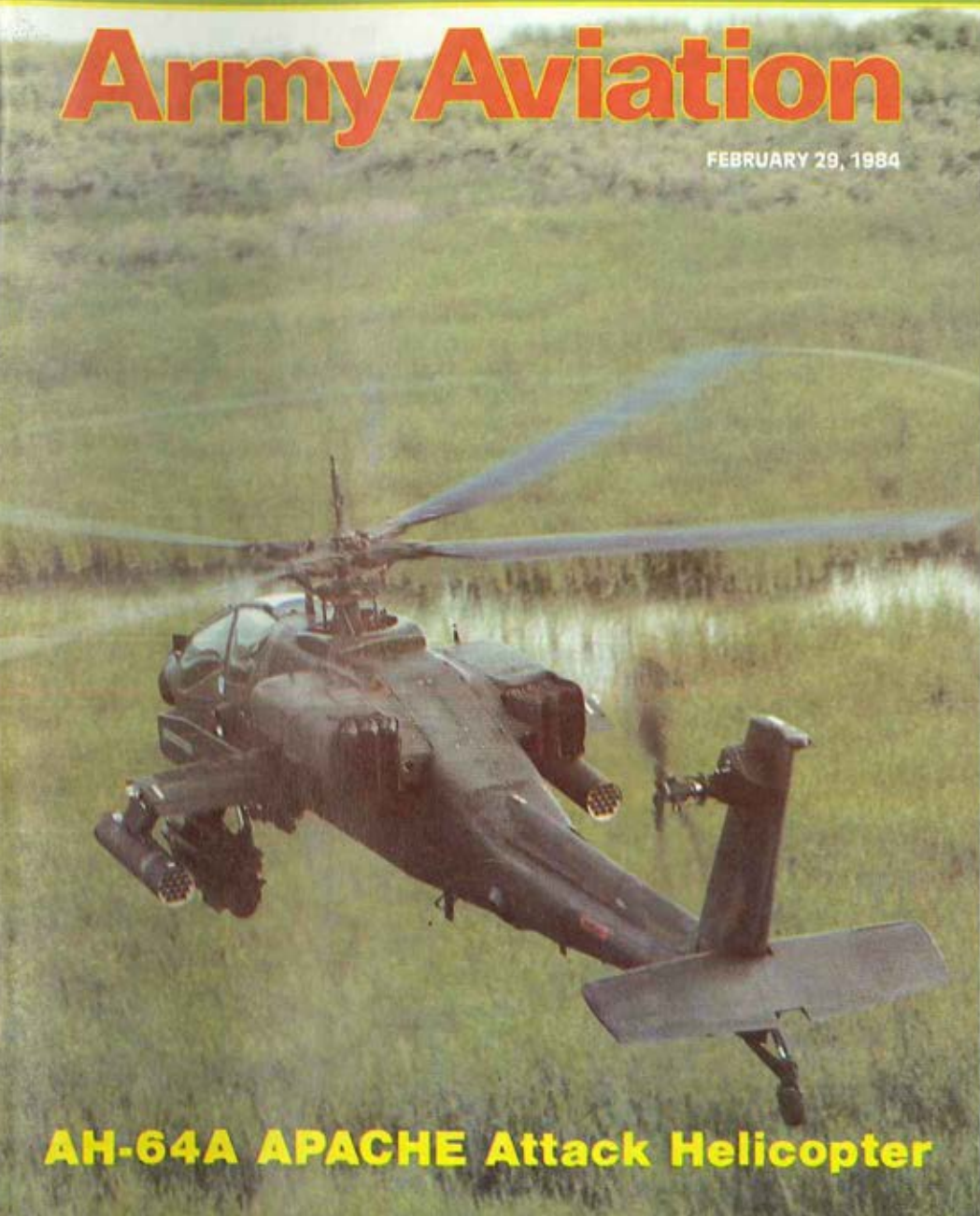
THIS MONTH: THE U.S. ARMY ACCEPTS ITS

FIRST AH-64A APACHE ATTACK HELICOPTER

Army Aviation

FEBRUARY 29, 1984



AH-64A APACHE Attack Helicopter

SPECIAL ISSUE: THE U.S. ARMY ACCEPTS FIRST AH-64A APACHE ATTACK HELICOPTER

Army Aviation

FEBRUARY 29, 1984

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ARMY AVIATION
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THE ARMY ACCEPTS THE APACHE, P.13

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FEBRUARY FEATURES

SPECIAL ISSUE ON THE AH-64A APACHE

The Issue's Authors:

OTHER FEATURES

AAAA CONVENTION COMING UP, P. 6-7

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Registration (Needed to attend AAAA Prof'l Sessions. Spouses... are not required to register)	☐ $15	☐ $55	☐ $11	☐ $51	$ _____	_____
Registration (1-Day Only).....	☐ $8	☐ $21			$ _____	_____
FRIDAY, MARCH 30 Spouse's Breakfast..... J.W. Marriott Hotel	☐ $10	☐ $10	☐ $10	☐ $10	$ _____	1 _____
FRIDAY, MARCH 30 AAAA Membership Luncheon... (Unreserved Seating)	☐ $12	☐ $17	☐ $8	☐ $13	$ _____	2 _____
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FRIDAY, MARCH 30 Spouses' Visit to Old Alexandria.. Fashion Promenade	☐ $ 6	☐ $ 6	☐ $ 6	☐ $ 6	$ _____	4 _____
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Draft Professional Program
1984 AAAA National Convention

(The presenters, the subjects of their presentations, and the date and time of their presentations are subject to change.)

THURSDAY, 29 MARCH 1984

Welcome by Major General James C. Smith, Ret., President, AAAA
Keynote Address — General John W. Vessey, Jr., Chairman, Joint Chiefs of Staff
Program Overview — Brig. Gen. Wayne C. Knudson, Army Aviation Officer, DA
"How We Got Here from There" — General William R. Richardson, CG, USA TRADOC
Putting It All Together — Major General Bobby J. Maddox, CG, USAAVNC
Structuring to Fight — Lieutenant General Fred K. Mahaffey, DCSOPS, DA
Aviation in the Real World—Lt. Gen. Jack V. Mackmull, CG, XVIII Abn Corps

FRIDAY, 30 MARCH 1984

Sustaining to Fight — Lieutenant General Richard H. Thompson, DCSLOG, DA
The University Role in Rotorcraft Technology — Dr. Wesley L. Harris, MIT, ASB
Army National Guard Aviation — Maj. Gen. Herbert R. Temple, Director, ARNG
Aviation in Space — Lieutenant Colonel Robert L. Stewart, U.S. Army, NASA
Increasing Effectiveness — Lieutenant General James H. Merryman, DCSRDA, DA
Aviation in Congress — Justus P. White, Jr., House Armed Services Committee
Then and Now — Lieutenant General Robert R. Williams, Ret.

SATURDAY, 31 MARCH 1984

FIRST LIGHT BREAKFAST

(Corporate Members' Breakfast - By Invitation)
Aviation RD&A — The Honorable James R. Ambrose, Under Secretary of the Army, Guest Speaker

PANEL: LHX, March 1984

Major General Orlando E. Gonzales, CG, USA Aviation Systems Command, Moderator

Panelists:

Colonel William H. Howard, PM-LHX and Colonel Patty E. Brown, Commander, ATL

Presentations:

Bell Helicopter Textron — Leonard M. Horner, President
Boeing Vertol Company — Joseph Mallen, President
Hughes Helicopters, Inc. — Jack G. Real, President
International Business Machines — Representative to be named
Sikorsky Aircraft Division, UTC — William F. Paul, President

THE AVIATION BRANCH

Manning the Force, A Presentation by Lt. General Robert M. Elton, DCSPER, DA

Aviation Personnel Panel

Brigadier General Wayne C. Knudson, Moderator

Panelists:

Lt. General Robert M. Elton — Maj. General Bobby J. Maddox
Major General Aaron L. Lilley, CG, USATC and USAALS
Brigadier General Charles E. Teeter, Deputy CG, USAAVNC
Joseph P. Cribbins, Chief, Aviation Logistics Office, ODCSLOG

AAAA National Award Presenters — 1984 Awards Banquet

Major General James C. Smith, Ret., President, AAAA, Master of Ceremonies
Honorable John O. Marsh — General Maxwell R. Thurman
General Donald R. Keith — The Honorable Howard E. Haugerud

AH-64A & LINK: A NATURAL

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Link began its decade of dedication to the Army's training needs by providing simulators for UH-1H (Huey) pilots. This training proved so successful that the Army chose Link to support other SFTS programs: CH-47C (Chinook), AH-1Q (Cobra) and UH-60A (Black Hawk).

Simulation realism can be enhanced by visual systems, providing digitally-generated images like the one above.

Now the Army is involved in a challenging new program: the AH-64A Combat Mission Simulator.

Link, as usual, is ready.

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FLIGHT SIMULATION DIVISION
THE SINGER COMPANY
Binghamton, N.Y. 13902

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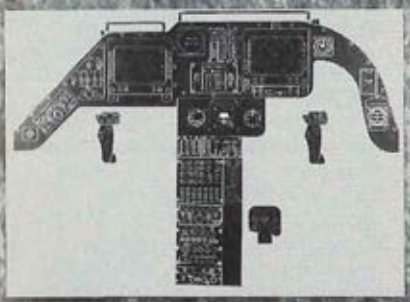

Bell's multi-mission OH58D is heading your way, on schedule, for delivery to the Army during the summer of 1984! This is *the* high-technology, innovative scout helicopter you've been needing. Its performance will exceed all contemporary helicopters in all altitude conditions. Its simplified, sophisticated control displays system will allow crews to do their demanding job more effectively, more efficiently. The OH58D will also serve as a stable, highly maneuverable command post. From the cockpit, to the mast mounted sight, to the dynamics, this aircraft is a multi-mission system; the result of farsighted engineering that will meet the Army's needs far into the future.

For more information on Bell's progress, write to Ray Swindell, Director, U.S. Government Marketing, Bell Helicopter Textron Inc., Dept 680, Box 482, Ft. Worth, Texas 76101.

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CLOSEUP: BRIG. GEN. WAYNE C. KNUDSON

WAYNE CHARLES KNUDSON was born in Austin, Minnesota, on October 31, 1940. A graduate of the University of Alabama (BS, Business Administration) he was commissioned a Second Lieutenant on June 27, 1962.

A Master Army Aviator and Parachutist, **General Knudson** is a graduate of the Advanced Course at the Infantry School, the U.S. Army Command and General Staff College, and the U.S. Army War College.

TOP: GEN. JOHN A. WICKHAM, JR., U.S. ARMY CHIEF OF STAFF, HOLDS A PLAQUE OF THE AVIATION BRANCH INSIGNIA DURING CEREMONIES HELD AT DA ON FEB. 15 FOR THE SIGNING OF THE GENERAL ORDER IMPLEMENTING THE NEW CAREER BRANCH FOR ARMY AVIATORS, EFFECTIVE APRIL 12, 1984. BOTTOM: GEN. JOHN W. VESSEY, JR., CHAIRMAN, JCS; MG BOBBY J. MADDOX, CHIEF OF ARMY AVIATION; LTG HARRY W.O. KINNARD, RET.; AND GEN. WICKHAM ARE SHOWN IN A POST-CEREMONY PHOTO.

Currently the Director of Force Requirements and Army Aviation Officer, ODCSOPS, DA, he has held a wide variety of assignments in his 21-year military career.

From June 1972 to September 1973 he was a Staff Officer in the Signal Security and Electronic Warfare Management Office, ACSFOR, DA, following this with duty as an Operations Research Analyst in the Program Analysis and Evaluation Directorate, Office, Chief of Staff, through August 1975.

Promoted to LTC in May 1975, he then commanded the 2d Aviation Battalion in Korea and served as the ACofS, G-3 (Operations) 2d Infantry Division, also in Korea, departing in July 1977.

A student tour at the USA C&GSC during August 1977-June 1978 was followed by his assignment as the Director of Control, Intelligence and Command, USA Combined Arms Combat Development Activity at Ft. Leavenworth during which time he received his promotion to Colonel on February 1, 1979.

Knudson then commanded the 6th Cavalry Brigade (Air Combat), III Corps at Fort Hood from September 1979 to September 1981 prior to becoming Chief of Staff of the USA Recruiting Command, his most immediate assignment prior to becoming the DA Army Aviation Officer.

Among his decorations are the Silver Star (with OLC), the DFC (with 4 OLC), the Bronze Star Medal (with 3 OLC), the Meritorious Service Medal (with OLC), Air Medals with "V" Device, and the Army Commendation Medal (with OLC). An OCS graduate, he also wears the Combat Infantryman Badge and the Ranger Tab.

A longtime member of the Army Aviation Association, **General Knudson** served as the President of the Fort Hood Chapter from June 1980 to September 1981 and now serves as a member of the AAAA National Executive Board under a one-year appointment and is Chairman of the 1984 National Convention's Presentations Subcommittee.

General Knudson and his wife, Judy, reside in Annandale, Virginia, and have three daughters, Andrea, 19, Lisa, 16, and Alexandra, 5. Lean and trim, his hobbies include "wood shop work and church activities." IIIII

It's an honor to serve

By BRIGADIER GENERAL WAYNE C. KNUDSON
Director of Force Requirements and Army Aviation Officer, ODCSOPS, DA

IT is an honor to assume the duties of the Director of Force Requirements and Army Aviation Officer in the Office, Deputy Chief of Staff for Operations and Plans. **MG "Bob" Molinelli** has departed ODCSOPS to become Commanding General of the US Army Readiness and Mobilization Region I at Ft. Devens. He did an outstanding job and we all wish him well in his new command.

Many challenges exist in finding ways to meet aviation requirements. Along with these challenges are rewards. One that I plan to take advantage of is the opportunity to consult with Army Aviation people and units in the field along with our exceptional combat and material development family. While the press of duty may preclude extensive travel, we all need to take advantage of occasions to gather professionally.

Your next chance is to join with me at the AAAA National Convention beginning the 29th of March. Please try to make it. As always it is shaping up as a great convention.

It's time to get excited

In this issue of **Army Aviation,** the AH-64 APACHE is featured. This year, the first AH-64 will be delivered to the Army. The Advanced Attack Helicopter concept and program have been around for quite a few years. Many of you have played a major role in bringing the Army to this milestone. APACHE is here — and it is time to get excited. The initiation of training and the selection of key personnel to launch fielding has begun.

The task of preparing tactical units to accept and field APACHE is at hand. Preparation for fielding has been coordinated by a **System Fielding Readiness Assessment (SFRA)** committee including every major action agency in the Army. The SFRA looks at each phase of the fielding to insure that it is planned, coordinated, funded, and interfaces with all Army objectives.

A new approach

APACHE fielding will not follow traditional aviation new equipment fielding concepts. The plan calls for single station fielding at Fort Hood, Tex. This concept will provide a single site for the flow of aircraft, equipment, and supply packages.

Additionally, single station fielding will allow organizations to train as units through a scenario which begins with individual qualification for pilots and maintenance personnel at the respective schools, and culminates with company and battalion level tactical training at Fort Hood. Single station fielding for the APACHE will reduce the difficulties involved in fielding a new and highly sophisticated item.

APACHE, with its proven capabilities, is another cornerstone in the modernization of Army Aviation. Fielding will continue to provide some challenges; however, I know you are ready to meet them.

I am confident that you will vigorously and effectively introduce this new and powerful weapon into the Army arsenal of land combat power. IIIII

Save 30% on your Convention fare by flying with Eastern or American Airlines!

The **AAAA** has made arrangements through its travel coordinator, **Convention & Group Travel Associates, Ltd. (CGTA)**, of Stratford, Conn., for **discounted air fares** on Eastern and American Airlines to the 1984 AAAA National Convention in Washington, D.C., March 28-April 2.

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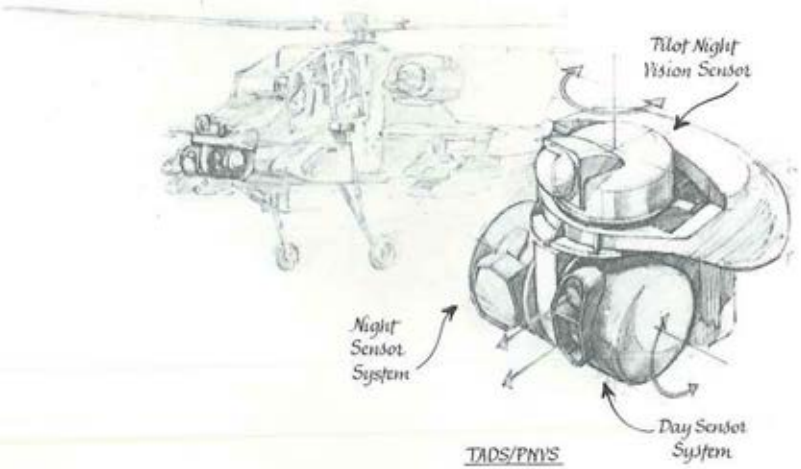
SPECIAL REPORT:

The Army accepts the APACHE

We make night vision avionics clearly effective.



TADS/PNVS

American military aircraft can perform night missions with impressive effectiveness, thanks to affordable night vision avionics systems pioneered by Martin Marietta.

The aircraft—from the Army's new AH-64A Apache attack helicopter to the Air Force's high-performance F-16—can fly at very low levels, avoiding radar detection. Pilots can see terrain features on a panel-mounted TV screen or a helmet-mounted/heads-up display. A companion system lets the pilots acquire, track, and destroy targets automatically—with guided or unguided weapons.

At the heart of these systems is Forward-Looking Infrared technology (FLIR) from Martin Marietta. Sophisticated techniques such as solution modeling, systems engineering, software design, and data analysis have all been employed in the development and application of FLIR.

By applying the same technology to advanced night vision systems, we have been able to develop, demonstrate, and deliver systems such as ATLIS, TADS/PNVS, and LANTIRN to improve the effectiveness of our fighting forces.

MARTIN MARIETTA

Martin Marietta Aerospace
6801 Rockledge Drive, Bethesda, Maryland 20817 U.S.A.

APACHE: CHALLENGES AHEAD

BY GENERAL JOHN A. WICKHAM, JR.
CHIEF OF STAFF, UNITED STATES ARMY

DELIVERY of the first AH-64 APACHE represents an important growth in Army Aviation capabilities. The APACHE significantly enhances the attack helicopter fleet with its capability to kill tanks and other armored vehicles in day, night, or bad weather. Its responsiveness, survivability, and versatility adds to our ability to win on the battlefield.

While the APACHE has had a long developmental cycle, much remains to be done before and after it begins fielding in Fiscal Year 1985.

Four challenges are crucial.

First, the APACHE must be produced on schedule, at reasonable cost, and with high quality assurance for all systems so that it makes the best use of our scarce resources.

Second, those who fly and maintain the APACHE must be so well trained that the APACHE will live up to its performance capabilities.

Third, we must ensure that the APACHE is supported properly. Unit, intermediate, and depot maintenance, contractor support, and the pipeline of supply and repair parts and personnel must function as a cohesive, efficient system. Recent experience fielding the M-1 tank and UH-60 will help make the APACHE transition to fielding the best ever.

Fourth, we must assure that our doctrine, combined arms training, and the chain of command employ the attack helicopter to its best advantage on the diverse types of battlefields we may face in the future. This is the most important challenge the Army faces.

The APACHE will be an indispensable asset in AirLand battle and is a major step toward **Army 21.**

Apache Power

The T700: More power for Apache

The rugged, remote Army flight environment has earned the T700 its reputation for toughness and reliability. Field statistics prove it. Now a higher-power derivative is in production for the Hughes AH-64A Apache. Designated the T700-GE-701, the engine produces 10% more power for extended NOE, and for hot and high missions. In addition, the -701 offers outstanding fuel efficiency, simple maintenance and low life-cycle cost.

The T700. In service and growing for a stronger army.

GENERAL ELECTRIC

THE ARMY RECEIVES PRODUCTION AH-64'S

BY BRIGADIER GENERAL (P) CHARLES F. DRENZ

THE Advanced Attack Helicopter is coming off the production line after more than 10 years of engineering development and qualification. As you read this, the first production APACHE will have already been accepted by the Army and we will be ramping up the production line to fulfill TRADOC training base requirements in 1984.

This long sought after event is a reality only because of the diligent efforts of many individuals both from government and industry who have made up the APACHE Team. The Army is justifiably proud of their efforts. These people have made it possible for the U.S. Army to acquire the most advanced and capable attack helicopter in the world. More importantly, it enhances the security of this great nation and the Free World in our critical years ahead.

