A SPECIAL ISSUE DEVOTED TO THE AVIONICS RESEARCH & DEVELOPMENT ACTIVITY (AVRADA)

Army Aviation

JULY-AUGUST, 1984

AH-64A Apache Attack Helicopter

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AH-64A Apache Attack Helicopter

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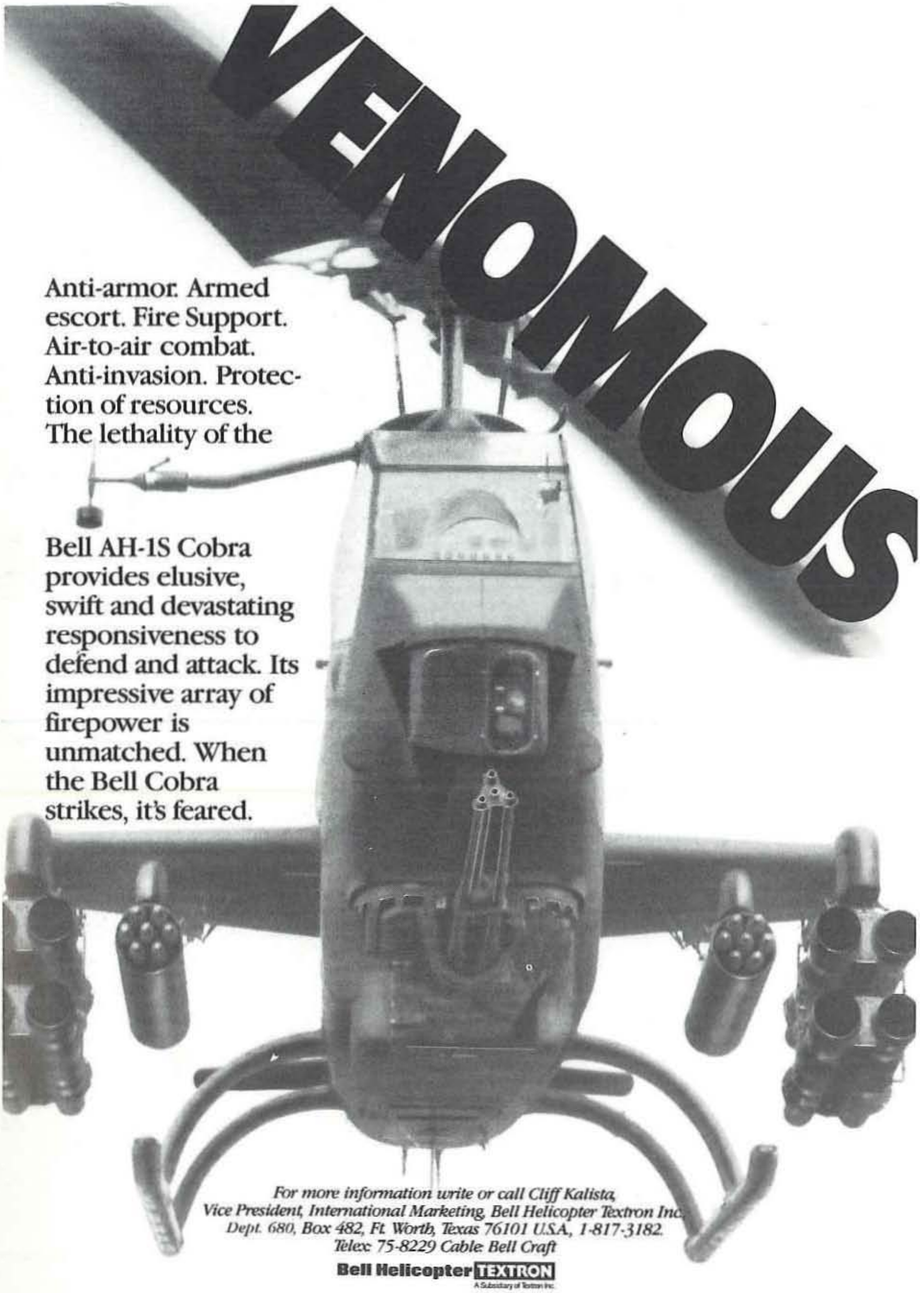
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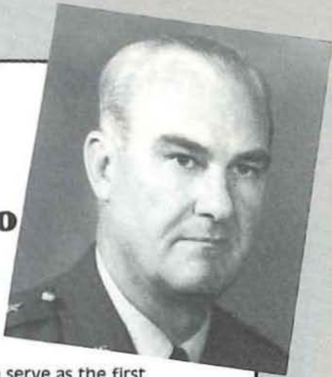

Army Aviation Associatio

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I've been asked, as the Association's Senior Vice President, to serve as the first "correspondent" in a series of information letters on the various programs, policies, and procedures pursued by the AAAA. My effort will be followed in subsequent issues by reports from your National Secretary-Treasurer and each of the seven Vice Presidents who also serve on your National Executive Board.

First, I thought you might like to know a bit about my AAAA office and how it relates to the Presidency. A long-standing Ass'n policy dictates that the President serve a minimum of one year in the office of Senior Vice President. The rationale is that the President-to-be should come up "through the ranks" and be thoroughly familiar with all National Board operations and procedures before taking the gavel. In my case, I'll have completed a two-year term in the Quad-A's catbird seat.

What does the Senior V.P. do? What responsibilities go with the job? I'm prepared to sub for the No. 1 at any time, of course, but in Jim Smith the Ass'n has a most healthy and highly motivated individual, and Jim simply has not missed any Board meetings. However, there have been occasions where your President has not been able to represent the Ass'n at a particular function, and I've served as his stand-in at these gatherings and have been delighted to do so.

One of the areas in which I feel that the Senior Vice President can serve the membership is in the area of "Program Development." He can do this by suggesting and developing new membership programs and services and then, after Board approval, implementing these in conjunction with the National Office. He can also accomplish this responsibility by receiving, reviewing, and refining the suggestions for new programs or services that are generated by his fellow Board members and/or the general membership.

One "new program" comes quickly to mind . . that of encouraging AAAA's worldwide Chapter/Regional structure, at year's end, to pursue a distinct local area Awards Program in which each membership activity would select its own "Aviator, Aviation Soldier, DAC, and Aviation Unit of the Year." To support such a program, the Ass'n is prepared to furnish attractive complimentary plaques and individually-inscribed "Certificates of Achievement" to each participating Chapter or Region together with follow-on magazine publicity. We'd suggest that such a program follow a calendar year zone of consideration so that a year-end Awards Dinner could be held by the activity and the same calender year awardees would qualify for consideration for concurrent CY AAAA National Awards.

George W. Putnam, Jr.
Major General, Ret.
Senior Vice President

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A Digital Map Generator (DMG) in the cockpit is worth a thousand words to military aviators who have to make quick, in-flight decisions. Developed by Harris and the U.S. Army Avionics Research and Development Activity, the DMG uses unique data compression techniques to store 10,000 square kilometers of map area on a single cassette. Harris and AVRADA . . . teamwork in action to improve NOE navigation, reduce pilot workload, and increase mission success. For a detailed description of this advanced avionic system, write to Harris Corporation (see opposite page for address).

For your information

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our name is Harris.

A VIEW FROM THE PENTAGON

BY BRIGADIER GENERAL WAYNE K. KNUDSON
AVIATION OFFICER, ODCSOPS, DA

THIS month's issue of **Army Aviation** is dedicated to aviation electronics and the primary DARCOM activity which has responsibility for developing and integrating most electronic systems on Army aircraft.

In the increasingly complex mission environment of Army Aviation, **Communication, Navigation, and Identification (CNI)** subsystems play a key role in the successful completion of the mission as well as aircraft survival on the battlefield. Vital to the development and fielding of those systems is the **Avionics Research and Development Activity (AVRADA)** located at Ft. Monmouth, New Jersey.

One of the major AVSCOM labs, AVRADA has, since 1965, provided R&D for virtually all the CNI equipment we depend on in our aircraft. Today AVRADA continues that function, looking ahead to integrated CNI subsystems for current production and future aircraft. I believe you will find the articles in this special issue both interesting and thought-provoking. Now, let's take a look at other recent news in Army Aviation:

The flying hour program

The Director of Training in ODCSOPS, **MG Johnny Johnson**, has refined ATM flying hour requirements to include the hours necessary for a unit to train for its unit mission and to conduct its combined arms training. He has done a great job and we owe him our thanks. Requirements have been packaged as flying hour models for each type TOE unit. The models include the hours required for individual/crew proficiency, unit training, combined arms training and those flying hour requirements that are unique to a MACOM's geographic area (transit times to training areas, environmental training, etc.).

