLFIRE/GLLD), Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS), Training Devices (TRADE), Aircraft Survivability Equipment (ASE), Navigation Control Systems (NAVCON), and 30mm Ammunition.

Let me assure you of my personal support for the AAH, and that all DARCOM Commands, from Armament Materiel Readiness Command (ARRCOM) to Troop Support and Aviation Materiel Readiness Command (TSARCOM) and all their laboratories, are in full support of the Program Manager in bringing this system into being at the earliest practicable time.

JOHN R. GUTHRIE
General, USA
Commanding

TADS/PNVS: A New Approach

BY COLONEL CLARENCE E. PATNODE, JR.
PROJECT MANAGER—TADS/PNVS, DARCOM

THE AH-64 is the first helicopter designed to fly and fight at night and in periods of reduced visibility. To perform this new role, a unique target acquisition and night sensor system was required. This would perform target acquisition and designation functions in conditions previously considered to be 'unworkable'.

The **Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS)** was the most feasible answer to this requirement. Its innovative components permit navigation and attacks to be carried out in the worst flight weather conditions.

Program Status

Integral parts of the AAH weapon system are the nose-mounted **TADS**, which acquires and tracks targets in a variety of visibility conditions, and the **PNVS**, which provides the imagery to allow NOE night flight. The **TADS/PNVS** development is a competitive program in which two contractors, Martin Marietta and Northrop, are currently striving to win the production contract and provide the Army with the best product. Both the Martin Marietta and the Northrop **TADS/PNVS** systems have been installed on the AH-64.

The AH-64 is in the Armament and Fire Control Survey testing preparatory to the conduct of the **TADS/PNVS** Competitive Flyoff. These two contractors work closely with the AH-64 prime contractor, Hughes Helicopters. The competitive flyoff, commencing this year, will yield important test data to be used in the selection by a **Source Selection Evaluation Board (SSEB)**.

The **SSEB** will evaluate each competitor's proposal and a great deal of supporting data. A contract will be awarded to the winning **TADS/PNVS** contractor in April 1980 for the Maturity Phase.

Initial efforts leading to this selection have been accomplished. The **Request for Proposals (RFPs)** for the Maturity Phase will be issued to the **TADS/PNVS** competitors in September 1979. Included in this solicitation will be requests for firm offers for initial production quantities of **TADS/PNVS** hardware enabling the establishment of firm options for production while still in competition. The contractors are also required to propose:

(1) a limited **Reliability Assurance Warranty (RAW)** program for the first two years of **TADS/PNVS** production, and;

(2) a price for a Competitive Technical Data Package.

Consideration of these areas during the competitive source selection process will promote a successful completion of development and initiation of production. Quantity production for AH-64 use is scheduled to begin in December 1981. Any other applications of the **TADS** and **PNVS**, together or separately, would result in increased production quantities.

TADS

The **TADS** provides the AH-64 with greater target engagement ranges, higher accuracy, and increased survival potential. The major parts that contribute to these functions are **Laser Rangefinder/Designator (LRF/D)**, Laser Tracker, Silicon Vidicon TV, **Forward Looking Infrared (FLIR)**, **Direct View Optics (DVO)**, Automatic Video Tracking, and Stabilization.

On a typical mission, as the AH-64 moves to its attack position, the **TADS LRF/D** may be used to determine range and relative bearing from known checkpoints. The AH-64 fire control computer uses this data for navigation system update without having to directly overfly a checkpoint. Upon entering the target area in periods of daylight and reasonable visibility, the crew will probably use the Mk.I Eyeball for a sharp visual lookout.

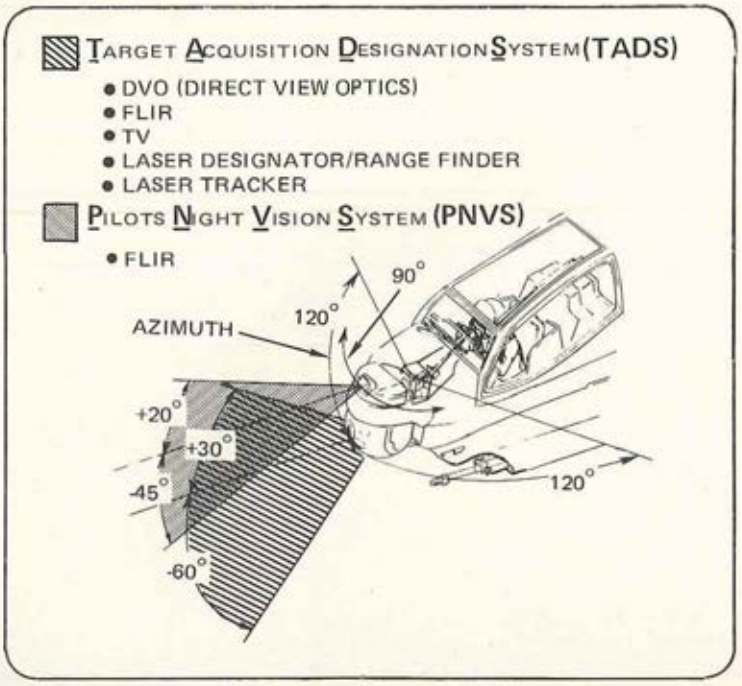
Pilot (P) and **copilot/gunner (CP/G)** may elect to scan different sectors.

Additionally, the **CP/G** may elect to view with heads-down **DVO, narrow field-of-view (NFOV),** or **wide field-of-view (WFOV).** Should the **P** desire to direct the **CP/G's** attention to a potential target, cueing symbols will aid the **CP/G** in putting his line of sight on the target. Now he may wish to get a more highly magnified look with the **TV, WFOV** or **NFOV,** or the **DVO NFOV.** He will be able to detect and recognize targets from safe standoff ranges with either the **TV** or **DVO.**

As the visibility deteriorates, due to weather or as darkness arrives, the **CP/G** will view with the **FLIR** to observe targets and terrain. Three fields of view are available. The **WFOV** nicely complements the **PNVS** should that system be inoperative or occupied by the **P.** Typically, the AH-64 crew will be attacking a target which has been found by someone else, usually a ground or airborne scout. As the AH-64 unmasks, the scout will lase the target. The laser tracker will be in operation to acquire the designated target within the **FOV** of the **TADS TV.** The AH-64 would then initiate a cooperative firing of the **HELLFIRE** missile.

Using laser-guided weapons

Should the AH-64 be searching for its own targets, it can use the **TADS LRF/D** to provide a laser spot on the target for laser guided weapons. Maximum laser designation ranges vary with the acquisition sensor being used. These options again are the **TV, DVO,** and **FLIR.** As the AH-64 designates the target a variety of



weapons can be employed. The **LRF/D** is compatible with the laser **HELLFIRE** carried by the AH-64, the **Copperhead** laser homing artillery rounds, and all DOD laser-guided munitions. The laser rangefinding solutions are employed by the AH-64 control computer for 30mm cannon or 2.75" rocket fire control solutions.

A "Prepointing" option

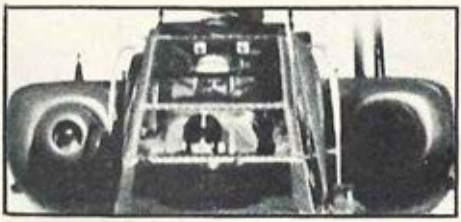
The **TADS** offers a variety of special features related to target acquisition and tracking. "Prepointing" is an option employed when the target coordinates are known but the target is not in view. Typically, this could be a "hand off" situation from a scout and another AH-64. The coordinates are entered into the AH-64 data input panel and, when activated, the **TADS** is aimed directly at that point — the target.

"Targeting" is somewhat the reverse. The target is in view but it is desired to store its position, perhaps for another AH-64, when all ordnance has been expended by the observing AH-64. The target is ranged by the **TADS**, a button is pressed to store the computed target coordinates based upon the helicopter's present position, range, and relative bearing to the target.

The various sight pictures (except **DVO**) can be displayed on the helmet-mounted display of both **CP/G** and **P**. The system's 120° in azimuth, 30° up, and 60° down, make it adaptable to fast moving, close-in combat situations. The 120-250 hour MTBF reliability assures dependable field use. The total **TADS** turret weight is less than 370 lbs.

PNVS

The **PNVS** turret is mounted just above the **TADS** and operates independently from the **TADS**. Primarily designed as a night flying aid



for the **P**, the **PNVS** can assist in target detection and day navigation using its **FLIR**. Using the **FLIR** common modules it presents infrared imagery, via a helmet-mounted **Cathode Ray Tube (CRT)**, on a monocle immediately in front of the P's eye. Flight Director symbology is also combined with the **FLIR** picture to afford a true "heads up" flying condition.

A "better way"

Topographical features are made distinct in haze or inclement weather conditions by the **PNVS**. NOE combat operation in total darkness is the most significant advantage provided by the **PNVS**. The **PNVS** turret is electronically slaved to the P's line of sight by the **Integrated Helmet and Display Sighting System (IHADSS)**. The P's line of sight is sensed by infrared detectors on the side of the lightweight helmet, eliminating the need for any mechanical linkage between the helmet and the helicopter.

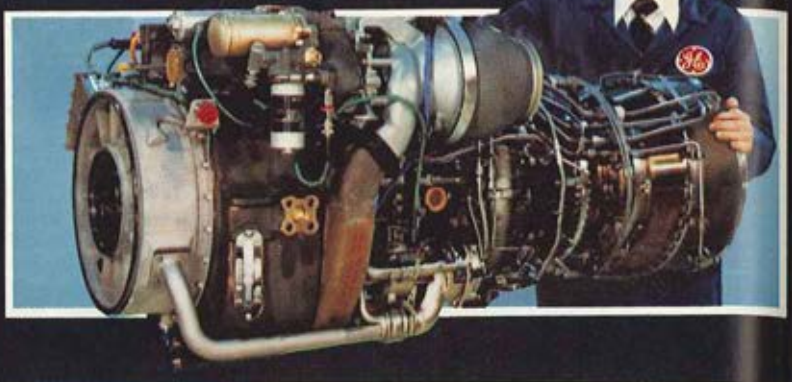
In addition to installations on the AH-64, two of these systems (one Martin Marietta and one Northrop) are also installed on the **AH-1S Cobras** currently used to train AH-64 P's in night NOE flight with **PNVS** and symbology. With the selection of the **TADS/PNVS** winning system and the integration of that system in the other AH-64 Phase 2 aircraft, the Army will be another step closer in its quest for a **"better way" to find and kill tanks.**

Program Manager's Comments

Up to this point, we have provided an update of the design aspects, the technical status, and the current program with its Army and Hughes management teams. Training to use this complex equipment required more time than was economical to use on the prototype equipment.

Surrogate equipment and a dedicated test training detachment were established so that the prototype AAH's could continue their development without training period interruptions. The **Development Test Training Detachment (DTTD)** Commander, **Major "Bill" Leach**, now provides us with an insight into the various **DTTD** activities.

AAH Power



The T700: Thoroughly proven power for the rugged AAH mission

When the Army/Hughes AH-64 Advanced Attack Helicopter arrives on the modern, tank-heavy battlefield, its T700 engines will be equal to the challenge. Backed by exceptionally rigorous testing, plus years of experience powering the Army's Black Hawk, the T700 will provide the extra reliability, survivability and simplified maintenance needed for the AAH's demanding operating environment.

GENERAL ELECTRIC

DTTD supports the developmental tests

BY MAJOR WILLIAM R. LEACH, COMMANDER
DEVELOPMENT TEST TRAINING DETACHMENT

THE Development Test Training Detachment (DTTD) was activated on 1 March 1979 (Fig. 1 next page). The unit, composed of four commissioned officers, twelve warrant officers, and forty enlisted personnel, is assigned to the Test and Evaluation Command (TECOM) but is under the operational control of the Advanced Attack Helicopter (AAH) Program Manager's Office.

In early 1978, the AAH Program Manager proposed a plan for developing a dedicated training detachment that would support development and operational testing of the AAH. A surrogate trainer course was envisioned to train incoming test player pilots, gunners, and maintenance support personnel on the complex and highly sophisticated night pilotage and target acquisition and detection systems found on the AAH.

Full line authority

DTTD is the direct result of the proposal. Its mission is to exercise full line authority and responsibility for the conduct of training on assigned surrogate subsystems in order to qualify pilots and co-pilot/gunners in the safe operation of these systems during day and night nap-of-the-earth operations.

All personnel assigned to DTTD were individually selected because of their expertise in their particular area of interest. The average aviator assigned to the detachment has 10.25 years of aviation experience; 2,800 flight hours of which an average of 1,800 are in attack helicopters; 800 flight hours as instructor pilots; and 350 hours of night flying experience.

All of the unit aviators have combat experience and some have enemy tank kills with 2.75" FFAR and TOW missiles to their credit. Other assigned aviators have extensive experience in development testing, Forward Looking Infrared (FLIR), Night Vision, Target Acquisition Systems, and/or Operational Testing.

Eight-aircraft fleet

The surrogate training aircraft assigned to the detachment are two AH-1S Cobras (ECAS) equipped with Pilot Night Vision Systems (PNVS) (Fig. 2 & 3). Two AH-1G's equipped with Airborne Target Acquisition and Fire Control System (ATAFCS) (Fig. 4); HELLFIRE Missile Systems (HMS); and two AH-1S's (ECAS) for direct view optics training utilizing the standard TSU installed in these aircraft. The detachment also has two UH-1H's assigned as crash/rescue aircraft.

The two AH-1G helicopters each contain an HMS and an ATAFCS. The HMS consists of two four-rail missile launchers, a pilot and gunner's control panels, and associated system electronics. These systems components are sufficient for launching laser-guided HELLFIRE missiles and are used by the DTTD to train operational test player personnel to transition into the HELLFIRE system of the AAH.

The ATAFCS system incorporates a Gunners' Imaging Display and Controller (GIDC), a Laser Designator/Tracker, a Television, and FLIR acquisition/sighting system capability. The ATAFCS system provided the ability to acquire and track targets with TV or FLIR viewed through the GIDC cathode ray tube (CRT). Targets can be manually or automatically tracked, autonomously designated

DTTD: Supporting the Developmental Tests

with an onboard laser designator or when remotely designated, acquired by the onboard laser tracker.

The HMS and ATAFCS systems are electronically integrated and, together with the helmet sight system acquisition device, can be employed to train gunners who will later transition into the Target Acquisition and Designation System (TADS) of the AAH.

Six of the detachments twelve instructor pilots have been dedicated to the ATAFCS/HELLFIRE System surrogates. The division of instructors into two groups was necessitated by a six-month self-training course development limitation. In the six months since effective date of organization, the ATAFCS/HELLFIRE section pilots each received 57 hours of ground school and three hours of system simulator training at the contractor facility in Ohio. The contractor provided 32 hours total flight training for the group in August 1979.

PNVS surrogate systems

Two AH-1S (ECAS) aircraft are dedicated to the PNVS surrogate systems. One aircraft is modified with one contractor PNVS system and the other aircraft contains a competitor's PNVS system. The PNVS provides a nighttime NOE flight capability by providing 30° x 40° field-of-view FLIR imagery to the pilot on his Helmet Mounted Display (HMD). Training in the two surrogate systems will effectively prepare development and operational test player pilots to transition into the AAH Night Vision System.

Six detachment pilots are dedicated to the PNVS surrogates and have received 16 hours ground school from each of the competing contractors. They also received 23.5 cumulative hours in a tactical avionics system simulator to experience a monocular video display. One aviator spent three months at the competitor's facility. These aviators returned to the DTTD and administered 25 hours of system flight training to each of the other instructors in the PNVS section. When time permits, all detachment aviators will be cross-trained in all systems, thereby broadening the instructor base and enhancing scheduling.

The purpose of the surrogate training course is to provide additional equipment, operational experience, and pilot training while reducing the risk, cost, and schedule impact of flight training operations with the AAH.

Surrogate training course

The AAH surrogate training course is 11 weeks and two days in length. The first training cycle began on 26 July 1979 with the arrival of student personnel pilots who will conduct Engineering Design Test (EDT) 3 and the TADS/PNVS contractor flyoff test. On 14 October 1979, they graduate from the surrogate trainer course and proceed to Hughes Helicopters for Mission System Simulator (MSS) training at Culver City, CA. They then return to the test site for YAH-64 flight training. EDT 3 and TADS/PNVS flyoff will follow the YAH-64 transition.

In early 1980, a second training cycle will prepare player pilots for the HELLFIRE Operational Test II. Eventually, additional players will be trained to participate in the AAH OT.

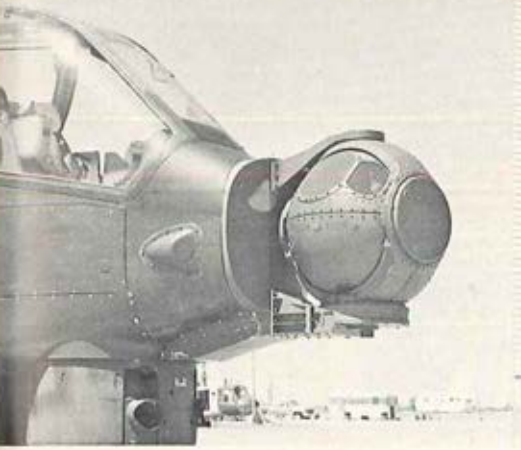
The surrogate training course is divided into two phases. In Phase I, all players will receive 28 hours of PNVS ground school and six hours and 30 minutes of flight training. Ground school training will consist of 10 hours of general subjects including a training program overview, program safety, and several classes relating to generic PNVS subjects, such as Infra-Red Theory, FLIR Imagery, Integrated Helmet and Display Sight System (IHADSS) (Fig. 5), and the Doppler Navigation System (DNS). There are eight hours dedicated to each of the contractors PNVS configuration, components, symbology, operating and emergency procedures, and safety.