Moving ahead of schedule

You may be aware by now of the highly publicized rollout of the First Production APACHE, PV-01, 30 September 1983. The APACHE Team is to be congratulated for rolling the first production vehicle off the production line two months ahead of schedule. The biggest payoff of this event was the extra time this provided to support the first flight on 9 January 1984. Delivery of this aircraft to the Army will easily meet contract schedule.

1983 was a good year for the APACHE program. We negotiated and awarded the second production contract for 48 APACHEs. This makes a total of 59 on contract thru Lot II and we will shortly contract for Lot III, another 112 aircraft. Most importantly, the contractor's production base was successfully established in 1983 and although there is still a lot of work to do to reach 12 aircraft per month, start up of the base has gone better than expected — the major risk areas are behind us.

ABOUT THE AUTHOR
A VETERAN AVIATOR AND MANAGEMENT SPECIALIST, BRIGADIER GENERAL (P) CHARLES F. DRENZ IS PROGRAM MANAGER, ADVANCED ATTACK HELICOPTER.

Production teamwork

As mentioned earlier, teamwork has made the AH-64A APACHE Attack Helicopter possible today. I would like to briefly explain the teamwork and integration involved in the production of the APACHEs.

Hughes Helicopters, Inc. (HHI) the prime contractor and AH-64A systems integrator is responsible for assembling the many subcontractor-produced components at the Mesa APACHE assembly and flight test facility for integration of the total APACHE system. The PM's responsibility is to insure that **Government Furnished Equipment (GFE)** items are available on schedule to support the Hughes assembly effort at Mesa. The General Electric Company (producer of the GE T-700-GE-701 Engine) and Martin Marietta Aerospace (producer of the GFE TADS/PNVS) are the major suppliers of GFE. Their delivery schedule and integration efforts are paramount to maintaining system production. They key to successful production of the APACHE lies in the time phased deliveries of these and many other components and subsystems to the assembly facility from all the HHI subcontractors, suppliers and vendors as well as GFE contractors. Meeting this challenge has required extensive planning and control by the prime contractor and the PM Office.

Product configuration is handled by a strong configuration management control team. Interface agreements, approved by the Government, between HHI, General Electric and Martin Marietta establish the ground rules for configuration management control coordination. The APACHE Program Manager's Office closely tracks and monitors all of the APACHE prime contractor "Production Team" members.

An integrated approach

It should be mentioned that the same team integration approach is used in developing and producing the comprehensive training devices and support equipment for the APACHE.

These critical support items get the same level of intensive management attention as the basic helicopter. The contractors, subcontractors, and government logistic personnel are major players on the APACHE team.

The challenges in 1984

With the delivery of the first production aircraft comes many current and future challenges.

First, we must maintain our momentum on the production line to remain on schedule for future deliveries. Most important, we must meet our delivery schedule within our current budget. These will not be easy tasks, but I believe with the dedicated team that we have, we can accomplish them.

Second, we plan to conduct thorough testing of the first two production vehicles to validate the contract specifications.

Third, and you will read more about it in this issue, we will shortly begin contractor training of TRADOC instructor pilots and maintenance personnel. This will begin to establish the TRADOC training base to produce the numbers of aviators, maintenance and support personnel necessary to man our attack helicopter units.

Fourth, one of the most important roles of the APACHE Program Manager is to insure the key logistics support elements — publications, support equipment, etc. — are ready and fully available to properly support the fielded AH-64A's.

NEXT MONTH

The March 31 issue of **Army Aviation Magazine** will serve as a 1984 AAAA National Convention Issue and Program.

APACHE logistics support

Mentioned in the above paragraphs and covered in considerable detail throughout this issue, contractor and government logistics support for the APACHE is now of primary importance as we look to fielding the system. The word "support" covers all aspects of integrated logistics: training, maintenance, supply, tech data, equipment systems, etc., designed to keep the APACHE operating in the field.

The APACHE Team is totally committed to providing full up 100% support packages to the user before the APACHE is delivered. The APACHE was designed for inherent maintenance supportability in the field and our support packages are geared to make this happen.

One note of importance regarding supportability. "Contractor Logistics Support" will be used initially with organic support phased in over a three year period. This concept has been developed to enable full and immediate support during fielding and deployment without imposing a special system on the user.

Summary

Over ten years of designing, developing and qualifying the APACHE has culminated in the Army's acceptance of the first production APACHE. Government and industry can be proud of their efforts.

During 1983 we witnessed three key events in the APACHE Program. First, we negotiated and awarded contracts for 59 aircraft and are negotiating for 112 more. Second, we established the production base. Third, we rolled out the first production APACHE two months ahead of schedule. These milestones demonstrate the dedication and skill of the APACHE Team.

We currently face several major challenges, to include meeting our production schedule within budget, first article verification testing, initial pilot and maintenance personnel training, fielding of the system in the training base and providing total logistics support.

The APACHEs are rolling off the production line — they will be in the field soon. A new era for attack helicopters has begun — an era of around-the-clock capability available to the Army Combat Commanders. IIIII

TOTAL SUPPORT FOR THE APACHE

BY GENERAL DONALD R. KEITH
COMMANDING GENERAL, USA MATERIEL DEVELOPMENT AND READINESS COMMAND

AN enormous amount of hard work has gone into designing, developing, qualifying, and producing the APACHE by both contractor and Army personnel. The product of their labor is the most technologically advanced attack helicopter in the world.

One of DARCOM's greatest challenges in the APACHE Program, however, is still ahead of us. In 1984, we will begin the TRADOC fielding of AH-64A APACHEs and with this fielding, our commitment to ensure total support for the aircraft and the crews that fly and maintain it.

DARCOM is committed to the total package fielding concept. The APACHE will be fielded using this concept. Simply stated, total package fielding means that DARCOM will stage an entire support package and provide it to the user before arrival of the APACHE aircraft.

Furthermore, we will ensure that sustaining replenishment support is available to support operational use. What this means to the Army user is that he will have an AH-64A system ready to train with and if necessary fight with.

In summary, 1983 and prior years were very successful years for the APACHE. The challenges of 1984 — equipping the training base to facilitate the training of crews and support personnel — will be significant. The men and women of DARCOM are committed to making this happen — successfully.

there's a lot of Bendix in the APACHE

Four Bendix divisions have combined to provide Hughes Helicopter with reliable, maintainable equipment to maximize battle readiness.

Electric Power Division
Bendix supplies both AC and DC power using two 35KVA air-cooled AC generating systems and a 300A transformer rectifier. The generators are specifically designed for helicopter use with special ribbed housings to withstand vibration.

Electrical Components Division
Bendix connectors are found throughout the APACHE. Our Tri-Start connectors are strategically located where severe environmental conditions exist. They withstand vibration, suppress electrolytic erosion, provide superior EMI shielding and resist corrosion.

Fluid Power Division
Bendix supplies all the flexible shafts, which eliminate the need for lubrication, as do the Bendix Free-Flux pivots on the gunsights. Flexible diaphragm-type couplings torque tubes and bearing hangers are designed to absorb small arms fire, which allows the helicopter to return safely. That's survivability.

Flight Systems Division
The Bendix Aerial Rocket Control System is a rocket management and fusing system with the capability to fuse and fire a mix of up to five rocket types from multi-zoned launchers located on four stations. The pilot can select and fire rockets in a variety of release modes and quantities.

The Bendix Corporation,
Aerospace-Electronics Group,
Arlington, VA 22209.

Bendix

We are dedicated to getting it "right the first time"

On 25 March we delivered the first Apache production fuselage, ahead of schedule. Before the rollout ceremony on 30 September, we had delivered the sixth.
We are geared to produce quality airframes for the *new generation* AH-64A in the quantities required by Hughes Helicopters and the *Army's newest branch.*

Our "right the first time" policy helps assure that production of the Apache's *rugged* airframe is on schedule and *cost efficient.*

TELEDYNE RYAN AERONAUTICAL
"right the first time"

FROM DEVELOPMENT TO PRODUCTION

BY NORMAN B. HIRSH

IN January 1977 the full-scale engineering development and integration phase (Phase 2) of the APACHE Program had begun. This phase included the development of the armament and fire control systems, **Government Competitive Tests (GCT)** of the TADS/PNVS, airworthiness qualification, and fabrication of three new prototype aircraft.

The **Ground Test Vehicle (GTV),** built in Phase I, was operated some 900 hours in qualification of the propulsion and drive system. The Phase 1-built prototype aircraft, AV02 and AV03, were modified/updated in stages during Phase 2 to incorporate all new design changes. Each of these aircraft was equipped with one of the competing TADS/PNVS designs from Northrop and Martin Marietta. The competitive fly-off in early 1979 resulted in Army selection of the Martin Marietta design to undergo continued development of the TADS/PNVS leading toward production.

A major design change

Early Phase 2 flight tests with AV02 and AV03 also resulted in a major redesign of the empennage from a fixed "T" tail to a movable horizontal stabilator (below the tail rotor) configuration. The stabilator with raised tail rotor was test flown on the first Phase 2-built prototype, AV04. AV04 was dedicated to flying qualities and structural testing. AV05 was also used as a structural test aircraft with AV06 the primary mission systems test aircraft.

Three aircraft, AV02, AV03 and AV06 were put through rigorous but successful operational testing by Army maintenance and flight crews during the summer of 1981 as a prelude to production decisions by the Army. During this same period, AV05 underwent a critical flight load survey needed to define the structural loads encountered in all flight regimes and maneuvers.

The winter of 1981/82 saw AV05 retrofitted with the upgraded and improved IR Suppressors in the exhaust nozzles and engine nacelles. Flight qualification of the GE T-700-GE-701 engines and a flight loads demonstration established the production aircraft flight envelope. AV05 testing also included high altitude performance and operator's manual verification.

Environmental testing

During this same period, AV03 underwent climatic hangar testing to extremes of -65° F to +130° F. This environmental test was followed by in-flight icing tests in Minnesota during the winter of 1982. AV06, during 1982, was subjected to a series of demanding tests on the avionics, electrical and weaponization systems, environmental control system and the newly designed Nitrogen Inerting System in the fuel cells.

In the latter part of 1982, AV02 and AV03 were essentially inactive while AV05 and AV06 were dedicated to tests supporting production design changes. Composite main rotor blades; thicker, stiffer wings and other structural and mechanical systems changes were tested on AV05. A maturity phase TADS/PNVS was tested on AV06 in the armament and fire control demonstration. AV06 was then modified to ac-

PRODUCTION (Continued on Page 84)

ABOUT THE AUTHOR:
A FORMER S. CALIFORNIA AAAA CHAPTER PRESIDENT, NORMAN B. HIRSH IS VICE PRESIDENT, AAH PROGRAM, AT HUGHES HELICOPTERS, INC.

Garrett turbine power: More fight for the Army's helicopters.

When it comes to getting a helicopter into action and keeping it there, the Army can depend on Garrett gas turbines to lead the way.

Helicopter APU's: The new AH-64A Apache is one of the most lethal attack helicopters in the sky. And Garrett's Model 36 – the lightest, most fuel-efficient APU in its class – is the heart of the AH-64's Integrated Pneumatic System, a design concept which reduces both the size and weight of the engine start and environmental control systems.

The Model 36 is a prime APU candidate for other new or retrofit helicopter programs. What's more our Model 36 can also bring self-sufficient

operation to a wide variety of helicopters which employ DC starting.

Aviation Ground Power Unit (AGPU): Currently being developed by the U.S. Army and Developmental Sciences, Inc., the turbine-powered AGPU is a small, versatile helicopter ground support cart which is sling-transportable by the UH-1H. Ready for production, the AGPU, powered by the Model 36 gas turbine, provides—simultaneously or separately—pneumatic, AC, DC, and hydraulic power for ground checkout or starting. In addition, its self-propelled feature allows helicopter towing.

Turbine-Powered Pumpers: Garrett is also developing a sling-transportable fuel pumper, powered by the Model 30 gas turbine, with 200 to 600 gpm operation and highly reliable starting capability down to -65°F. Now being evaluated as part of the Army's Forward Area Refueling and Bulk Transfer program for the Arctic, Garrett's Model 30-powered fuel pumper can add range, flexibility, and reliability to any type of mobile fighting system.

For more information, contact: Power Systems Sales Manager, Garrett Turbine Engine Company, P.O. Box 5217, Phoenix, AZ 85010. (602) 231-1946.

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SIMULA INC. is proud to be a member of the Apache Team, providing crash protection to crewmembers since the beginning of the program. Simula seats have flown in all AH-64A pre-production helicopters and are now being installed in all production Apaches—ready to provide the same outstanding crash protection now being afforded to crewmembers of the first 300 plus UH-60A Black Hawks.

SIMULA INC. retains its leadership in crashworthiness technology by continually advancing the state of the art through research and development, including accident analysis, computer simulation, and testing. This constantly improving technology contributes to the store of public knowledge and assures the superior quality of our products.

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WORLD LEADER IN THE DEVELOPMENT OF AVIATION CRASH SAFETY TECHNOLOGY AND PRODUCTS

APACHE PRODUCTION "TAKES OFF"

BY JACK G. REAL

THE production phase of the AH-64 Program became airborne on January 9, 1984, with the textbook-perfect inaugural flight of the Army's first production APACHE attack helicopter.

This momentous program milestone came just three days after Hughes Helicopters, Inc., prime contractor for the APACHE Program, officially became a subsidiary of the McDonnell Douglas Corporation.

Following routine self-start, engine run-up and systems checks, our veteran Chief Test Pilot, Steve Hanvey, pulled collective pitch to begin a flawless 30-minute maiden flight over the Arizona desert.

On this historic occasion, eight additional production APACHES were in various stages of assembly at our APACHE Assembly and Flight Test Center in Mesa. Ground had been broken for our modern $40-million, 550,000-square-foot facility just 20 months earlier.

The pilot's report confirmed that our Arizona facility — and the AH-64 industrial team in some 40 states — had produced a top quality production vehicle.

A remarkable performance

"Aircraft performance was remarkable for the first flight," Hanvey said. "APACHE No. 1 handled just like the prototypes — even smoother. Power response was excellent. I could have closed my eyes and believed I was in prototype No. 2 (first to fly in September 1975). There were no failures at all during the flight."

ABOUT THE AUTHOR
A LEGENDARY AERONAUTICAL ENGINEER AND INDUSTRY SPOKESMAN, JACK G. REAL IS PRESIDENT AND CHIEF EXECUTIVE OFFICER, HUGHES HELICOPTERS, INC.

The first APACHE reached a forward airspeed of approximately 120 mph and 20 mph in both sideward and rearward flight.

With the completion of additional routine flight acceptance testing by Hughes and Army pilots, the Army accepted APACHE No. 1 for service more than a month ahead of the contract schedule. **We intend to continue this pace.**

The first two production APACHES will serve as dedicated test vehicles for evaluating systems performance. The first AH-64s for training military personnel are scheduled to arrive at Fort Eustis, VA, in September, and Fort Rucker, AL, this October.

An emotional greeting

APACHE No. 1 rolled out two months ahead of schedule on September 30, 1983. The free world's first round-the-clock, adverse weather attack helicopter was greeted by 1,600 well-wishers with hearty applause.

Accompanied by an Apache Indian on horseback, the long-awaited anti-armor helicopter quickly was surrounded by a curious crowd, including representatives from the Army, the Congress, the Administration, state and local governments, the media and Hughes employees.

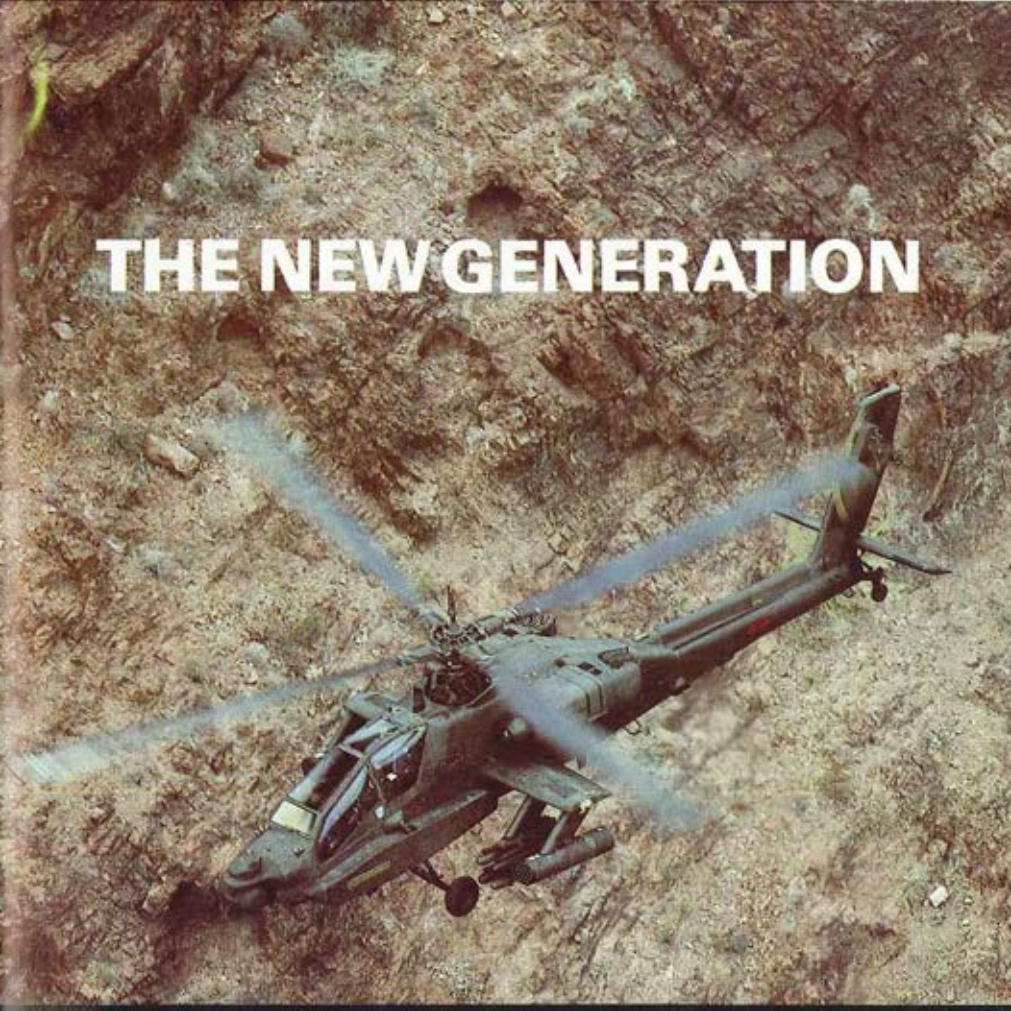
During the ceremony, the Army, Hughes Helicopters, and its industrial partners made an important statement for the future by publicly pledging their combined resources to defend our country.

Thus was introduced the essential airborne component of the Army's Combined Arms Team. The APACHE will serve the Army's battlefield requirements well into the 21st century.

The rollout of the first of 515 AH-64s cul-

U.S. ARMY/HUGHES HELICOPTERS, INC.

AH-64A PRODUCTION TEAM



Teledyne Systems Company provides the integrated Fire Control Computer for the Apache. This powerful and compact computer provides fire control, navigation, and self-test functions, while also acting as the primary Multiplex Data Bus Controller for the helicopter.

TELEDYNE SYSTEMS COMPANY

19601 Nordhoff Street Northridge, California 91324 (213) 886-2211

minated two decades of effort by Army leadership to field a dedicated attack helicopter.

The Army has worked hard and courageously to keep its "better idea" alive. The Army's persistence in developing this incomparable weapon system has been proven wise and farsighted in the face of continuing Soviet adventurism and the emergence of its formidable threat vehicles.

The finest in the world

Many thoughtful remarks were made by important speakers at the rollout, and they shed light on the significance of the APACHE Program.

Secretary of the Army John O. Marsh, Jr. described the AH-64A as "the finest attack helicopter in the world today — a deterrent to prevent war and preserve peace."

"It is especially gratifying to know the APACHE production is ahead of schedule," said **Lieutenant General Robert L. Moore,** Deputy Commander for Research, Development and Acquisition, Army Development and Readiness Command. "This is an accomplishment we infrequently experience in the weapons system business, and we enjoy it!"

"The people who have worked so hard — Hughes employees and the industrial team — have a valid and justifiable reason for celebrating this enormous and successful achievement," said **Brigadier General (P) Charles Drenz,** AH-64 Program Manager. "This is primarily because the APACHE is the first U.S. Army attack helicopter designed from scratch to meet Army gunship requirements."

Congressman Eldon Rudd of Arizona noted that the AH-64 "Has a capability to strike out like lightning for a target and at the same time evade being a target itself."