Recognizing and including unit training and combined arms training hours in the model will increase the Army's ability to project accurate flying hour programs into the future and identitfy lead times for development and financing of support requirements.

AHIP

The AHIP is here! The Army accepted its first OH-58D from Bell Helicopter Textron on 8 July. Numbers two and three were accepted 11 July. Those three helicopters were flown to Yuma Proving Grounds to start their **Developmental Testing (DT II)** which will certify the AHIP ready for operational testing. In a series of subtests, demonstrations, and analyses of test results, the system will have to meet the requirements of system specifications and the **Required Operational Capabilty (ROC)**. The principle areas of investigation will include: aerodynamic flight characteristics; mission equipment; survivability; human factors engineering; **reliability, availability, maintainability (RAM)**; system safety; integrated logistics support; and environmental testing. To date, contractor test results have met and, in many cases, exceeded the Army's specifications. DT II is scheduled to last through September, 1984.

Fixed wing

A word about the fixed wing fleet. The Army will receive six new C-12s in FY 85, displacing six U-21s which are scheduled to be transferred from the Active to the Reserve Component. The total Army requirement for administrative support aircraft is over 350 with just over 200 of the preferred aircraft (C-12/U-21) on-hand to fulfill these requirements. The Army staff is reviewing current aircraft requirements and is developing guidance for the MACOMs for leasing aircraft services should that be a cost effective alternative for some users. Additionally, we are examining the merit of acquiring small executive jet aircraft to better support our senior commanders. Priorities on the administrative aircraft program, for acquisition of additional aircraft, are being reviewed. Finally, AVSCOM continues to acquire confiscated drug enforcement aircraft to satisfy some administrative support aircraft requirements.

Flight simulators

The development, procurement, and fielding of flight simulators continues to move forward. On the development side, final efforts are ongoing to field the AH-64 **Combat Mission Simulator (CMS)** in time for its August, 1985, ready for training requirement at Ft. Rucker. The AH-64 CMS is the most sophisticated simulator ever fielded by the Armed Forces. In addition to replicating the AH-64 flight characteristics, this device will match the full range of mission equipment, from FLIR to direct vision optics to the **Target Acquisition and Designation System/ Pilot Night Vision System (TADS/PNVS)**.

This simulator system will come with the most sophisticated, high resolution computer generated visual system in existence today. This system, known as **Army Tactical Digital Image Generation (ATACDIG)**, was developed by the Singer-Link Company and will not only allow the conduct of NOE flight but will also allow for target acquisition and engagement as well as threat-force interaction.

A strong year

1984 is a strong year for procurement of flight simulators. Contracts have been awarded, or will shortly be awarded, to buy six additional AH-64 Combat Mission Simulators, 15 UH-60 BLACK HAWK simulators, three AH-1 COBRA **Flight and Weapons Simulators (FWS)**, and one CH-47D CHINOOK simulator. Also, a contract will be awarded this year to begin the conversion of our already fielded "C" model CH-47 simulators to the "D" model configuration. In all, over $100 million worth of flight simulators will be procured this year.

The Army proudly accepted delivery of the first two production model AH-1 FWS this year. The first was officially declared ready for training at Ft. Hood in June, and the second will be officially dedicated in Hanau, West Germany, in September.

The COBRA simulator has a LASER SCAN image generated model board visual system. This visual display represents a step forward from the older CH-47 camera model board visual system. Like the APACHE simulator, the AH-1 FWS will replicate flight characteristics, mission equipment, and weapons effects. It also has the unique feature of side-by-side independent pilot and co-pilot motion bases. This feature, along with a complex computer interface, allows the simulator to be operated in an integrated mode (pilot and co-pilot flying the same mission) or an independent mode (pilot and co-pilot flying different missions).

In the independent mode, each aviator can work on those training tasks he desires without taking valuable training time from his fellow aviator. By July, 1985, Ft. Campbell, Illesheim, and Ft. Lewis will have AH-1 Flight and Weapons Simulators ready for training.

Team training

While fielding flight simulators for individual pilot training is a long overdue fact, it does not satisfy one of Army Aviation's toughest training problems: team training. Success of Army Aviation in the future is dependent on the ability of each of our aircrews to work together with other members of the combined arms team. Where our current simulators provide training for individual aircrews, no device bridges the gap between individual and team training skills.

To overcome this shortcoming, a draft training device requirement for a team trainer was developed by a Joint Working Group at the Aviation Center in January, 1984. At this point, while plans for the **Aviation Combined Arms Team Trainer (ACATT)** are still in their infancy, the program calls for the development of scout modules (OH-58 A/C and AHIP); attack modules (AH-1 and AH-64); a battle captain module; and an instructor station. Each module will interact with the others, allowing target acquisition and designation, target hand-off coordination, team coordination and control, inter- and intra-team communication, and as many other team tasks as technology will allow.

(Pentagon View — Continued on Page 77)

IT'S MORE THAN A NEW PANEL, IT'S A NEW WAY OF THINKING.

When the U.S. Navy set out to select an avionics system for its new TH-57C training helicopter (a modified Bell JetRanger), it applied a new way of thinking. Why specify heavy and expensive Mil-Spec avionics for a helicopter that was going to be operating in a training environment? What was needed instead was the most capable, lightest weight, smallest, lowest cost avionics system available off-the-shelf.

Enter King Radio with dual KNS 81-30 TACAN/RNAV systems. Each integrated RNAV system is contained in a single panel-mounted unit which includes a 200-channel VOR/LOC receiver; an RNAV computer with preselection and storage of up to 10 waypoints; and a 40-channel glideslope receiver. Both systems rely on a single remote-mounted 252 channel TACAN.

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In addition, safety is further enhanced by a KT 79 Transponder with its single push button emergency squawk capability. Add to that a KY 196 VHF/COMM (with active and standby frequencies digitally displayed for easy "flip-flop"), a KR 87 digital ADF, a KRA 405 Radar Altimeter and 10 other units—and you have a fully capable and reliable helicopter avionics system (which, incidentally, is why King avionics systems are found on just about every type of commercial helicopter flying in the free world). And all this translates into unprecedented IFR training capability for the Navy.

So if you think your special program might not need the expense and weight of Mil-Spec avionics or if you find some of the advanced state-of-the-art features of commercial avionics helpful to your particular mission—contact us. Write or call: Director, Special Programs Department, King Radio Corporation, 400 North Rogers Road, Olathe, Kansas 66062. (800) 255-6243. Telex WUD (0) 4-2299 Cable: KINGRAD.

Special Report

The U.S. Army's Avionics Research and Development Activity

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AVRADA: KEY TO VICTORY

BY GENERAL DONALD R. KEITH, RET.
FORMER COMMANDING GENERAL, USA DARCOM

INCREASINGLY, Army Aviation is becoming an electronics dependent combat force. In the past 40 years, Army aircraft have evolved from relatively simple mechanical devices to complex and lethal combat weapons systems.

The use of electronics in Army aircraft has jumped from a few simple gauges to an array of cockpit instruments that rivals those found in advanced fighters.

For that reason, the management of aviation electronics has taken on ever-increasing importance as we seek to provide a modern aviation fleet that keeps pace with a rapidly changing threat by applying the technologies that are available to us.

The efforts of the Avionics R&D Activity, and the industry that supports them are essential to achieving that goal. IIIII

AVIONICS: THE EMERGING GIANT

BY MAJOR GENERAL ORLANDO E. GONZALES
COMMANDING GENERAL, USA AVSCOM

AVIONICS development and management is big business in Aviation Systems Command. Gone are the days when aviation electronics was but a small part of the total aircraft. With the LHX in the planning stages it looks like avionics may amount to more than half of the total aircraft cost! With such high avionics development and acquisition costs it is essential that avionics be managed more intensely than ever before.

An important step in ensuring the affordability of avionics in the future is to standardize aviation electronics throughout the fleet. That promises to ensure not only affordability but effective and timely logistical support as well. In the end that means increased aviation combat effectiveness; one of the primary goals of AVSCOM.