Two track training

In Phase II, the players are split into two separate tracks. Phase IIA is the PNVS track. Each player selected will receive an additional 18.5 hours in intermediate and advanced PNVS flight training. Phase IIB is the ATAFCS track. Selected players will receive 27 hours in ATAFCS/HELLFIRE ground school and 15 hours flight training.

This training will provide PM-AAH with dedicated gunners and pilots for easier implementation into the YAH-64 transition program. By

Top Left: The Integrated Helmet and Display Sight System (IHADSS). **Top Right:** The Martin-Marietta PNVS as installed on a test YAH-64. **Bottom Right:** Northrop Corp.'s Pilot's Night Vision System (PNVS). **Bottom Left:** The Airborne Target Acquisition Fire Control System (ATAFCS).



the completion of the AAH surrogate training course, all players will have been screened for helmet display units compatability and will be qualified to safely operate either **PNVS** or **ATAFCS/HELLFIRE** in day, night, and NOE operations.

The Development Test Training Detachment is a concerted effort to implement an entirely new training program for the most advanced helicopter in the world. That effort is being met head-on. Ultimately, today's surrogate-trained aviators will be better prepared to meet the challenges imposed by the highly sophisticated aircraft of tomorrow.

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Bendix

We speak technology.

HELLFIRE: The Armor Nemesis

BY COL(P) BENJAMIN J. PELLEGRINI AND CAPTAIN(P) JAMES L. McCULLOUGH, II

THE Army has a commitment to "fight outnumbered . . . and win"!

One means of accomplishing this mission is to equip the troops with the most versatile, cost effective, and devastating weapons our technology can offer. The AH-64/**HELLFIRE** Team is one of these weapon systems. The **HELLFIRE** member of this team features a missile that has the accuracy and a warhead that can destroy threat armor.

Laser technology utilized

HELLFIRE also enhances the survivability of the AH-64 by having greater standoff range than existing **Anti-Tank Guided Missiles (ATGM)**, and it travels faster. The present pace of the **HELLFIRE** development program will shortly equip our soldiers with a tank killer employing laser technology. This allows the helicopter to attack firing a volley of missiles from behind cover, yet with the pinpoint accuracy required to "blow-away" two or more platoons of tanks.

This same missile is also designed to adapt to the emerging technologies of fire and forget and self-defense against radar without redesign of the missile, launcher, or avionics.

In short, the **HELLFIRE** missile offers a wide variety of attack features containing a devastating and effective warhead against armor — and is truly the tank's nemesis.

HELLFIRE is the combination of a modular missile, two- or four-rail launcher, and helicopter avionics. The AH-64 has a capability of carrying 16 missiles. In this configuration, the helicopter can land and completely reload in less than 20 minutes, due to the unique "Load and Lock" feature of **HELLFIRE**. The AH-64 will also be able to carry a mixed load of Laser, Infrared and Anti-Radar (RF/IR) **HELLFIRE** missiles using the emerging guidance technologies as they are developed.

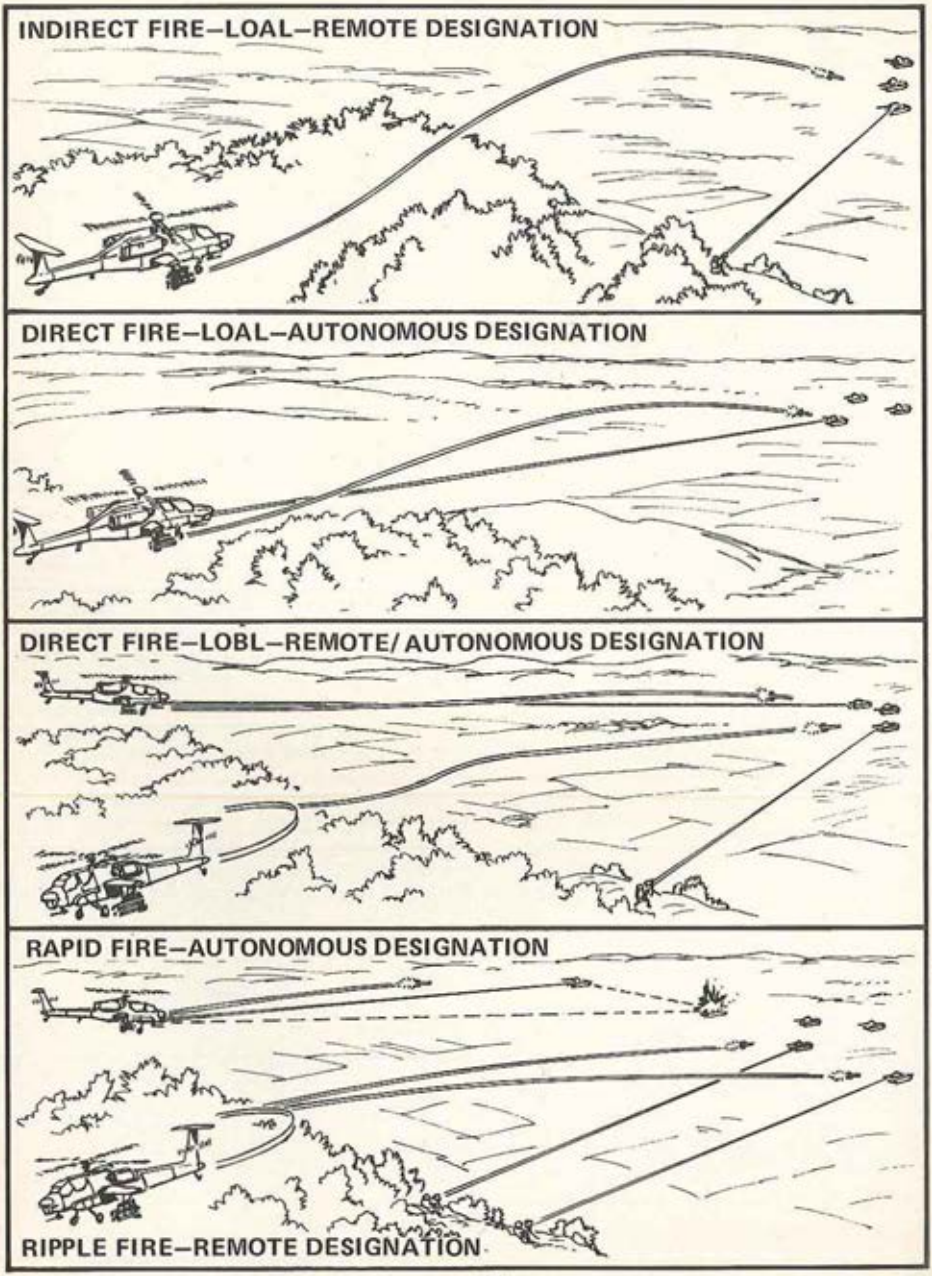
Launch and leave capability

One of the primary techniques for firing the missile is in the **Remote Designation Mode**, providing a launch and leave capability for the helicopter. The targets can be designated by a **ground laser locator designator (GLLD)** or by other designators, day or night, while the attack helicopter remains behind mask or standing back, well out of the range of enemy ground fire.

After a minimal amount of target information exchange between the attack helicopter and the designator crew, giving the location of the target and lock-on option, the attack helicopter launches the missile in direct fire while the designator illuminates the target; or while still in defilade the attack helicopter can use the indirect fire mode and the **GLLD** can designate the target. Thus, the **HELLFIRE** kills the tank without ever exposing the helicopter.

When a remote designator is not available, the AH-64 crew can utilize the onboard **Target Acquisition and Designation System/Pilot Night Vision System (TADS/PNVS)** to allow the launch of **HELLFIRE** in the **Autonomous** mode. In this mode, the attack helicopter illuminates the target yet still remains well out of the range of enemy ground fire.

Another desirable launch method is the **Lock-On-After-Launch** technique. Here the unique features of laser technology allow initial missile launch without acquiring the target, and the designator illuminates the target allow-


INDIRECT FIRE–LOAL–REMOTE DESIGNATION
DIRECT FIRE–LOAL–AUTONOMOUS DESIGNATION
DIRECT FIRE–LOBL–REMOTE/ AUTONOMOUS DESIGNATION
RAPID FIRE–AUTONOMOUS DESIGNATION
RIPPLE FIRE–REMOTE DESIGNATION

HELLFIRE LAUNCHER AND MISSILES

HELLFIRE AVIONICS

ing the missile to home-in while in flight. This unique capability for the helicopter to fire a missile in the general direction of the target and the missile to acquire the target after launch lets it destroy targets at either short or long ranges. When the attack helicopter engages targets with this technique, it can remain indefilade or use direct fire.

helicopter engages targets with this technique, it can remain in defilade or use direct fire.

A versatile weapon

As described earlier, one of the most versatile capabilities of this **HELLFIRE/AH-64** Team is its ability to use either **rapid fire** or **ripple fire** launching techniques.

In **Rapid Fire,** missiles are fired at intervals against a number of targets designated in succession. As the first missile strikes the first target, the designator is directed to the second target while the second missile is already in flight. This allows several targets to be engaged by an individual attack helicopter without going through a complete engagement sequence for each target as required by current missile technologies.

In **Ripple Fire,** multiple targets are illuminated by two or more laser designators, each designator operating on individual pulse frequency codes (similar to radio channels) which are keyed to that of each missile. In less than a minute two or more tank platoons could be "blown-away" by the **GLLD/AH-64/HELLFIRE** Team, and a single AH-64 would still have a great deal of its payload remaining.

Remote designation capability

The **HELLFIRE** has already demonstrated remote designation capability in the ongoing **HELLFIRE** engineering development program. Using the **Cobra AH-1G** as a launch platform, there have been successful **HELLFIRE** direct hits against targets designated by the Army's first precision ground laser designator, **GLLD.**

The remainder of the **HELLFIRE** program

FUTURE APPLICATIONS

M113

AH1-J/T

A-10

UH-60

HELLFIRE: The Armor Nemesis

will complete missile qualification and operational tests using the **Cobra** AH-1G as a representative platform during 1980. Support of the AH-64 firing program will also go on in parallel. To further enhance this proven concept of cooperative firing, there is also a program to increase the speed of target handoff that began initial testing in 1978, and plans call for it to be available by the time the system is fielded.

Multi-platform usage

The unique feature of the **HELLFIRE** missile is its capability to be utilized by other platforms. **HELLFIRE** adaptability has been studied by the Air Force for the A-10 close air support aircraft; the Army is conducting a study for the use of **HELLFIRE** in a Ground Launched Mode; the Marine Corps has signed a Joint Services Operational Requirement with the Army to develop the proven technique on the **Cobra** for their use; and there have been recent inquiries to look at the **Black Hawk** as a potential platform.

HELLFIRE, which will soon be available to soldiers in the field, will have a devastating capability . . . a warhead that will defeat the threat armor. It is adaptable to many platforms, giving each a survivability not currently offered by any missile system. This missile takes advantage of the early guidance technology developed for laser, and allows for growth with the evolution of new technologies, beginning with a Fire and Forget **HELLFIRE** development starting in early 1980.

Tank's advantages diminished

HELLFIRE will revolutionize the battlefield. Before, the tank had all the advantages of shock action, fire power, and mobility . . . and other systems had to remain stationary, attempting to attack the tank as it was on the move. Now, the tank can move anywhere on battlefield terrain but the new technology of the laser effectively strips it of all its mobility and protection without exposing the helicopter crew.

The **HELLFIRE/AH-64** Team allows the modern soldier to "fight outnumbered . . . and win"!

* * *

The "HELLFIRE" article is co-authored by Colonel Benjamin J. Pellegrini, Project Manager, HELLFIRE/GLD, USA MICOM, and Captain(P) James L. McCullough, II, Senior Project Representative, PMO-HELLFIRE/GLD.

Co-Author
Captain(P)
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Representative
PM-HELLFIRE

The YAH-64 Fire Control Computer Maximizes AAH Weapons Effectiveness

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- Rapid Fire Control Solutions
- Fault Detection/Location
- Reduced Crew Workloads
- Back Up Degraded Modes
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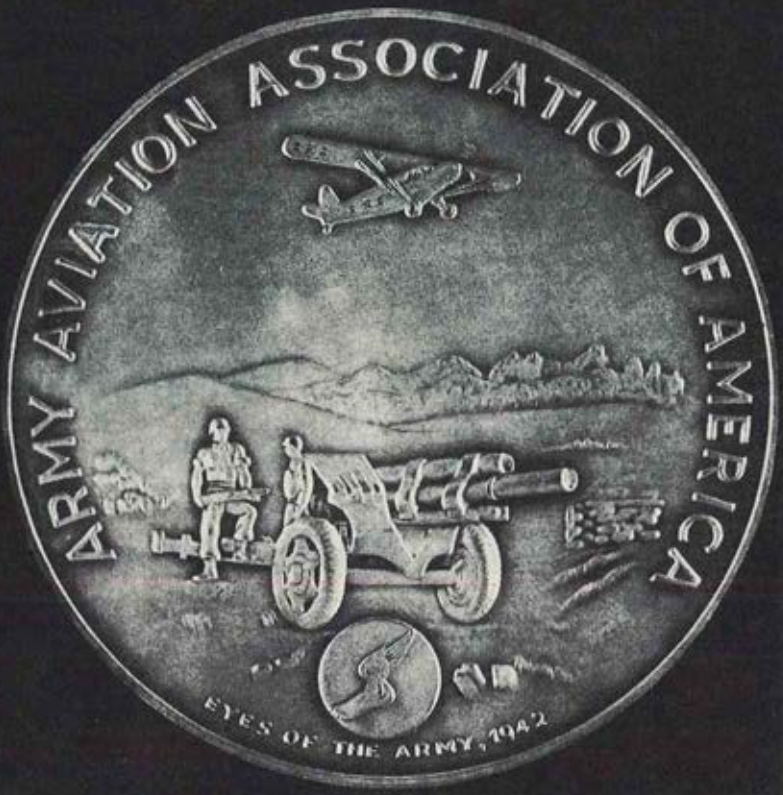

CALENDAR YEAR 1979 NOMINEES ARE SOUGHT FOR AAAA'S NATIONAL AWARDS

(FOR ADDITIONAL DETAILS, TURN TO PAGE 103.)

THE YAH-64: The Future is Now!

BY LTC WARREN GRIFFTH, RET., AAH FLIGHT TEST DIRECTOR, HUGHES HELICOPTERS

WHENEVER a YAH-64 Advanced Attack Helicopter prototype lifts off the pad, I realize that all of us involved in the testing of the AAH are experiencing a rare opportunity because we're helping lay the foundation for the future anti-armor force of the Army.

That unique opportunity also carries with it a tremendous responsibility for all of us involved in testing the AAH. We're well aware that the AAH is Army Aviation's No. 1 development program. Our challenge is to make it work as a weapons system that will meet the Army mission requirements.

Our mission is to hand over to the Army, in two years, a thoroughly tested and proven weapons system that will serve into the 21st century as the most advanced and lethal anti-armor helicopter in the world.

Into high gear!

Hughes Helicopters activated a government test site last spring with things going into high gear on June 3, when the first YAH-64 (Ship No. 3) arrived from the Hughes Flight Test Center at Palomar, CA. The No. 2 ship came to us four weeks later. The No. 1 YAH-64 is the ground test vehicle for the research and development program, and it is in operation at the Hughes Helicopters' Flight Test Center at Palomar. In addition, a full AAH fuselage is being instrumented at the structural test facility at Hughes in Culver City for an intensive fatigue testing program.

Prior to coming to the test site, the two YAH-64 flight test prototypes had logged more than 900 hours air time, which were mainly devoted to testing handling characteristics, expanding of the flight envelope, and verifying operation of all systems required for safety of flight. There was also some weapons testing to verify compatibility with the airframe, which included firings of the **HELLFIRE** missile, the Hughes 30mm Chain Gun, and 2.75 inch air-to-ground rockets.

The job ahead

Our job during the next 22 months covers four main tasks:

(1) Integration and flight testing of the complete weapons delivery system;

(2) Preparation for and support of the Army's conduct of the competitive fly-off to determine which **Target Acquisition Designation System/Pilot's Night Vision System (TADS/PNVS)** is selected to go on production AAH's;

(3) Integration of the winning system onto the YAH-64 prototype fleet, and

(4) Preparation of the AAH for the Army's extensive operational field testing.

Since last spring, our team has built up to approximately 200 Hughes Helicopters' employees and Army personnel. Our first tasks after the YAH-64's arrival were to do in-flight vibration tests and cooling surveys on the two aircraft. The vibration tests verified the vibration levels at the bulkhead where the **TADS-PNVS** attaches, while the cooling surveys verified that the YAH-64 environmental system provides air that is the proper temperature for cooling the avionics equipment of each of the competing **TADS/PNVS** systems.

The successful completion of those tests then led into the **Fire Control Survey (FCS)**, which basically is an integration of all of the fire

The suppressor system is shown clearly in this view of the YAH-64 No. 3 being run up prior to takeoff on the Fire Control Survey.