Our vice president for the AH-64 Program, **Norm Hirsh,** emphasized that, like the Apache warrior, "The rugged AH-64 will live in the wild and strike with speed, agility and precision — day or night and regardless of weather, and can be counted on to turn the tide of battle. May it never fight in anger, but, if it must, let it be victorious for freedom!"

Proud to play our role

Hughes Helicopters is proud to play a vital role in fulfilling the Army's important attack helicopter requirement. We are committed to providing first class technical and engineering support during the APACHE's extensive service life to ensure that this outstanding helicopter fully serves changing Army requirements over the years.

We will continue to produce this advanced, flexible weapon system on or ahead of schedule and with stringent cost and quality controls.

Our freedom depends upon it. IIIII

UPDATE ON TADS/PNVS

BY COLONEL DONALD P. WRAY
AND MICHAEL S. LYKENS

THE **Target Acquisition Designation Sight/Pilot Night Vision Sensor (TADS/PNVS)** is one of the most important parts of the AH-64 APACHE's mission equipment package.

The APACHE is required to fly day and night **Nap-of-the-Earth (NOE)** operations in all kinds of weather and deliver ordnance accurately and effectively. The TADS with its multiple sensors (FLIR, TV, Direct View optics, laser rangefinder, designator and laser tracker) is the primary system used by the co-pilot/gunner to accomplish the weapons delivery task and the PNVS FLIR allows the pilot to fly NOE at night and in restricted visibility. Previous issues of **Army Aviation Magazine** have contained more detailed descriptions of the various TADS/PNVS sensors and operational modes which will not be repeated here. For this program update, we will discuss briefly contractor logistic support, the PNVS Surrogate Program, potential additional production requirements (both domestic and foreign) and the current program status.

Contractor Logistic Support (CLS)

The concept of providing contractor logistic support for initial fielding of a system is not unique to the APACHE and TADS/PNVS. The BLACK HAWK is the most recent major Army aircraft to use this concept, which worked very well. It is particularly desirable when fielding relatively complex systems such as the TADS/PNVS to have the technical expertise developed by the Contractor over the development and initial production years immediately available and to have the contractor involved in initial fielding.

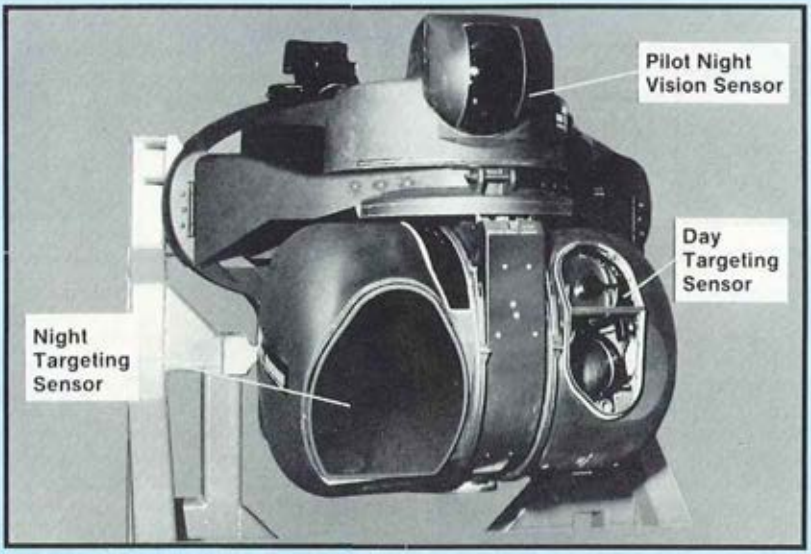
In the case of TADS/PNVS, we have contracted with Martin Marietta to provide supply support (and depot level repair of the TADS/PNVS **line replaceable units (LRUs).**) based on the flying hour program.

This support concept will allow maximum responsiveness to meet all program requirements during initial fielding by providing the flexibility to support the production line and logistic support requirements from a common pool. This results in a more efficient use of hardware and should result in reduced program cost. CLS is more valuable in supporting fielded systems before we've had the opportunity to acquire field experience and a demand data base. CLS is included in the first two production contracts and we plan to continue it in the third production buy. Transition to full organic logistics support is scheduled for FY 87.

Contractor-Army teamwork

Overall guidance for the AH-64A fielding effort which includes TADS/PNVS requirements, will come from the Integrated Logistics Support Management Team consisting of contractor and Army personnel from each technical and managerial area of logistics. The team includes U.S. Army **Training and Doctrine Command (TRADOC)** representatives. A Materiel Fielding Team will provide temporary assistance at each installation and will be responsible for detailed planning of the AH-64A fielding effort as well as on-site logistics support. **Colonel Keating** will discuss in greater detail the preparation for fielding the AH-64As (APACHEs) in his article elsewhere in this issue.

COL. DONALD P. WRAY IS PROJECT MANAGER, TARGET ACQUISITION DESIGNATION SIGHT/PILOT NIGHT VISION SENSOR SYSTEM; MICHAEL LYKENS IS A PROGRAM ANALYST IN THE PMO, TADS/PNVS.



DETAILS OF THE TARGET ACQUISITION DESIGNATION SIGHT/PILOT NIGHT VISION SENSOR (TADS/PNVS) ARE SHOWN ABOVE.

PNVS Surrogate Trainer Program

Another element important to the success of the TADS/PNVS program and ultimately the APACHE AH-64 fielding success is the PNVS Surrogate Trainer. Initially during the competitive development phase each of the two contractors (Martin Marietta and Northrop) designed and fabricated a single PNVS surrogate. Each Surrogate contract provided for the installation of a PNVS and **Integrated Helmet and Display Sight System (IHADSS)** on an AH-1S airframe. These aircraft were used for extensive evaluations of PNVS capabilities under a wide variety of conditions throughout the U.S. and in Europe. They have also proven invaluable in training pilots on PNVS flight operations rather than tying up prototype AH-64s which are needed elsewhere for essential development testing.

Due to the success of the prototype PNVS Surrogate Trainers, a separate production contract was awarded to Northrop Corporation in December 1982 to provide an additional ten PNVS Surrogates. Northrop Corporation will integrate the government furnished Martin Marietta PNVSs in addition to the IHADSSs and other electronic equipment into the AH-1S(MOD) airframe. The PNVS Surrogate Trainer aircraft are scheduled to be delivered to Fort Rucker at a rate of one per month beginning in July 1984. These aircraft will be used by the Aviation Center to provide initial PNVS training to all AH-64 pilots. Using the Surrogates instead of AH-64 aircraft results in a reduction of AH-64 flight training time of 25 hours per student and a substantial cost savings. The Critical Design Review was successfully completed at Northrop Electro-Mechanical Division during the week of 8 December 1983.

Add'l production requirements

Besides our planned production of 521 TADS/PNVSs to support APACHE requirements, the Navy has submitted a **Military Interdepartmental Purchase Request (MIPR)** for the procurement of five Pilot Night Vision Sensors with spares (which they will treat as Engineering Development Models) for their **Helicopter Night Vision System (HNVS)** program. This procurement will be through the **Aviation Systems Command (AVSCOM)** Procurement Directorate with technical assistance by the TADS/PNVS Project Manager's Office. An integration contract is to be completed through

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Pacer OADS – the total air data system. Provides the pilot with a display of the entire airspeed envelope. Enhances radio navigation. Feeds flight control systems to allow automatic approach and hold of any end-speed (including zero). Provides fire control systems with air data for first round hits. For information regarding the safe, reliable, full use of your helicopter's capabilities, write or call Pacer.

Chosen for the U.S. Army/Hughes Apache Advanced Attack Helicopter. Provides dual axis airspeed and air mass data for fire control, automatic flight control, display and navigation.

Pacer Systems, Inc.

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Northwest Industrial Park,
Burlington, MA 01803 (617) 272-5995

THE U.S. ARMY'S AH-1S SURROGATE TRAINER TO BE EMPLOYED IN THE EVALUATION OF THE TADS/PNVS IS SHOWN ABOVE AT THE YUMA PROVING GROUND, AZ.

Sikorsky, the CH-53 prime contractor. Development covers FY 83 through FY 88 for this program with production contract award planned for FY 89.

In addition to domestic production requirements, we are currently working potential foreign military sales with Germany.

Status

Production began with the award of a long lead contract in January 1981. The first full production contract was awarded in April 1982 for delivery of 13 (11 for aircraft plus two trainers) TADS/PNVS systems following the successful **Defense System Acquisition Review Council (DSARC)** III. The second year production contract was awarded in December 1982 for an additional 52 systems (48 for aircraft plus four trainers).

We are currently negotiating the third year production contract for 112 TADS/PNVS systems with award expected in January 1984. Flight tests of the production micro-miniaturized (4 box) electronics configuration TADS were successfully completed in April 1983. This test verified the compatibility of all essential interfaces between TADS/PNVS and the AH-64 production configurations. Our first major production milestone occurred on 30 July 1983 with the Army acceptance of the first production TADS/PNVS. The unit was subsequently delivered to the Hughes Helicopters production facility at Mesa, Arizona, in August 1983 for integration on the first production aircraft. A total of five production TADS/PNVSs have been delivered as of 1 January 1984. Production rate is scheduled to build to three per month in early 1984 and should reach 12 per month in 1986.

On time deliveries

In summary, we have produced TADS/PNVS units and delivered them on time to Hughes Helicopters, Inc., to support APACHE production. Initial integration and check-out on the Hughes production line has thus far gone very smoothly. We are bringing the production line up and will continue to build the rate capability to support the maximum aircraft requirements of 12 per month. Further, we expect production requirements (both domestic and foreign) to grow as the system continues to prove itself. In the following article, **Bill Wesley,** Martin Marietta Program Manager, will provide more detail on TADS/PNVS production, delivery, and integration. IIIII

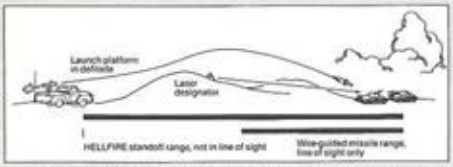
HELLFIRE SCORES AGAIN.

THIS TIME FROM A GROUND-LAUNCH PLATFORM.

HELLFIRE, the U.S. Army's newest anti-armor missile, has been scoring hit after hit from airborne platforms, against a variety of armor and bunker targets.

In a recent organizational and operational tactics test conducted by the U.S. Army's 9th Infantry Division, HELLFIRE scored again. This time from a ground-launch vehicle hidden behind a hill. After clearing the hill, HELLFIRE detected the target and scored a direct hit.

In this test, HELLFIRE emphatically proved its cost-effective ground-launch capabilities. A capability superior to current direct fire systems in survivability, range and lethality.



HELLFIRE's versatility is a result of the practical application of tactical technology.

The ground-launch HELLFIRE vehicle offers rapid deployment forces the only indirect fire, anti-armour capability that can be air lifted onto the battlefield by Black Hawk helicopters.

Ground-launched HELLFIRES give the field commander unsurpassed mission flexibility, mobility, survivability and destructive power.

We'd like to tell you more about our skills in designing and producing practical, affordable weapon systems. Why not call or write us? Missile Systems Division, 1800 Satellite Blvd., Duluth, Georgia 30136. Phone: (404) 476-4191.

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ADVANCED MANUFACTURING AND TEST PROCESSES:

CONFIDENCE BUILDERS IN TADS/PNVS PRODUCTION

BY WILLIAM P. WESLEY

SEVERAL years ago many people (Government and Industry alike) believed that producing a system as precise, sophisticated and versatile as TADS/PNVS, in rates on the order of 17 equivalent systems per month, could not be done . . . or if it could be done, it couldn't be done affordably. Believe me, it has been a significant challenge. Today in 1984 we have proven that we can do it.

By now most of the free world is familiar with the awesome, long-stand-off, day/night targeting and night navigation capabilities provided by TADS/PNVS for the APACHE.

"Behind the scenes"

Over the past few years, issues of **Army Aviation Magazine** dedicated to the APACHE and TADS/PNVS, have provided detailed descriptions of the multi-functional TADS/PNVS features and operational capabilities.

Colonel Don Wray, in the preceding article, has explained the support and fielding plans being implemented by the Army/Industry team as the APACHE enters the field for training this year and in preparation of the **First Unit Equipped (FUE)** in 1985.

The road from development of the flight hardware and automatic test equipment to production has been long and, as with all advanced state-of-the-art systems, to say the least — challenging. As **Colonel Wray** has stated, a tough and very successful product development is now behind us. TADS and PNVS have matured significantly over the past two years. The rigorous test programs have yielded what we believe is a quantum jump forward in an around-the-clock, dependable, operational aviation fire control capability second to none in the world today.

I think it's important now that the user of any product understands what goes on "behind the scenes" in the manufacture of the product their very lives will depend on. You ought to know what goes into the manufacture and test of the product before you ever see it.

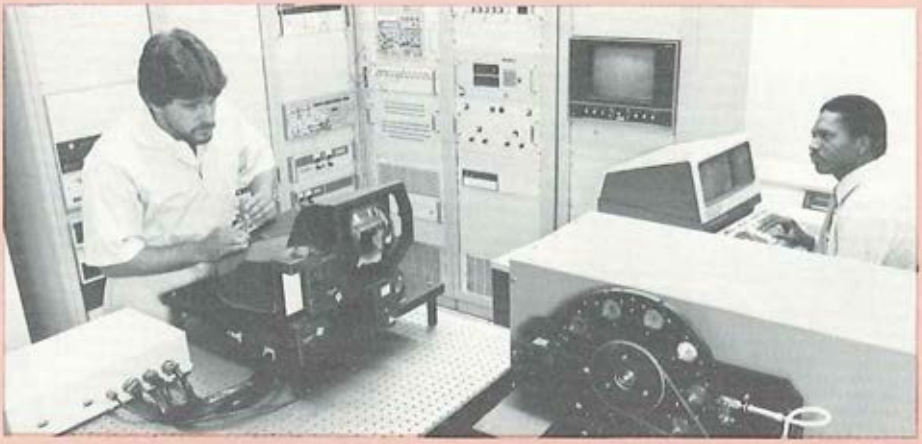
As you can well imagine, the manufacture and test capabilities to produce TADS/PNVS and the Electro-Optical Bench and Electronic Stations (GPSE) had to be state-of-the-art as the hardware itself. At the same time, the sophisticated alignment and test stations had to be easy to operate by manufacturing personnel while maintaining the highest standards of precision and thoroughness technology can provide.

Quality control is omnipresent

Quality control is present at every step in the production of TADS and PNVS starting with 100% screening and burn-in of parts as they are received. This weeds out any weak parts early in the process. Testing of individual boards, subassemblies and assemblies includes extensive rough handling and integrity tests at extreme temperatures, vibration and shock to again weed out failures and manufacturing errors early in the process.

Because TADS and PNVS are made up of 24 separate **line replaceable units (LRUs)** and 30 **shop replaceable units (SRUs)** that must be totally interchangeable, manufacturing flow allows assembly, precision alignment and test in modular fashion.

ABOUT THE AUTHOR:
WILLIAM P. WESLEY IS THE VICE PRESIDENT, TADS/PNVS PROGRAM, AT MARTIN MARIETTA AEROSPACE ORLANDO DIVISION.



ABOVE: PNVS COMPUTERIZED ALIGNMENT AND TEST STATION.

Taking advantage of the built-in test circuitry inherent in each LRU, automating the alignment and test processes with computer assisted test stations was made possible. In each alignment and test station the computer measures with absolute precision every performance parameter of a specific LRU/SRU referenced to a prime item development specification and "prompts" the operator to make the required adjustments to make the grade. Automating these precision alignments and performance measurements has simultaneously insured product uniformity of quality and performance. Also, automation has generated much lower cost through accuracy and task performance that previously was only available using high paid technical personnel.

A stringent testing program

Each LRU, once assembled, aligned and performance tested, is then put through stringent temperature, vibration, shock and environmental tests equal to or greater than any operational environment experienced from the tropics to ice cold winters of Europe before they are integrated into a total TADS/PNVS system.

Once they have passed their individual tests, all LRUs (Day Sensors, Laser Designator/Range Finders, Night Sensors, PNVS, Boresight Modules, Electronic Boxes, Gimbal, Optical Relay Tube and aircraft mounting structure) are married together as a total system in final integration, and tested again.

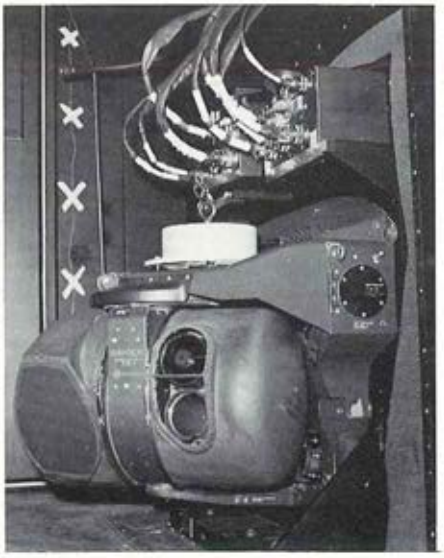
The entire TADS system is mounted in a specially designed acceptance test and dynamic reliability chamber known as TAT/DR for a real operational shakedown test prior to delivery. Two times in this chamber, the TADS system is simultaneously vibrated at various operational loads and temperature soaked from minus 25°F to plus 131°F at five different levels. At each level of temperature and vibration level over 90 separate specification performance measurements are verified. The system must completely pass the second cycle totally failure free. When, and only when, the system has passed this grueling 87 hour test, verified every step of the way by Martin Marietta Quality inspectors, DCAS resident inspectors and Army Program Office test inspectors, is it ready for final acceptance by the U.S. Army DCAS on a DD-250.

Putting it all together

Following final packing Martin Marietta ships the completed unit to the Hughes Helicopters assembly plant in Mesa, Arizona for installation and integration into the APACHE. An on-site technical support and integrated logistics support team assists Hughes Helicopters and Army representatives at each step of integration and final flight testing in a completed total APACHE System where again all major performance

ABOVE: TADS/PNVS PRODUCTION INTEGRATION IN FULL SWING.

BELOW: TADS TAT/DR DYNAMIC RELIABILITY TEST CHAMBER.



parameters are tested on the aircraft throughout the operational flight envelope prior to acceptance and delivery of the APACHE to the United States Army team.

Our one objective

As you can see by this brief description of the flow of TADS/PNVS from piece parts through final operational acceptance and follow-on field support, TADS/PNVS production assembly, alignment and test facilities, processes and procedures have been put on line with one objective in mind — quality, consistency and operational excellence at an affordable price. We continually pursue productivity improvements, producibility improvements, and cost reduction/avoidance improvements which will be incorporated as the program progresses. An aggressive product improvement program is underway with the Army today, carefully evaluating additional capabilities for future incorporation in TADS and PNVS keeping pace with operational requirements, emerging threats and proven available technology to make the crew member's job easier and more effective.

TADS/PNVS is in production and in the inventory now. We pledge to you our continued dedication to excellence. IIIII

GENERAL ELECTRIC'S T700-701:

PROVEN PERFORMANCE FOR THE APACHE

BY LOUIS A. BEVILACQUA

APACHE Advanced Attack Helicopters now entering U.S. Army service are powered by a proven production helicopter engine — General Electric's T700-GE-701.

Through the end of January, General Electric supplied 35 production T700-GE-701 APACHE engines to support the APACHE production line. Engine deliveries will increase to 10 installed engines a month by the end of 1984. Production of more than 1,200 T700-GE-701 APACHE engines and spares is expected for the 515 APACHE helicopters the Army now plans to procure. Engines are being procured under a Department of Defense multi-year program that benefits the Army, Navy, and Air Force.

A smooth transition is expected

The success of the General Electric T700 engine family — demonstrated by more than 375,000 flight hours — is expected to contribute significantly to a smooth transition to operational status of the Army's newest helicopter with its demanding mission requirements.

The APACHE T700-GE-701 is an upgraded version of the BLACK HAWK T700-GE-700 engine. It produces 10% more shaft horsepower than the baseline engine during normal operation and 20% more power for single engine contingency operation in hot ambient temperature and high altitude environments. The 20% increase in the single-engine contingency rating provides the APACHE with greater flexibility under adverse operational conditions. Although more powerful, the T700-GE-701 uses the same basic hardware as the baseline engine and the two models are therefore interchangeable.

The T700-GE-700-701 engine has already accumulated over 14,000 hours (more than 9,000 flight hours) in flight test programs. The continuing development flying includes three prototype aircraft with production engines installed. After more than 200 T700-GE-701 production engine flight hours, there had been no unscheduled production engine removals.