The **Avionics Research & Development Activity (AVRADA)** works closely with the aviation Program Managers to ensure affordable, dependable, and sustainable aviation electronics. The U.S. Army Aviation Systems Command is dedicated to ensuring that the aviation fleet is equipped with the avionics which will maximize combat effectiveness. This effort is ongoing and growing in its importance as technology advances with increasing speed. The threat mandates a need for the Research & Development community to manage resources as never before. The challenge of meeting tomorrow's needs with today's dedicated effort will continue to be one of AVSCOM's primary objectives. **IIIII**

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AVRADA: A TEAM EFFORT

BY COLONEL DARROLD D. GARRISON

ALL of us at the **Avionics Research and Development Activity (AVRADA)** at Fort Monmouth, New Jersey, are proud to be members of the Army Aviation team. The challenge of making sure that Army Aviation gets the latest technology in the cockpit is no small task. With electronics technology marching along somewhere at the speed of light it demands that our engineers and technicians keep current in the art. Our job, making what you read about in science fiction magazines into something that actually works, is an exciting and formidable challenge.

A unique role

The Activity is dedicated not only to exploring basic electronic research but also to improving the hardware that is already in the field. AVRADA is unique among most of the DARCOM laboratories because its mission spans all the way from basic research to improving fielded equipment. That job takes the dedicated labor of numerous people throughout the aviation community.

With aviation electronics providing increased capability to Army Aviation and consuming a greater percentage of acquisition cost, we must ensure that the things we develop are truly needed and affordable. One of our biggest challenges is to provide avionics equipment to the field in a timely manner and to provide engineering support to the Aircraft Systems Managers. As stated, it takes a team effort to do this, so we have been concentrating on building our own team and being a responsive member of the whole aviation team.

AVRADA prides itself on the close contacts we have with the Aviation Center and the aviator in the field. We enjoy outstanding support and help from **COL Clark Burnette,** who never fails to give us a full measure of his vast aviation experience. **LTC Steve Ballard** and **LTC Roy Golly** have worked endless hours to keep us on track and keeping the right programs moving. We are looking forward to continuing our relationship with **MAJ (P) Jim Kaye** when he replaces **Roy** this summer.

Mr. Dick Lewis, the Director of Army Research, is well acquainted with the R&D of avionics and has been of immeasurable assistance while serving as the Technical Director at AVSCOM. We look forward to his direction in his new capacity.

Vital connections

Deserving of a lion's share of the praise is our Pentagon connection: **Dick Ballard** and our DASC, **LTC Jim Holder** (who took the reins from **LTC Rick Ferguson**) give us our voice in DCSRADA while **LTC Charlie Canon,** our FISO, does the same for us in DCSOPS. **Mr. Griffin, Jim Bender,** and **Laird Stanton,** keep us tuned to vital guidance from DARCOM HQ. Our able voice in TRADOC HQ is **Bob Dodd.**

Within AVSCOM headquarters AVRADA does not lack for guidance but notable for their dedicated assistance to the organization and its mission are **Dave Weller, Chris Tsoubanos** and **Charlie Johannigsmeier.**

AVRADA enjoys exceptional aviation support from the ERADCOM Flight Test Activity at Lakehurst, New Jersey. **LTC Martin Kleiner**

ABOUT THE AUTHOR
COL GARRISON IS THE COMMANDER, U.S. ARMY AVIONICS RESEARCH AND DEVELOPMENT ACTIVITY, (AVRADA) LOCATED AT FT. MONMOUTH, NJ.

and his crew of military and DA civilian pilots deserve Kudos for their "can do" attitude.

Like all good organizations, AVRADA depends on its most precious resource: people. AVRADA is fortunate to have a solid core of highly skilled, capable electronics engineers. Supporting them are our technicians and administrative staff. AVRADA'S mission of giving the Army aviator an edge in combat is possible through the devoted work of the AVRADA team.

What it's all about

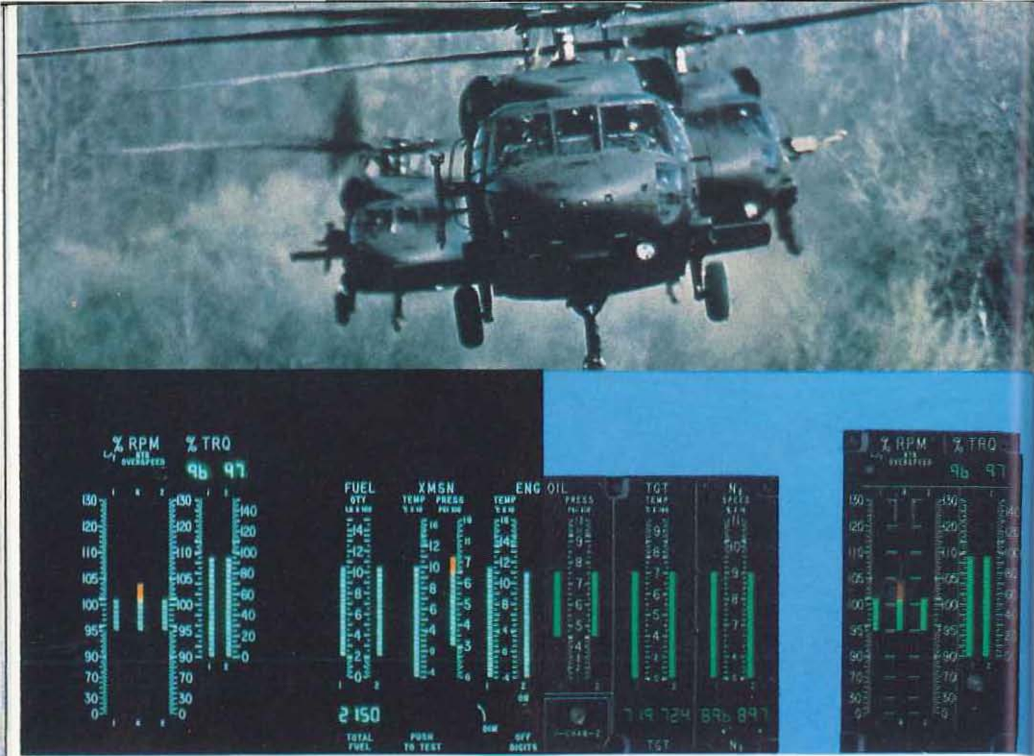
The articles in this issue of **Army Aviation** provide just a hint of what AVRADA is all about. Firsthand reports about using satellites for navigation, cockpits which can respond to spoken commands, and electronic maps which can actually show relief with amazing detail should make it clear that AVRADA is working hard to provide you with the very best in avionics.

ABOVE: HQ AVRADA and the Avionics Lab (foreground) are located adjacent to the CECOM and ERADCOM labs. HQ CECOM is in the high-rise in the distance.

AVRADA ensures its technological currency by locating its headquarters and laboratory at Ft. Monmouth, NJ — in the midst of the Army's communications and electronics development center. To ensure responsiveness, AVRADA also maintains several branches in St. Louis, MO — just a stone's throw away from the AVSCOM Aircraft Project Managers.

An exciting business

It's always an exciting time in this business! It's always a very fast moving train. The articles in this issue can give you only a flavor of all the work going on in aviation electronics. Only one thing remains the same and that's our desire to give the soldier a battlefield advantage that will give him that margin and let him win to fight again. IIIII



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AVRADA OVERVIEW

BY MAJOR CORNELIUS J. WESTERHOFF

THE **Avionics Research & Development Activity (AVRADA)** is located at Fort Monmouth, NJ. The activity is one of the three **Aviation Systems Command (AVSCOM)** research and development laboratories. Organized with some 245 Department of the Army civilians and 14 active duty military its contributions belie its relatively small size.

AVRADA is unique in that it has active programs ranging all the way from basic research to the actual fielding of avionics equipment. AVRADA's involvement in avionics goes well beyond the fielding of equipment as AVRADA is also involved in numerous product improvement projects of existing, fielded equipment.

The Avionics Laboratory

The Avionics Laboratory, one key part of AVRADA, consists of four separate Divisions: the Navigation Division; the Command, Control and Communication Division; the Advanced Systems Division; and the Research and Technology Division. As you might expect of an electronics laboratory AVRADA is working some very exciting programs. Some of those programs are:

Navigation Division — Navigation technology is constantly evolving as the Army searches for better accuracies and higher reliability in its aviation navigation systems. One of the more interesting technologies being investigated is the Ring Laser Gyro. This device, just as the name implies, uses a laser beam to take the place of a mechanical gyroscope.

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The advantages of that are enormous. The system promises a lot of very attractive characteristics like weight reduction, much greater reliability and, most importantly, greatly improved navigational accuracies. Another area where this Division is very active is in the development of ground navigational systems. This is an area where aviation technology can be useful to the ground combat leader.