The YAH-64: The Future is Now!

control and sighting systems into the airframe.

As I write this, we're just starting the **FCS (Figure 1)**, and things are looking good. The AAH Contractor Team philosophy, which has worked extremely well, is certainly in evidence during the **FCS**.

System integration

For example, we have Rockwell with the **HELLFIRE** missile; Pacer with its air data sensor, which feeds into the fire control computer built by Teledyne Systems. All of these boxes talk into one another through a **multiplex (MUX) bus**, which is made by Sperry. Another division of the Sperry Company makes our automatic stabilization system.

The integration task is to insure that these systems play together and talk to one another properly through the **MUX bus**. In essence, we're verifying in the air what has already been proven in our **Mission Equipment Development Laboratory (MEDL)** and the **Mission System Simulator (MSS)** in our laboratory in Culver City.

After integrating all of the systems on the two aircraft during the **Fire Control Survey**, we'll be firing **HELLFIRE** missiles **(Figure 2)**, the 30mm Chain Gun **(Figure 3)**, and 2.75 inch rockets **(Figure 4)**. The **FCS** will initiate the first autonomous laser designation and guidance firings of the **HELLFIRE** from the AH-64.

Compatability proven

The five **HELLFIRE** missiles previously fired at Palomar were launched from the YAH-64 in the ballistic mode (unguided) to prove the compatibility between the missile, launcher, and airframe.

Also, we'll be performing various navigation functions with the doppler system, and doing NOE flying during the day and night. The NOE night flight is to prove out the **PNVS** and the Honeywell **Integrated Helmet and Display Sighting System (IHADSS)**, in addition to the night attack functions.

The **IHADSS** will also be used to aim the 30mm Chain Gun and air-to-ground rockets during firings. As you read this in mid-October, we'll be getting ready to start training the Army pilots who'll be flying in the **TADS/PNVS** fly-off.

In late November, Army test pilots from Ft. Rucker and Edwards Flight Test Center are scheduled to conduct **Engineer Design Test (EDT 3)** on the full AAH system for two weeks.

The AAH fires its 2.75 inch air-to-ground rockets during the Fire Control Survey.

We'll then be ready to go into the **TADS/PNVS** fly-off.

The competitive fly-off is scheduled to begin this December and continue through February of 1980. To assure fairness and objectivity in the **TADS/PNVS** competition and fly-off, we've established separate and equal facilities for the competing contractors. Each contractor has his own hangar, laboratory, and YAH-64. The No. 2 YAH-64 is equipped with the Martin Marietta **TADS/PNVS (Figure 5)**, and the No. 3 ship carries the Northrop **TADS/PNVS (Figure 6)**. In addition, each contractor has a **Cobra** equipped with its version of the **PNVS**, which is used in conjunction with the **IHADSS** to train pilots.

Data collection

During the fly-off, the competing systems will generally be required to do the same things they did during the FCS, such as fire the **HELLFIRE** missile and the 30mm Chain Gun, and fly day/night NOE, using the **IHADSS**. Another important factor will be **Reliability and Maintainability (RAM)** of the systems during the fly-off. We and the Army will be collecting data on **Mean Time Between Failure (MTBF)** and **Mean Time Between Change (MTBC)**. In fact, the Army and Hughes have been collecting **RAM** data and maintaining a daily **RAM** log since the first day the aircraft arrived.

The role of Hughes in the fly-off is to provide the aircraft, all the ground support, and the engineering effort to support the fly-off in accordance with the Army-approved Hughes test plan. We're also responsible for participating in the tests, acquiring and reducing the data, performing some analysis, and providing data for the Army's Source Selection Board for its study and selection process. At the completion of the evaluation, the Army will select the winner of the competition and award the Maturity Phase contract in April 1980.

Modification phase

Following the Army's selection of a **TADS/PNVS** winner in early spring, Hughes will be back in the modification business. First, we'll modify the two aircraft used in the fly-off — No. 2 and No. 3 — by removing the T-tail and installing the new stabilator that's scheduled to begin flight testing in October on the No. 4 YAH-64. Also, the winning contractor's **TADS/PNVS** will be installed on both aircraft. That will be a major task because there'll be changes to the wiring, the black box installations, and the cooling system.

About that time, the ships No. 5 and No. 6 YAH-64 prototypes (new Phase 2 design) will

30mm Chain Gun was tested during the AAH Fire Control Survey.

arrive; so we'll have three aircraft in test. Two of the aircraft will go into another Fire Control Survey that's designed for a tighter integration of the system and fine tuning process. The third aircraft will be used to test the modifications and improvements to the winning system that will no doubt be dictated by what was learned from the tremendous amount of data that'll be gathered during the fly-off. Those changes will be flight tested on the third aircraft.

A comprehensive program

Beginning in mid-1980, we'll be conducting many additional tests, including radar reflectivity, acoustical, and infrared signature. We'll always have at least three aircraft in test. The No. 4 YAH-64 will remain at Palomar, where it will do air loads testing, structural demonstrations of composite blades, and any other non-fire control-related flight testing. The Army's extensive Operational Field Testing will start in mid-1981 at another test site, where the YAH-64's operational readiness will be proven.

As you will have realized by now, the AAH test program is probably the most comprehensive helicopter weapons system program yet conducted. Other programs have had some of the AAH type subsystems involved, but not to the extent of the spectrum of capabilities being integrated into the AH-64.

The Army-industry "team" concept is in evidence across the board at the test site. Hughes Helicopters, the industry team leader; Martin-Marietta and Northrop Co., the two **TADS/PNVS** competitors; and seven other companies — General Electric, Honeywell, Litton, Rockwell, Singer, Sperry Flight Systems, and Teledyne Systems — have full time representatives participating in the tests.

Working well!

The team concept is working extremely well; the support from the Army contingent, the AAH-PMO, and the team members is outstanding; and the machines are performing as expected.

Considering the tremendous spirit of professionalism and enthusiasm to get the job done right, on time, and within cost, I'm very confident that by the time we're done with our testing, the Army will have what it needs — **the world's most combat-efficient tank-killing helicopter.**

Program Manager's Comment

The new DCSOPS Army Aviation Officer and former Project Manager — Black Hawk, **Brigadier General "Dick" Kenyon,** provides us comments in the following article.

AAH: A Great Leap Forward

BY BRIG. GEN. RICHARD D. KENYON
ARMY AVIATION OFFICER, ODCSOPS, DA

IT is altogether fitting that I address the Army's top priority aviation system in my first message to the Army Aviation community following my assumption of duty as the Aviation Officer at Headquarters DA.

The **Advanced Attack Helicopter** (AH-64) will indeed be a great forward leap for Army Aviation. This aircraft is the **first** Free World helicopter designed from the ground up as an attack system. Both the airframe and its associated systems have been optimized to accomplish the anti-armor mission in the mid-intensity battlefield environment.

This optimization was based on what has been perhaps the most thorough, all encompassing program of tests and studies ever conducted by the US Army on a new weapons system. Terrain, weather, and the latest threat information for likely worldwide areas of employment have been considered in great detail.

A bold expansion

The capabilities of the AH-64 — which evolved from these efforts — will permit bold expansion of attack helicopter employment doctrine and tactics to meet the ever increasing armor threat on the battlefields of the future.

The combination of the **Target Acquisition Designation Systems (TADS)** and **Pilot's Night Vision System (PNVS)** with the **HELLFIRE Modular Missile System (HMMS)** offers the potential for long range kills of hostile armor at night and during periods of obscured visibility.

Target acquisition, engagement ranges, and missile accuracy and lethality will increase dramatically. The AH-64 will offer a high probability of kill against all postulated future armor from firing positions beyond the effective range of hostile air defenses virtually around the clock.

The flexibility of the **HELLFIRE** missile will offer opportunities for both direct and indirect fire and autonomous or remote laser designation, either by another aircraft or by the FIST team's GLLD. Eventually, the **HELLFIRE** will offer a true fire and forget capability, thereby shortening the already short exposure time of the AH-64 to threat weapons.

The AH-64's improved fire control and stores management systems will offer improved 2.75" rocket delivery accuracy for suppressive and special purpose munitions while the XM-230 30mm cannon will offer not only suppressive fire capability but light armor kill potential.

NOE flight optimized

The vast improvements in agility, vertical rate of climb, and hover out of ground effect will permit optimization of nap-of-the-earth flight by the AH-64. This — coupled with the improved levels of airframe protection — will make this attack helicopter a very tough nut for the threat air defenses to counter.

Improvements in reliability, availability, and maintainability will significantly improve readiness, while the AH-64's self-deployment capability will offer strategic mobility to the attack helicopter force for the first time.

While all of the foregoing may be somewhat redundant in view of the other articles in this issue, I believe that the stage must be set for a brief discussion of the opportunities and challenges associated with the fielding of the AH-64.

While the aviation force structure of the Army is presently tailored by the results of the

AAH: A Great Leap Forward

ARCSA III Study, the on-going **Division 86 Study** will have a great impact on AH-64 deployment and the structure of future attack helicopter companies and battalions.

Another important force structure consideration is the retention of significant numbers of AH-1S **Cobras** in the low side of the high/low attack helicopter mix for the foreseeable future. Affordability will preclude filling all attack helicopter units with the AH-64. Therefore, we must very carefully structure the attack helicopter force based on national priorities, the postulated threat in areas of likely employment, and the availability of assets.

Force structure will also be impacted by any changes in tactics and doctrine which develop, based on the AH-64's improved capabilities. Primary among these must certainly be the cockpit crew ratio driven by the 24-hour capability of the helicopter.

Innovative solution needed

While TRADOC is studying this issue there are no simple solutions. Manpower will continue to be seriously constrained in the active force. Therefore, an innovative solution to manning the force will be required.

Selection and training of both crew members and maintenance personnel will also require some changes from our present way of doing business. We must seriously consider the impact of more complex systems, such as the **TADS/PNVS** and fire control computer. Not only will high caliber personnel be required but training time may increase. Crew members may require some degree of physical selection and screening due to the requirement to interface with the **PNVS**.

Additionally, retention of personnel trained

in high technology fields must be continually addressed due to competition from an ever expanding civilian aerospace industry. Retention of highly-trained attack helicopter crew members and maintenance personnel will have significant impact on force effectiveness due to the experience gained with each tour in an operational unit.

Greater simulator use

Due to the cost of both flying hours and ammunition (particularly **HELLFIRE** missiles) an ever increasing percentage of unit training must be accomplished in full function simulators. This type of training will be even more important where environmental impact and safety precludes firing of live ammunition, missiles, or laser and NOE flight at night.

Therefore, although the AH-64 will be a great leap forward, we, the Army Aviation community, are challenged to move quickly in adjusting our thinking to take advantage of all it offers in capability. As a force multiplier, the **AH-64 has no equal!**

We must therefore make every effort to optimize its performance as a member of the combined arms team to assure maximum contribution in winning the first battle of any future conflict.

Program Manager's Comment

In the materiel development process, the **Training and Doctrine Command (TRADOC)** represents the user. In the case of the AAH, however, several Centers are involved as well as a TRADOC-chartered system manager, the TSM.

In the next few articles, **Major General "Tom" Lynch**, Commander of the Armored Center discusses the employment of the AH-64 in the **Air Cavalry Attack Brigade (ACAB)**, and **Colonel "Bob" Molinelli** tells us what the 6th Cavalry Brigade (Air Combat) at Fort Hood, Texas, is doing in preparation for the production AH-64's.

THE STANDARD FOR DOPPLER RADAR NAVIGATION SYSTEMS

Kearfott's AN/ASN-128 lightweight Doppler Radar Navigation System for U.S. Army

Kearfott's AN/ASN-128 Lightweight Doppler Navigation System is the U.S. Army's standard airborne doppler navigator.

The Receiver/Transmitter Antenna (RTA) and Signal Data Converter (SDC) constitute the Doppler Radar Velocity Sensor (DRVS), which continuously measures the velocity of the aircraft. The Control Display Unit (CDU) provides control and display functions for the operator, and contains the navigation computer.

With inputs from external heading and vertical references, the ASN-128 system provides accurate aircraft velocity, present position, and steering information. It is completely self-contained and requires no ground based aids.

The DRVS accepts heading, roll, and pitch as synchro inputs and converts them into digital format for transmission to the computer. The DRVS can also be used separately from the ASN-128 to provide velocity inputs to other aircraft equipment.

The CDU accepts beam velocities, heading, roll, pitch and true air speed (in some installations) from the Doppler Radar Velocity Sensor and performs the navigation computations. The front panel includes provisions for entering operator inputs and for displaying system data such as present position, steering information to 10 destinations, and status of the system. The CDU also puts out velocity and navigation data in ARINC digital format.

The CDU performs three functions for the ASN-128:

- Provides mode controls, display controls, and keyboard entry of destinations and other data.
- Performs all computations for LDNS including Doppler processing, velocity coordinate transformations, navigation in both UTM and latitude/longitude, steering signals to 10 destinations, and BITE functions.
- Displays navigation data on its front panel.
- BITE function identifies and displays failed LRU.
- Provides BCD and binary outputs for external equipment.

Operational Advantages:

- Weight 28 lb (12.7 kg)
- FM-CW transmission, with Doppler tracking of the J1 sideband providing accurate velocity measurement from ground level, to over 10,000 feet (3,048m).
- Printed-Grid Antenna—"Land-sea" switch eliminated, because of inherent beam shaping.
- Single transmit-receive antenna, utilizing the full aperture for both transmission and reception, minimizing beam width and reducing fluctuation noise.
- Navigation data in both UTM coordinates and Latitude/Longitude.
- Redundant navigation modes for backup.
- Single time-multiplexed signal processor module—only one-fourth the number of components of previous designs.
- Over 2000 hour MTBF for the ASN-128 and over 4500 hour MTBF for the DRVS alone.
- No maintenance adjustments at any maintenance level.
- No special test equipment at the flight line.

For additional information write to: The Singer Company, Kearfott Division, 1150 McBride Ave., Little Falls, N.J. 07424.

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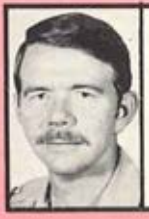

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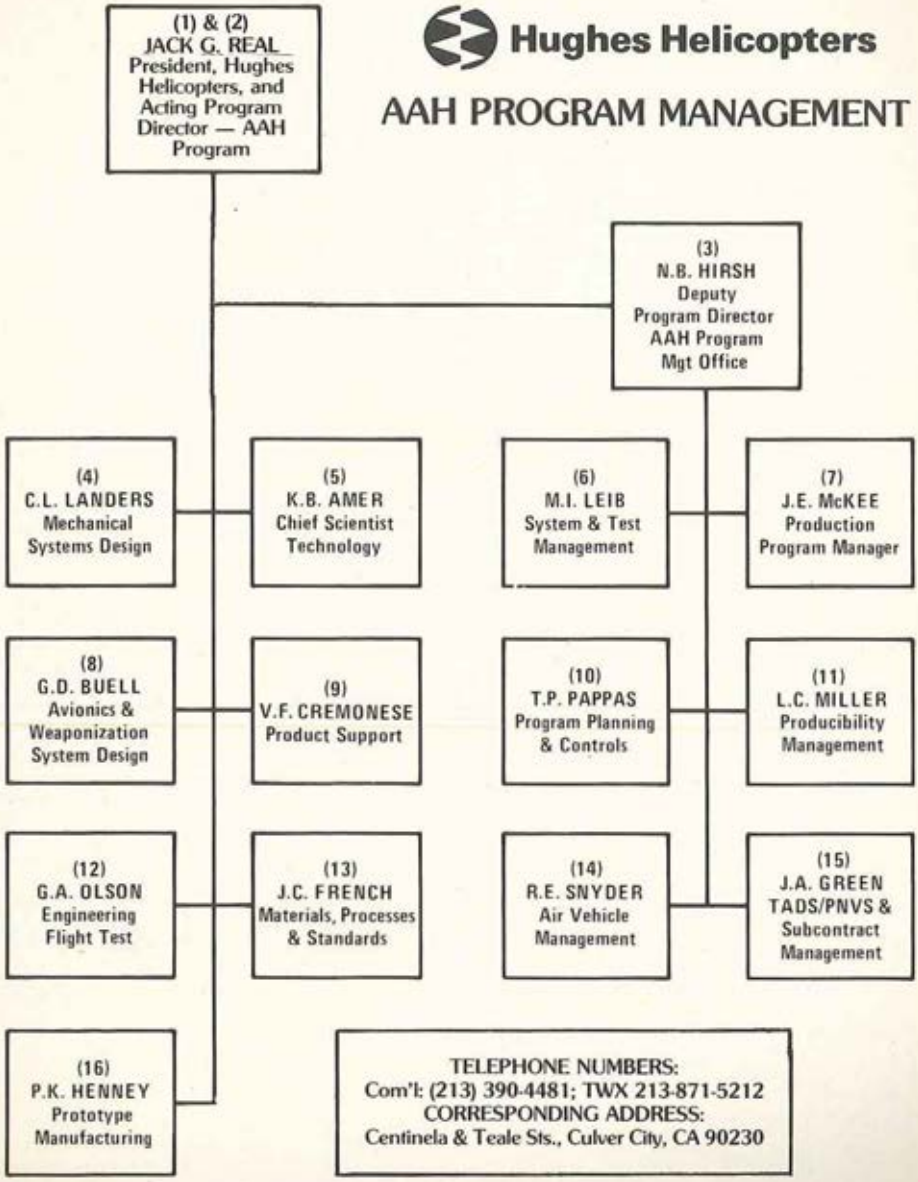
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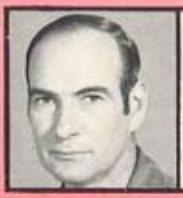
THE TRADOC SYSTEM MANAGER— ATTACK HELICOPTER ORGANIZATION



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AAH Employment in the CAB

BY MAJ. GEN. THOMAS P. LYNCH
COMMANDER, US ARMY ARMOR CENTER

AS Commanding General of the Armor Center and proponent for the development of tactics, doctrine, and training for all Air Cavalry and **Attack Helicopter (AH)** units, I welcome the opportunity to share some of my thoughts and philosophy on the tactics, doctrine, and employment of attack helicopters in the **Combat Aviation Battalion. (CAB).**

Under ARCSA III all divisions contain **Combat Aviation Battalions** structured with at least one attack helicopter company.