The General Electric T700 first went into service in 1979 on the Army's BLACK HAWK helicopter in what is acknowledged as the most successful helicopter engine introduction ever. Over 1,200 T700 engines have been produced by GE since 1979 — and they now power more than 500 in-service aircraft. In addition, this highly successful powerplant is backed by an already in-place Integrated Logistics Support program designed to meet all Army requirements, and is combat proven in Grenada.

The dependability is proven

General Electric T700 engines now have an average age of 375 hours. The high-time engine exceeds 2,000 hours. Performance records to date show an in-flight shutdown rate for all T700 engines of one every 12,500 hours, and an unscheduled engine removal rate of one every 4,000 hours of service — dependability that is essential in meeting the tough power demands of the APACHE.

The T700-GE-701 was chosen to power the APACHE helicopter because its capabilities exceed all other helicopter engines in the same class. The twin General Electric engines must provide the APACHE with sufficient power to effect a minimum vertical rate of climb of 450 feet

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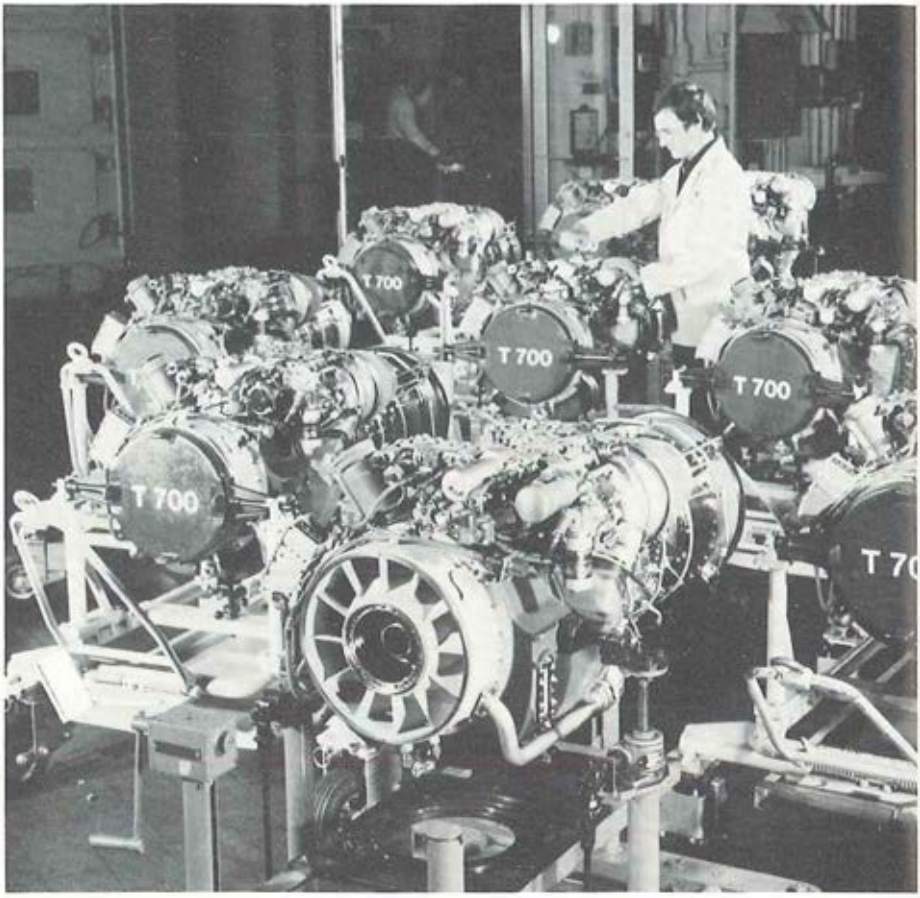


ABOVE: T700 ENGINES READY FOR SHIPMENT FROM GE'S LYNN, MASS., MANUFACTURING PLANT.

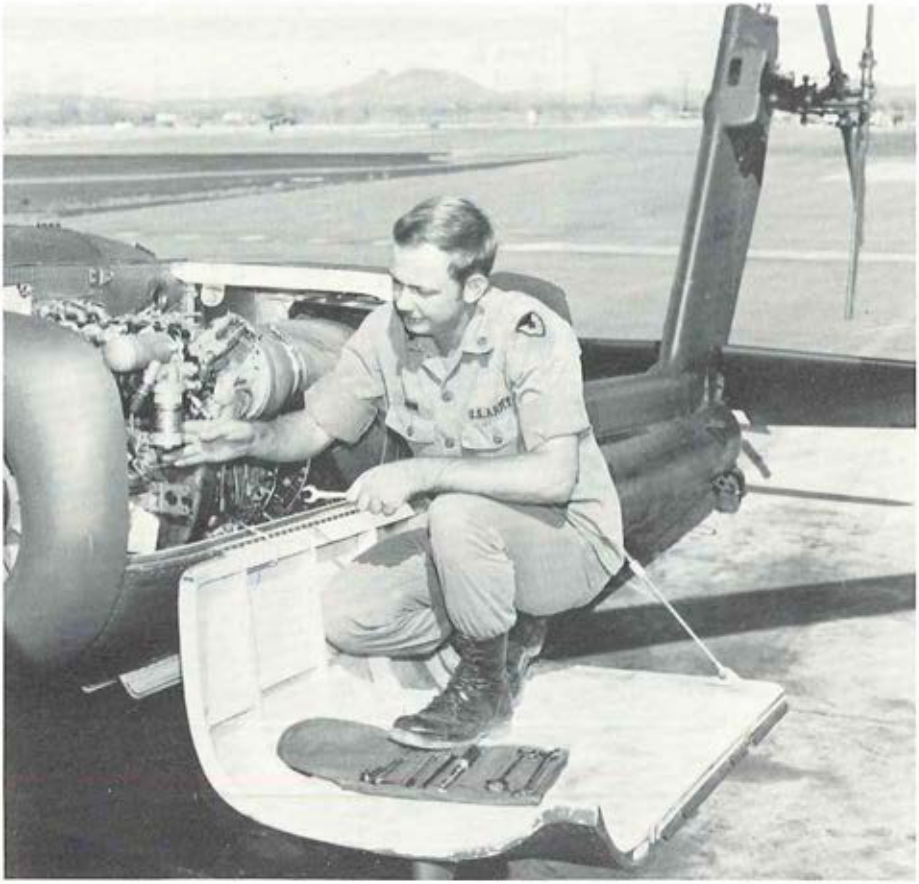
per minute and a cruise speed of 145 knots while equipped with eight HELLFIRE missiles, 320 rounds of 30mm ammunition and fuel for 1.83-hour mission at the standard Army hot day of 4,000 feet altitude and 95ºF. The T700-GE-701 also helps improve aircraft maneuverability and survivability under the harshest environmental conditions.

In combat, the APACHE will seek protection by flying at high speeds close to the earth, both in the daytime and at night. The T700-GE-701 will provide the APACHE with the dependable power supply required to operate with a high degree of safety in this environment.

Better all around

Improvements in reliability, maintainability, combat survivability and fuel consumption have been combined in the T700-GE-701 to provide a helicopter engine for the Army that will provide long engine operating life and low life cycle costs despite the tough combat environment in which the APACHE must operate.

While the APACHE flight test program was underway, the **Accelerated Simulated Mission**



ABOVE: A MECHANIC PREPARES TO REPLACE A T700 FUEL FILTER ABOARD AN AH-64A APACHE.

Endurance Testing (ASMET) was successfully completed on the T700-GE-701 engine in the factory. The ASMET demonstrated 5,000 equivalent mission hours for the engine, with the APACHE mount system and all engine mount accessories under simulated aircraft operating environment including engine power spectrum and vibration. Throughout all testing, the T700-GE-701 in the APACHE operated totally trouble-free.

The entire T700 program is geared for volume production which will result in an overall cost-effective engine program. By 1986, General Electric will have the capacity to produce 86 engines a month.

State-of-the-art plus

The development of the T700-GE-701 is an excellent example of an Army program that took a state-of-the-art military engine and upgraded it to meet demanding new aircraft mission requirements. The APACHE, with its powerful twin General Electric engines, will prove to be an excellent addition to the Army's arsenal of modern weapons. IIIII

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HELLFIRE MODULAR MISSILE SYSTEM

BY COLONEL STANLEY D. CASS
AND LTC EARL HUGHES

THE AH-64 APACHE with its primary armament, the **HELLFIRE Modular Missile System (HMMS),** brings to the battlefield an awesome tank killing capability.

The shaped charge warhead of HMMS has repeatedly demonstrated its ability to defeat all known armor threats of today and of the foreseeable future. Pinpoint accuracy has been achieved with both airborne and ground laser designation systems in over 150 test firings. This tank killer provides a degree of accuracy, employment flexibility, lethality, and launch crew survivability not heretofore known in U.S. anti-armor systems.

What HMMS does

The HMMS will bring a host of combat attributes to the modern battlefield which are certain to find favor with field commanders at all echelons. Primary among these attributes are engagement flexibility, increased firepower/lethality, and launch crew survivabilty.

a. **Engagement Flexibility.** When carried by the APACHE, the HMMS has great maneuverability which aids the commander in concentrating his combat power quickly at the decisive place and time on the battlefield as the tactical situation develops. A variety of designation schemes are available; autonomous designation by the AH-64 or remote designation from the air by scout helicopters or on the ground by ground laser designator teams. If designator teams are in the immediate area of the prospective engagement, the HMMS can be fired from behind a mask, thus affording launch crew cover.

Otherwise, the AH-64 can designate its own targets at standoff ranges and thereby avoid counterfire from the targeted threat weapon systems. Depending upon the density of the threat armor formation, the APACHE can launch HELLFIRE missiles against single or multiple targets. In the case of the multiple targets, if only one designator is available, the rapid fire mode of launch may be used. In this mode, missiles are fired in rapid succession and the designator beam is shifted from one target (upon missile impact) to another one nearby.

An indirect fire capability

If two designators are available, the ripple fire mode may be employed. In this mode, two successive missiles track their respective precoded designator laser beams killing two targets within only a few seconds. With HMMS's indirect fire capability, no longer does the commander have to carefully position the anti-tank system so as to provide line-of-sight for the launch crew — a big advantage in hilly compartmented terrain such as Europe. Because all designators for the HMMS are used with night sights, the commander has a 24-hour a day capability.

During the next calendar year, HMMS will cut a product improvement into its production lines — the **improved low visibility (ILV)** autopilot. This new autopilot will permit launches over all of the trajectories previously available with the old autopilot while allowing the launch crew the flexibility to select a flat trajectory option during periods of low cloud ceilings. In future years as millimeter wave seeker technology matures more fully, the HMMS could accommodate this

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ABOVE: COL STANLEY D. CASS (2D FROM LEFT) INSPECTS MISSILES WITH ROCKWELL MISSILE SYSTEM DIVISION MEMBERS, L-R, DON WEBB, BOB WYNE, TOM MURPHY, AND BOB TINDER.

seeker which shows great promise during limited visibility weather.

Additional engagement flexibility will be afforded field commanders as the HMMS fire control system is integrated into other potential launch platforms. The HMMS has been launched from COBRAS, BLACK HAWKS, and LYNX helicopters as well as ground vehicular platforms and towers. Analyses indicate that this missile can, with minor modifications, be launched from fixed wing aircaft such as the Navy OV-10 and Air Force A-10. With HMMS, the field commander will not have to stylize his tactical engagements; he will be free to bring his innovative talents to bear against threat armored echelons.

b. **Increased Firepower/Lethality.** The HELLFIRE missile is the most accurate and highly lethal anti-armor missile ever developed. Trajectories have been shaped to enable the missile to strike threat armor from the top where it is most vulnerable. The short flight time of this missile means less opportunity for the target to perform evasive maneuvers. Rapid and ripple firing modes (discussed previously) enable HMMS to engage multiple targets quickly and thereby render HELLFIRE the type of system required in a target rich corridor of the battlefield. With its tight circular error probable (CEP) and its devastating penetrating power, HELLFIRE is truly a "one launch, one hit, one kill" anti-armor missile system.

c. **Launch Crew Survivability.** The HMMS has been designed, developed, and continuously improved to afford its launch crew minimal exposure to hostile counterfire. The missile seeker's lock on after launch capability enables the missile to engage and destroy enemy armor without the firing platform ever seeing the target. Although the current production version of HMMS is not a fire-and-forget system (remote designation is required when launch occurs from a masked position), efforts are ongoing to initiate a development program for fire-and-forget HELLFIRE during the late eighties. In addition to a capability to launch from a masked position out of harm's way, HMMS has a number of other features which contribute to launch crew survivability. Its standoff range — much greater than that of other existing anti-armor systems — enables it to operate out of range of target armaments. To further capitalize upon this survivability aspect of HMMS, development of an extended range HELLFIRE is contemplated in the late eighties.

HELLFIRE is quick to leave the launch rail and attains maximum speed in minimum time. The resulting short flight time means less exposure time for the launch crew during direct fire engagements. Finally, a minimum smoke rocket motor has been successfully flight tested which will significantly reduce the launch signature and thereby reduce the likelihood of enemy forces locating the launch platform. The HMMS is a missile system which will permit its launch crew to return to the battle again and again to deliver its potent anti-armor punch.

Conclusion

The first production units of HMMS are soon to be added to the anti-armor inventory. As this occurs, the U.S. Army will realize an addition to its force structure of incomparable lethality, accuracy, employment flexibility, and survivability. As combat developers generate requirements to kill more advanced armored threats from various launch platforms for a wide range of battlefield conditions, the highly modularized HELLFIRE missile system stands ready to demonstrate its adaptability. IIIII

PREPARATIONS FOR FIELDING

BY COLONEL DAVID W. KEATING AND DONALD S. BARTON

THE APACHE fielding effort, like the aircraft, will be unique. But, as the aircraft is designed to be easily supported in the field, the fielding plan is equally well designed.

Under the DARCOM total package fielding concept, the fielded unit or TRADOC location will be provided all AH-64 peculiar and non–peculiar equipment as a part of a complete support package, 30-60 days prior to first aircraft arrival. The receiving unit will not be required to take any supply action for either initial repair parts or TOE equipment until replenishment is required. Within DARCOM, the Program Manager is responsible for all aspects of fielding the APACHE — from training, to supply, to monitoring distribution of TOE equipment for both the new and converting Attack Helicopter Battalions.

Built-in simplicity

Supportability has been planned since the inception of the AH-64 program. The term designed for support has not been taken lightly. We will field a complex and sophisticated aircraft that will be simple to maintain and operate by troops in the field. Although all ILS elements are critical to a successful logistics program, during the transition from production to fielding — **TRAINING — SUPPORT EQUIPMENT** and **SUPPLY** seem to outweigh the others. The ILS program must be executed successfully in the production phase to insure successful fielding. We will have the manuals, the training, the supply and the maintenance support structure to capitalize on our past design support efforts.

Under the APACHE training concept the institutional TRADOC schools will train the pilots and maintainers rather than New Equipment Training Teams training each unit. The institutional school base will be established prior to fielding the first APACHE in the first unit. In January 1985, institutional maintenance training will begin at Fort Eustis and Fort Gordon and aircrew training at Fort Rucker. To get the schools ready and transfer knowledge from the contractor to the TRADOC instructor, the contractors will begin flight training of Army instructor pilots at Mesa, Arizona, this summer. Similar maintenance instructor training will begin at Fort Eustis and Fort Gordon in September. This training effort is covered in more detail in other articles.

Specially designed tools

Trained troops need adequate support equipment and from the Logistics Support Analysis effort of the past ten years, APACHE **Peculiar Tools and Support Equipment (PGSE)** have evolved. This equipment is designed specifically to support both AH-64 unit (AVUM) and intermediate (AVIM) maintenance operations and were used and demonstrated during operational testing in July 1981. Unit sets of PGSE are currently on contract and scheduled for delivery to support the DA distribution plan.

The most critical piece of AH-64 PGSE is the Automatic Test Station. In the past, this section was called the ATS. Now it has been renamed the **Electronic Equipment Test Facility (EETF).** It will be fielded only to Corps AVIMs. The ATE will provide the means to diagnose faulty modules that are removed and replaced

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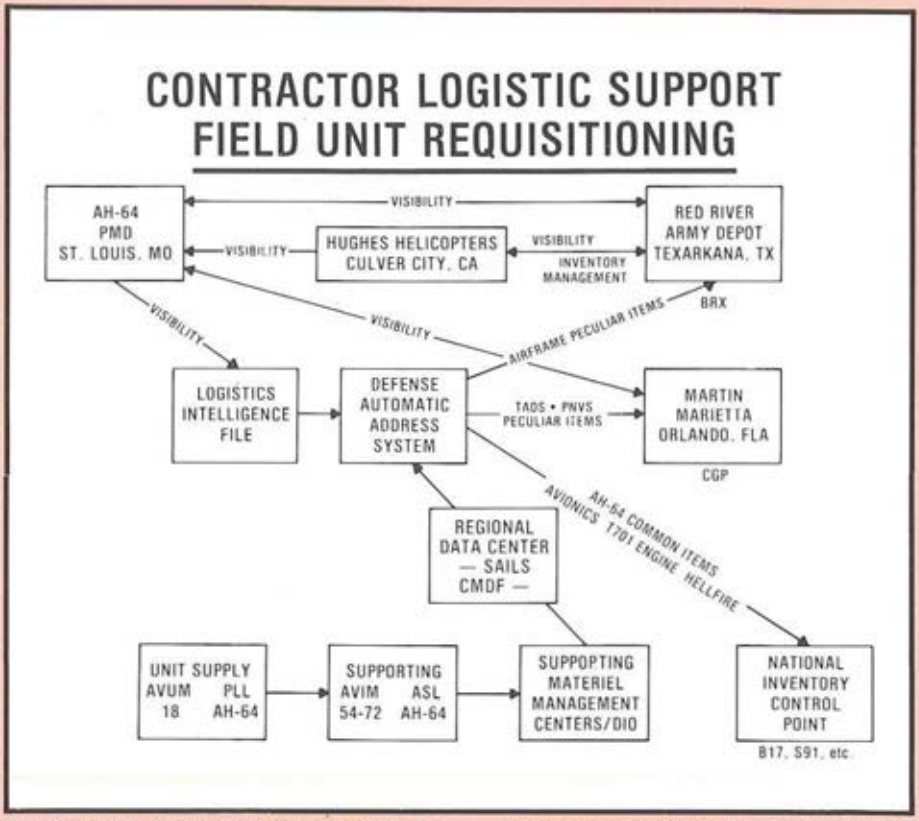


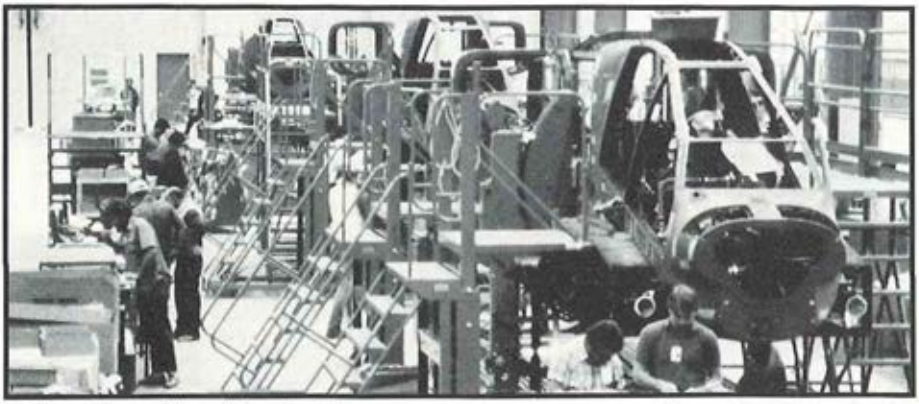
at organization maintenance (AVUM). With its capability to diagnose, repair, and quickly turn around modules, the EETF is critical to provide adequate spares to operational units. **Major David Aaronson's** article in this issue further describes the system.

Fast and accurate

Another major piece of PGSE is the Captive Boresight Harmonization Kit which provides units the capability to boresight the entire AH-64 weapons system in one hour or less. This is just one of the many maintainability features enhanced by PGSE. These AVUM and AVIM peculiar tools and equipment will be on hand in each unit at least 30 days prior to the arrival of a unit's first aircraft as part of the PM's total package fielding responsibility.

The third ILS element ctitical for successful fielding is supply support. Nothing is more frustrating or as non-productive as forcing a mechanic to cannibalize parts to make up for inadequate supply support. The APACHE spares have been fully funded throughout this program and we intend to buy and have available the right parts in PLL's and ASL's.