Command, Control and Communication Division — The C³ Division is in the forefront of developing Command and Control technology for Army Aviation. An extensive analysis of what aviation Command & Control really means and what the needs are has recently been completed. Now the first steps are being taken to determine what hardware should be developed to meet those unique aviation requirements.

Some very promising projects are taking place within the C³ Division. One project involves the use of computers to recognize spoken voice commands. Army cockpits may get voice recognition equipment which will perform some of the functions now performed by a co-pilot. Another program, called **Integrated Communication Navigation and Identification Avionics (ICNIA),** is working to combine all the common circuits of what are now separate avionics systems.

The idea behind this joint Army-Air Force program is to build something of a Super-radio which performs all the functions of those separate black boxes which are now scattered throughout the airframe. It promises to not only save weight but to perform with much better reliability. The Division is busily investigating the effect of composite materiels on avionics, especially the antennas. This work is essential

ABOVE: This foil-wrapped EAGLE WIND DECKER was used by AVRADA to investigate antenna performance and electromagnetic interference problems associated with the Advanced Composite Aircraft Program (ACAP).

as composite materiel becomes more and more common in advanced aircraft.

Research and Technology Division — There is no Army Aviator today who hasn't had to wrestle with yards of paper maps while trying to navigate NOE. The solution may be around the corner. The Research and Technology Division is working hard to develop a display for the cockpit which will give the aviator a multicolored map. Using digitized data the map display system boasts a number of advantages over the standard Army map.

Besides the obvious elimination of all that paper, it will allow for the selected display of certain information; eventually it may be refined to show a horizon view; it can possibly evolve into a significant navigation system; and it promises to be a major step towards making the single pilot aircraft a reality.

The Division is also developing a means for the aviator to conduct mission planning, load the mission information on a cassette or other device, and then load that data into the aircraft systems. That will eliminate a great deal of runup time as well as making quicker mission turn around time much easier to acheive.

Advanced Systems Division — This Division takes the products of the other Divisions and integrates these into a total system. In other words, this is where all the separate pieces of the avionics suite come together. What may sound simple in concept is actually one of the most complex operations in the laboratory. Getting all of the individual black boxes to "play together" is fundamental to the development of a modern cockpit.

An exciting project

One of the most exciting projects now in progress is the development of a computer which can handle the enormous demands of tomorrow's avionics. As avionics become more complex and as more demands are placed on Army aircraft the need for onboard computers rises dramatically. Rather than developing a separate computer for every avionics function it is essen-

SCIENCE/SCOPE

Night will turn into day for helicopter pilots flying low and fast over rough terrain while using a new infrared system. The Helicopter Night Vision System (HNVS) is designed to make it easier for a pilot to fly low-level missions at night, in adverse weather, or in hazy and smoky conditions. The system uses a forward-looking infrared (FLIR) sensor, mounted in a turret under the nose of the helicopter, to project TV-like pictures of the outside world on the pilot's helmet visor.

When the pilot glances in any direction, a helmet servo linkage causes the turret to aim automatically along his line of sight. The pilot can have flight symbology superimposed on the helmet, further reducing his need to look down at cockpit displays as he flies. Hughes Aircraft Company produces HNVS.

A prototype electronic map developed for the U.S. Air Force makes map reading as simple as pushing a button. The Airborne Electronic Terrain Map System stores digitized terrain data to provide a moving, color-coded computer map of the area over which an aircraft is flying. The map can be projected on standard color or black-and-white cockpit displays or on the head-up display.

Like paper charts, the Hughes map can show the aircraft's actual position or be "unfolded" electronically to let the pilot look ahead. It can be presented in a shaded relief plan view, much like a standard paper chart, or in a perspective view as though the pilot were looking at terrain ahead of the aircraft. Tactical symbols can be selectively added to reduce clutter and improve display readability.

For more information write to: P.O. Box 11205, Marina del Rey, CA 90295

HUGHES
AIRCRAFT COMPANY

tial that future aircraft use only standardized computers. That allows for significant weight savings and gives the added bonus of allowing for a redundant system where two or more onboard computers can individually perform almost all of the needed functions.

On the other side of materiel development, the side where equipment is manufactured and fielded, improvement programs are progressing in upgrading the headset microphone, developing an improved GCA radar, making several improvements to the Doppler, and handling the Night Vision Goggle cockpit lighting compatibility problem. Work is also being done on the development of a High Frequency NOE radio and an Improved FM radio. AVRADA is also busy supporting the Project Managers and Weapon System Managers of the AH-64, AH-1, AHIP, CH-47D, UH-1 and **Special Electronics Mission Aircraft (SEMA).**

Working together

AVRADA is an active participant in several joint service programs. One such program is the **Joint-Surveillance Target Attack Radar System (JSTARS).** One of the benefits of this program is the development of a standardized Control Display Subsystem which will depict essential pilot information. This subsystem is suitable for installation in the AHIP, a modernized UH-1 and, of course, the OV-1 MOHAWK. Standardization of a display system is a major step in standardizing avionics within the Army aviation fleet. Besides standardizing within the Army, the J-STARS program will develop a system that will be interservice useful. That will ensure low unit cost and increased supportability at the DOD level.

Important parts of AVRADA's research and development thrusts are the several facilities which are found in the Laboratory. The Advanced Systems Division built a UH-60 simulator which is used extensively to demonstrate futuristic avionics systems. The cockpit simulator uses imagery projected on a large-screen television to provide the pilot a visual reference. The simulator has been extremely effective in demonstrating technologies for future Army aircraft without going to the time and expense of actual flight hours. The entire simulator facility, to include the dedicated computer systems, is known as the **Tactical Avionics Systems Simulator Facility (TASS).**

For those systems which can best be demonstrated and tested through actual flight AVRADA has a UH-60 specially outfitted to serve as a test bed for avionics research. The aircraft, called the **System Testbed for Avionics Research (STAR),** is maintained at Lakehurst Naval Air Station. The STAR is currently undergoing a major refit and is being modified to accept a digital flight control system.

The STAR is constantly evolving in order to provide AVRADA with the most current aviation technology available. The STAR gives AVRADA a test facility which simply cannot be duplicated anywhere else. It's in actual flight tests that avionics can show their stuff and continue to earn their keep.

AVRADA uses a Computer Aided Design and Engineering Facility which is co-located with an Audio/Acoustic Facility. These facilities are used in the development of avionics equipment such as the Voice Interactive Avionics system and other audio based improvements.

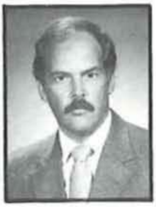
The trend to software

Aviation systems now being fielded and developed, such as the AH-64, use enormous amounts of computer software throughout the aircraft. The dependence of weapons systems on computer software is relatively new in the development of military systems. As systems become more sophisticated this trend is certain to increase.

To make sure that Army Aviation will keep pace, AVRADA is putting final touches on a Post Deployment Software Support facility. This facility will have the responsibility to ensure that the software in fielded systems will perform properly and that necessary changes will arrive in the field in a timely manner. The extent of this job is still unknown, but is probably going to be a very significant part of ensuring combat readiness in the Army Aviation fleet as we move ahead into the 21st Century.

AVRADA is a multifaceted, thriving organization working to ensure that Army Aviation avionics will keep pace with technology and, more importantly, with the threat as it is projected in the years to come. There is no question that the challenge will continue to grow.

AVRADA is striving to make certain that the Army's most precious commodity, the soldier in the field, will be supported by the most modern combat aviation force in the world. **IIIII**



THE DIGITAL MAP GENERATOR

BY ROBERT W. CAMPAGNA

TO increase helicopter survivability in the high-threat environment of the modern battlefield, today's Army Aviator must be proficient in the tactics of terrain flight. Among the most demanding tasks in this arena is **nap-of-the-earth (NOE)** flight which requires aircraft to manuever as close to the earth's surface as vegetation and obstacles will permit.

Course, airspeed, and altitude are varied in order to take maximum advantage of the cover and concealment offered by terrain, vegetation, and man-made features. Pilots operating under these high workload and hazardous flight conditions must also be able to maintain geographic orientation at all times.

Where are we now?

Visual navigation at such low observation angles is difficult for even the ground trooper who must be skilled at interpreting landform information from paper topographic maps. When the primary task of aircraft pilotage is added, geographic disorientation becomes a common occurrence. The Research and Technology Division at AVRADA is committed to the solution of this problem with the development of the **Night Navigation And Pilotage System (NNAPS).**

The NNAPS is a special purpose, very high speed digital processing system consisting of flight and tactical symbology generation, topographic map display generation, and an autonomous terrain-aided navigation system. A wide variety of operator-selectable symbology formats are used to display pilotage information which is superimposed on a FLIR or TV image, and navigational information which is superimposed on a map image.