The **Attack Helicopter Company (AHC)** is a highly mobile, potent maneuver force that provides the division commander with a responsive combat multiplier for both the central battle and force generation activities.

An integral component

The **AHC** destroys enemy armor and other other forces by aerial means using fire and maneuver employed as an integral component of the Combined Arms Team. The **AHC** is the only combat maneuver unit of the **CAB** and must be considered by commanders when planning any combat action against hostile forces.

The combat maneuver elements of the battalion use nap-of-the-earth flight techniques, stealth, and fire and maneuver in concert with other members of the Combined Arms Team.

The **Attack Helicopter Company** is normally employed under the **Operational Control (OPCON)** of the ground maneuver brigades. They are integrated into the concept of operations and scheme of maneuver utilizing the same control measures as those of the ground forces and other members of the Combined Arms Team.

The **AHCs** contain both scout and attack helicopters providing the capability to identify and destroy enemy armor formations. The companies provide increased combat power and continuous operations capability for the brigade. The **AHC's** acceptance and use as a component of the Combined Arms Team is a vital tenet to success on the future battlefield.

It provides highly mobile, responsive killing power to the force commander and is well suited in situations requiring rapid reaction, economy of force, or overcoming the barriers of terrain, time and distance.

Open-ended employment

Task organization and employment is only limited to the imagination and resourcefulness of the commander. Mobile warfare demands that the commander combine and employ all combat maneuver elements in order that the strength of one enhances the mission capability of the other.

> The attack helicopter must be viewed, integrated and employed, not as an "AIRCRAFT" or an "AVIATION ASSET" but as a highly mobile anti-tank weapon system.

The attack helicopter provides a new dimension to the battlefield and provides the commander with the means to overcome terrain restrictive to ground-bound forces. Obstacles to a ground maneuver unit may become vantage positions for an attack helicopter equipped unit. Proper use of terrain enables the unit to maneuver on the enemy force, gain advantageous positions, and attack with direct and indirect fire weapons at maximum standoff ranges.

AAH Employment in the CAB

Offensive Operations

Ultimate success in battle is usually achieved by offensive action. Even when on the defensive the commander must take every opportunity to seize the initiative and carry the battle to the enemy in order to seek an advantageous decision. In offensive operations, the concentration of superior combat power at the critical time and place, followed by the employment of strong mobile exploitation forces, is usually required to achieve decisive results.

The offensive requires the commander to seize and retain the initiative. To do this he must use all the tools of his trade effectively to orchestrate the battle and minimize losses. He must quickly concentrate his forces and aggressively pursue all advantages offered him. His force must be mobile and flexible, and have superior firepower — all qualities inherent of attack helicopter units.

The attack helicopter provides the commander with the capability of providing heavy, **long range anti-armor firepower** anywhere in the area of operation.

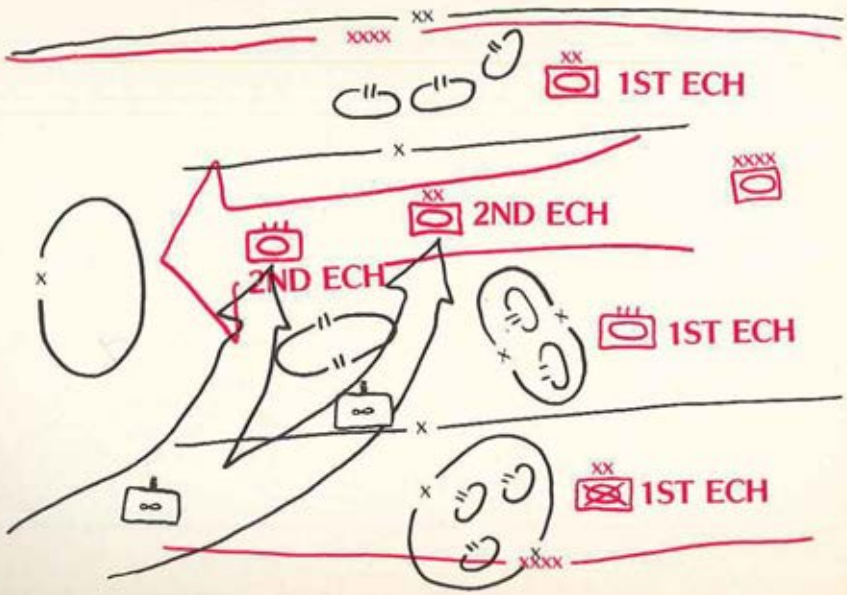
Collisions of forces

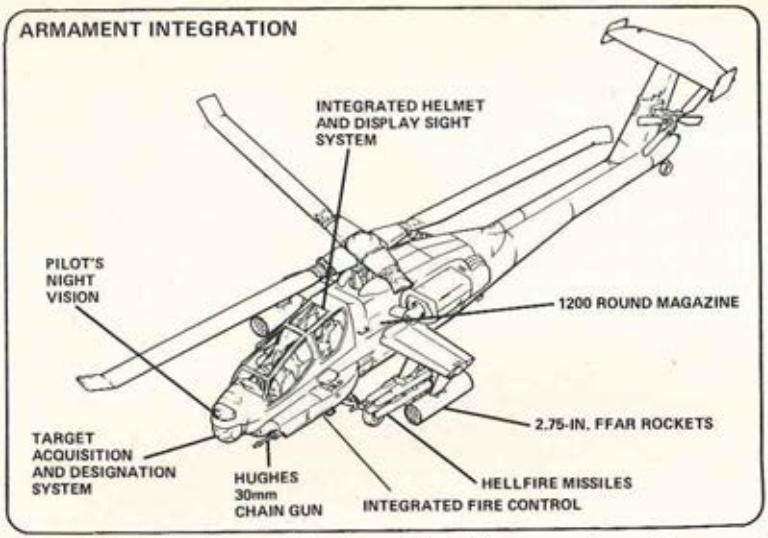
Offensive operations in the central battle are collisions of forces on the battlefield characterized by violence and high lethality. The **AH** is most effective when employed as part of a combined arms force inflicting mass destruction on moving enemy armor forces. The **AH's** integrate their long range anti-armor fires and overwatching fires with those of the ground combat force. The **AH** is capable of denying the use of key terrain to the enemy, thus securing the flanks of an attacking force.

The following scenario illustrates the employment of the maneuver units of the **CAB** on the non-linear battlefield **(Figure 1)**. The northern brigade has defended successfully against the attacking first echelon threat force. However, in the center the first echelon threat force has broken the integrity of that brigade's defense and a second echelon tank division is passing through to exploit the success.

The southern brigade is under heavy pres-

NON LINEAR BATTLEFIELD





sure from first echelon threat forces. A fourth brigade from the southern flank division has just been cross-attached and ordered to move north to occupy a battle area in front of the advancing threat second echelon forces. In response to this situation, the division commander placed the **AHC** units under the operational control of this brigade. The brigade commander has directed that both **AH** units attack the flank of the penetration to inflict maximum destruction and slow the advance of the penetration.

Two axes of advance were established for attack companies. Between these two axes is a maneuver battalion located in a battle area that has been isolated by the penetration.

Immediate response provided

The division commander placed this isolated battalion under the **Operational Control** of the fourth brigade for this operation to facilitate command and control, and fire distribution under one commander. This concept and scheme of maneuver provides immediate response to the threat, concentrates massive firepower where it is needed the most, and provides the unity of command necessary to effectively coordinate and conduct the attack.

As can be seen, much more is required of the commander, team leaders, and crews of attack helicopter units then just aircraft manipulation. They must plan and integrate all facets of the combined arms team in order to achieve success on the modern battlefield. It becomes obvious that these men are more than just pilots, they are aerial combat crewmen.

They must be highly trained, motivated professionals in order to survive the conflicts of the future. No unit is stronger than its weakest link, and the effectiveness of attack helicopter units, as well as all combat organizations, is directly proportional to the competence of its leaders.

A joint responsibility

The proper employment of the Attack Helicopter Company is a joint responsibility of both the **CAB** commander and the ground maneuver commander. All commanders of combined arms elements must be thoroughly familiar with the strength and weakness of each interfacing force in order to ...aximize these capabilities and gain a synergistic effect. In the past, combat aircraft, as well as the first tanks, were misutilized and committed to battle without regard to their unlimited potential. We can ill-afford to repeat these mistakes of the past.

I want to reassure the combat aviation community that the U.S. Army Armor Center will continue to provide the unit commander with the most up-to-date how-to-fight tools necessary to train his unit to fight and win the next battle.

Wanted: An Integrated Weapon to Kill Tanks!

BY COLONEL ROBERT F. MOLINELLI, CDR, 6TH CAVALRY BRIGADE (AIR COMBAT)

AS a young Armor officer, I was repeatedly told that the best tank killer is another tank. I considered that an absolute law of nature until my first experience with armed helicopters in Vietnam in 1964. The speed, mobility, and agility differential of the helicopters compared to other modes of Army movement was tremendously intriguing. So many tasks could be accomplished with this equipment which were otherwise clumsy, slow, and a drain on manpower that I began to change my mind about the tank being the ultimate weapon.

The strap-on era

The early helicopters had their limitations. Basically, they were designed for the medical evacuation mission. Then, among other uses, we began strapping on armament packages to marry firepower with mobility. Remember the four M-60 machine guns and two seven-shot 2.75" rocket pods called the M-16; the two 24-shot rocket pods called the M-3, or the nose mounted 40mm grenade launcher called the M-52? Or, if that is too long ago, remember the SS-11 missile system called the M-22 and the miniguns on a **Huey** called the M-217? The first gunships were evolutionary, consisting totally of strap-on armament systems.

Ideas for fully integrating helicopters and weapon systems came from those early efforts and interviews with the first armed platoons. The product, named after the platoon I was commanding in the 114th Aviation Company, was called the **Huey Cobra** and was designed specifically for the Vietnam conflict. In that environment the **Huey Cobra** totally fulfilled the requirement until the later stages of the war when we encountered enemy armor and sophisticated air defense weapons. I remember the first helicopter vs. tank engagement in February 1971 during the Laotian incursion. **Charlie Troop, 2/17 Cavalry** flushed five PT-76 tanks and literally beat on them with 20mm cannon and 2.75" rockets, stopping all five and leaving three burning.

Later, we engaged T-55 and T-34 tanks with varying degrees of success. These encounters clearly displayed the need for a better armor-killing weapon system which was fielded rapidly by strapping the TOW system on a **Huey**. Although we did not have an integrated weapon system, the **Hueys**, with the strap-on TOW, responded to the need, busted North Vietnamese armor, and proved the concept.

A radical change

At the conclusion of the Vietnam War we again turned our attention toward Europe and the mid-intensity conflict. Its sophisticated battlefield environment required a radical change from low-intensity tactics. We quickly found the Vietnam era **Huey Cobra** totally inadequate. It was under-gunned, unsophisticated, and under-powered to fight armor and survive in a mid-intensity conflict. With the demise of the AH-56 **Cheyenne**, we took an evolutionary step modifying the **Huey Cobra** to the **Cobra-TOW**. This evolution continues today was we continue a ten-year program to adapt, update, and improve our existing attack helicopter fleet. This modification is expected to be completed by 1982.

We have learned that a strap-on armament package can meet an emergency or be used to prove a concept, but only a totally integrated

prove a concept, but only a totally integrated system satisfies the need and provides room for evolution as the threat changes. We can now engage tanks from rapidly changing positions with deadly accuracy but limitations remain. The AH-64, with its improved survivability, its increased staying power during night and adverse weather, its capability to engage multiple targets at extended ranges, and its great growth potential for evolutionary requirements, is critical to our success as we postulate the European wartime environment.

We're ready for the AH-64!

We in the 6th Cavalry Brigade are ready to kill tanks with our Cobras. However, we know that a better tank killer is on the way the AH-64!

This new, totally integrated HELLFIRE-equipped, all-weather capable weapons system will be the best tank killer in the world. In anticipation of the fielding of this new aircraft, we have given considerable thought to what the AH-64 will mean to the using units in terms of changes in training and operations.

This new equipment will bring on new and expanded training requirements. We are anticipating a requirement for larger training areas and, in fact, a new III Corps and Fort

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YAH-64 Transatlantic Ferry Mission

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Frobisher Bay
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Sonderstrom, Greenland
to Reykjavik, Iceland..... 760 NMI

Reykjavik, Iceland
to Prestwick, Scotland..... 790 NMI

Wanted: An Integrated Weapon to Kill Tanks

Hood range plan was recently approved which incorporates these added requirements. The ranges will be ready before we receive our first AH-64.

Our people are thinking about and planning for the AH-64. Several of our aviators have been selected to participate in operational testing. Their experience will be instrumental in planning further toward introduction of the AH-64 into our units.

Air-to-air operations

From an evolutionary standpoint, the threat from enemy helicopter and attack aircraft has caused us to focus attention on air-to-air operations. We have initiated air-to-air gunnery training by using the turret-mounted 20mm to engage the MERCAT drops representing high performance aircraft. They are flown at scale speeds and turn rates which equal or exceed anything expected from manned aircraft. The next step is to modify the performance of the drones so that they represent encounters with other armed helicopters.

In addition to the training value received, we will be able to evaluate both our tactics and the performance of the 20mm cannon. Looking to the future, the AH-64's 30mm cannon will give us more punch and more range that could provide a marked edge in air-to-air combat with other helicopters, and make enemy fixed wing aircraft reluctant to pursue us.

TASVAL performance acceptable

Significant operational experience is being accumulated by our crews who are participating in the **Tactical Aircraft Survivability Evaluation (TASVAL)** test. This test is a Joint Army, Navy, Air Force test that is comparing the performance, lethality, and survivability of several airborne anti-armor systems, including our AH-1S.

Although it is too early to discuss results, we do know that our tactics and radar detection equipment are both performing at the level we expected. We're expending an attack platoon's 40 TOWS at maximum standoff ranges in 17 to 24 minutes and achieving the number of hits we anticipated.

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If you want superior attitude and heading in your helicopter, get Litton's LR-80 strapdown HARS. You'll get your job done better and faster.

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AAH.....OPTIONS

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EUROPE ALTERNATE 2000'/70°F	8 HF	995 RDS	8 HF	450 FPM	150 KTS	2.5 HRS
COVERING FORCE (AIR CAV) MID-EAST ALTERNATE 4000'/95°F	4 HF	536 RDS	4 HF	450 FPM	145 KTS	1.83 HRS
EUROPE ALTERNATE 2000'/70°F	4 HF 19 RKTS	654 RDS	4 HF 19 RKTS	450 FPM	150 KTS	2.5 HRS
AIRMOBILE ESCORT MID-EAST (4000'/95°F) ALTERNATE	19 RKTS	195 RDS	19 RKTS	450 FPM	145 KTS	1.83 HRS
EUROPE (2000'/70°F) ALTERNATE	38 RKTS	313 RDS	38 RKTS	450 FPM	150 KTS	2.5 HRS

From our experience we believe that to increase our tank killing capability we really need three things: increased missile lethality, greater standoff range, and more missiles. Frankly, we need the **HELLFIRE** system with its larger warhead, multiple target capability, and increased range which will significantly improve the hit/-kill ratio.

The AH-64, by at least doubling the missile load and increasing our survivability, will permit us to stay on station with sufficient ordnance and range to get into the second echelon of this regimental attack.

Will the AH-64 become the king of the tank killers?

What other weapon system can provide an all-weather mobility differential coupled with target acquisition/detection and the lethality of the HELLFIRE?

As a minimum, it will significantly increase the totality of our combat effectiveness. It will not replace the tank or any other component of the combined arms team. The AH-64 will make that team a more deadly, mobile, flexible force and will significantly reduce the Army's casualties in any future conflict.

Program Manager's Comment

Continuing inputs from the user, **Major General "Jim" Merryman** from the Aviation School and Center discusses crew selection and training. Immediately following **"Jim's"** article, I asked **Colonel Boris Pogoloff** to describe the AH-64 **Combat Mission Simulator (CMS)** that we have been planning. The development of this complex AAH "trainer" crew members will aid the school in its mis-sion accomplishment and lower the training costs.

A telescopic sight modified with an infrared sensor will allow TOW anti-tank missiles and other weapons to be fired from the U.S. Army's Cobra attack helicopter at night. The sight is modified to include a forward-looking infrared (FLIR) device, which creates television-like pictures by sensing small temperature differences between targets and their background areas.