During our first 35 months of production deliveries, February 1984 through January 1987, the contractors, **Hughes Helicopters, Inc. (HHI)** and **Martin Marietta Aerospace (MMA),** will be responsible for providing wholesale supply and depot maintenance support for all AH-64 peculiar parts. During this period, however, the soldier in the field at AVUM and AVIM will requisition repair parts using normal supply procedures and national stock



numbers. The soldier will be virtually unaware that we are under **Contractor Logistic Support (CLS).** The contractors will manufacture or procure and manage a range of initial spares (AVUM, AVIM, Depot) adequate to support the Army's flying hour program and distribution schedule.

Under CLS, the contractor is committed to full supply support and will have the backing of his production line to insure adequate and timely support. Through CLS we hope to preclude buying obsolete parts and rationally transition to organic support over the next three years. **Chart 1** portrays the replenishment requisition process that will enable the contractors and **Red River Army Depot (RRAD)** to perform their support functions transparent to the field.

Where it all begins

RRAD will play a major role in APACHE fielding. It will be the wholesale storage location as well as the packaging point for all unit tailored fielding support packages of PLL's, ASL's, PGSE, and equipment. Under DARCOM's total package unit fielding process, the unit fielding will be controlled by AVSCOM and the PM Office. In this manner a single organization will requisition and maintain status of all items comprising a unit's support package.

Support package items will flow into RRAD where they will be consolidated into a unit "push package." When packaged, the tailored support package will be shipped directly to the unit where an inventory and stock records posting will occur. This effort will be conducted jointly between the receiving unit and the on site APACHE Materiel Fielding Team 30-60 days prior to the first aircraft delivery.

Pulling this fielding effort together is the Materiel Fielding Branch in the AAH PMO supervised by **LTC Ken McIntyre.** Fielding Teams will be established in TRADOC, FORSCOM, and USAREUR. The TRADOC teams will be directed by **LTC Dave Lum** with contractor technical assistance at Fort Rucker, Fort Eustis, and Fort Gordon. The TRADOC team is currently onboard and busy orchestrating the fielding effort at the three TRADOC locations.

Year of the Apache

The first two aircraft to arrive at a TRADOC installation will be in September at Fort Eustis. Fort Rucker aircraft will arrive in October. However, Fort Rucker will take possession of four APACHES at Mesa and Yuma this summer for instructor pilot training. Fort Hood will be the initial FORSCOM fielding location and will receive their first APACHE in May of next year. Under DA's single station training concept for the APACHE, all units will receive their APACHES and tailored support packages at Fort Hood. Units transitioning from COBRAS to APACHES will bring a portion of their people and equipment to Fort Hood, marry up with their AH-64s, train as a unit, then deploy back to their post.

1984 is the year of the APACHE within TRADOC. Our effort this year will establish the institutional training base and pave the way for subsequent fielding as the Army modernizes.IIIII

THE APACHE TRAINING PROGRAM

BY CHIEF WARRANT OFFICER (W4) FLOYD ROE

THE AH-64 APACHE is the Army's newest and most complex aerial weapons system. This aircraft is the culmination of an exhaustive ten year development effort involving the U.S. Army **Development and Readiness Command (DARCOM)** the U.S. Army **Training and Doctrine Command (TRADOC)** and more than 200 contractors in 30 states.

To the field commander, the APACHE represents a valuable new addition to the modernized force structure and will provide an expanded dimension to the Combined Arms Team.

"An exciting new machine"

To the attack helicopter pilot, the APACHE is an exciting new flying machine with true multi-engine performance for hot day operations with greatly increased mission loads, and greater agility for day and night NOE operations, stand-off ranges for combat survivability, and adverse weather capability. Full day and night operational capability, redundant flight controls, and a primary structure designed to withstand combat damage help the APACHE to survive to fight again.

To the TRADOC community, the APACHE represents another challenge. A challenge to insure that Army aviators are equipped with the technical knowledge and skills required to get the maximum out of this advanced weapons system. To meet this challenge, DA, DARCOM and TRADOC have worked closely with the APACHE Team contractors to design and build a totally new training and fielding package.

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Among the first innovations was the decision to accomplish individual training at the institutional level versus sending **New Equipment Training (NET)** teams to the field. Another new approach is single site fielding at Fort Hood, Texas. Units will be formed with already trained personnel and a full complement of hardware prior to the start of unit training and ARTEP qualification.

A very early start

APACHE aircrew training and qualification was initiated very early in the research and development phase and has paralleled the aircraft. The first training was for HHI Experimental Test Pilots and Army Engineering Test Pilots who participated in the Government fly-off between the Bell YAH-63 and the HHI YAH-64 in 1976. Other training was conducted by HHI for the various engineering test efforts and finally 12 Army Warrant Officer aviators were trained and qualified to conduct **Operational Testing (OT II)** in 1981. In all, more than 50 pilots were trained and qualified in the APACHE during development. Collectively these aviators have flown more than 4,000 hours in prototype aircraft. Their experience has provided a valuable input into the development of the APACHE training program, selection and development of training media, and identification of prerequisites for selection of aviator candidates for qualification in the APACHE.

The APACHE **Program Manager's Office (PMO)** together with personnel from the **U.S. Army Aviation Center (USAAVNC)** and the **U.S. Army Aviation Logistics Center (USAALC)** have worked closely with HHI to develop courses of instruction for aircraft qualification, Instructor Pilot Qualification and Maintenance

APACHE TRAINING PROGRAM

Test Pilot Qualification. These courses are designed to comply with TRADOC Regulation 350-30, Interservice Procedures for **Instructional System Development (ISD)** and are now in the final development stages. The ISD procedures are a very complex system designed to identify training tasks and construct a **Program of Instruction (POI)** defining training media, such as, curriculum outlines, lesson guides, student evaluation sheets, maneuver guides, instructor guides, criterion tests, student information guides, and audio visual aids.

Draft courses of instruction will be used by HHI during **Instructor and Key Personnel Training (IKPT)** beginning in March 1984. Ground school and basic aircraft training will be conducted at HHI, Mesa, Arizona, facility. Live ordnance, live laser, and combat skills training will be conducted at **Yuma Proving Ground (YPG),** Arizona. During IKPT, courses will be validated and updated by HHI. They will then be delivered to USAAVNC and USAALC for verification and implementation. Institutional APACHE qualification is scheduled to begin at Fort Rucker in January 1985 and at Fort Eustis in April 1985.

Unique training devices

The complexity and sophistication of the APACHE systems and related mission equipment established a need for several unique training devices, including a **Cockpit Weapons and Emergency Procedures Trainer (CWEPT), TADS Selected Task Trainer (TSTT), several computerized classroom system trainers, and the AH-64 Model 2B40 Combat Mission Simulator (CMS).** Also, several AH-1 aircraft are being reworked as PNVS surrogate trainers. These aircraft will be utilized by the USAAVNC to compliment the AH-64 training aircraft. These devices are explained in detail in accompanying articles.

In October 1983, HHI commenced training their own Production Test Pilots, Instructor Pilots, and Army Test Pilots. HHI **Instructor Pilots (IPs)** will be used for IKPT starting in March 1984. This will include five USAAVNC IPs and one USAALC **Maintenance Test Pilot (MTP)** IP. Upon completion of their training, these six pilots will assume instructor pilot duties teaching the remaining Army and contractor pilots. This will include 19 additional IPs for the USAAVNC, two MTP/IPs for the USAALC, two MTPs for Northrop Worldwide Aviation Services (USAAVNC Maintenance Contractor), two MTPs for the PMO Materiel Fielding Teams, and one MTP for the first operational unit at Fort Hood. These IKPT students will be trained in production aircraft. During IKPT, HHI will provide logistics support, ground instructors, and training facilities.

Ground instructor training

In addition to Aviator Training and Qualification, HHI will train 16 ground instructors for the USAAVNC. Eight will be trained as CWEPT platform trainers. Eight will be trained as platform instructors on the computerized aircraft systems trainers.

During IKPT the USAAVNC will validate their APACHE Combat Skills Course which will be conducted at YPG and will include live firing of the HELLFIRE missile.

USAAVNC is currently developing and validating a PNVS qualification course at Fort Rucker. This course will utilize PNVS surrogate aircraft and USAAVNC personnel previously qualified in these aircraft during the R&D phase.

Upon completion of IKPT, the AH-64 AQC, PNVS Qualification Course and Combat Skills Course will be fused together and will become the full blown APACHE Qualification Course at the USAAVNC.

Aviator qualification requirements for selection to attend the APACHE Qualification Course are: AH-1S qualified with at least one utilization tour, instrument rated, NOE qualified, NVS goggle qualification is desired by not required. Class II physical is required. Present equipment precludes acceptance of aviators who require glasses.

In summary, the APACHE Training and Qualification Course is one of the most comprehensive and sophisticated ever developed by the Army. It is designed to produce highly proficient APACHE crew members, to fly and fight in the world's most advanced attack helicopter giving them the margin of victory needed on future battlefields. IIIII

TRANSMISSIONS
BY
Litton Precision Gear
Chicago, Illinois


Engine Nose Gearbox

Main Transmission


IN PRODUCTION


Engine Nose Gearbox


U.S. Army/Hughes AH-64A APACHE

Colt Industries

Menasco Inc
California Division

TRAINING OUR PEOPLE HOW TO FIGHT

BY MAJOR GENERAL BOBBY J. MADDOX

A new era for Army Aviation will begin in January 1985. That is when training and qualification of aviators destined to fight in the world's most sophisticated attack helicopter, the AH-64 APACHE, will start.

Because of the complexity of the AH-64 and the length of the training programs, all APACHE aviators will be trained at the U.S. Army Aviation Center, Fort Rucker, AL, rather than by New Equipment Training Teams at individual unit locations.

COBRA experience a requirement

Those selected to fly the APACHE will already be qualified in the AH-1S COBRA and will have had field experience with at least one COBRA unit. When they arrive at Fort Rucker, they will be enrolled in the 14-week, 3-phase AH-64 APACHE **Aviator Qualification Course (AQC),** which will cover 80 flight hours and 156 classroom hours. That flight time will be a combination of actual aircraft, AH-1S **Pilot Night Vision Sensor (PNVS)** Surrogate, and **Combat Mission Simulator (CMS)** flight time. Additionally, there will be an extra 32 hours of flight experience in the **Cockpit, Weapons and Emergency Procedures Trainer (CWEPT)** during the academic portion.

This program may seem extensive to the uninitiated; however, one must keep in mind that never before in Army Aviation's history has there been so much firepower and capability available in one aircraft for the aviator to manage!

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MAJOR GENERAL BOBBY J. MADDOX IS CHIEF OF THE ARMY AVIATION BRANCH AND COMMANDING GENERAL OF THE U.S. ARMY AVIATION CENTER AND FORT RUCKER.

Phase one of the course, PNVS qualification, will teach APACHE aviators to fly with reference only to thermal sensor imagery and flight parameter symbology. Instruction occurs in the AH-1S PNVS Surrogate aircraft which has the same PNVS system as the AH-64. Most of this phase will be flown during daylight using blackout curtains, affectionately known as "the bag."

The "bag" will be used to seal the rear cockpit where the transitioning aviator flies essentially creating night time conditions. Use of those curtains provides an important safety factor because the instructor pilot in the front seat will be in a daylight environment. Additionally, the transitioning pilot will be prevented from using any cues other than those presented on his helmet display unit as reference for control of the aircraft.

Night flight experience

The "bag" will be removed in the final portion of the PNVS training to provide night flight experience, using a combination of PNVS and outside-the-cockpit Night Hawk type visual cues. Data obtained from the AH-64 Operational Test II and the PNVS Training Effectiveness Analysis indicate that PNVS qualification is the most crucial phase of AH-64 training. If an individual can successfully complete this phase, the probability of completion of the remainder of the course is very high.

Having mastered PNVS flight, the aviator will enter the second phase of instruction, AH-64 basic flight transition training. The objective of this phase will be to train aviators to operate the aircraft and all of its subsystems. Training will include basic weapons systems gunnery, terrain flight, nap-of-the-earth techniques and DOP-

PLER navigation operations. Use of part-task trainers and the CMS will enhance the overall training, as well as provide a means to train tasks that cannot safely or economically be accomplished in the aircraft.

Learning combat skills

Once proficient at AH-64 operator skills, the aviator must then learn to tactically employ the aircraft as an integrated fighting system. This occurs in the most important phase, Combat Skills. Each aviator will learn how to apply his previously acquired operator skills in a simulated tactical threat environment while flying 13 simulated combat scenarios. He will learn how to fight the AH-64 in the CMS. With the realistic threat forces, the CMS will have the capability to engage and "kill" the transitioning aviator's "aircraft." However, the aviator can learn to defeat the threat and survive once he masters the use of the full complement of operational AH-64 weapons systems, aircraft survivability equipment and maneuverability available in the CMS.

As with any aircraft, instructor pilots will be required. Previously qualified and experienced AH-1S IPs who are designated to be AH-64 instructor pilots and who complete AQC will attend a two-week add-on instructor pilot course. Once AH-64 qualified aviators begin to return from the field in FY 87, this course will be replaced by a full-scale Instructor Pilot Methods of Instruction Course.

APACHE AQC will be an extremely demanding course of instruction for which only the best and most highly motivated AH-1S aviators will be selected. Due to the complexity of the AH-64, the cost of the HELLFIRE missile, and the fact that ranges at Fort Rucker, as at most other installations, cannot accommodate realistic employment of the TADS laser or HELLFIRE missile, training devices are critical for total systems training of an AH-64 aviator. This training program and the incorporation of the CMS and other training devices into the instruction will result in an AH-64 aviator who is both technically and tactically proficient upon graduation.

Our Goal: Combat Readiness

Our goal at the U.S. Army Aviation Center is to provide the Army with combat ready, combined arms oriented aviators who are ready to fight in the AH-64 at any time under the extremes of weather.

We are proud to welcome the AH-64 APACHE into the Combined Arms Team. This aircraft, with properly trained crews, will be a significant force multiplier to the Total Force. IIIII

USATC seeks to honor deceased personnel

The U.S. Army Transportation Center at Fort Eustis, Va., is seeking the names of deceased U.S. Army Transportation Corps personnel for memorialization at various sites on the post. Those persons knowing of suitable candidates should submit their names and accompanying justification of no more than two pages to Dennis Mroczkowski, Director, U.S. Army Transportation Museum, Fort Eustis, Va. 23604.

The justification should include the individual's accomplishments and contributions to the U.S. Army and, specifically, his or her contributions to the Transportation Corps.

CW4 Dumas is AAAA's "High Timer"

CW4 James K. Dumas of Aurora, Colo., posted the highest individual flight time total in the December, 1983 "Who's Who in AWO Aviation" Directory. Dumas had 14,043 flight hours. The listing incorrectly placed CW2 Ernest W. Frost in the No. 1 position with 16,000 hours; Frost has 1,600 hours. Somewhere, somehow our input operator or the IBM System 34 gave CW2 Frost a 14,400 hour boost. Our CW2s work hard and fly often, but not that often.

LOOKING AT APACHE AIRCREW TRAINERS

BY MAJOR ANTHONY SOBUL

AS with any military equipment program, the development of realistic training devices must be given a high priority in support of the fielding effort. Since the APACHE is now in production and the first aircraft is due at the USAAVNC this year, the Program Office has shifted its priorities not only to meet the production effort, but more importantly to support the fielding of the entire system.

Now this is not just last minute emphasis in the training area. Rather, the AAH Program has worked diligently since 1972 with PM TRADE, TRADOC, and the Commodity Commands to develop, validate and finalize configurations such that realistic, up-to-date trainers can be provided with the system hardware. This feat is not as simple as it may sound since lead times required for the development of sophisticated trainers is often longer than it takes to build the actual system. But in the case of the APACHE, foresight and the support of the APACHE Team has prevailed and we are now ready to field, with the APACHE, the most comprehensive set of aircrew training devices ever developed.

This year's article is an overview and update of Aircrew Training Devices from a previous article in the October 1982 issue. The Primary APACHE aircrew trainers include: The AH-64 **Combat Mission Simulator (CMS),** the **Cockpit Weapons Emergency Procedures Trainer (CWEPT),** the **Target Acquisition Designation Sight (TADS) Selected Task Trainer (STT)** and the **Simulated Laser Target** (SLT) device AN/GVT-1.

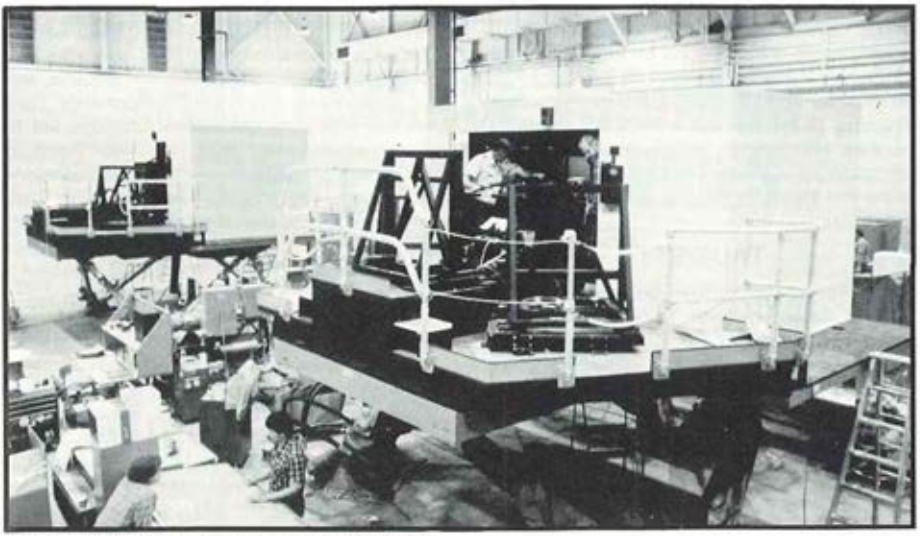
ABOUT THE AUTHOR:
WITHIN THE APACHE PROGRAM MANAGEMENT OFFICE, MAJOR "TONY" SOBUL IS RESPONSIBLE FOR COMBAT MISSION SIMULATOR (CMS) PRODUCTION AND FIELDING.

Combat Mission Simulator

The Singer-Link Company was awarded the prototype CMS contract by PM TRADE in July 1982 with a scheduled ready for training date at Fort Rucker in August 1985. Since that time, the top management responsibility of the CMS effort has been placed with the AAH Program Manager at St. Louis to insure CMS integration with the fielding support plan and to provide the necessary GFE for the construction of the device. While all functional responsibilities still remain with PM TRADE, this managerial relationship has proven quite beneficial by promoting closer working relationships with the two offices and providing the necessary support to get the CMS to the field on time.

The prototype CMS is considered an **Interim Combat Mission Simulator (ICMS)** because visual requirements for the device exceeded the current state-of-the-art visual technology available. However, this device will totally comply with all the other users' requirements. A parallel effort called the **Visual System Component Development Program (VSCDP)** has been initiated and upon development, it will be incorporated into the CMS. Funding has also been provided for a preplanned product improvement program to modernize the CMS. This incorporation is planned for the 1988 timeframe.

The CMS itself consists of pilot and co-pilot gunner stations which can simulate the capabilities of the actual APACHE. Each pilot/co-pilot module consists of a trainee station, instructor station and observer station with computer generated imagery for each and a central computer complex that can drive the modules in



A COMBAT MISSION SIMULATOR (CMS) IN PRODUCTION

an integrated/crew mode or as separate/independent training stations.

With training costs what they are, the Army can no longer afford to fly its aircraft or fire its weapon systems at a rate sufficient to maintain its personnel at a high state of readiness. This is especially true when flight hours cost around $3,000 per and HELLFIRE missiles cost over $40,000 each. It is, therefore, significantly important for the CMS to be part of the training fleet to keep those costs down while still providing a well-trained aviator who is ready for combat.

CWEPT

The **Combat Weapons Emergency Procedures Trainer (CWEPT)** shall be a full scale mockup crew station structure that encloses and supports the various components of the air crew station, pilot (rear) and co-pilot/gunner (front), plus an instructor console for each crew station which shall be designed to be electrically interconnected to either or both crew stations. The CWEPT will provide a means to instruct and develop pilot and co-pilot/gunner proficiency with basic operating, normal, and emergency procedures for the aircraft; and operating, normal, and emergency procedures for the mission and avionics equipment to the extent specified herein. The requirement exists to provide semi-independent training of each crew station.

The trainers representation of the air vehicle's geographical position, velocities and acceleration shall be identical in both cockpits as on entity. The master caution and warning panel and the caution warning and advisory panel shall operate independently by cockpit at the control of the instructor. Switches and controls, exclusive of flight, germain to each cockpit shall operate independently.