The symbology was developed at AVRADA in the flight simulator and intensively flight tested in the UH-60 **Systems Testbed for Avionics Research (STAR).** The map image is generated from a digitized topographic data base consisting of terrain elevations and planimetric features such as vegetation, hydrography, transportation networks, structures, etc.

This same topographic data is also accessed by a terrain-aided navigation processor which uses a Kalman filter to estimate the vehicle's position errors. When these estimates are coupled with the unaided Doppler navigation system, positional accuracies of 50 to 100 meters can be achieved.

A major advantage

The capability to use digitized topographic data for both map generation and other functions such as terrain-aided navigation and threat management is a major advantage of a digital mapping system over alternative map display systems which are paper map based such as projected map displays, remote film strip map readers, etc.

The first flyable digital map hardware was developed at AVRADA and flight tested in the STAR in early 1983. It consisted of storing precomputed map images on magnetic tape for recall to a digital display memory and subsequent video readout to a standard television monitor located on the instrument panel. Stationary, black & white TV map images could be displayed at several fixed orientations and scale factors. For flight demonstrations conducted at

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Carlisle, PA, north up 6x6km and 12x12km map formats were used exclusively. Navigation symbology which included a moving aircraft symbol driven by an unaided Doppler output was generated externally for registration and video insetting on the map image. A course line was also provided by the symbol generator for insetting on the map between check points. This system achieved high acceptance by Army test pilots during many NOE flights at Carlisle.

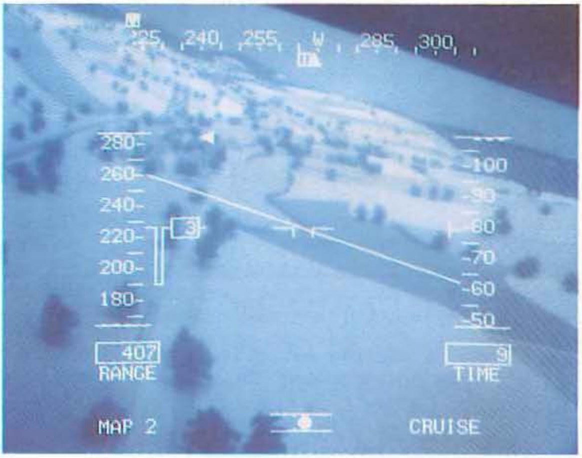
Moving ahead

Concurrent with AVRADA's in-house development of this rudimentary system, a contract was awarded to the Harris Corporation, Melbourne, FL, for the design and fabrication of a **Digital Map Generator (DMG)** whose principal function would be the real-time generation of a topographical map portraying both terrain elevation and planimetric information in a standard closed-circuit color television format. The first of these highly interactive, moving-map systems has been delivered and installed in AVRADA's flight simulator for test and evaluation.

The Digital Map Generator consists of a full ATR unit containing 34 wire-wrapped circuit cards which perform all of the digital mapping functions, and a half ATR unit as the power supply. The design goal for future operational systems is a printed circuit version incorporating map generation, symbology generation, terrain-aided navigation processing, and power supply in a single unit.

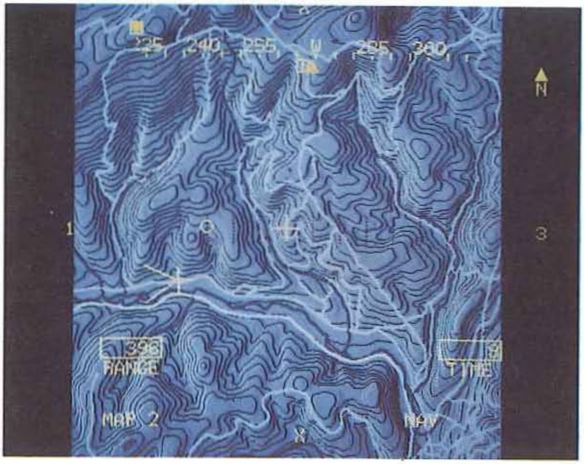
Data storage

Two small units in the DMG suite comprise the Model 6425 **Magnetic Tape Loader (MTL)** manufactured by Raymond Engineering, Inc., Middletown, CT.



ABOVE: PILOTAGE SYMBOLOGY SUPERIMPOSED OVER A TV IMAGE.

ABOVE: A 3x3km TERRAIN-ONLY MAP IS SHOWN IN THE ELEVATION SHADING MODE.



ABOVE: NAVIGATIONAL SYMBOLOGY SUPERIMPOSED OVER A MAP IMAGE.

ABOVE: THE SAME 3x3km TERRAIN-ONLY MAP IS SHOWN IN THE SLOPE SHADING MODE.

The MTL is a four-track military-qualified tape unit used as the bulk storage device for the digitized topographic data base which is compressed for efficient storage. Enough terrain elevation and planimetric data can be stored in a compressed format on the first two serial tape tracks to cover a geographic area of 100x100km. The remaining two tracks are available for field intelligence and mission-specific data which can be added during mission planning. The DMG contains a tape controller which permits data base read/write operations with an external computer while the MTL is still connected in the DMG configuration. This is essential for tape annotation functions.

Seeing it on the screen

During operation, the desired map position and orientation angle are transmitted to the DMG, which can process these inputs at a rate of 60 Hz. The appropriate blocks of data are read from tape into an intermediate buffering memory from which special high-speed hardware reconstructs this data at the requested display scale into a buffering scene memory.

Readout to the video display at the desired map orientation angle can be accomplished with additional special purpose hardware processors which generate the selected contour field and execute the terrain-shading algorithms. If the aircraft position is input as the commanded map position, the map will translate and rotate smoothly in an aircraft-centered, moving-map mode with no time lags or display degradation. This is due to the 60 Hz update rate coupled with sufficient data buffering between the MTL input and the video readout. The maps can be displayed on any standard television monitor — or CRT — which accepts a 525 line, RS-170, three-port RGB (red, green, blue) video signal.

A programmable color mixing table located in the DMG output circuitry is loaded at initialization and used to assign desired colors to specific planimetric features such as green for vegetation, blue for hydrography, etc. A programmable symbol table is also loaded at initialization and used to assign 8x8 matrix shapes to each of the 128 point features that the DMG can process. The point symbols are pinned at their specific map coordinates but always displayed in a screen up orientation for readability.

Input/Output communication with the DMG is accomplished through a 16 bit parallel interface under external computer control. At AVRADA's flight simulator, this is done with a DR-11W interface to a DEC VAX-11/780 computer. This design offers maximum flexibility in the development of map control software which can be tailored for the user's specific applications.

Making it work

Operator interaction with the DMG is accomplished with a **Control Display Unit (CDU)** which is also interfaced with the external computer. The CDU presents the pilot with a list of control options via a computer generated menu and transmits selected options back to the external software which sends the appropriate commands to the DMG. The CDU and the external software package was developed under a separate contract with Harris Corporation.

There are several types of DMG interface functions which permit the operator to actively configure the map video to any desired format:

For example, the DMG may be commanded to any map coordinate stored in the compressed data base on tape. This map point may be selected to coincide with either screen center or ¼ of the way up from bottom which affords more look ahead distance if the aircraft position is used to drive the map in a moving mode.

Map orientation angle may be driven by the aircraft heading, in which case the map will rotate in a heading up mode, or by the aircraft track or some other fixed angle, such as north, resulting in map translations only.

Map display coverage per screen area may be selected by the operator as well. There are four display scales available for Army applications — 3x3km, 6x6km, 12x12km, and 24x24km. The 6km and 12km scales appear to be the most useful during actual flight, however the 3km scale may prove useful at lower velocities and the 24km scale is desirable during mission planning use.

Two types of shading are available for operator selection — elevation shading and slope shading. In the elevation shading mode, the map is shaded as a function of terrain elevation bands with the darker shades normally assigned for the higher elevations. There are eight elevation bands whose relative width and absolute vertical positioning may be chosen by the operator for optimum information content. This mode can also incorporate the aircraft altitude into the shade assignment to provide the capability for terrain avoidance.

In the slope shading mode, the map is shaded with sixteen levels of intensity as a function of terrain slopes. The result is a more realistic visual presentation analogous to the relief shading associated with paper maps.