In addition to detecting targets at night, the system can see through smoke or haze to improve day sightings. Hughes developed the unit, called the FLIR Augmented Cobra TOW Sight (FACTS), with advanced electro-optical and mechanical hardware, as well as the Army's FLIR common modules.

A rocket launcher developed for Army helicopters by Hughes is less costly, more durable, and lighter in weight than equipment now in service. The aluminum launcher, available in 19-tube and 7-tube versions, is used to fire 2.75-inch unguided rockets. Though inexpensive enough to be disposable, it can be reused for as many as 32 firings.

A key reason for the new advantages is the use of electromagnetic force to press the skin and tubes of the launcher into the support structures. This approach saves labor and trims weight associated with such conventional metalworking methods as riveting and welding. The weight savings allow improvements to be added to the helicopter rocket launcher system without sacrificing critical fuel.

Crew Selection and Training

BY MAJ. GEN. JAMES H. MERRYMAN, COMMANDER, US ARMY AVIATION CENTER

THE fielding of the AH-64 will, for the first time provide the US Army with an attack helicopter that can effectively fight during day, night, and adverse weather, and live with the front-line units.

As the AAH development program proceeds toward production, one of the most significant challenges facing us is that of using the tremendous capability of this helicopter to its fullest extent. Two of the key ingredients in meeting this challenge are **crew selection** and **training.**

How enormous this task will be must be recognized by everyone involved. However, through a well conceived program of studies and operational testing, we will identify a realistic set of crew selection criteria and develop an effective training program.

Easy, but not so easy!

The AH-64 is an easy aircraft to fly. It is agile with great responsiveness and has power to spare. However, when a pitch black, rainy night is added to the scenario, and the pilot is required to maneuver his machine in the terrain flight regime using the **Pilot's Night Vision System (PNVS)** through the **Integrated Helmet and Display Sight System (IHADSS)** that has a horizontal and vertical field of view of 40° and 30° respectively, then "easy" becomes a much different four-letter word.

This analogy helps point out that just flying the AH-64 is not enough. Its mission is to kill enemy targets during all but the most severe weather conditions — 24 hours a day. This is a problem for Army Aviation trainers to solve. The following present some current thinking pertaining to crew selection and training which are the keys to solving the problem.

A typical combat mission would proceed in the following manner. While the pilot in the backs seat is devoting full time and attention to flying the helicopter to the Scout-selected optimum battle position, his companion in the front seat, the **Copilot/Gunner (CP/G),** is performing the myriad of tasks required to prepare the aircraft for its primary mission: **the defeat of threat armor.**

The navigation responsibility

During the flight from home station to the operational area, the **CP/G's** primary task is navigation. He accomplishes this by comparing a known map position with that shown on the doppler display. Over time he must update the doppler to achieve the required navigation accuracy. To do this, he uses the alpha-numeric keyboard located on his right console to insert new coordinates.

Simultaneously he must perform the pre-launch test of his ordnance delivery system. This is done by using another alpha-numeric keyboard on his left side and punching in a series of words and numbers so that the on-board **Fault Detection Location System (FDLS)** can interrogate the individual fire control components. Another task he must perform is that of encoding his laser **HELLFIRE** missile with the appropriate laser code. This requires him to use his left hand to manipulate thumb wheels located on the instrument panel.

This vignette illustrates only a few of the steps necessary to fight the AAH. It is used to point out that only "the best of the best" will be selected to operate the AH-64.

Currently, we have not formulated the final criteria for air crew selection. Studies con-

Crew Selection and Training

ducted by the **U.S. Army Aeromedical Research Laboratory (USAARL)** and the **Army Research Institute (ARI)** have provided preliminary data which indicate AAH crew members must possess special visual capabilities — exceptional night vision, higher standards of visual acuity, and not wear corrective glasses.

This is not a planned vendetta against aviators with glasses. The **Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS)**, the heart of the AH-64, in locating and killing targets as well as night flying at NOE, is comprised of many visionic displays. For example, the pilot, to use the PNVS at night, will fly using a one square inch TV type display in front of his eye.

Aviator fatigue

Another area where we are plowing new ground is **aviator fatigue**. Although considerable fatigue research has been accomplished, very little has focused on the impact of fatigue on aircrews operating in the demanding day/night nap-of-the-earth combat environment. NOE flight demands complete concentration, rapid perceptual judgments and precise control response.

USAARL is planning, with my complete support, additional study of the NOE envelope. Physical and mental fatigue will become the crew's biggest limitation in that the endurance of the most physically fit pilot will be far less than the endurance of the AH-64.

Four track approach

Concurrent with our endeavors to determine selection criteria for AH-64 crews is our effort to develop a comprehensive, cost effective training program. In this era of increasing fiscal constraints, we must make maximum use of every training dollar. Toward that end our current **Initial Entry Rotary Wing Program (IERW)** is dual track, that is, 25% of each class is selected for transition and training as **Aerial Scouts.**

This training takes place before graduation and once a man receives his wings he is a qualified scout ready to fill an aerial scout position in the tactical force. We are examining a plan to add two additional tracks, attack and cargo, to the **IERW** course.

This four track approach appears to be a step in the right direction. Selection and training during one's initial qualification will result in considerable dollar savings for the Army. However, it is not enough. The Army must seek and find better methods to train and maintain tactical and gunnery proficiency. We must strive to achieve a goal that 90% of our attack crew's blade time will be flown as a part of combined arms tactical operations.

Crew coordination

One possible avenue to achieving this goal is simulation. The **Synthetic Flight Training Sysem (SFTS)** has proven its ability to teach instrument flight. Breakthroughs in simulator technology make it possible to construct devices called **Combat Mission Simulators (CMS)** and that is precisely what the **CMS** does. These devices will allow air crews to train as they would fight, and in the simulated terrain where the battle will be most likely joined. These devices when fielded will provide attack crews the experience required to fight and survive actual combat.

Another area being given close scrutiny is **crew integration.** Various exercises and studies, such as the **Air Combat Engagement (ACE)** and **Joint Countering Attack Helicopters (J-CATCH)** tests, have shown the value and increased effectiveness of a well-coordinated crew. To achieve this coordination, each crew member must be proficient in his individual station, thus, a family of part-task trainers will be required.

Credit Card Use

The use of credit cards in paying for new and renewal AAAA dues has been approved for a trial period, and applicants and members may now use either a MASTER CHARGE or VISA card for this purpose. The form appearing below — which may be locally reproduced in quantity if necessary — is the appropriate AAAA form.

An inside-the-cockpit close-up view of the instrument panel of the AH-64 attack helicopter.

The Directorate of Training Developments at the Aviation Center, in conjunction with the Armor Center, is developing these requirements for attack helicopters. Once these requirements are finalized, training device requirements letters will be prepared and the trainer procured. Part-task trainers will not be the exclusive property of the operator. The Transportation School and Signal School are also examining training requirements so that each AAH maintenance MOS will not only be efficiently trained in the school environment, but can maintain that proficiency in the field.

Some other training tools in support of the AAH are the Aircrew Evaluator and the **Air-to-Ground Engagement Simulation (AGES)** System. The Aircrew Evaluator, an on-board snap-in, snap-out device with video recording and playback capability, can be used by unit commanders to evaluate crew strength/weaknesses and develop meaningful training programs. **AGES** is a force-on-force tactical training system which provides unit commanders real-time assessment of their unit proficiency under combat conditions.

From the foregoing discussion, it should be evident that the AH-64 embodies many sophisticated systems with which the Army lacks field experience. Crew selection criteria and effective training programs are complex problems, and it is unrealistic to expect all of the answers to be available at the **Initial Operational Capability (IOC)** date. Our goal is to field the AAH with useable crew selection criteria and a training program to insure its effectiveness in combat from the outset.

The AH-64 Combat Mission Simulator

BY COLONEL BORIS POGOLOFF
PROJECT MANAGER—TRANING DEVICES

THE AH-64 Combat Mission Simulator (CMS) will be the most advanced and sophisticated training device ever developed to support Army flight and combat mission training. The AH-64 CMS is the fifth simulator to be developed by PM TRADE as part of a family of utility, cargo, and attack trainers known as the Synthetic Flight Training System (SFTS).

This simulator will approach the fidelity required for full mission simulation, to include target engagement with all weapons systems, an enemy threat, and friendly scout helicopters. The automated training capabilities of a simulator, the ammunition savings, and the capability to safely practice what would be hazardous in the actual aircraft makes the simulator a vital part of the AH-64 training system.

Need for total simulation

Training is needed for operations including preflight, takeoff, enroute activity, target engagement, target acquisition, weapons delivery and return to base. The threat environment includes tanks, air defense weapons, aircraft, ground fire and jamming. The complexity and extent of visionics equipment on the aircraft to meet the threat accents the need for a total simulation capability in the AH-64 CMS.

The AH-64 will consist of two cockpits simulating the pilot and gunner station respectively. A motion system will be included to provide roll, pitch, yaw, lateral displacement, vertical displacement, and longitudinal displacement cues. Trainer stations will be able to conduct separate training missions simultaneously or team training may be accomplished. The entire trainer will be simulated using a computer complex which will analyze pilot or gunner inputs to the aircraft controls and then direct appropriate responses from the aircraft instruments, motion system and visual system. The training scenario will be managed by means of a remote instructor station consisting of monitoring, control, and recording equipment.

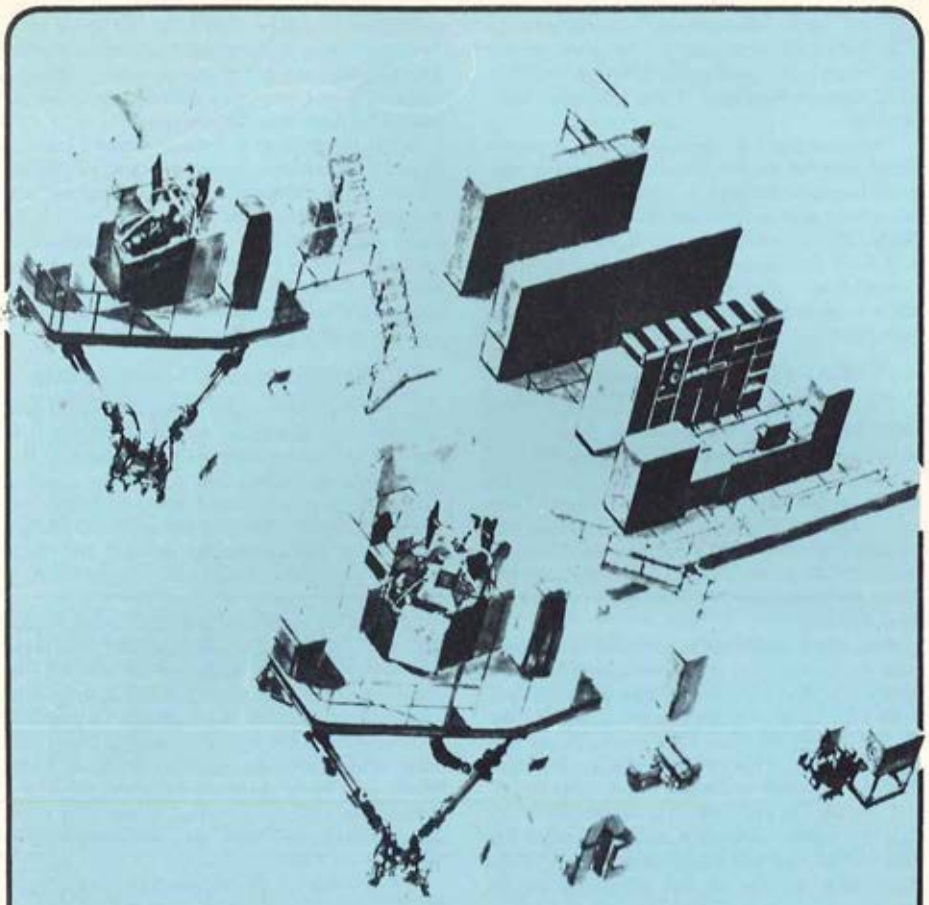
Advanced "visual system"

The most advanced feature of the simulator will be the visual system. A computer generated image (CGI) wide angle presentation will be utilized which will provide the cues necessary for contact flight and for gunnery training. Information pertaining to hostile activity also will be provided by the visual system. A new challenge exists in the case of the AH-64 CMS because of the complexity and high visionics performance characteristics of the aircraft coupled with the low level and Nap-of-the-Earth (NOE) operational environment.

A faithful duplication

The simulator will provide the out-the-window scene in concert with the images available from the Target Acquisition Designation System (TADS) and the Pilots Night Vision System (PNVS). Present specifications require the AH-64 CMS to provide faithful duplication of the many operating modes, switching con-figurations, sensor types, and fields of view.

Delivery of the AH-64 CMS will provide the Army the most advanced trainer in the inventory yielding tangible benefits in the form of operations and ordnance expenditure cost savings and intangible benefits in the form of lives and equipment saved through professional crew proficiency.



The CMS — The most advanced and sophisticated training device ever developed to support Army flight and combat mission training

Program Manager's Comment

Since TRADOC initiated the TSM concept in order to have a single "user" point of contact, we have improved coordination with the user. Colonel "Lynn" Shrader has recently become the TRADOC System Manager for the Attack Helicopter. In the next article he describes his organization and shares some of his thoughts with us.

TSM Comments on the AH-64

BY COLONEL CECIL L. SHRADER
TRADOC SYSTEM MANAGER—AAH

THE total system management concept for attack helicopters is focused in the user community through the office of the **TRADOC System Manager (TSM)** for Attack Helicopters.

I am delighted to again be deeply involved in the combat and materiel development process. I assumed duties as TSM — Attack Helicopters in July of this year from **Colonel Bob Mills.** My former assignments as **Cheyenne** and **AAH Department of the Army Systems Coordinator (DASC)** from 1971 through 1974 have helped me adapt to my present responsibilities.

Day-to-day coordination

The TSM works for the Commander, TRADOC, Fort Monroe, VA, under the direct supervision of the Commander, U.S. Army Aviation Center. We coordinate all that we do with the Commander, U.S. Army Armor Center. The Fort Rucker/Fort Knox day-to-day link up has been a key to the TSM's success. Additionally, the TSM office has daily interchange with the Program Manager—AAH and the Project Manager—Cobra.

Our task focuses on three functional areas: Personnel, Training and Logistics. The TSM Office is staffed correspondingly with Assistant TSM's for each of these functions. Additionally, because of the increased emphasis on testing, my office is augmented with an Assistant TSM for Test and Evaluation, **Major Jim Roop.** We are also supported on a temporary basis with a civilian aerospace engineer, from the Director of Combat Developments, **Mr. Don Artis,** who provides us with temporary on call aeronautical engineering expertise which is so important to a program of this nature. Probably the only member of our team we cannot do without is our secretary without whom we all would be lost, **Mrs. Shirley Ray.**

LTC Jerry Hipp is the personnel specialist in our organization. **Jerry's** precinct runs from man-machine interface to TOEs. Human factors and man-machine interaction have long been under-emphasized in the development process. This is not true for the AH-64. Every task associated with the AAH, flight and maintenance, is being scrutinized for human factors compatability.

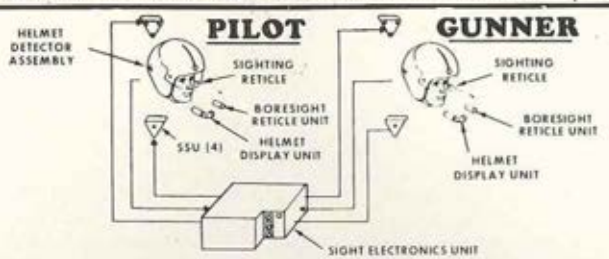
Computer-assisted wargaming

Aircrew ratios and maintenance manpower requirements are being identified through the use of computer simulation modeling, the model being based on a realistic combat scenario on a projected battlefield. Personnel initiative such as this will insure that while we may fight outnumbered, we will not fight without adequate personnel in maintenance and aircrews.

The TSM Logistician is **Major Chuck Crowley.** Reliability and maintainability have been prime factors in the design of the AH-64 from the start of the program. Our office, in coordination with the PM, the Logistics Center, the T-School, and the Signal School, is immersed fully in the **Logistics Support Analysis (LSA)** effort. **LSA** is the review of each AVUM, AVIM, and Depot maintenance task in terms of manhours, MOS, skill level, and tools required to perform the tasks.

The trainer is **LTC Joe Moffett.** In his capa-

INTEGRATED HELMET AND DISPLAY SIGHT SYSTEM (IHADSS)



IHADSS FUNCTIONS

- FLY BY NIGHT
- POINT TADS/PNVS
- DISPLAY LAUNCH WINDOWS
- POINT GUN
- POINT SEEKER
- ALIGN AIRCRAFT

IHADSS FEATURES

HMS ACCURACY	45 MR TO 10 MR
ANGULAR LIMITS	AZ ± 120
DISPLAY FOV	EL +40 TO -70
HELMET WEIGHT	≤3.5 LBS
IHADSS TOTAL WEIGHT	≤55 LBS.

city he is involved in a broad spectrum of activities. Some of these are Skill Performance Aids, Training Devices, Tactical Training Systems, Gunnery Ranges, Military Construction, and Individual and Collective Training. Our goal is to field not only the hardware, but to also provide the field commander with a usable, executable, and affordable training program that will develop and sustain combat effectiveness for the AAH unit.