A coordinated team

There shall also exist the capability to integrate into a coordinated team effort the tasks of the pilot and co-pilot/gunner as a crew to depict overall systems operation of the aircraft. Procedure operations shall provide effective training in most of the procedures for which the aircraft is capable. Simulation of the CWEPT crew station instruments and displays video shall reflect appropriate response to aircrew functions, control inputs, or instructor inputs with respect to aircraft parameters without utilizing complex visuals. CWEPT crew station controls shall be monitored to the extent specified herein to provide the instructor an indication of the procedure initiated by the pilot or the co-pilot/gunner.

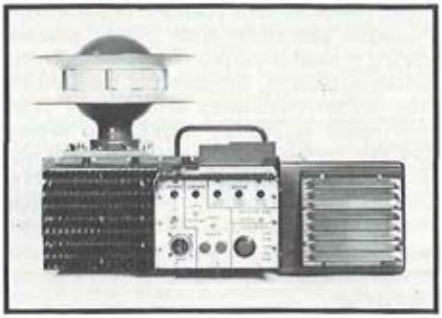
The CWEPT will be used to support institutional training at Fort Rucker for the AH-64 Aviator Qualification Course and the Instructor Pilot courses as well as **Instructor Key Personnel Training (IKPT)** at Yuma, Arizona. Currently, Hughes Helicopters, Incorporated, the prime contractor, is in the final stages of development of the first trainer for delivery to Mesa, Arizona in July to support IKPT.

TADS/STT

The **Target Acquisition Designation Sight (TADS) Selected Task Trainer (STT)** was designed specifically to support initial co-pilot/gunner qualification and refresher training in the AH-64 and in maintenance of TADS proficiency during mission and continuation training in field units. The device was also designed to support instructor pilot training.

The device's principal characteristics provide for exact replication of the actual **Optical Relay Tube (ORT),** including the Heads Down Display and Heads Out Display. The trainee will experience comparable operating characteristics of the actual system to include resolution, field of view, gimbal limits, and performance parameters. Weapons simulation functions will be representative of those in the CWEPT and actual aircraft. Additional capability includes use as either an instructor-prompted or self-prompted device with the same video scene being presented to the trainee available to the instructor on a separate monitor.

ABOVE: TADS/STT BELOW: SIMULATED LASER TARGET



The Phase II TADS/STT (originally called ORT) developed for the Operational Test II and Aviator Training in November 1981 will be upgraded (Phase III unit) with extended training capabilities to include an improved visual system, TADS and Weapons Sysem Simulation, Light Weight Doppler Navigation, Aircraft Motion, and Performance Monitoring and Scoring. Two of the Phase III units will be delivered to support contractor training and follow-on IKPT at Mesa, Arizona, with an additional two due at Fort Rucker in September 1984 to support institutional training.

Simulated Laser Target (SLT)

The SLT has been designed to provide eye-safe laser pulses to laser seekers for pilot/co-pilot gunner training. As an off-the-shelf, small, man-portable signal service, it will be used in conjunction with HELLFIRE Training Missiles to provide realistic training for the APACHE aircrew. By using this device aircrews will be able to practice various combat skill tasks which they otherwise could not do because of safety constraints. Current plans call for procurement of 250 devices from Martin Marietta at Orlando, Florida, pending sufficient funding availability.

Meeting user needs

In summary, the APACHE Team has worked to develop and procure a sophisticated, comprehensive set of aircrew training devices to support the user in the field. Emphasis has been placed on these devices to insure that they meet user needs and will be integrated with the fielding effort to fully support the training base as well as the follow-on maintenance of aircrew proficiency.

This effort will not only provide effective, realistic training resulting in a combat ready force but will do so at a much lower cost. IIIII

MAINTENANCE TRAINING COURSES AND DEVICES

BY RICHARD C. WALTERS

THE APACHE is here and all Logistics thrusts are focused squarely on introduction of this super-copter into the TRADOC training base and subsequently into FORSCOM and USAREUR.

During the Full-Scale Engineering phase the training community came to the realization that the "Apache" with its assciociated complex systems and its schedule for fielding did not fit the traditional **New Equipment Training (NET)** mold. To do the things that had to be done and to do them within the time available, a radical new approach to NET establishing the resident training base had to be pursued.

With the assistance of the cognizant MRC's, TRADOC-TSM's, the proponent schools, DARCOM, DA and MILPERCEN (not to mention the prime contractors HHI, MMC, RIC and RCA) the task was undertaken with these simple ground rules:

- Do it right the first time.
- Eliminate duplication and redundancy.
- Have it done on time.
- Coordinate, coordinate, coordinate.

The way it turns out if you do the latter diligently, i.e., coordinate, coordinate, coordinate, the others are accomplished as a matter of fact.

The following are a few of the more critical aims pursued:

- Have contactor(s) develop curriculum in consonance with the receiving schools format and requirements with In-Process Reviews by the training community throughout its development.

ABOUT THE AUTHOR:
RICHARD C. WALTERS IS CHIEF, MAINTENANCE AND TRAINING BRANCH, IN THE LOGISTICS MANAGEMENT DIVISION IN THE AAH PROGRAM MANAGER'S OFFICE.

- Contract with the prime contractors for approved training devices to be developed in conjunction with the Logistics support analysis, task analysis and training analysis with In-Process Reviews by the training community throughout their development.
- Develop technical manuals concurrent with the above with In-Process Reviews by the training and technical publication community throughout their development.
- Identify and procure Initial Bench Maintenance Components. Define these requirements through the LSA Process and full participation of the training community.
- Transfer knowledge to the resident training base by contractors onsite in lieu of NET. With this concept, the contractor will teach the Fort Eustis Maintenance Instructors during the first iteration of training then act as assistants to the Military Instructors during the second iteration.

The following represents those Maintenance Courses and Maintenance Training Devices to be introduced into the Transportation School starting September 1984:

Maintenance Courses

- Advanced Attack Helicopter Repairer Course, MOS 67R, 264 hrs
- Advanced Attack Helicopter Technical Inspector Course, MOS 66R, 120 hrs
- Aircraft Pneudraulics Repairer Course, MOS 68H, 160 hrs
- Aircraft Electrician Course, MOS 68F, 160 hrs
- Aircraft Powertrain Repairer Course, MOS 68D, 144 hrs

- Aircraft Powerplant Repairer Course, MOS 68B, 160 Hours
- Aircraft Armament Technical Inspector Course, MOS 66J, 120 Hours
- Aircraft Armament/Fire Control System (FCS) Repairer Course, MOS 68J, 280 Hours
- Aircraft Weapons System Repairer Course, MOS 68M, 240 Hours

Maintenance Training Devices

(By Type)

Aircraft Equipment Trainers (AET)

Nomenclature	Quantity
AH-64A Composite	1 each
AH-64A Flight Control/Powertrain	1 each
AH-64A Engine/APU	1 each
AH-64A Armament/FCS/Visionics	1 each

Classroom Panel

Nomenclature	Quantity
AH-64 Fuel System	1 each
Electrical System	1 each
Mission Equipment	1 each
Hydraulic System	1 each
Pressurized Air System	1 each
Digital Automatic Stabzn Equipment	1 each
Fault Detection Location System	1 each
De-Ice System	1 each

Individual Panel

Nomenclature	Quantity
Mission Equipment	14 each
Digital Automatic Stabzn Equipment	3 each
Electrical	3 each

The following represents those maintenance courses to be introduced into the Fort Gordon Signal School starting in September 1984. (Note: The OQ290V2/MSM ATE will be initially taught at RCA, Burlington, Massachusetts, prior to transition to the resident training base.)

Maintenance Courses

- Avionics (AVUM) Mechanics Course, MOS 35K, 80 Hours.
- Automatic Test Equipment (ATE) Operator Course, MOS 35C20, 115 Hours.
- ATE Repairer Course, MOS 35C30, 82 Hours.

Maintenance Training Devices

Nomenclature	Type	Qty
Integrated Avionics	AET	2 each

The intense training activity will commence in July 1984 with the trainers and Bench Maintenance Components being progressively delivered to the schools for installation and checkout to support a training start of September 1984.

The transfer of knowledge from the contractor to the resident schools is intended to be completed by mid-January 1985 with the schools fully operational by February 1985.

The preceeding plan is viable and do-able only if the close cooperation of all concerned continues and the degree of "coordination, coordination, coordination" presently enjoyed, continues. With that coordination, the Army will receive a supportable AH-64A of which we all can be proud.

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ATE: NECESSARY FOR AAH SUPPORTABILITY

BY MAJOR DAVID B. AARONSON

FROM the outset of the **Advanced Attack Helicopter (AAH)** Program, supportability has been a high priority item and as we near fielding, it becomes more important.

The AAH Program Manager, in conjunction with Hughes Helicopters, Incorporated (HHI), RCA,Martin Marietta Aerospace (MMA), the TRADOC community and the Commodity Commands has worked diligently since 1977 to develop one of the most comrpehensive automatic testing capabilities ever produced to support a fielded weapon system. This support will be provided by the OQ 290 (V)2/MSM Electronic Equipment Test Facility.

ATE and how it works

The APACHE Electronic Equipment Test Facility utilizes computer based **Automatic Test Equipment (ATE)** to test and diagnose failures in APACHE aircraft components. This is accomplished by providing stimuli to the units under test, which simulates the aircraft environment, and then measuring the results to determine the faulty parts within the tested components.

We start with an AN/USM 410 ATE, similar to the ATE now found in the AN/MSM 105 (V)1 system fielded in USAREUR. It is comprised of a computer, power supplies, input and output devices, equipment necessary for control, and a station which allows the ATE to interface with the equipment under test. To this basic set we add equipment that is necessary to test APACHE peculiar aircraft components; a programmable 400 Hz power supply, a pneumatic module, video monitor, photometer, and an additional interface station.

Examples of APACHE systems requiring this augmentation are the Air Data Subsystem, HELLFIRE Subsystem and the **Integrated Helmet and Display Sighting System (IHADSS).** The basic AN/USM 410 and APACHE peculiar augmentation are produced for the Army by RCA in Burlington, MA, under subcontract to HHI.

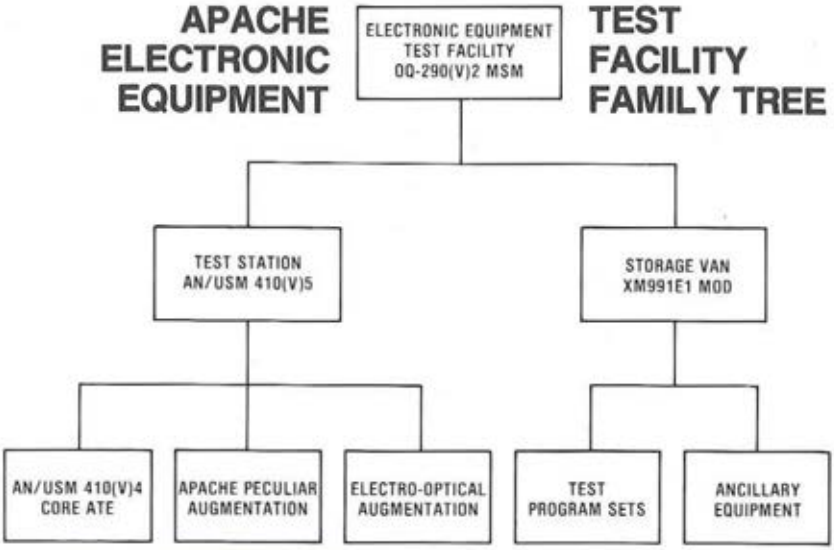
Also incorporated into the APACHE ATE is a unique electro-optical test capability for use with the TADS/PNVS related aircraft components. The electro-optical bench is a precision device which will provide to the field a capability that previously required time consuming and subjective analysis of complex data to test and diagnose failure in electro-optical components. The measurement and analysis is now done automatically with a high degree of accuracy and represents a first for Army ATE. The Electro-Optical Augmentation is being produced by Martin Marietta Aerospace, Orlando, FL.

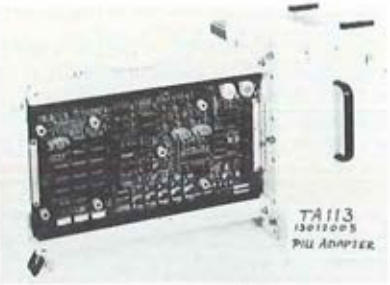
Lead-in: A Test Program Set

To allow the Automatic Test Equipment to do its job, each component that will be tested required a **Test Program Set (TPS).** A TPS is comprised of a computer program, cabling, interface devices and any special documentation that might be required. The computer program instructs both the ATE and the operator how to test the particular component, and the cabling and interface device provide the electronic connection between units under test and the ATE. Approximately 180 TPS's are being developed for fielding to the **Aviation Intermediate Maintenance (AVIM)** units.

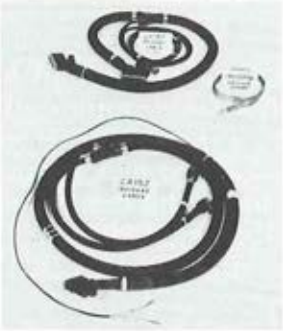
ABOUT THE AUTHOR:
MAJOR AARONSON SERVES AS THE R&D COORDINATOR FOR THE AAH AND IS RESPONSIBLE FOR DEVELOPMENT OF AUTOMATIC TEST EQUIPMENT (ATE).

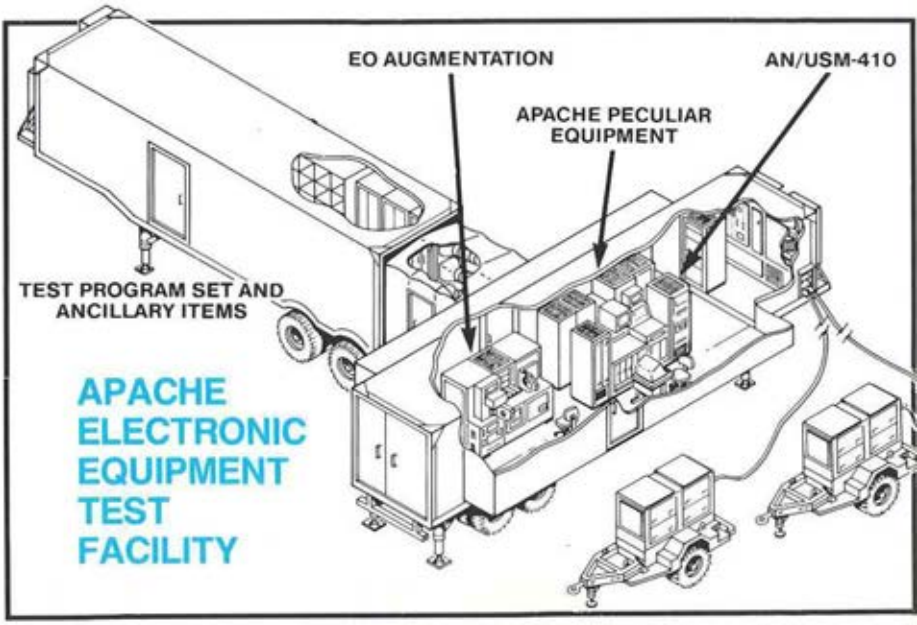
APACHE ELECTRONIC EQUIPMENT TEST FACILITY FAMILY TREE





TYPICAL TEST PROGRAM SET





All the Automatic Test Equipment is housed in an expandable 35 foot environmentally controlled semi-trailer van. The van, when in the transport mode, is the normal width of 8 feet. When deployed, however, it expands to 14.8 feet and provides a spacious mobile shop for the testing of APACHE aircraft components. As a companion to the expandable test van, we are fielding a standard 35 foot non-expandable semi-trailer van (XM991E1 Mod). When deployed, it will be physically connected to the test van by a passageway and will be custom configured on the interior to store all test program sets and ancillary equipment. The development and production of the expandable van, the modification of the storage van and the integration of the equipment into each is being accomplished by RCA, Burlington, again, under subcontract to Hughes Helicopters, Incorporated.

The APACHE Electronic Equipment Test Facility will be operated by MOS 35C personnel, who will be trained at Fort Gordon, GA. Preliminary training was conducted during November-December 1983 at RCA, Burlington, for six Fort Gordon personnel. These soldiers then participated in a Physical Teardown/Logistics Demonstration also at RCA, in January-February of this year to validate maintenance procedures and insure the ATE is logistically supportable.

Field evaluation

Early this summer we will go to Fort Huachuca, Arizona, and evaluate the prototype test facility in an operational environment to ensure that we provide a system to the user which is both operationally effective and maintainable. This will be followed by a system being delivered to Fort Rucker in the fall to support the aircraft training base and one to Fort Gordon for the training of 35C personnel. The initial fielding of the test facility will be to Fort Hood early next year.

In summary, the AAH Program Manager's Office has systematically developed a facility that extends to U.S. Army Field units a consolidated capability heretofore only found in many separate TMDE test sets. This capability will greatly enhance the AVIM mobility and supportability of the APACHE allowing it to be smoothly integrated into the modernized Army combat forces.

"THE SURVIVOR"...to the target and at the target

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Instruments & Life Support Division

POST DEPLOYMENT SOFTWARE SUPPORT

BY JULIUS ROMANO

THE APACHE mission equipment package is an integrated avionics and distributed processing fire control system which incorporates a variety of microprocessors intermeshed in a closed loop operation and communicating through a **multiplex subsystem (MUX).**

Thirteen different subsystems contain significant amounts of computer software functionally organized to provide a total system software for the employment and control of the APACHE. In addition to the onboard computer software, **Ground Support Equipment (GSE)** software is extensively utilized to support the onboard equipment systems. This includes the software required to automatically test equipment, the trainer software, and the software required to operate and maintain the equipment to support the software.

The impact of software changes

It is a well known fact that the majority of software cost occurs in maintenance during the post deployment phase rather than during the development phase. During deployment, software changes will be required for various reasons from correction to meet original requirements, to changes needed to meet new requirements. A main advantage of computer software is that the system function can be changed easily without impacting weight or volume. However, unlike hardware, there are no visible products available for evaluation except the formal documentation. This gives rise to a complex process requiring careful integration of diverse disciplines, technical activities and management controls. Within the complexity of the APACHE software dependent system, each change must be treated from a modular, subsystem, and total system aspect. Each change must be verified and validated, interfaced, documented, and configuration managed. It is the composite of these capabilities that make up **Post Deployment Software Support (PDSS).** Without PDSS, a system is not supportable regardless of the integrity of hardware definition and documentation. The APACHE Program Manager has recognized the need for total supportability and to this end has undertaken the task to develop the APACHE **Post Deployment Software Support Facility (PDSSF)** consistent with the policies of DOD Directive 5000.29.

The APACHE computer resources

The APACHE computer resources consist of computers, **Computer Program Configuration Items (CPCIs)** and software documentation for the onboard systems, the trainer systems, GSE and the PDSSF itself. The onboard computer resources consist of 13 CPCIs optimized under the distributed processing and integrated Multiplex Bus **(MUX)** techniques. These computers, more appropriately called microprocessors, perform the necessary computations and logic commands to define the APACHE's weapon firing modes and constraints and to deliver munitions on target. In addition, these microprocessors provide navigation and backup (fly by wire) flight control capabilities.

The trainer systems make up five CPCIs. This software provides the capabilities to identify and produce maintenance tasks related to the air

ABOUT THE AUTHOR:
WORKING WITH 13 DIFFERENT SUBSYSTEMS, JULIUS ROMANO IS THE AAH PMO ENGINEER RESPONSIBLE FOR THE DEVELOPMENT OF APPROPRIATE SOFTWARE.

craft subsystems and familiarize crewmembers with the crew stations' controls and displays.

The GSE includes the **AN/USM-410 Automatic Test Equipment (ATE)** System which is a Data General Eclipse minicomputer based system. The ATE system provides for automatic testing and fault isolation of electronic components. The ATE includes a Test and Repair Subsystem, AVIM capability, a Peculiar Subsystem, Electro Optical Subsystem and operating system software. **Test Program Sets (TPSs)** control specific functional and fault isolation testing on a **Unit Under Test (UUT).** These test programs are prepared at the source language level and interface with the operating system software. The TPS consists of the test program, test program instructions, interface device and supplementary data utilized to test units on the AVIM test station.

The **Government Furnished Equipment (GFE)** computer resources consist of two CPCIs embedded in the **Target Acquisition Designation System (TADS)** and are part of the 13 total onboard CPCIs.

Finally, the PDSSF computer resources consists of the hardware and software resources required to meet the requirements for PDSS and to operate and maintain the PDSSF itself.

The vital tool

The APACHE PDSSF is the tool required to support the totality of the long-term APACHE software maintenance tasks. "Maintenance" is used here to refer to software changes rather than to "repair". The "ones" and the "zeros" that combine to make up instruction words do not deteriorate or fail as mechanical or electronic components do, so software has no need whatsoever for maintenance in the usual repair sense.