Freedom of choice

One of the most useful attributes of the DMG is the flexibility afforded the operator in selecting exactly what planimetric features appear on the display. Any combination of topographical and/or tactical feature subsets may be chosen via the CDU. The external computer then transmits a cultural preselect table over the interface to the DMG and only those features which are selected will be displayed.

Another very critical function which is accomplished with the DR-11W interface is data base interrogation. The external computer may request a block of reconstructed elevation and planimetric data from the DMG. This data is then available for manipulation by external software which executes the terrain-aided navigation and threat management computations. As stated earlier, this is a major advantage of a digital mapping system and the importance of such a capability cannot be overestimated.

Integration of digital map technology into demonstration programs, such as ARTI and AHIP, and full scale development programs, such as LHX, is being planned by Army Aviation. Uses for a digital map generator in applications other than aviation are rapidly becoming apparent. The Harris DMG has contributed greatly in accelerating the advancement of this technology among other competitive electronic companies. IIIII

HOW THE HIDE-WHILE-YOU-SEEK SIGHTING SYSTEM TAKES THE SHAKES OUT OF BATTLEFIELD TARGETING.

While the helicopter hovers below tree and ridge lines, only the steerable, ball-shaped Mast-Mounted Sight is exposed to hostile eyes. The crew sees without being seen.

The crew also has a sharp, more jitter-free view of targets because the sensor mounts float in a magnetic field, virtually free of vibration. The result is crisp, unblurred images on the cockpit interactive displays. The mast-mounted sensors include telescopic TV for day sighting and infrared thermal imaging for missions previously limited by night, weather or battlefield smoke and haze conditions.

The McDonnell Douglas Mast-Mounted Sight is now being flown on Bell Helicopter Kiowa Aeroscouts under a fixed price development contract.

The Mast-Mounted Sight is the result of ten years of stabilized platform research. It has passed more than 300 hours of Army laboratory testing and 100 hours of development flight testing at the Army's Yuma proving ground.

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The U.S. Army AH-64A Apache. An advanced technology helicopter weapon system that delivers an awesome array of firepower with deadly accuracy in day, night and adverse weather conditions.

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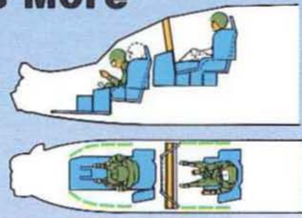

Crew Protection

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That's not all. Survivability also means minimum detection. The AH-64A's low-flicker rotor, low-glint canopy, low sound level , Black Hole engine-exhaust IR suppressor and compact size add up to minimum detectability across the board. And maximum crashworthiness is designed into the Apache to protect both crew and aircraft.

All in all, it's one tough helicopter.

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SOFTWARE IN ARMY AVIATION

BY EDMUND T. TOGNOLA

THE art of warfare has undergone many changes through the centuries. We have moved from Cain slaying Abel with a rock, to the Bronze Age, the Iron Age, the Age of Chivalry, the advent of firearms, and the rapid-fire weapons of the First and Second World Wars, to what we presently term the modern battlefield.

The new field of battle

This modern battlefield is a rapidly shifting and volatile environment covering vast areas. The Armed Forces that operate on this battlefield are highly mobile and armed with extremely effective and deadly weapons. The speed of battle has been greatly advanced, and the information required to survive and win on this modern field of conflict has increased to the point where mental faculties can no longer keep up with the enormous flow of battlefield information!

However, man is a gifted creature, and in exercising these gifts, he has developed various **Battlefield Automated Systems** or **BAS's** that have the ability to absorb this tremendous volume of information.

In the world of Army Aviation, Battlefield Automated Systems exist in three major areas. They are: command and control; navigation; and, of course, the aircraft itself. The use of computers in each of those three areas has grown enormously in the past few years and is likely to keep increasing dramatically. As these heavily computer dependent systems are fielded, our very survival on the battlefield is becoming more and more computer dependent.

For that reason, it becomes more and more important that military computers and processors are maintained meticulously. The explosion of computers in Army Aviation systems brought with it some problems that are just barely understood even today. Supporting hardware in the field has always been fairly straightforward. Even Hannibal had to be able to repair elephant harnesses when crossing the Alps. Yet, when going from fixing wagon wheels in the field to repairing tank tracks, you have not made a tremendous leap in the concept of logistical support. When computers became a part of military hardware, it added the first new dimension to combat support since field supply was invented in the Old Testament. It added something called software support.

The heart of the matter

Software, the very heart of all Battlefield Automated Systems, requires maintenance and support just like any hardware system in the field. Software, in general, is not a perishable product, however, the computer program that consists of thousands of lines of code can easily develop a "glitch".

A "glitch" can have disastrous results. A recent Space Shuttle launch was delayed extensively due to a software problem. Satellites have gone spinning into deep space and more than one honest American has received a million dollar bill or refund check from the IRS because of a software "glitch". Software is one of the most difficult things about a computer to understand. Although many Americans can now get a computer to flash their name a few times, to

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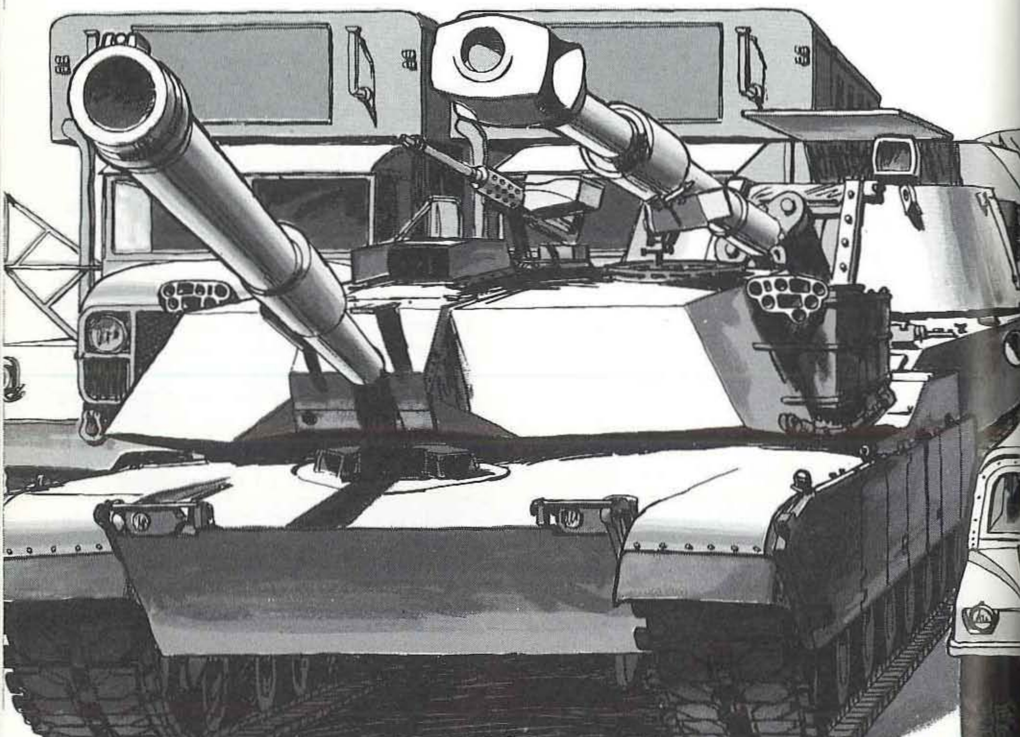
WHAT GOOD ARE ALL THE KING'S HORSES IF THEY'RE 300 MILES FROM ALL THE KING'S MEN?

With our existing force of large transports, we're able to airlift sizable quantities of cargo from the U.S., but only to those airfields with runways large enough to accommodate these big planes. Smaller aircraft must complete the movement into smaller, forward-area bases–where the troops are.