Some of the more prominent issues confronting the Army as we continue to improve our **Cobra** fleet of attack helicopters and develop the AAH are as follows:

Gunnery

Decreasing monies, escalating maintenance costs and higher training ammunition costs dictate that the Army find a more cost-effective method to teach aerial gunnery while maintaining combat readiness. One answer to this problem is simulation.

Recent improvements in simulator technology have enabled development of **combat mission simulators (CMS).** When a crew "returns" from a tactical mission flown in these devices, they should feel as though they were in battle.

The TSM Office, the Armor Center, the Aviation Center, and the **Project Manager-Training Devices (PM-TRADE)** are cooperating in developing and procuring the best available devices and more importantly in the number required to keep our attack crews combat ready. There are many things that can be taught in simulators that cannot be done realistically in actual aircraft: among them are missile avoidance techniques and various in-flight emergencies.

One of the weakest links in attack helicopter operations is the lack of an Army-wide standard gunnery program. The Armor Center, the Aviation Center and the TSM Office cooperated in writing FM 17-40, "Attack Helicopter Gunnery." This manual is the first step in a long march to get and sustain attack helicopter gunnery to the high level we will need on the next battlefield.

Aerial Gunnery Ranges

Adequate attack helicopter gunnery ranges are practically nonexistent forcewide. We all agree that ranges must present realistic threat arrays in the manner found in battle. Seldom will attack pilots experience the luxury of a full 90° deflection shot. More than likely a twisting, turning, fleeting glimpse will be what one sees and engages. Future ranges must be able to accommodate all large caliber direct fire weapons. We can't afford separate tank and attack helicopter ranges.

Pilot selection for the AH-64 is an emotional issue. Only the best qualified pilots will be selected for AH-64 transition. We may have

to establish special standards for selection of AH-64 pilots for the highly demanding AH-64 human/machine interface requirements will tax the limits of the crewmembers.

Advanced visionics in the TADS/PNVS package will demand attention and require decisions. The development of the **Integrated Helmet and Display Sighting System (IHADSS)** and accompanying sets of symbology to enable the crew to fly and fight in adverse conditions places heavy demands on the crew. We must select only the most capable, most competent, most mentally, and most physically prepared aviators to crew our AH-64's.

AH-1 pilot selection

As we improve the AH-1S Cobra fleet with better visionics, better night vision devices, and reliable NOE navigation systems, the same criteria used with AH-64 selection should apply to AH-1 pilot selection. Furthermore, attack crews must train in a combat environment as a team in order to maximize the attack helicopter effectiveness and minimize combat losses.

Pilot night vision capability and the ability to maximize the advanced visionics of the AH-64 can make the difference in battle. Preliminary research has determined that about 15% of the Army population has exceptional night vision; about 30% are marginally effective at night; and a number are essentially **night blind.** We anticipate future use of a "Light Emitting Diode Dark Adaptometer" to distinguish accurately both above average and below average night visual sensitivity in the aviator force. Interestingly, the night vision capability of the current Army Aviator force generally is an unknown quantity. We intend to identify weaknesses in this area, and to include night vision sensitivity in future pilot selection processes.

Logistic Support

Our office has been actively involved in the development of the logistic support package for the AH-64. The AAH is being designed for 'quick turnaround' at the AVUM level through use of an on-board **Fault Detection and Location System (FDLS),** quick change components, built-in maintenance stands, and minimal — but highly efficient — **Ground Support Equipment (GSE).**

Simply stated, this means that the AAH will be capable of checking out all on-board systems using **FDLS.** If a failure occurs the **FDLS** will determine what "black box" is at fault. AVUM personnel will replace the faulty box and the AAH will be then be mission ready. The faulty box will be evacuated to AVIM for DX/repair. This maintenance concept should reduce the unit commander's operational downtime to a minimum.

Newly-developed **GSE** for AAH is being kept to an absolute minimum. When a requirement is determined, a search is first conducted to see if any existing piece of equipment will suffice. In many instances where no equipment exists, we have often found that modifications to existing **GSE** will work. When new **GSE** is required we've been able to insure that the **GSE** will also be capable of use by other aircraft within the Army inventory. **Commonality** is a must to reduce any logistical problems and to enhance overall operational readiness.

Responsive maintenance

Our primary objective in the logistical area is to insure that the attack helicopter is supportable in the field and the maintenance system is responsive to the units needs. Easily said, but infinitely more difficult to do.

The thrust of our efforts is directed toward providing the field with the simplest, most up-to-date and cost effective methods of preparing attack crews to fight as members of the combined arms team in any environment, anywhere in the world. Our TSM mission is to work with the development community to provide the Army the best total system possible, to include hardware, personnel, training, logistics, and the tactics needed to fight the next battle.

We in the TSM Office are working toward establishing a strong base so as to keep the arrow sharp. To help us do our job better, we encourage communications from you in identifying areas of concern and possible solutions.

Program Manager's Comments

The AAH system is complex and the crew stations sophisticated within the state-of-the-art of "man-extenders." To obtain biomedical and behavioral compatability, I fund the Aeromedical Research Laboratory at Ft. Rucker to conduct tests and provide me consultation on those aspects of the AH-64. To this end, **COL "Stan" Knapp** has prepared the following article to portray their efforts in supporting AAH.

Advanced performers like this..

require high performance instruments.

When Hughes specified instruments for their YAH-64 program they wanted the best. Thats why they chose Rosemount to supply the ICE DETECTION SYSTEM and AIRSPEED TRANSDUCER. Rosemount products have been demonstrating their reliability on tough jobs like this for over 20 years, and Rosemount has the resources, the facilities and the people to back these products now, for the next generation of high performance aircraft, and beyond.

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A Ceremonial Salute to the YAH-64

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The Army's Viper Fighter of the '80's

BY COL STANLEY C. KNAPP, COMMANDER, USA AEROMEDICAL RESEARCH LABORATORY

COLONIAL Warriors piloting the Battle star Galatica's **Viper Fighters** look with envy at some of the sophisticated "man-extenders" available to the YAH-64 crew. They smile as they consider man's 80-year partnership with the flying machine " on earth."

Since man and the flying machine first came together, the physical, mental, and sensory capabilities of man remain unchanged; but the machines he flies have changed dramatically. Advances in airframes, avionics, sensors, and weapon control systems design have extended man's capabilities well into the cybernetic age.

The YAH-64 crew members fly and navigate "heads-up" day or night. They fire their guns at wide angles from the aircraft fore-aft axis simply "looking" at a target and firing - the **fire control computer (FCC)** does the rest. The **FDLS** -"fiddles" - (Fault Detection Location System) lacks the sexy female voice of the **Viper Fighter** computer, but the same type of information is automatically displayed to the YAH-64 crew.

More complex and demanding

Mission performance in the nap-of-the-earth environment is more complex and demanding than the vast expanses of open space the **Viper Fighters** face. The YAH-64 dodges trees, hides behind obstacles, and follows waterways and trails as its warriors find and kill tanks -more formidable adversaries than the Cylons!

With all the "man-extenders" helping them to fly, navigate, and shoot better, our Warriors should be on easy street! No more searching all over the crew station for dials and gauges! No matter where they look, needed information is always symbolically displayed right in front of them with the **integrated helmet and display sight system (IHADSS)**. Constant flight control manipulation is antiquated; automated stabilization equipment helps with the task.

The Doppler keeps track of location, checkpoints, and destination; no need to follow the map as closely to navigate. The fire control systems guide the ordnance to a target. All this in the comfort of a plush, air conditioned cockpit. Easy street aboard the YAH-64, right? **Don't you believe it!!!**

Fundamental "doability" questions

Our Warriors' cognitive processes must be continually active. Flying the YAH-64 is more mental than it is physical. Peering into the tactical operations of the YAH-64's future raises biomedical and behavioral questions of "doability."

- **Can the crew effectively use all the extenders available to them?**
- **Are they going to fatigue more rapidly using all that electronic gadgetry and deciding which one of the myriad weapon modes would be the most effective for a particular situation?**
- **Do the many displays available overwhelmthe crew with information?**
- **Can a man track targets with a helmet-mounted tracking system while flying nap-of-the-earth?**
- **Do navigation tasks overload a co-pilot who is readying weapons systems for an impending attack?**
- **Can our Warriors fly and fight as well at night as they can in the day?**
- **Has this sophisticated YAH-64 crew station exceeded man's physical, mental, and**

Army's Viper Fighter of the '80's

sensory capabilities and limitations?

USAARL's multidisciplinary staff of flight surgeons, physiologists, engineers, psychologists, physicists, optometrists, audiologists, biochemists, and life support specialists are researching these and other related questions.

Our scientists are providing research data, consultation, and advice on biomedical and behavioral matters relating to the YAH-64. We are assessing ways to extend man's innate capabilities through technological means without compromising his physical and mental well being.

Eye dominance study

Prototype components of the YAH-64 systems are being carefully scrutinized. We're measuring man's head aiming/tracking capability while using **IHADSS**. Good helmet design, fit, and maintenance, we have found, are absolutely essential to keeping the display in the pilot's field-of-view. An eye dominance study resulted in our recommendation that the IHADSS be compatible with both right eye and left eye viewing.

Investigation of the compatibility of the human eye, statically and dynamically, to alternative display phospors will help determine what color and how bright the displays have to be for optimum day/night viewing. An instrumentation package has been developed to determine whether the visual extenders prevent or contribute to pilot disorientation. Aviators wearing corrective lenses require us to develop spectacle frames or modify existing frames to be compatible with the **helmet display unit (HDU)**.

GOOD NEWS!

Major David L. Grieger, Ret., who was hit by a propeller in a Flying Club accident at Ft. Benning, Ga., wants all of his friends to know "I'm alive and progressing well, and would welcome some letters. I'm learning to read and write, and eventually will be O.K." " Write Dave at 5452 Gettysburg Way, Columbus, Ga. 31907.

FOUNDATION'S FIRST—A $500 check is presented to the Army Aviation Museum Foundation, Inc., at Ft. Rucker, Ala., by LTG Robert R. Williams, Ret., of Ft. Worth, Tex., Chairman of the Foundation's Board of Directors. Accepting the check is Jean Eastman, Administrative Assistant to the Directors. Not only did his contribution make Williams the Foundation's first Charter Member, it also brought in a matching amount from his employer, Bell Helicopter International, and its Textron Charitable Trust.

Standards and test procedures developed for the SPH-4 helmet provide a basis to test the impact and noise attenuation of the specially devised helmet used in the YAH-64.

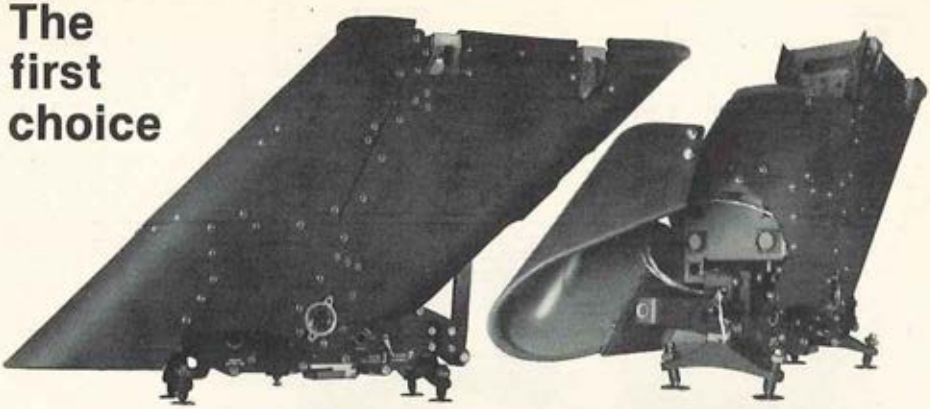
Studies are underway of aviator work load while navigating at terrain flight altitudes. We're researching the advantages and disadvantages of integrating various navigation systems and map display information into the crew station with an eye toward lightening co-pilot work load and improving intra-crew procedures.

A close coordination

We maintain close coordination with the YAH-64 Program Manager, the TRADOC Systems Manager, and the aviation user and testing communities to properly integrate USAARL's biomedical data into the AAH system development process. Our job is to ensure the Army ends up with enhanced combat effectiveness without unnecessarily compromising crew safety, health, or survivability.

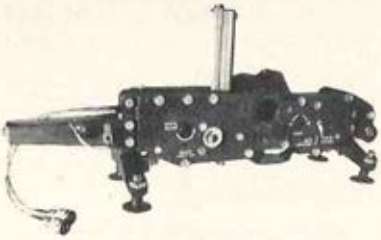
Biomedical and behavioral research for the soldier are part of USAARL's contribution to making our valiant **Warriors** compatriots of the **Colonial Warriors!**

The first choice



AHF EJECTOR SYSTEMS

Aircraft Hydro-Forming (AHF) specializes in building lightweight ejector systems for military helicopters and aircraft. All branches of the military use AHF ejector racks.



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AHF ejector racks are designed to obtain maximum strength at a minimum weight. They can be provided with internal safe locking, self latching suspension hooks, automatic swaybracing and emergency jettison when desired.

PERFORMANCE & ECONOMY

AHF Engineering has its own research laboratory for both experimental and qualification testing. AHF manufacturing includes machined parts, sheet metal forming and electrical assemblies. AHF supplies the YAH-64 helicopter pylon assembly as a result of this all-in-one capability at a lower per unit cost.

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Aircraft Gear Corp. Performs
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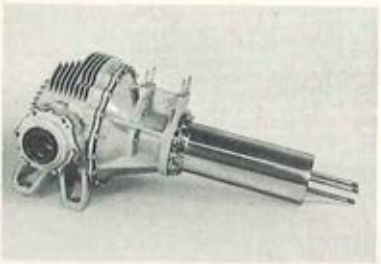

Aircraft Gear Corporation produces the intermediate and tail rotor gearboxes for the Hughes YAH-64. A unique feature of the gearboxes is that they employ only grease lubrication for high reliability and low maintenance. These grease gearboxes represent the first time this technology has been successfully demonstrated in the helicopter industry. Complete load-run testing is accomplished on test facilities established at Aircraft Gear Corporation.

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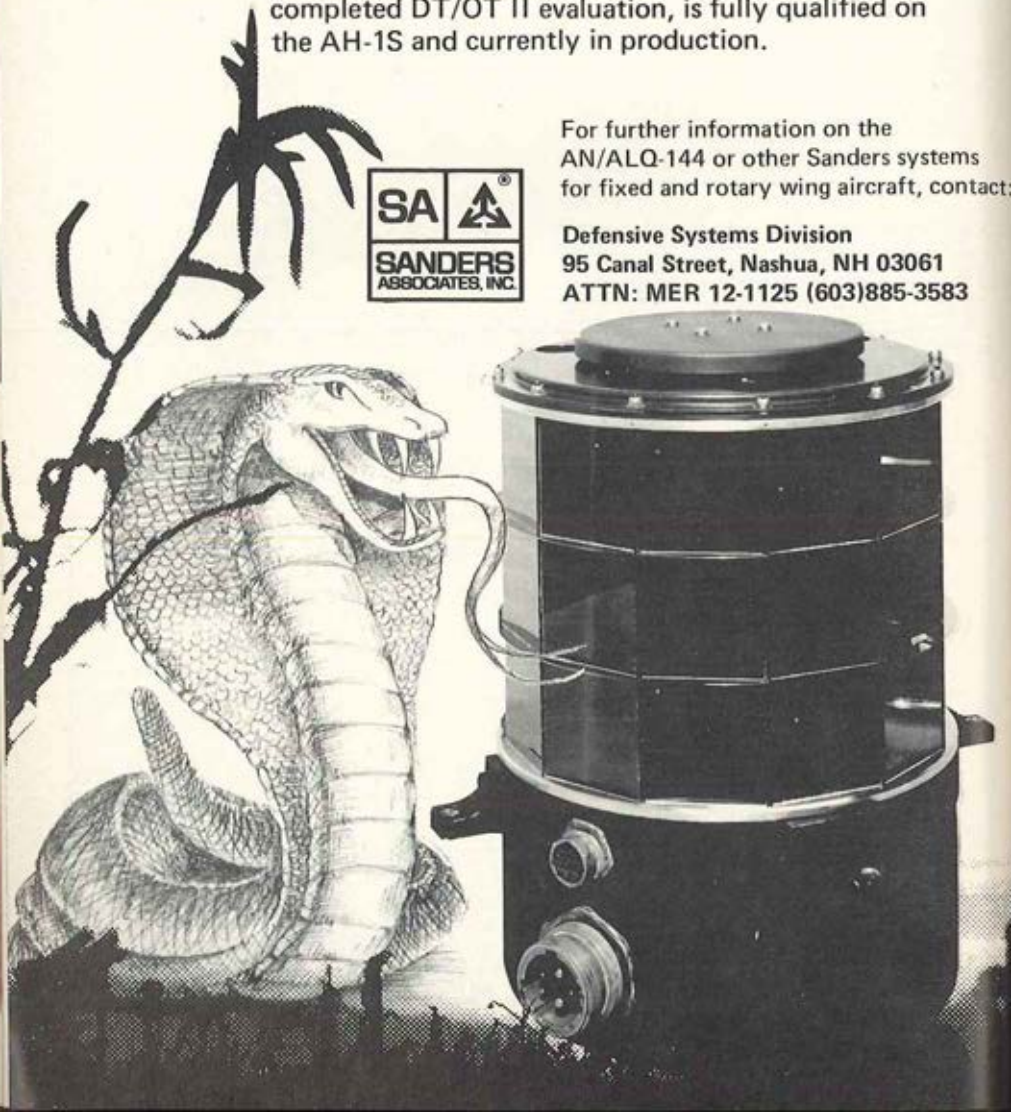

TECHNOLOGY does not stand still and the "bad guys" are aggressively researching, developing, and deploying gunships and tanks with amazing capabilities. To make sure your AAH is not caught short, we have been leaning forward in the fox hole of new technology.