The APACHE PDSSF is functionally made up of two elements: the **Software Support Station (SSS)** and the **Software Support Library (SSL).** The SSS is a collection of hardware, software and formal documentation that provides the capability to modify, verify, and validate changes to the APACHE software independent of the original designer. The SSL provides for maintaining configuration-managed software documentation, recording program changes and their rationale, traceability of changes, status of software programs, software quality assurance and configuration management procedures, and maintenance of machine readable source and object codes. The SSL also contains a set of documentation of all onboard, trainer, GFE, ATE TPSs, PDSSF and PDSSF maintenance and operation procedures manuals.

The development of the APACHE PDSSF is in accordance with a contractual statement of requirements. Implementation of these requirements follow the details stipulated in the **APACHE PDSSF Development Plan (PDSSF-DP)** where each approach implementing a requirement is evaluated as alternatives and deemed most cost effective. The PDSSFDP is a Government/Contractor living document stipulating exactly how each PDSSF requirement is to be satisfied.

What the facility can do

The basic capabilities of the PDSSF are:

- Source Code Assembly and Compilation
- Program Listings and Cross Reference Printouts
- Access to Program Memory
- On-line Access — Debug Modes
- Program Control
- Program Execution
- Verification and Validation
- Library Capabilities

Assembly and compilation of source data, storage of resultant object modules and generation of executable load modules are provided using a host computer based assembler system. The assemblers for the onboard CPCIs are based on the **System Engineering Laboratory (SEL)** Model 32/55 host computer. SEL-based assemblers allow commonality of user interface and output format since there is only one basic procedure. The ATE source code is produced by its own station. Source code assembly and compilation for trainer devices is currently under study.

Access to mass storage is accomplished in part by mapped programming execution in conjunction with the SEL host computer. Information on disc packs is either written to or read from text files containing 80-character words, 72 characters of printable ASCII data and eight characters of sequence numbers. These files are used as source input to the CPCI assemblers, the MUX Data Base programs, the standard SEL programs, and other programs.

With this feature, the program editor can add, delete, copy or modify program lines.

On-line access requirements are met by implementing a **Software Emulation Development System (SEDS).** The Hi-Level DS 370 system was chosen for this task because of its versatility to support any of the **Programmable Read Only Memories (PROMs)** and **Random Access Memories (RAMs)** used in the onboard CPCIs. In general, the DS 370 provides a writable control store RAM to replace the control store PROMs of the CPCI memory. A trace capability allows tracking of micro-instructions throughout the multibus paths within the memory architecture.

Program control is also achieved by implementation of a SEDS. The onboard CPCIs are composed of eight, 16, and bit-slice architectures. A TEKTRONIX Model 8540 SEDS is being considered for this eight and 16 bit architectures while the DS 370 emulation system will be used for the bit-slice machines. The 8540 system consists of an emulator pod with support software, logic analyzer, and a RS 232 communication link. The system replaces the microprocessor of the CPCI by way of the interface pod. The software emulation processor of the 8540 operates in a mode that is transparent to the CPCI and provides the host computer with direct memory access and interrupt capabilities. The logic analyzer is used for analysis, debugging, verification, and software performance evaluation.

Testing software functions

The capability to support CPCI software functions testing is also provided by the SEDS. Modified CPCI hardware is used to obtain access to the **Central Processor Unit (CPU)** and PROM to allow the unit to be integrated into the software emulation system that supports CPCI level tests. Integrated CPCI level tests will provide the capability to execute any function described in the CPCI specification and can be explicitly demonstrated in a pseudo system environment.

A Software Development Center developed by the trainer contractors is being considered as part of the PDSSF to support the five trainer CPCIs. Each trainer is actually supported by a computer, core memory, mass storage system, bus controller, compiler, and operating system. Under no alternative will the trainers become an integral part of the PDSSF. While a trainer software modification can be developed and tested in the PDSSF, final validation of the change will be accomplished on the actual trainers.

All in one place

The **PDSS Library (PDSSL)** is responsible for the storage and maintenance of all APACHE onboard, ATE, and trainer software media and documentation. It also supports software configuration management. Storage maintenance and change control are supported by the SEL host computer which is part of the PDSSL.

Each CPCI is represented by ten (10) different types of software files in the PDSSL. They are:

- Program Source Files
- Program Listing Files
- Program Object Files
- Program Load Files
- Program Revision Files
- Program Revision Logs
- Program Execution Task Files
- Program CPCI Executive Task Files
- Program Scenario Files
- Program Flow Chart Files

The SEL Computer and a word processing station supports the PDSSL. All the files are stored on magnetic tapes. The word processing station is a stand alone Wang Model OIS 115-2 station consisting of a line printer, a CPU/Winchester desk unit, and two video display terminals. This station is used to create and update PDSSL documentation. Processing of files is accomplished on the SEL computer. A **Data Base Management System (DBMS)** is planned to accomplish the tasks of file research, sorting, modification, and report generation.

The ATE System, TPSs, and supporting devices will be provided within the PDSSF. These systems have the inherent capability to evaluate design, development, and testing design change.

A first for the Army

In conclusion, the APACHE PDSSF will provide total system software support for the life cycle of the APACHE. When completed, it will be the Army's first major software support center capable of independently maintaining and controlling all aspects of the APACHE computer resources. IIIII

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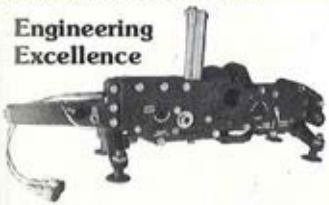

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APACHE: ON THE ROAD AGAIN

BY MAJOR (P) SAMUEL D. WYMAN, III

THE APACHE made its national and international debut in 1982. The CONUS portion stopped at twelve installations to give the Army community a firsthand look at the new APACHE.

The international portion not only presented the APACHE to USAREUR forces, but also included a demonstration to the West German Government by **Hughes Helicopters, Incorporated (HHI),** a visit to SHAPE Headquarters and General Rogers, the APACHE's first crossing of the English Channel and the Farnborough Airshow — the capstone of the entire tour. To say the least, 1982 was a very busy year for the APACHE. The CONUS and European tours gave most of the aviation community their first glimpse of the promised APACHE.

A workout in the desert

Nineteen hundred and eighty-three found the APACHE on the road again. This time to Israel with a stop-off at the Paris Airshow. The following is a glimpse of the APACHE on its overseas trip:

The same prototype APACHE that trekked across the U.S. and Europe in 1982 was prepared and loaded with its ground support equipment into an Air Force C5A at the Marine Corps Air Station in Yuma, AZ, for its trip to Tel Aviv, Israel. The purposes for going halfway around the world were to conduct a detailed quantitative and qualitative **sand erosion test (SET)** so that the effects of the actual Middle East environment could be verified on the APACHE and, while there, honor a request by the Government of Israel with a demonstration of the APACHE's capabilities. The various types of sand found in Israel are representative of those throughout the entire Mid-East region and are remarkably different from those found where the APACHE has been previously tested.

While enroute to Israel, the APACHE stopped in Germany and was leased to HHI for the Paris Airshow. When the APACHE arrived at Rhein Main Air Base it was ferried to Finthen Army Airfield, home of the 8th Aviation Battalion (Combat), 8th Infantry Division. Finthen became the temporary home for the APACHE during the lease transfer from the Army to HHI and back again. The soldiers of the 8th AB(C) and especially those of the host unit, D Co, provided the APACHE with outstanding support and friendly hospitality.

Who was escorting who?

HHI took the APACHE to the Paris Airshow where it created quite a stir among the aerospace community and visitors. An interesting happening occurred enroute to Paris from Finthen. The weather was typically European-marginal albeit legal. The HHI escort aircraft accompanying the APACHE required the APACHE to navigate for him. While the APACHE was proceeding comfortably along with its precise navigation system and visionic aids, the escort aircraft kept falling further behind until it was obvious that he would have to wait for better weather the next day. This is a practical example showing only in a small way, the capability of the APACHE with its state-of-the-art systems.

Normally "jets" draw all the attention at the

ABOUT THE AUTHOR:
MAJOR "SAM" WYMAN SERVES AS THE ASSISTANT PROGRAM MANAGER FOR INTERNATIONAL OPERATIONS IN THE APACHE PROGRAM MANAGEMENT OFFICE.

ISRAELI SOLDIERS ASSIST IN LOADING AN APACHE DURING A DEMONSTRATION IN ISRAEL.

big international airshows, but this time at Paris the APACHE was the notable exception to that rule. The APACHE aptly demonstrated for all to see that it is truly a "Total System For Battle" giving the tactician battlefield superiority and the strategist new flexibility in applying the principles of war. The APACHE piqued the interest of the world's aerospace experts because of its performance and integrated technology.

Representatives from countries were given orientation rides in the APACHE, each one being entranced with APACHE's capabilities. **Martin Marietta Aerospace (MMA),** manufacturer of the TADS/PNVS, supplied HHI with a TADS trainer that was used to give selected VIPs a thorough briefing on the operation of the TADS. This enhanced the orientation rides and gave those who did not have a flight an opportunity to get some "hands on" experience with the system. When all the orientation flights and walk-around briefings were completed, all attending were convinced that the APACHE was not only the best helicopter around, but also the best new weapons system too. The time and effort spent by HHI at the Paris Airshow reawakened NATO's interest in the AH-64 and certainly kindled awareness of the APACHE in many of our other allies' eyes also. The APACHE left Paris after a week in the limelight to continue on its mission to Israel.

Returning to Finthen AAF, the APACHE team gathered its equipment, said its goodbyes and moved back to the Rhein Main Air Base staging area where it quickly loaded the APACHE back on a C5A and departed for a non-stop flight to Israel.

A warm welcome in Israel

Arriving in Israel on 8 June, after a short seven hour flight, the APACHE was met by a very warm welcome from a contingent of the **Israeli Air Force (IAF)** and met an equally warm, sunny day. The reason the IAF met the APACHE is that in Israel, everything that moves on the ground belongs to the Army and everything that flies in the air belongs to the Air Force. So the demonstration was to the IAF and not to the Israeli Army. Then it was time to unload and move to an IAF base just south of Tel Aviv which would be home for the APACHE for the next month during the demonstration to the IAF and the Sand Erosion Test.

The APACHE continued demonstrating its inherent reliability by being ready to start a demanding flight and performance evaluation the very next day after being on the road for over two weeks. IAF test pilots and maintenance managers were given a comprehensive ground school prior to the aircraft's arrival which made the IAF pilot's transition much quicker and provided the IAF maintenance personnel the background to properly evaluate the APACHE's reliability and maintainability.

The IAF pilots fell in love with the aircraft the first time they flew it. The first part of the evaluation, as stated above, was the "checking out" of IAF pilots. For each flight during the evaluation there was an HHI test pilot in command of the aircraft. The next portion of the evaluation was flight performance and handling qualities. Much to the IAF pilots surprise, not to ours, they could not believe the APACHE could operate at or above its primary mission gross weight in the hot Middle Eastern environment when days were hotter than the 95º F design day and have the agility and extra power margin that they

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found. The APACHE not only measures up on paper, but also out in the real world where it counts.

The remainder of the demonstration consisted of an operational evaluation of flying mission profiles in different configurations and in different locations throughout Israel to evaluate the flexiblity of the APACHE's mission capabilities. One such mission demonstrated the extended range capability by using two external fuel tanks with two racks of eight HELLFIRES each giving a deep interdiction capability. It was not only the flight performance that caught IAF pilots attention, but also the visionics (TADS/PNVS) and fire control. The TADS/PNVS proved to the IAF the night capability of the APACHE which adds another dimension to the battlefield. There is "night fighting" and then there is "night fighting." The APACHE is the system designed to win on the battlefield at night. The demonstration to the IAF showed this.

Sand erosion testing

After three weeks of exhaustive demonstration to the IAF, the APACHE entered one of its most demanding tests to date — The Sand Erosion Test. At the start of this test, the IAF provided a captured Soviet-made T-62 tank as a target for the APACHE. The APACHE, never having fired at an actual T-62 before, accepted the target offer. The firing was conducted on an operational mission profile. The APACHE navigated to a firing position in the desert, put the "laser spot" on the target, launched the HELLFIRE and killed the tank. **(See opposite).**

To say the least, the Sand Erosion Test started with a bang. Even though the HELLFIRE shot was spectacular to those who hadn't seen one before, and proved again the APACHE's capability, the real value of the two week sand test was in the drudgery of the daily routine of collecting ground and air samples of sand and dust to document the environment that the APACHE flew in during the course of the test.

The APACHE had been "baselined" at the beginning of the test so that measurements of the effects of sand erosion and dust ingestion could be correlated with the samples taken during the flights. For each flight, an escort helicopter (provided by the IAF) carrying members of the APACHE team would accompany the APACHE on its mission profile to photograph and retrieve samples of the sand and dust environment. Flight profiles were chosen to provide a variety of different types of sand that are found throughout the entire Mid-East region. The APACHE team members taking those pictures and samples got a real "taste" of the desert having to trudge through the 100° + F temperatures and blowing sand to get them. They'll not forget the Negev Desert for a long time.

The results of this extensive sand erosion tests are being used to validate performance predictions and maintenance procedures for the APACHE. The combination of the demonstration to the IAF and the sand erosion test provided over a months' time (54 flight hours operating in the Mid-East environment. This once again provided the APACHE's capability to do the job anywhere.

Heading home again

Celebrating the 4th of July in Israel, the APACHE team loaded up once more and on 5 July 83 headed home one more time. Everywhere the APACHE goes, there are new friends to make and new things to learn. This trip provided an abundance of both. The APACHE — on the road again. IIII

APACHE'S ITINERARY

20 May 1983. . . . . Trip Starts
24 May—5 June. . . . . Paris Airshow
8 June-24 June. . . Demonstration to USAREUR
25 June-3 July. . . . . Sand Erosion Test in Israel
7 July. . . . . Arrive Home

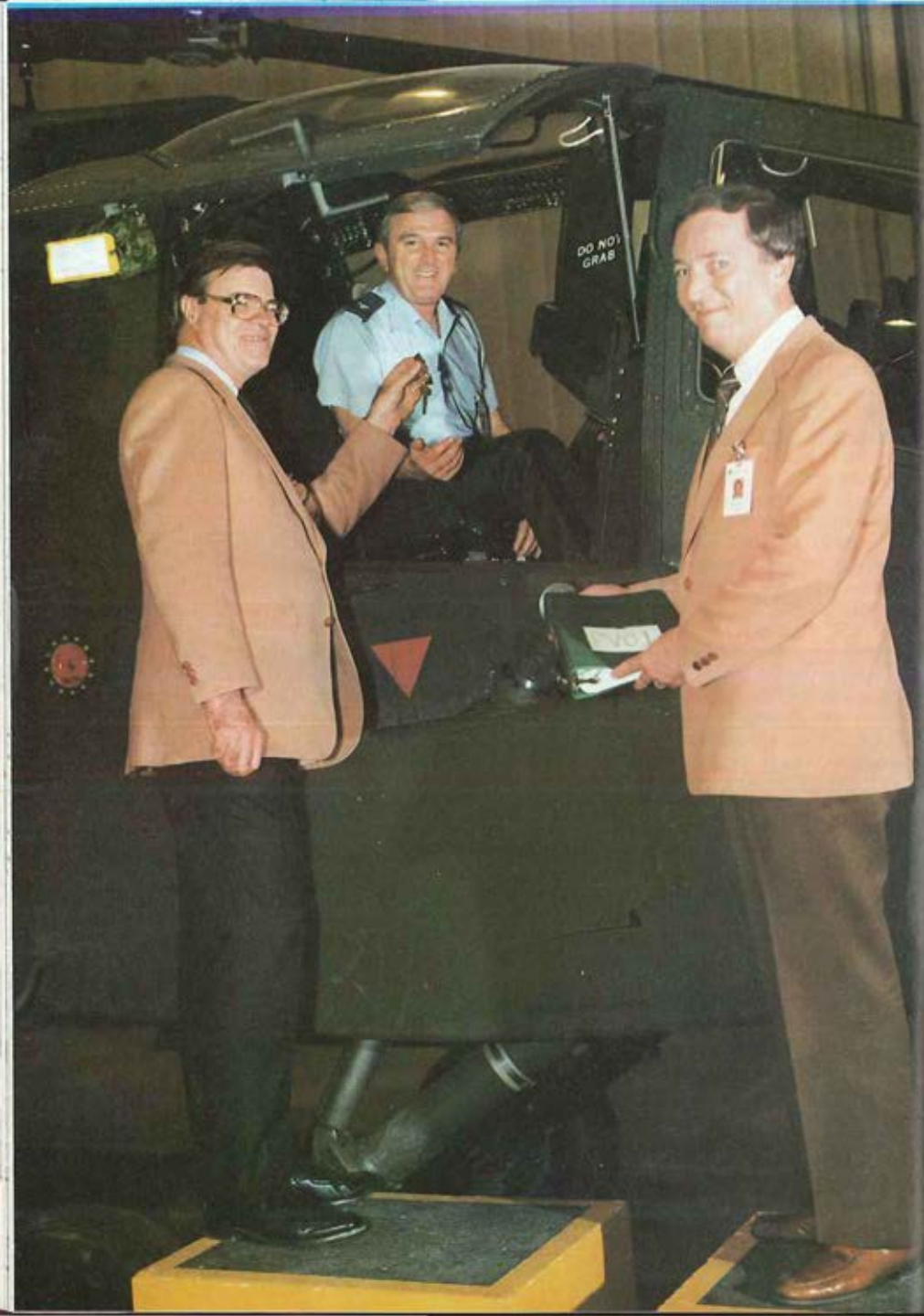
1983: APACHE ON THE ROAD AGAIN!

LEFT: Besides the daily flight routines at the Paris Airshow, the APACHE is also put on public display.

BELOW: APACHE departs an Israeli base to fly another evaluation mission profile.

LEFT: APACHE fires a HELLFIRE missile at a T-62 target tank during sand erosion testing in Israel.

BELOW: The captured T-62 target tank supplied by Israel.


DO NOT
GRAB

APACHE ACCEPTED ONE MONTH EARLY

BY BRIGADIER GENERAL (P) CHARLES F. DRENZ

ON January 26, 1984, the U.S. Army accepted delivery of the first production AH-64A APACHE attack helicopter at the Hughes Helicopters AH-64 Assembly and Flight Test Center in Mesa, Arizona.

Delivery of the first production APACHE took place only seventeen days after it made a textbook-perfect first flight on January 9, 1984, and one month ahead of contract delivery schedule. The initial thirty minute flight was conducted without incident, confirming the quality of work performed by the entire Hughes Helicopters APACHE Production Team.

A vigorous effort

Full-scale production of the APACHE began just ten months earlier, in March 1983, when the first APACHE fuselage arrived in Mesa from the Teledyne Ryan Aeronautical facilities in San Diego, California. Since then, Mesa assembly and flight test workers have labored diligently to produce a high quality "first article" for the U.S. Army. Current plans call for the production of 515 APACHEs by 1989.

The first production APACHE became Army property during a ceremony in which **Norm Hirsch** — Vice President of the AH-64 Program, and **Paul Henney** — Vice President and General Manager of the Mesa facility, completed official paperwork and presented the aircraft's logbook to **Colonel Joseph Campbell,** Commander of the U.S. Army Plant Representative Office at Hughes Helicopters.

During the past 11 years, the AH-64 program has passed many significant milestones on its way to becoming a fully mature weapon system.

From program inception in June 1973 throughout competitive development and fly-off, the AH-64 prototypes exhibited superior performance characteristics that resulted in the Army's selection of the Hughes AH-64 prototype as the best airframe for the engineering development and system integration phase of the program.

Hughes built five prototype APACHEs during development. All total, the prototypes have undergone more than 4,500 hours of rigorous testing before the first production APACHE began its historic journey down the assembly line in Mesa. Throughout the program, all of the APACHE's electronics, sensors, computers, and weapons were successfully integrated and tested. Rotor systems, flight controls, dynamic components, and aircraft structure were subjected to torture tests to verify that durability and survivability standards had been met.

High tech enhancements

Early in the development program, the weapons and sighting systems were upgraded. The Rockwell laser-guided HELLFIRE missile replaced the TOW anti-tank missile, the Hughes 30mm Chain Gun automatic cannon replaced the WECOM 30, and a more advanced **Target Acquisition and Designation Sight/Pilot Night Vision Sensor (TADS/PNVS)** system was chosen to replace the M-65 Tow Sight.