The new McDonnell Douglas C-17 can land on short, unimproved runways and can make direct deliveries of cargo–the

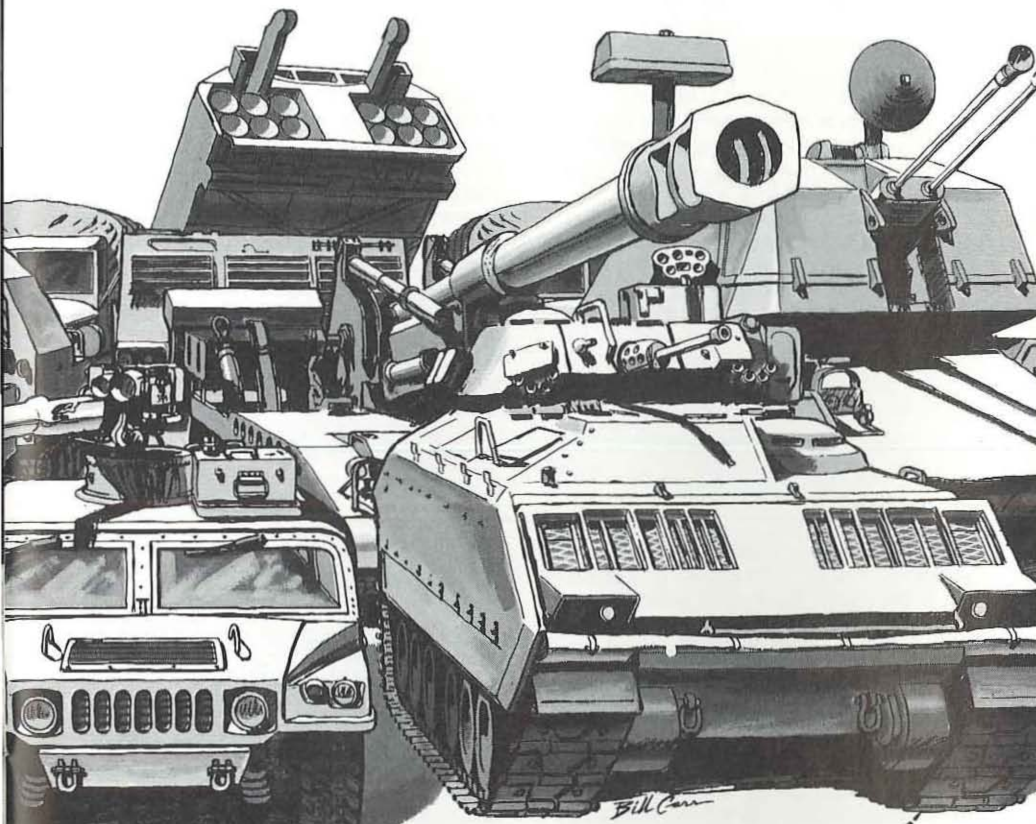


biggest tanks, artillery pieces, even helicopters–to forward areas.

On the ground, the C-17's exceptional maneuverability speeds delivery. This aircraft can be turned completely around in just 90 feet. It can back up. It can be maneuvered into small ramps and even unloaded with the engines running without disrupting ground operations.

The result: a rapid, sustained flow of needed cargo right to the "king's men."

The C-17. Brings the mission down to earth.



MCDONNELL DOUGLAS

really get a computer to do something useful is still pretty much the perview of a few anointed souls. To get a military processor, which is planted within the bowels of a flight control system or your weapons system, to work right is even more complicated because it uses assembly languages that are even more difficult to work with than the higher order computer languages most of us have at least heard about, such as Basic and FORTRAN.

Unfortunately the procedures to maintain software are not nearly as well defined and regulated as the support of hardware. It was only in the 1970's that the need to maintain software at all began to be recognized. The Army has had systems which used computers since the 60's but each of these systems was generally unique and problems were usually resolved individually, very much like handtooling a driveshaft for a specific tank or aircraft.

Software, because of its complexity and being extremely people-dependent, is usually the most expensive part of any system that uses computers. As the use of battlefield computers increased, it became obvious that a way to manage and maintain software had to be established. This need was the driving force which led to the **Post-Deployment Software Support (PDSS)** concept.

Tackling the problem

In 1978, the U.S. Army Materiel **Development and Readiness Command (DARCOM),** decided to come to grips with the issue of software support. At the Department of Army's direction, DARCOM established a working group to develop a plan for how software support should be handled to satisfy the overall Army need. This working group developed the PDSS Concept Plan for Battlefield Automated Systems which was approved in May of 1980.

The Concept Plan called for the establishment of eleven PDSS centers. These centers were to be created to handle different weapons systems and different Army requirements. The **Army Aviation System Command (AVSCOM) PDSS Center (PDSSC)** was established at Fort Monmouth to support the AVSCOM developed Aviation-Electronic systems.

What exactly is the AVSCOM PDSSC?

Forget the fancy acronym and think of it as a place where the Army maintains aviation software. The size of that job is much greater than most aviators are apt to imagine. It's easy to visualize the changing of an engine or rotor blade but the maintenance of the codes that make the SAS work on a UH-60 is not that easily visualized. The job is done by a small group of software experts who maintain software programs and who are constantly looking for ways to improve the existing software in Army aircraft today. The mission of the PDSS Center is to provide expertise, advice and assistance to the AVSCOM PM's and Project Leaders as they manage their systems through the various phases of development.

The PDSS Center provides software expertise at the earliest possible stages in the development cycle. Support early on makes the eventual transition of accepting the support job during fielding that much easier. PDSS personnel participate in the design reviews and in the monitoring and evaluating of the developing contractors software performance and products. The PDSSC also supports product assurance and test activities as part of the verification and validation process. PDSSC personnel assist in the evaluation of the configuration management effort as well. It is during these pre-deployment phases that the PDSSC begins to look at and participate in initial production planning from a software point of view.

As development moves to deployment, the role of the Center changes. At the transition, the Center assumes responsibility for maintaining the software for the readiness organization. Following fielding, any latent defects detected by field activities or by "hot bench" testing within the PDSS Center will be corrected by the Center.

The key to the future

The challenge to the AVSCOM PDSS Center is considerable, but also exciting. Software is the key to improving existing hardware with a minimum of cost. The potential for expanding Army Aviation performance is enormous. It is our charter to ensure that Aviation systems perform to the very limit of their capabilities.

DA and DARCOM recognize the magnitude of this challenge and have dictated a serious approach to satisfying the need for software support. DARCOM recently issued the **Life Cycle Software Support (LCSS)** Implementation Plan which ensures that the soldier receives the support he needs. **IIIII**

Converting ARC-186 to SINCGARS is little more than putting on a good front.

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TALKING AIRPLANES

BY MAJOR CORNELIUS J. WESTERHOFF

A currently popular television show sports a car as one of its lead characters. Not just an ordinary car, of course, but one that talks to the driver. Hollywood is well known for its gimmicky creations but this time the "impossible" is not that far from reality. In just a few months the **Avionics R&D Activity (AVRADA)** at Ft. Monmouth will have a "talking" UH-60. It probably won't have as much personality as its Hollywood counterpart but the difference is that ours is real and Hollywood's is not.

Not a new idea

The idea of using computers to generate machine generated speech is not new. Voice warning systems have been around a long time. Today there are even talking soft drink dispensers. If you are passing through the Atlanta airport you have probably heard the computer generated voice in the airport subway. They seemed to have gone out of their way to make the voice an irritating monotone.

What is new is that computers can now not only generate speech but can recognize it as well. That amounts to a sizeable leap in technology. Programming a computer to utter certain sounds is well within the ability of the home computer tinkerer. Programming a computer to recognize words with reasonable accuracy and reliability is quite a bit more advanced.

The reasons for the Army to investigate this exciting technology is that it promises to be part of the answer of how the Army aviator is going to perform a full mission profile in the seat of a single pilot cockpit. If you don't have a co-pilot to talk to at least you won't be totally alone! Actually, the computer can possibly perform many of the functions of a co-pilot yet never have to share the "glory" at cocktail parties. Not bad.

It is one of the ironies of modern technology that although it has made life a bit easier for the aviator, the aviator in turn is expected to do a lot more. The hundreds of switches, gauges and flight instruments which the aviator must know, challenge even the most seasoned pilot during times of stress. By providing the aviator with another means to access and control his equipment it may very well prove to be the margin he needs to win in future combat.

Genuinely different

Voice technology in aircraft is unique in that it is the first genuinely different way for Army aviators to operate an aircraft since the first instruments were invented. An aviator has always related to his aircraft instruments by looking at them and manually tuning, dialing or switching. Although instruments have become more complicated and have been improved with digital displays, aviators still relate to them in the same way pilots have since the first ones appeared almost three quarters of a century ago.

Now aviators can be given an alternative by being able to command a switch or display to do certain things using only the voice. This whole new approach raises some very complicated human factors issues. Those issues are the subject of studies being conducted at various laboratories, including AVRADA.

AVRADA's chief engineer for researching voice technology is **Lockwood Reed.** Working closely with the other services which are also

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researching voice technology, **Reed** is the chairman of the Voice Interactive Systems Sub-Technical Advisory Group. This group meets periodically to share information and experience. It is an effective way to ensure that the services do not duplicate research and get the full benefit of work accomplished.