Some new concepts/developments are the **Helicopter Adverse Weather Target Acquisition and Destruction System (HAWTADS)**, an Automatic Target Cueing device and an Automatic Target Handoff device. The **HAWTADS** has the potential to be a follow-on advanced seeker system for the **HELLFIRE**. The automatic target cueing device could be employed on the AAH, ASH, RPV, or other airborne vehicle with a target acquisition mission. Target engagement times can be reduced significantly when automatic target cueing and handoff devices are employed between attack helicopters and external sources of targets such as the ASH, GLLD, or ground forces.

New doctrine expected

Last, but not least, the inherent capabilities of the advanced technologies in the AAH coupled with the potential capabilities provided by these future systems, in my opinion, will dictate new doctrine and tactics for the employment of the AAH. To this end, personnel of the PMO AAH work continually with the TRADOC System Manager for Attack Helicopters, **COL Lynn Shrader**, to ensure that the ultimate users will be ready, organizationally and tactically, for the fielding of an Advanced Attack Helicopter and that we can all proudly say: "AAH MISSION . . . KILL TANKS . . . CAN DO, SIR!

During the 1950s and 1960s, the military-industry team learned, and put into practice, very successfully, the science of systems engineering of modern weapon systems. Completely integrated "total systems for battle," such as the **AH-64/HELLFIRE** Weapon System, have resulted from implementing this engineering practice. Systems engineering is now a very mature discipline, and we are in the process of further improving our approach to weapon system design. The 1970s will be known as the period when we reduced to practice the concept of "growth through modularity." On a life cycle cost basis, this process is highly economical because it utilizes our ability to design systems today so that future developments can be integrated into the hardware without throwing away the existing basis system and starting over.

Planned growth a factor

The AH-64/**HELLFIRE** Weapons System is one of the first examples of this design approach. The overall system is designed so that both the target acquisition subsystem and the missile subsystem will accept planned growth in capability as the state-of-the-art improves while retaining the earlier capability.

The growth of the AH-64 acquisition and armament system to provide adverse environment operation is called **HAWTADS**. The AAH Program Office at St. Louis, originator of the **HAWTADS** concept, has enlisted the support of DARCOM laboratories to conduct the concept formulation studies. The MICOM laboratories have been assigned the lead in defining the specifics of the **HAWTADS** concept. With the participation of other DARCOM laboratories and the support of industry, several viable approaches have been defined.

A Look into the Future

COMMENTS BY BG EDWARD M. BROWNE, PROGRAM MANAGER—AAH, USA DARCOM

A Look into the Future

The Missile Systems Division of Rockwell International Corporation, prime contractor on the AH-64's primary armament system — **HELLFIRE** — and subcontractor to Hughes Helicopters for the **HELLFIRE** missile equipment, has been working under company sponsorship to support the AVRADCOM/MICOM laboratories' **HAWTADS** concept formulation study. One of the approaches being considered by the laboratory resulted from this work and is described in this article.

The AH-64 will reach combat-ready status initially with a semi-active laser guided **HELLFIRE** missile which works in conjunction with the multi-sensor **Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS)**. The **TADS/PNVS** provides optical and infrared target acquisition capability, as well as laser designation, for a complete day-night capability.

IRIS to follow

This system provides autonomous (self-designated) as well as cooperative (remotely designated) capability with both direct and indirect fire (seeker lock-on-before or-after launch) when using a remote designator. The laser system will soon be followed by the **Infrared Imaging System (IRIS)** fire-and-forget guidance which should enhance the close-in direct fire autonomous operation. This guidance system will be integrated with the **TADS** so that handoff from IR or optical target acquisition to the missile seeker lock-on sequence is accomplished automatically with an image-matching correlator.

Why is it necessary to grow to an all environment system for the AH-64? The reason is to ultimately provide a fighting helicopter system which can literally **fly and fight anywhere, anytime**, and under any conditions of battlefield obscuration. It should be recognized that the adverse weather system is complementary to and not a replacement for, the laser and infrared systems, which will still be used in conjunction with Scout helicopters and ground designators as a normal operating mode.

It must also be recognized, however, that the enemy will take advantage of darkness, weather and obscuration whenever he can make it work in his favor. Sufficient weather statistics are available for Central Europe which indicate the extent of the adverse weather problem. It is important to note, however, that the utility of an adverse weather system cannot be directly derived from these data because periods of obscuration are predictable, and the enemy may choose to use this as part of his strategy. If you give the enemy the option of attacking under (or creating) conditions which are to his advantage, he will surely use it, and attack when you are least able to defend yourself. The enemy must be denied the option of safe movement and employment of armor under the protection of a weather cover.

Another question

Another question, which must be answered during this conceptual phase, is: "Where do we stand in the state-of-the-art required to implement an all-battlefield environment system which will satisfy the acquisition range and terminal accuracy requirements?" We have concluded that all of the elements of the system have been successfully built and demonstrated, and all that is required is a formal statement of the operational requirement to focus the laboratory and industry effort toward an implementation program.

HAWTADS would be a logical extension of the AH-64 modular weapon system. During those times when targets are obscured, **HAWTADS** could provide target acquisition, target classification (tracked vs wheeled), missile hand-off for lock-on-before-launch, and missile guidance for "fire and forget" destruction. This completely integrated system could be self-contained and require no external tactical support to provide a true adverse weather, fire and forget capability. It could also work in conjunction with SOTAS or RPV, to form a powerful threat against "movers".

Two main components

HAWTADS consists of two main components which will be added to the AAH. These components are:

1. The Target Acquisition Radar, providing:
   - Quality ground map display for area navigation.
   - Target search indicating all moving targets.

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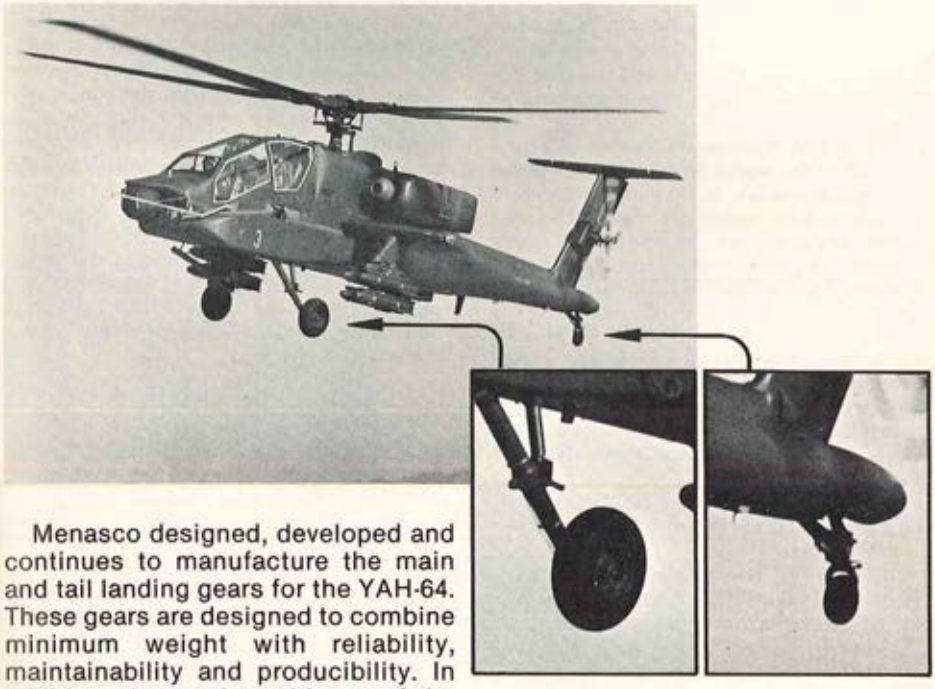

Menasco designed, developed and continues to manufacture the main and tail landing gears for the YAH-64. These gears are designed to combine minimum weight with reliability, maintainability and producibility. In addition, the crashworthiness of the vehicle has been significantly enhanced by integrating additional state-of-the-art energy absorption into both gears. Menasco—an original Hughes Helicopters AAH Team Member.

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A Look into the Future

● Target track providing target classification and missile hand-off data of target azimuth and elevation position, range and speed.

2. Adverse Environment **HELLFIRE** Missile Seeker.

● Tracks moving targets and provides direct hit terminal guidance.

Rapid search capability

The **Millimeter Wave (MMW)** Acquisition Radar provides the capability to rapidly search a large area, detect targets and generate the signals necessary to track, classify and hand-off specific targets.

The Radar Processor/Classifier unit performs all of the signal processing and control functions necessary to operate the radar. It consists of both special purpose, high-speed digital circuitry and microprocessor components. As illustrated below, it may be thought of as a logical extension to the **Remote HELLFIRE Electronics (RHE)** portion of the HME. This processor implements the **Moving Target Indicator (MTI), and Moving Target Tracker (MTT)** modes of **HAWTADS.** It also performs the functions of target classification, recognition, and prioritization before providing hand-off information to the **RHE** for transfer to the missile.

An Adverse Environment **HELLFIRE** could be a modular **HELLFIRE** missile with an active **MMW** seeker capable of being **locked on before launch (LOBL)** up through the full range of the missile.

HAWTADS, designed to operate nearly "hands-off", automatically provides target detection, priority allocation, and hand-off data to the **Co-pilot Gunner (CPG)** requiring only concurrence and missile launch. Manual override capability is also provided.

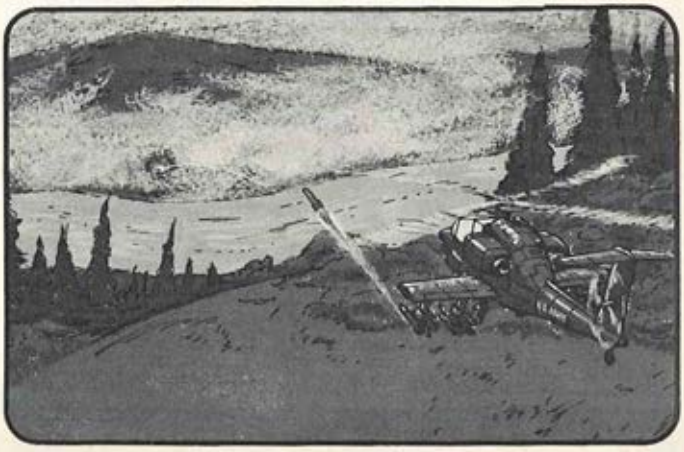
Summary

The above discussion shows that **HAWTADS** is more than a concept. It's elements are a reality. The characteristics of each of these elements provide the component feasibility and substantiation needed to synthesize a system. These characteristics describe a system that denies the enemy a place to hide; smoke, dust, and weather no longer offer concealment. The system tends to immobilize him since, by his motion, he increases the chances of detection and destruction.

Even though the target cannot be seen visibly, **HAWTADS** can still engage the threat. In short, the **HAWTADS** can significantly expand the capability of the **AH-64** to fly and fight outnumbered anywhere, anytime, on any battlefield, and WIN!

Automatic Target Cueing

One of the overriding fire control problems in airborne weapons delivery is target acquisition. The ability of the man/machine system to detect, classify, and recognize a threat is the fundamental first step in every target engage



The Adverse Environment HELLFIRE Missile as described above.

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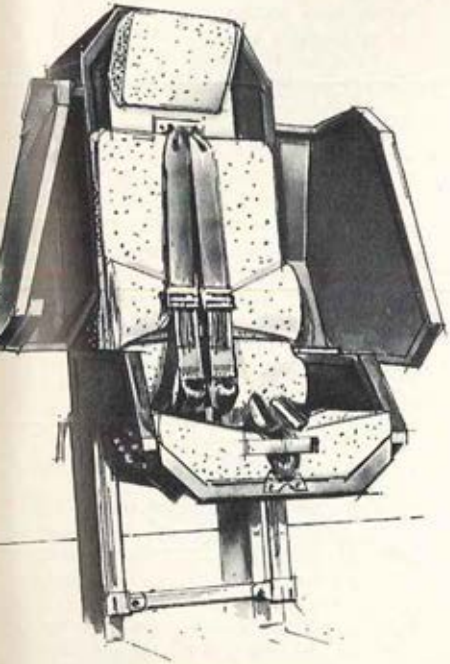

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A Look into the Future

ment. That is, the effectiveness of an aircraft weapons system depends on and is limited by an operator's ability to acquire targets rapidly in his weapons system displays. Laser designation systems will improve the attack helicopter capabilities, but they are in the most part based on the premise that a Scout or other combatant had acquired the target and the attack helicopter crew locates the threat by use of sensors which are sensitive to the reflected laser energy. All other target engagements by attack helicopters will depend on the pilot or gunner accomplishing the basic task of target acquisition.

Army and other agency test reports, have shown the need for automatic cueing aids by indicating that a poor operator/system ability to perform these tasks is typical for airborne sighting systems in target acquisition under combat conditions. Data taken for the STANO systems test covered infrared, low light level TV and image intensifier systems. Results showed that none of the systems performed the detection task at, or even near, the maximum range at which they were capable of detecting targets. For example, an infrared system, which can be taken as a representative case, detected vehicles and personnel targets at only 20% of the average detection range demonstrated for that system in static tests against known targets. In most instances, detection occurred at ranges equivalent to those associated with target identification capabilities of the sensor.

Goal: To improve acquisition

Analysis indicate that there are two major factors which contribute to poor system performance, in terms of man/system ability to detect and recognize tactical targets. They are (1) the time available to examine a scene and (2) the frequency at which targets appear in the sensor field of view.

Because of this need, the state-of-the-art in performing automatic target detection and recognition was surveyed by the Army and the current on-going automatic target cueing program was initiated.

The basic purpose of this program is that of improving Army helicopter fire control system target acquisition capabilities. This is accomplished through the application of advanced pattern recognition techniques to video signals generated by remote view imaging fire control sensors. Appropriate implementation of these techniques will result in significantly increased target detection probabilities and drastically reduced target acquisition times. Both of these benefits will be instrumental in providing for increased overall weapons system effectiveness and increasing survivability.

High rate achievable

The program began in 1972 with a concept study to determine the feasibility of using a digital image processing technique to assist FLIR operators in their task of target detection. This study involved computer simulation of the processing techniques to detect and recognize tactical targets from 16mm filmings of actual display imagery from various FLIR systems. The investigation indicated that automatic detection/recognition rates of 80% or higher can be achieved with associated false alarms rates of approximately 6%. This represents a performance level at least twice that of the human operator, which has been measured at approximately 30%.

Flight testing was conducted to gather additional imagery in large quantities and further computer simulation study was performed to increase the statistical confidence of the preliminary study results. This imagery was then put into the simulation program and the results achieved directly supported those of the initial study. After successful completion of the simulation study effort, the program advanced to its current level wherein a breadboard of the system has been fabricated for testing and to demonstrate hardware feasibility.

Automatic Target Handoff

The **Nap-of-the-Earth (NOE)** environment has placed increased operational burdens on the crewmembers of tactical helicopters and has significantly increased the crew workload. Increased need for visual contact with the terrain on the part of the crew leaves little time for communication controls manipulation. Inadequate voice intelligibility and signal reliability factors require messages to be repeated which requires additional crew workload and time.

With the current helicopter radio package and the above problems, transmission time required for voice communications to request Attack Helicopter anti-armor fires by voice communications crowds the frequency spectrum, delays target engagement and increases exposure of the Scout and Attack Helicopters to enemy threats. In addition, the target handoff/target engagement times as a result of poor/slow communications can take inordinately long time lines especially when firing the **HELLFIRE** missile in the indirect mode with cooperative designation.

Close coordination needed

The employment of the AAH launched **HELLFIRE** missile with remote target designation requires close coordination involving an accurate exchange of large amounts of target data. Thus, the Army may require a reliable, high speed and ECMP resistant information transfer capability between the Scout or GLLD operator and the AAH in order to deliver responsive, efective anti-armor fires especially at moving or fleeting targets. The communication equipment of front line tactical helicopters must be capable of minimizing enemy detection and jamming and reduce human error while decreasing crew work and target engagement time.

The **ATH** capability was first developed and demonstrated with the **Digital Message Device (DMD)** in the artillery TACFIRE net. The **DMD** can send and receive tactical information quickly and accurately.

With the success of the TACFIRE **DMD** and the communications problems previously addressed, it appears that an **ATH** capability may be required within the Attack Helicopter team.

Accordingly, elements of TRADOC and DARCOM are working to determine the requirement for this capability with two systems. The first system is called the **Airborne Target Handoff System (ATHS)**. The goal of the DARCOM/TRADOC team is to have **ATHS** quickly with the target date early in the AAH production schedule. The **ATHS** could be developed for the ASH and AAH.

During the **HELLFIRE** missile OTII a TACFIRE **DMD** with the AAH/**HELLFIRE** format will be used to show the concept/capability.

The AH-64 will reach combat-ready status with a semi-active laser-guided HELLFIRE missile which works in conjunction with the TADS/PNVS.