These decisions to move dramatically into emerging high technologies have significantly enhanced the combat capability of the APACHE, and have given the AH-64 day/night, all weather capability and the standoff ranges

LEFT: NORM HIRSH, VP, AH-64 PROGRAM, LEFT, AND PAUL HENNEY, MESA VP & GENERAL MANAGER, FLANK COL JOE CAMPBELL AT THE ACCEPTANCE.

needed to insure survivability. The addition of these advanced systems afford the knock-out punch required to fight out-numbered and win against hostile armored forces on the modern battlefield.

During the summer of 1981, prototype AH-64s completed a 3-month field exercise — Operational Test II — designed to prove their effectiveness in an operational environment. Three prototypes, operated and maintained by Army crews, were used in the tests and earned very favorable marks from the evaluators. In fact, operational data collected during the field tests clearly indicated that the AH-64 performed better than required by Army specifications.

To illustrate, a total of 412 flight hours were flown by the APACHEs during the tests at Ft. Hunter-Liggett. Army crews achieved a maintenance manhours per flight hour performance of 5.65, compared to the Army standard of 14.4; and, the Army-operated AH-64s recorded a mean time between failure rate of 21.1 hours, compared to the Army standard of 17 hours.

The statistical data demonstrate that fielded APACHEs will require significantly less maintenance time and support than other Army helicopters. Also, life cycle costs will be greatly reduced.

ABOVE: BG(P) "CHUCK" DRENZ, THE AAH PROGRAM MANAGER, CHECKS OUT THE COCKPIT.

By the end of August 1981, the prototypes had accumulated a combined flight time of more than 3,000 hours. Extensive and rigorous contractor testing, and the high marks received during the operational testing clearly indicated that the AH-64 was ready for production.

Although **President Reagan** had signed the Defense Bill authorizing the first year procurement of APACHEs in 1981, production wasn't formally launched until March 1982 when the **Defense System Acquisiton Review Council (DSARC)** gave the go-ahead. By then, the APACHE was the most thoroughly tested and proven helicopter weapons system ever made.

Entering a new era

With the delivery of the first production APACHE, the Army enters a new era of high performance and technology. The APACHE will provide commanders with reliabile and flexible firepower around-the-clock and in adverse weather to meet rapidly changing battlefield requirements. With the APACHE, Army Aviation joins forces with the Infantry, Armor, and Artillery as a full-fledged member of the Combined Arms Team. IIIII

FIRST ARTICLE TESTING

BY PAUL W. BASS
AND ROBERT D. HUBBARD

BY now, if you have been following the progress of the APACHE helicopter, you have probably heard statements like ". . . the most thoroughly tested helicopter ever" or "never has such an extensive development test program been conducted by any service prior to production. With more than 4,000 flight hours on the development aircraft, what can possibly still be required?"

These statements certainly have a basis. Perhaps an obvious question is then, "Why do you have to conduct the extensive first article testing planned for the program?" This short dissertation will hopefully answer the question and provide some detail.

Aim: No degradation of attributes

First article testing is a regulatory requirement that must show/validate successful transition from development to production. The test results must confirm that the attributes of the APACHE have not been degraded during the transition process to production. There are good and valid reasons for this Army requirement. While many examples can be given for the requirement, we will state a few in the various engineering disciplines.

During development, because of the very low procurement numbers, many mechanical components are fabricated using what is commonly referred to as "hogouts." "Hogouts" are basically the use of material billets and performing necessary machining operations to make the part. This is a time consuming and expensive process that could not be used in production to meet the rates required. So, in production these "hogouts" are transformed into castings or forgings. First article tests must confirm that the strength and operating characteristics of these components are not degraded.

Electrical wiring of prototype aircraft go through an evolutionary process during development. Most economical wire sizes and optimum wire or harness routings are of secondary importance. In production, the wire size and routings are optimized to take full advantage of production efficiencies. By the way, there are about 17 miles of wire in an APACHE.

Software patching along the way

On-board computer software is maintained in a readily changeable configuration during development. As discrepancies are found, "patches" are made to the software to correct the problem. In production, the software becomes a tightly controlled configuration end item. Including micro-processors, the APACHE has 13 computers with about a 380,000 word capacity. As can be readily seen, the challenge of confirming the production software is a formidable task.

In the Government's contract with Hughes Helicopters, a detailed matrix of individual first article test requirements has been laid out. The first two production APACHE helicopters (PV01 and PV02) have been specially prepared for the task by incorporating a large array of on-board instrumentation. PV01 has been designated the structural, performance and flight handling aircraft while PV02 is ear-marked as the systems test vehicle. Both of these aircraft have recently started the contractor portion of the first article

ABOUT THE AUTHORS:
PAUL W. BASS IS TEST PROGRAM COORDINATOR IN THE AAH PMO WHILE ROBERT D. HUBBARD IS CHIEF OF THE SYSTEMS ENGINEERING DIVISION, AAH PMO.

tests. During a span of approximately 10 months, both contractor and Government test pilots will execute the planned test requirements. Initial emphasis will be on PV01 in order to establish an operating flight envelope for all succeeding production aircraft. PV02 will concentrate on systems operations and accuracies.

1984 testing schedule

Figures 1 and **2** below portray a generalized plan for the conduct of the APACHE first article flight testing. Preceding the flight tests, there are extensive ground tests and checkouts. We anticipate that the actual duration of flight tests may be somewhat shorter than shown due to the use of modernized computer operated test and checkout equipment on the APACHE production line.

The periods shown as "Army Evaluation" are when Government testers from the **Army Engineering Flight Activity (AEFA)** of the **Aviation Systems Command (AVSCOM)** and the **Aviation Development Test Activity (ADTA)** of the **Test and Evaluation Command (TECOM)** make their independent judgments. We obviously do not repeat every data point achieved during development. The contractor spot checks data points validating performance and the Government tester makes a limited spot check of those data points deemed most critical to the total system performance and usage.

Not obvious from the above, or from the figures, are a number of related first article test activities. Certain mechanical and electronic components are undergoing **verification and validation (V&V)** testing. These tests are conducted in laboratories and cover such things as component level **electro-magnetic interference/electro-magnetic compatibility (EMI/EMC),** corrosion, fungus, fatigue, and static tests. In the main, this V&V testing is required due to producibility changes made during transition to production. Another important effort is the final qualification of **peculiar ground support equipment (PGSE).** Essentially, PGSE must go through the same type of tests as the aircraft. This effort is on-going and will be completed in time to meet deployment requirements. Automatic Test Equipment also follows the same basic procedures as outlined above and is discussed in another article in the magazine.

In summary, it is hoped that this short description will provide the reader with a better appreciation of the APACHE's first article test. The results of this test effort will provide the user with the best possible attack helicopter and insure the U.S. Army gets all the "bang" for the bucks it invested. IIIII

FIRST ARTICLE TESTING

FIGURE 1 — PV01

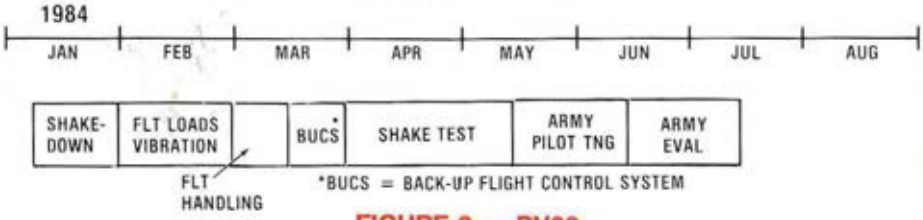
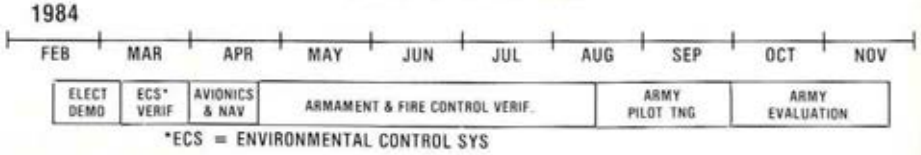


FIGURE 2 — PV02



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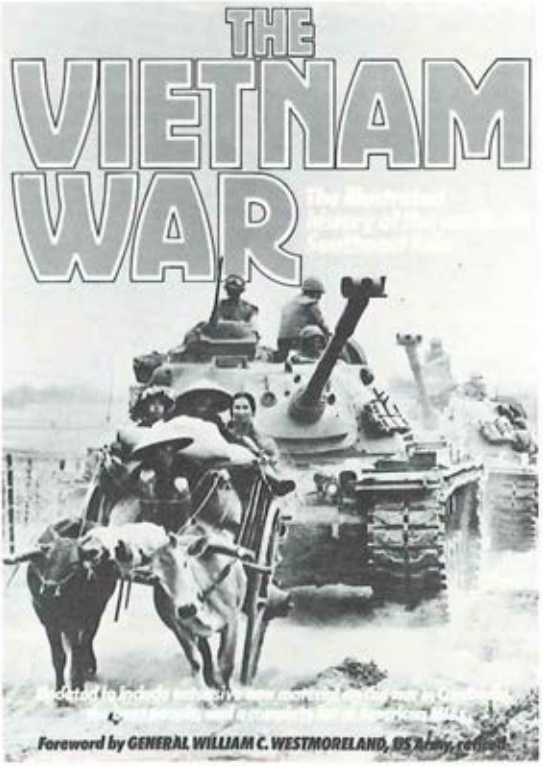

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PRIMARY EMPHASIS: FIELDING THE SYSTEM

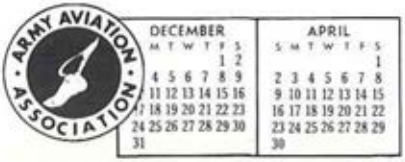
BY BRIGADIER GENERAL (P) CHARLES F. DRENZ

AS the APACHE Production Vehicles continue to roll off the production line, the reality of the APACHE joining the combined arms team in the field in fast approaching. The AH-64A APACHE Attack Helicopter will soon meld with the other new fighting vehicles, significantly increasing their combined lethality.

From the foregoing articles, it can readily be seen that the primary emphasis is now on fielding and supporting the system. The APACHE Program Manager's Office, the contractors and subcontractors, and the DARCOM community as a whole, are committed to providing the user with total system support. I view this as a major challenge, but I also have confidence we will meet that challenge with the same spirit and dedication that have existed throughout the program.

In closing, on behalf of the APACHE Team, I am looking forward to the day we hand over the first production APACHE to the soldier in the field. IIIII

BELOW: The first production model of the U.S. Army's AH-64A APACHE Advanced Attack Helicopter is shown lifting off Jan. 9 on its inaugural flight at Mesa, Arizona.



FEBRUARY 1984

■■FEB 21. The Citadel Chapter, Professional-Business Meeting. MAJ Randel Robinson, Cdr, D Troop, 1/101st Cav, guest speaker. Jenkins Hall Auditorium.

■■FEB 21. Washington D.C. Chapter. Professional Dinner Meeting. Mr. Richard Lewis, ODCSRDA, guest speaker. Fort McNair Officers' Club.

■■FEB 22. Greater Atlanta Chapter. Late morning professional-business meeting. COL Frank Estes, Chief, Army Aviation Proponency Office, USAAVNC, guest speaker. Ft. McPherson Officers' Club.

■■FEB. 24. Combined Arms Center Chapter. First Annual Aviation Ball. MG Dave R. Palmer, Dep Comdt, USA C&GSC, guest speaker. Main Ballroom, Ft. Leavenworth Officers' Club.

■■FEB. 24 Aloha Chapter of Hawaii. Late afternoon professional-business meeting. John Labansky, Sikorsky Aircraft, guest speaker. Nakai Bar Room, Schofield Barracks Officers' Club.

■■FEB. 28. North Texas Chapter. Chapter Activation/Elections. Rodeway Inn, Arlington, Texas.

MARCH 1984

■■MAR 6. Cedar Rapids Chapter. Professional dinner meeting. COL "Hank" Maloney, Chief, Aviation Systems R&D, USA DARCOM, guest speaker. Cedars Hotel.

■■MAR 7. Ft. Bragg Chapter. Late afternoon professional-social Meeting. COL Gerald E. Lethcoe, MILPERCEN, DA, guest speaker. Ft. Bragg Officers' Club.

■■MAR 7. Jack Dibrell (Alamo) Chapter. Professional luncheon meeting. BG(P) Charles F. Drenz, Program Manager—AAH, guest speaker. Fort Sam Houston Officers' Club.

■■MAR 14. Chesapeake Bay Chapter. Business-Social Meeting. Edgewood Officers' Club.

■■MAR 15. Army Aviation Center Chapter. Professional luncheon meeting. BG Charles E. Teeter, Deputy CG, USAAVNC, guest speaker. Ft. Rucker Officers' Club.

■■MAR 16. Pikes Peak Chapter. Late afternoon professional-social meeting. FAA Representative, guest speaker. I-House Officers' Club Annex.

■■MAR 16. Air Assault Chapter. Mid-afternoon professional-social meeting. MAJ Bill Elder, Cdr, B Co, 82d Avn Bn (Cbt), and MAJ Tim Lynch, Cdr, B Troop, 1/17th Cav, guest speakers. Ft. Campbell Officers' Open Mess.

■■MAR 16. Fort Monmouth Chapter. Professional luncheon meeting. GEN Donald R. Keith, CG, USA DARCOM, guest speaker. Gibbs Hall, Ft. Monmouth.

■■MAR 22. Old Ironside Chapter. Chapter Party. Abrams Hotel, Garmisch.

■■MAR 22. Rhine Valley Chapter. Social Hour. Von Steuben Hotel, Garmisch.

■■MAR 17-24. 1984 USAREUR Regional Convention. Professional Sessions, Ski Week, Social Activities, Regional Awards Banquet. AFC, Garmisch, Germany.

PRODUCTION
(Continued from Page 23)

commodate a new micro-miniaturized TADS/PNVS system reduced from 6 to 4 "black boxes." The 4-box TADS/PNVS preproduction system was extensively tested and integrated with the other avionics and weaponization systems, which had also undergone production-type hardware and software updates during early 1983.

AV03 was retired in early 1983. AV05 continues to be utilized for support of individualized production changes. AV02 and AV06 were retrofitted with -701 engines and have been dedicated to training new pilots since November 1983. IIIII

It takes eight to tango!

Our special issues have been, are, and always will be "team" efforts and this 1984 "Army Accepts the APACHE" Special Issue is no exception . .

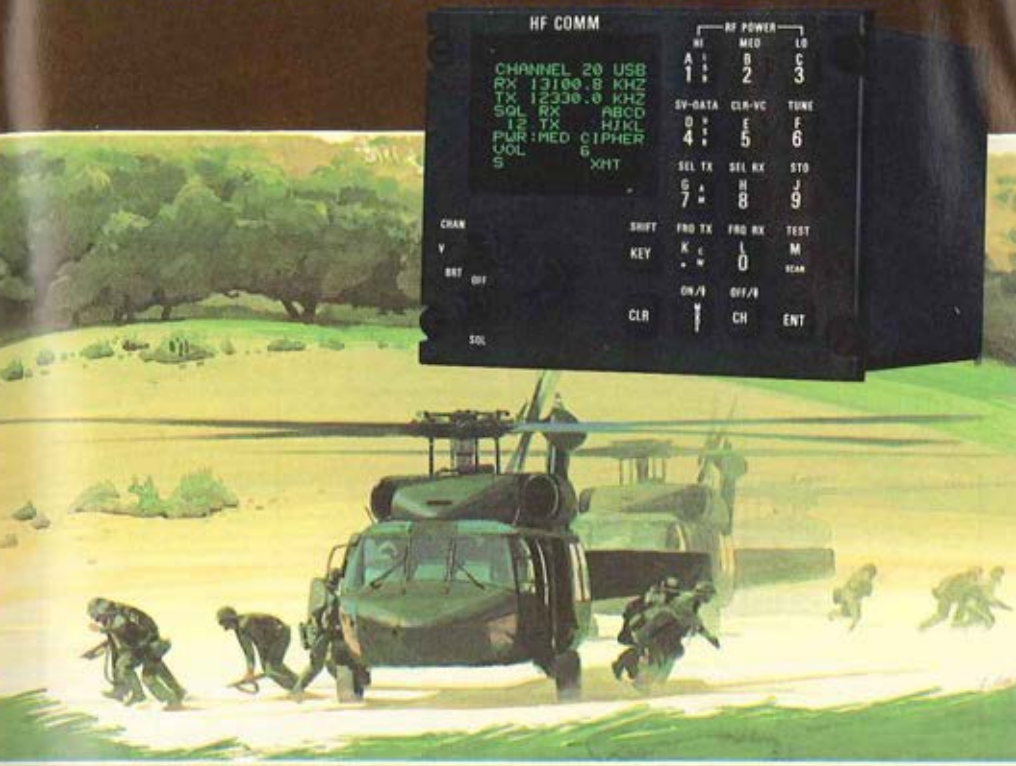
Working behind the scenes in the development of the editorial plan, author contacts, and the assembly of the issue's articles, photos, and charts were **Majors Samuel D. Wyman, III,** and **"Tony" Sobul,** both of the AAH Program Management Office.

The two field graders — **"Sam"** sports a "P" after his title — rode herd on the issue and made certain that we dotted all of our "I's" and crossed all of our "T's" by proofreading each of the 25,000-plus words that make up the issue. Three of us here in Westport also reviewed all of the copy and, hopefully, with five pairs of eyes, we've minimized the speling errors.

A few others also did more than their share to help us get it down on paper: **BG(P) "Chuck" Drenz,** and **Jack Sallee** and **Greg Burrows,** both of Hughes .. and each has our sincere thanks.

The issue turned out to be a much larger one than we thought it would be, and this impacted on our final production and delivery dates. No fault of **"Sam"** or **"Tony,"** however. We worked as quickly as we could and hope that the efforts of all of the foregoing action officers and authors provide you with a more detailed look at all of the facets of this really amazing machine.

KING RADIO'S AN/ARC-199
THE LATEST WORD IN TACTICAL HF



For more than a year King Radio engineers have been busy developing and testing the latest word in HF capability: the AN/ARC-199.

When the first units enter the U.S. Army inventory, they will provide Army helicopters (including the UH-60 Black Hawk, OH-58 Kiowa, the CH-47D Chinook, the new AHIP and the UH-1 Huey) with advanced radios for the demanding nap of the earth (NOE) mission.

What does the U.S. Army find so appealing about King HF? Several features make the AN/ARC-199 stand out. One is the MIL-STD 1553B data bus interface which provides compatibility with the new avionic systems architecture. Other points in King's favor include the small size and light weight of the AN/ARC-199 (approximately 30 pounds for an installed system) and the reliability associated with King equipment. These weight and space savings allow for the addition of other mission payloads.

Utilizing four microprocessor chips, the AN/ARC-199 is able to automatically scan 20 preset channels and to automatically recognize incoming voice calls by their addresses. Add to these features selective squelch, BITE, variable power output, secure voice and data capability plus the growth potential for frequency agility, frequency link analysis, automated communications and electronic operating instructions—and you have the potential of a truly ADAPTIVE HF SYSTEM.

King Radio Corporation has also developed the companion radio to the AN/ARC-199—the AN/VRC-86. This radio, which is functionally identical to the AN/ARC-199, will be installed in Army vehicles. Both radios work with telephone-like simplicity to allow helicopter pilots to keep in touch with ground forces during tactical operations.

Since winning this U.S. Army contract over a year ago, King Radio's successes in tactical HF haven't gone unnoticed. Another HF contract has already come our way—this time to build an advanced HF for use in the rugged operational environment of tactical fighter aircraft. King is developing the AN/ARC-200 (a derivative of the AN/ARC-199), which will be used in an RAAF version of the F/A-18 strike fighter aircraft.

If King's tactical HF story interests you either from the standpoint of off-the-shelf products or adaptations of the systems we are building, contact: Dan Rodgers, Special Programs Department, King Radio Corporation, 400 North Rogers Road, Olathe, Kansas 66062. (800) 255-6243. Telex WUD (0) 4-2299 Cable: KINGRAD.

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CHINOOK DELTAS. GOOD NEWS FOR COMBAT COMMANDERS.

In their first six months with the 159th Aviation Battalion, 101st Airborne Division (Air Assault), new Chinook D models have turned in an impressive 87% availability rate. The Chinooks' versatility plus the Delta's lift capacity and availability make it a new ball game for the combat commander.

New Night Vision Goggle (NVG) compatibility gives the Delta around-the-clock air assault support capability. For artillery movement, one Delta can carry an M-198 gun, basic ammunition load and gun crew — twice the load at faster en route speeds compared to earlier models. Also, it can airlift most of the 101st Airborne's engineering equipment without disassembly, and can carry 3,000 gallons of fuel (six blivets) for forward area resupply.

BOEING HELICOPTERS

The Leading Edge

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