A Look into the Future

The second system is the **Airborne Data Transfer System (ADTS)**. This system represents a second generation **ATHS** which will provide an even more increased capability over the **ATHS/DMD**. The **ADTS** is in its initial phase of a four phased program which should yield an advanced automatic data transfer system in the mid- to late-1980's. This initial phase is to gather information from both the user and developer community to define the requirements. This phase should result in feasibility hardware which will lead to the production hardware configuration.

Immediate info transfer

Some of the capabilities envisioned for the **ADTS** are to be compatible with the **TACFIREs DMD**, and the **ATHS**. It should also have variable data rates to include higher data burst rates than all previous automated systems which will give it the capability to handle more information than those systems. Production compatibility with the **ADTS** is desired so that it will be interchangeable with the **ATHS**.

ATH devices will allow immediate transfer of target information, thereby allowing armored targets to be rapidly engaged with direct or indirect **HELLFIRE** missiles as soon as they are recognized. This will improve the target killing rate while decreasing the likelihood of enemy detection and/or jamming. These systems will be capable of providing target information transfer during periods of extensive ECM operations. The integration of these systems into the Army inventory would increase target kills by Attack Helicopters while decreasing the effectiveness of enemy **Electronic Support Measures (ESM)**.

The statement of performance for a recognition system involves a trade-off between the recognition probability for targets and the false alarm rate on non-target areas, as its sensitivity is varied. In field operations detection rates of 31% and recognition rates of 25% of available targets are typical with manual target acquisition systems. On the basis of this level of human performance, it is anticipated that target acquisition rates could be doubled with the use of automatic cueing. During previous tests, target detection ranged from 87% to 98% with false alarm rates of 2% to 19% was reported with low- to high-sensitivity respectively.

In summary, the employment of an automatic target cueing device will increase target detection and recognition of airborne fire control systems. The benefits of this technology lie in its potential to increase system effectiveness, while decreasing helicopter exposure and improving survivability. The automatic target cueing concept has now been tested through the stages of feasibility and statistical performance demonstration, using computer simulations, and by the construction and test of high-speed special purpose digital hardware. It has been applied successfully to a wide variety of sensor images to include airphotos, TV, radar, SLAR, FLIR, and side sonar images.

Preliminary study of the system configuration has shown that through application of available electronic technologies, operational size and weight characteristics can be readily achieved. Thus, an automatic target cueing device could be developed for the AAH, ASH, RPV and similar vehicles with a target acquisition function should the need arise.

EAST AND WEST

In the East (left), COL Darwin A. Petersen, I., AAAA's Monmouth Chapter President, chats with MG Story C. Stevens, AVRADCOM CG, during a recent AAAA Symposium. In the West (right), CW4 Garald J. Sauer (foreground) and 2LT Garald J. Sauer, Jr., a father-son aviator team, share the cockpit controls. Following in his dad's footsteps, LT Sauer earned his Army Aviator wings July 18, just two weeks before his father's retirement, and has since reported to Fort Lewis, Washington. ■

What the rest of the world is doing in Attack Helicopters

As the world moves cautiously to develop a true AAH, the rest of the world, having heeded the U.S. lessons learned in Southeast Asia, has moved rapidly in developing and fielding anti-armor attack helicopters. The aircraft shown on this page depict some of the major international efforts.

AH'S WORLDWIDE

Top left and clockwise: MIL MI-24 Hind-A, USSR's armed assault helicopter.

Top center — Great Britain's Westland LYNX.

Top right, France's DAUPHINE SA 361H.

West Germany's MBB BO-105 PAH-1 (Panzer Atk Hel-1)

A French and German entry, the PAH-2/HAC.

At the bottom right is France's ALOUETTE 3.

Below is Italy's Agusta A-109.

At bottom left, Italy's A-129.

The Soviet Union's Hind-D.

France's GAZELLE SA 342L.

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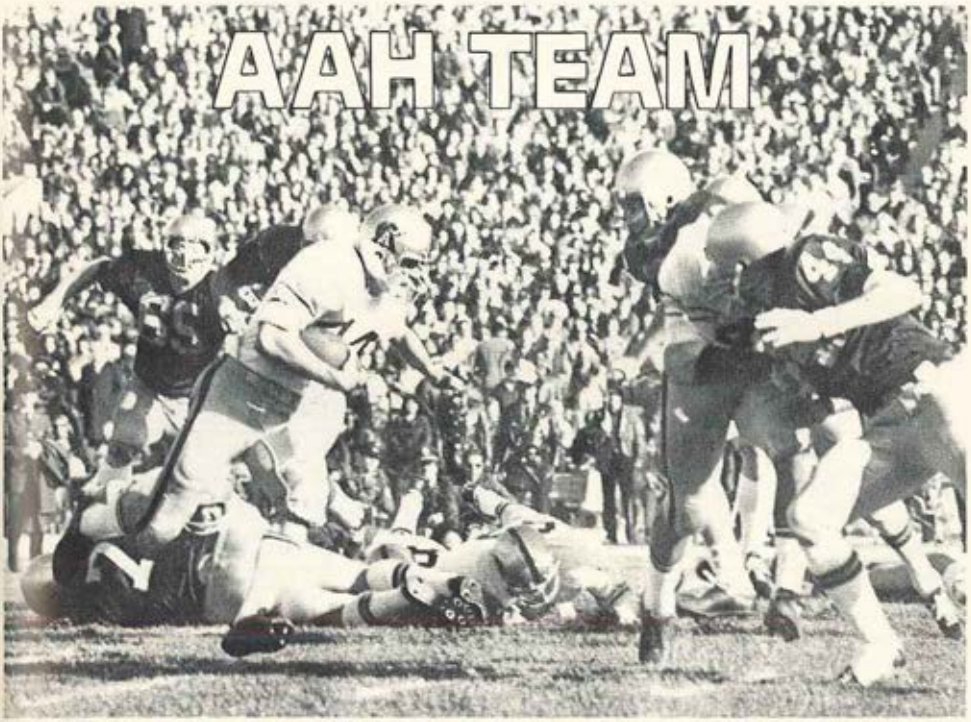

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AAH – Firepower on

A TOTAL System fo

Summary: Your AAH is Coming!

BY BG EDWARD M. BROWNE, PROGRAM MANAGER—AAH

AS we move closer to the production decision, through total system testing and evaluation, I am excited at the dramatic capabilities of our AAH.

Having personally flown in the nap-of-the-earth environment using one eye with the FLIR imagery in the IHADSS display, I cannot find words that adequately describe the edge this equipment will provide our fighting aviators.

Night operations will significantly alter the battle schemes. The enemy will no longer be free to move under the cover of darkness or inclement weather. The superior technology in our TADS/PNVS will influence the battlefield.

A significant improvement

The AH-64 with its HELLFIRE missile will provide a significant improvement/equalizer in defeating the numerically superior Warsaw Pact ARMOR threat. Around-the-clock assignments will become routine with the AAH and the other frontline tactical helicopters employing systems developed for the AAH such as the PNVS. Outstanding U.S. Army equipment will dominate the battlefields of tomorrow.

While it is true that we have not yet demonstrated all of our performance goals as stated in the **Materiel Need Document (MN)**, the prototype AAH's as they launch from the government test site today have more combat capability and performance than our AH-1, which is, in itself, a supergood **Anti-Armor Attack System.**

My job is to continue the pursuit and acquisition of the full systems' capabilities as set forth in the MN and accomplish this task between now and June 1981 when we put the AAH's into Operational Test II as a prelude to the production decision.

I assure you no stone will remain unturned by the Army and industry AAH teams to make sure that the AH-64 will superbly accomplish its tank killing mission.

Combined Arms Team, get ready. Your AAH IS COMING!

The Nominations Are Open


NATIONAL AWARDS

NOMINATION FOR THE AWARD TO THE ARMY AVIATOR OF THE YEAR

ELIGIBILITY:

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POSITION OR ASSIGNMENT

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BRIEF OUTLINE OF REASONS FOR NOMINATION (Several supporting information should be attached as indicated.)

Please TYPE all entries to assure thoughtful study of this Award.

NAME

BRANCH TITLE

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LIMIT NOMINATIONS TO:

1,500 words or 3 single-typed pages, and include a recent photo of the nominee and his official biography, if available.

MAIL NOMINATIONS TO:

AAAA, Attn: Awards Chairman, 1 Crestwood Road, Westport, Connecticut 06880

NOMINEE DATE: August 1 of this year This Form may be reproduced locally

Be a participant in the selection of the "Aviator of the Year" and the "Aviation Soldier of the Year." Write to AAAA for the one-sided, simple nomination form that will put your candidate into the hopper for national recognition at the coming AAAA National Convention.

Many deserving people are never recommended because they are never nominated.

Please join in!

AAAA's "Outstanding Aviation Unit Award" along with its "Outstanding Reserve Component Aviation Unit Award" recognize the finest unit performances during the 1979 calendar year. Does your unit measure up?

The "James H. McClellan Aviation Safety Award" and the "Outstanding DAC Award" single out unique people. Tell us about them. The nominations close January 15.

1979 AAAA National Awards

Submit your nominations to AAAA, 1 Crestwood Road, Westport, CT 06880 by January 15, 1980.


COMMAND MOBILITY

NEW QUINTET—Newly-arrived IP's from West Germany who are ready to begin their three year tour at Ft. Rucker are, l-r, 1LT Heiko Kienemann, CPT Horst Scharf, 2LT Siegfried Blab, and 1LTs Udo Leck and Wilhelm Kuefner. Welcoming them are COL Frederic W. Watke, 2d from right, Dir of Flt Tng, and LTC Nick J Primis, Cdr/Lowe Div. ■

SPLASH!—The Lee Field House pool at Ft. Bragg churns as pilots and crew chiefs of the 18th Aviation Company jump into the pool and activate their inflatable life preservers. The training was the hands-on portion of the water survival equipment class taught to Ft. Bragg aviation personnel by the Aviation Life Support Facility (ALSF). ■

HELPING HAND—SP/4 Kevin K. Gaston, 101st Avn Bn, back to camera, passes out C-rations at the small village of Las Naranjos, Dominican Republic, following Hurricane David. The airborne food lifts by the U.S. helicopter forces were emergency supplies intended to tide the victims over until the supply roads were re-opened. ■

SKILLED!—CWOs Gary L. Bivens, right, and Lloyd A. Drennon chat about the in-flight emergencies which resulted in each of them receiving the Army's Broken Wing Award at Ft. Rucker, Ala., recently. They distinguished themselves in separate incidents last April by landing their OH-58's safely when trouble occurred. ■

CLOSE ENCOUNTERS

OF THE TACTICAL KIND

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CONTROL DATA

LETTERS

Dear Editor:

Finished reading the July issue this a.m. complete with a larger than usual collection of typographical errors. What happened? Was the staff on vacation?

I regret missing the recent AAAA Board meeting at Ft. Campbell as it would have been nice to see what's happened to the place since WW II. When I was there in '44 (possibly '43), our three lightplanes — two L-4 **Cubs** and one L-2 — were the only aircraft on the field, except for a twin Beech used by the Corps Commander.

There was a completely staffed tower, meteorological office, and what have you so we got good service. The pilot of the Beech would taxi on the ramp leading to the hangar at a pretty good clip, pull both mixtures, and roll smartly into the hangar and do a neat 180. Today, I'm sure this might not be appreciated, but there was never any problem.

One thing I've mentioned before but seldom see discussed in the magazine is fuel for all those thirsty turbo choppers. I did note that **CW4 Carl Hess** mentioned fuel in "Speaking Out". When I think that our L-4's would go all of three hours on just ten gallons, it scares me to think of the logistical problems with fuel today.

And what good will all of our sophisticated machines be if there is no fuel? A not unreasonable outlook for the future. Can they (the turbines) be converted to coal? The Germans did it, and we may have to do so also.

Glad Quad-A didn't pick the Atlanta Hyatt Regency for their '80 gathering!

LTC Sam Freeman, Ret.
Far Hills, N.J.

(Ed. Note: In the July 1973 issue, MG "Bill" Maddox's article, "Fuel Shortage," addressed the problem as it affected the FY 74 Flying Hour Program. Since then, zilch.)

Dear Editor:

I noted the pitch for nominees for '79 National Awards and wondered just what permanent recognition is given to the selectees, other than an annual listing in the convention issue of the magazine.

CPT Eldon F. Quince
Hattiesburg, MS

(Ed. Note: The names of each "Aviator of the Year" and 'Aviation Soldier of the Year" are to appear on separate plaques that will be displayed in the Army Aviation Museum. The "Outstanding Aviation Unit Trophy" (see the photo on page 102) perpetuates the names of all winning units, as does the "Outstanding Reserve Component Aviation Unit Plaque." Action has yet to be taken on the 'James H. McClellan Aviation Safety Award" winners and the "DAC of the Year" selectees.)

* * * * *

Dear Sir:

I'm doing research for a book and I'd greatly appreciate it if you could offer an explanation of the following . . . It's been stated that no plane (commercial or otherwise) has flown directly over the pole.

"They can come no closer than 1,500 miles of the geographic pole and 250 miles of the magnetic pole," the reason being that the "gyroscopic compasses do not work within 150 miles of the Pole. It is unable to decide when it is being swerved or not being swerved from its axis of rotation."

Magnetic compasses and inertial guidance are also said to be ineffective near the Pole. Does anyone agree with these statements and if so, why?

Mr. Z. Mamak
60 Fuller Avenue
Toronto, Ont, Can, M6R 2C3

(Ed. Note: We need help on this one.)

LETTERS TO THE EDITOR ARE WELCOMED ON ANY ARMY AVIATION SUBJECT. THE LETTER SHOULD BE SIGNED; HOWEVER, THE WRITER MAY REQUEST THAT HIS NAME BE WITHHELD. THE MAGAZINE ADDRESS MAY BE FOUND ON PAGE 4.

PLANNING CALENDAR — PERTINENT DATES
MAJOR NATIONAL AND REGIONAL ACTIVITIES

★ ★ ★

December 1, 1979
Suspense Date for the Submission of Nominees for 1980-1982 Induction to the Army Aviation Hall of Fame

★ ★ ★

December 15, 1979
Suspense Date for Requests for Applications for AAAA National Scholarships

★ ★ ★

January 15, 1980
Suspense Date for the Submission of Nominations for AAAA National Awards
Aviator of Year — Aviation Soldier of Year — DAC of Year
Outstanding Aviation Unit — McClellan Aviation Safety Award
Outstanding Reserve Component Aviation Unit

★ ★ ★

March 15, 1980
Selection and Announcement of Winners of AAAA National Scholarships

★ ★ ★

March 26-29, 1980
1980 USAREUR REGION—AAAA CONVENTION
Garmisch-Partenkirchen, Germany

★ ★ ★

April 10—April 13, 1980
22ND AAAA NATIONAL CONVENTION
Sheraton Atlanta Hotel, Atlanta, Georgia

★ ★ ★

April 11, 1980
1980—1982 Hall of Fame Induction Luncheon
Sheraton Atlanta Hotel, Atlanta, Georgia

★ ★ ★

June 18-19, 1980
1980 Product Support Symposium sponsored by the Lindbergh Chapter—AAAA
St. Louis, Missouri

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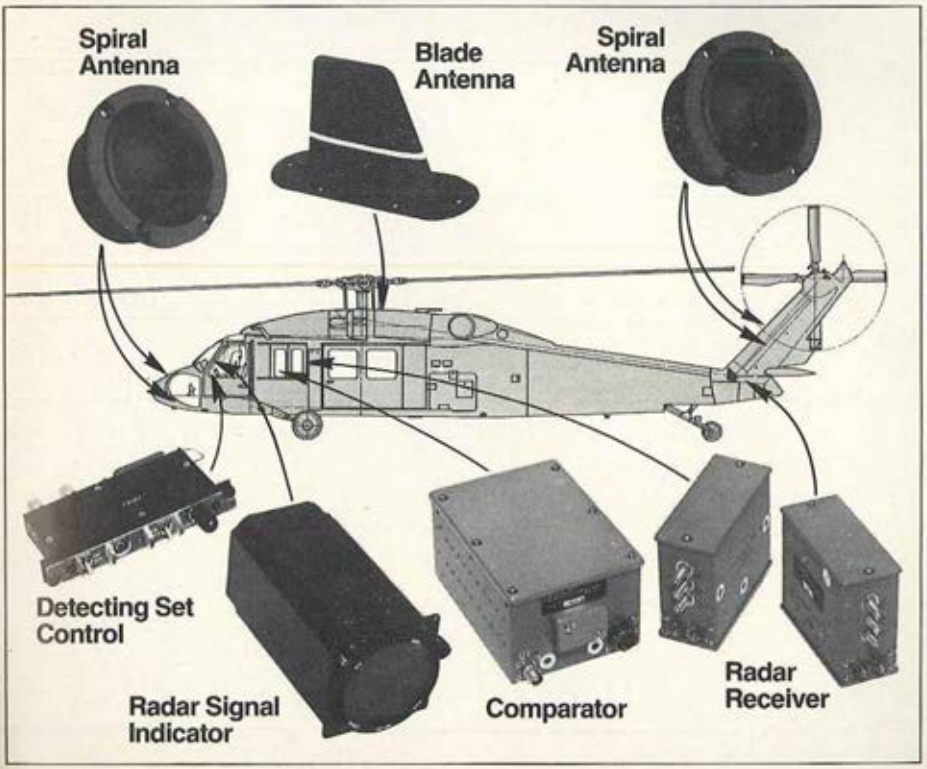

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