Mr. Reed frequently reviews the research being done by commercial firms as well. By keeping in tune with all work being done both within and outside of the government the Army will get the greatest return from its R&D dollar.

When research began on voice technology it became immediately obvious that there were a lot of questions needing answers. One of the first issues looked at was the feasibility of adapting existing commercial systems for use in Army Aviation. A major problem in Army Aviation is the amount of background noise in which a system has to operate. The programming and operation of voice recognizers in the quiet, sterile atmosphere of a laboratory is a far cry from using them amidst the noise levels found in a CH-47 or a UH-60.

Compounding that problem are the microphones typically used in Army aircraft. Whereas Air Force pilots can use the oxygen mask to reduce some of the outside noise from entering the microphone, Army Aviators do not have that luxury.

Aiming for perfection

The Air Force is looking at voice technology as a candidate for their Advanced Fighter Program. In one test their computer achieved 90% correct recognition even when the pilot was pulling 5 g's. The Army doesn't have very severe g force requirements, but a near perfect recognition rate is considered the most important requirement for Army needs. The goal is 95% absolute accuracy with a 99.5% confidence factor. A voice recognizer will prompt you if it doesn't understand your command by asking you to repeat it again. Obviously you don't want to have to repeat yourself too often which is one of the reasons that work is continuing in this technology.

Even when using already developed commercial systems the technical problems of creating a system useful to the Army aviator is no small job. Software has to be developed, test routines devised, and hardware interfaces designed.

Lockwood Reed chose an AHIP type of display system as the first candidate for a voice activated system because AHIP type missions can require frequent manual tuning and adjustments to various avionics equipment. Using voice systems for activating flight controls appears feasible but is well beyond the first proposed use of this technology.

Extensive testing has already been conducted in the intelligibility of computer generated speech. There was concern that the mechanical tone of synthetic speech generators might not be as easily understood as normal human speech. Testing shows that there does not appear to be much difference between understanding human or computer speech. There is even some evidence that the monotone of computer speech may be desirable because it is easier to pick out of a noisy background.

Being able to pick out a computer generated warning when several radios are chattering may turn out to be a life saver in combat.

Our Vietnam experience has told us that at least a few residents of the "Hanoi Hilton" were there simply because they did not respond to a voice warning device in time. The human factors work still to be done will undoubtedly generate some fascinating data on how man responds to his machines.

Astounding potential

AVRADA is looking at the hardware of various industry leaders in this technology. Among the commercial equipment being investigated is a voice recognizer from VOTAN and another from Interstate. Other, more rugged, non-commercial systems from ITT, Lear-Siegler, and Texas Instruments are also being compared. A great deal remains to be done in this revolutionary approach to interacting with avionics systems.

Developing the hardware is only one part of the job and may prove to be the easy part. Finding the best way to use the hardware is a challenge in itself. The use of voice activated and responsive avionics has been proposed as one of the necessary ingredients for a one man cockpit that can do all of the things the Army demands. The LHX is a strong candidate for using voice technology.

If you let your imagination soar, the potential uses for voice activated systems are virtually endless. AVRADA expects to remain one of the leading laboratories investigating this potential combat multiplier. **IIIII**

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MIDLAND ROSS

EFTA: DEDICATED TO EXCELLENCE

BY CAPTAIN GREG KAUFMANN

THE **Electronics Research and Development Command's Flight Test Activity (EFTA)** is the primary organization within DARCOM for providing both the technical aircraft modifications and RDT&E flight testing for electronic airborne systems.

This mission hasn't changed since 1909, when the first aircraft purchased by the U.S. Army Signal Corps was used to research the airplane for possible military applications. This original flight section, after numerous moves and name changes, now finds itself located at the Naval Air Engineering Center in Lakehurst, NJ, as EFTA. Along with the **Flight Test Detachment (FTD)** at Ft. Belvoir, VA, EFTA is able to provide technical assistance for aircraft modifications, human factors engineering advice, and the planning and conducting of flight testing of electronic airborne R&D systems.

Aside from evaluating voice, data communications, and non-communications emitters EFTA also provides services in fuzes, technology, electro-optics, lasers, sensors, searchlights, and ECM/ESM.

Our biggest client

Among the many laboratories and project managers EFTA services, the **Avionics Research & Development Activity (AVRADA)** ranks as the largest. EFTA currently is working on numerous projects for AVRADA, including SINCGARS-V; AN/ASN-132 **Inertial Navigation System (INS); Global Positioning System (GPS);** AN/ARC-199 (HF-SSB) NOE Communications System; the **Decelerated Steep Approach & Landing System (DSAL);** and the **Systems Testbed for Avionics Research (STAR).** Also, AVRADA, in conjunction with the FAA, continues to work on the **Microwave Landing System (MLS).** EFTA uniquely provides both the technical expertise to modify the basic aircraft to accept developmental items and provides pilots for advising on aviation-peculiar matters as well as performing the flight testing.

Exceptional assets

In order to support such varied and numerous requirements, EFTA maintains a fleet of both rotary wing and fixed wing aircraft. The inventory fluctuates with test requirements, but ranges from an 0-2 through an RV-1D and from a UH-1B with autopilot and Microwave Landing System (MLS) installations to the YEH-60B SOTAS "Daddy Longlegs". To successfully conduct such a varied operation 30 military, 29 DACs, and 67 maintenance contractor personnel are employed. The 13 DAC aviators provide both stability and extensive aviation expertise.

These highly qualified individuals all have a long history of involvement with Army Aviation, and bring great experience to the conduct of the testing. Also, DACs serve as Quality Assurance inspectors. Again, stability and a long-standing term of involvement help to assure a quality operation. The contract maintenance personnel also have exceptional technical backgrounds and are capable of supporting all phases of our test activities.

A recently concluded RDT&E project, the Ring Laser Gyro, not only required extensive modifications to the UH-1H, but also involved a flight test envelope consisting of continuous,

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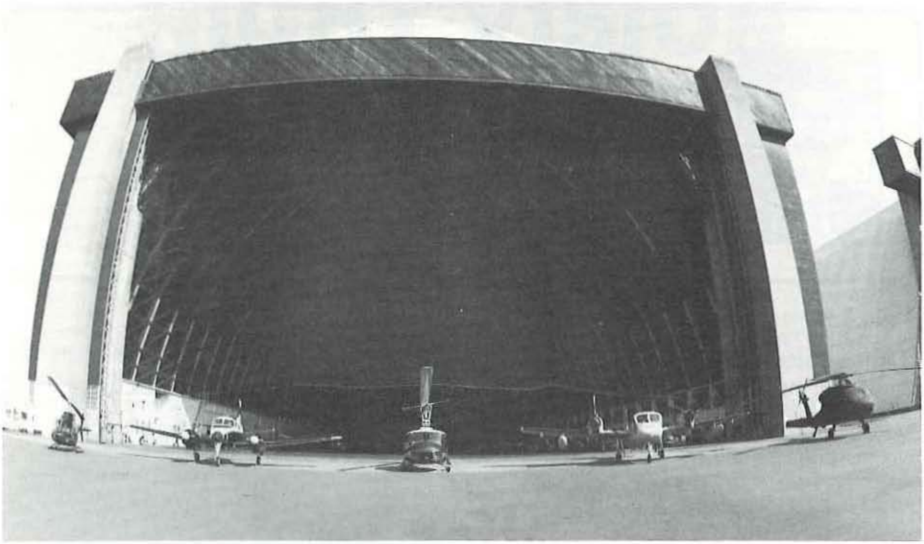

ABOVE: The five major aircraft types currently active in the ERADCOM Flight Test Activity's inventory are displayed in front of the EFTA hangar at the Lakehurst Naval Air Engineering Center in New Jersey.

unusual attitudes of bank and pitch to the extremes of normal operational technique. These maneuvers were necessary to evaluate the stability of the test gyros. EFTA has the resources and experience to meet the requirements for any airborne electronic RDT&E mission.

Another project, the **Airborne Steerable Null Antenna Processor (ABSNAP),** demands very specialized skills. This test will involve extended NOE operations to evaluate the computer's capabilities under jamming conditions with various antenna configurations. This test requires pilots to fly the test flight profiles and not deviate significantly from them. A difference of just 100 feet in altitude or failure to remain on course can negate all data gathered on any particular test run. But piloting the aircraft within the test profiles is just a small part of the total contribution this activity can make to any RDT&E project.

Seasoned professionals

As mentioned earlier, the DAC pilots working at EFTA have a long association with Army Aviation. All have served in the active Army and, with the exception of two who are retired warrant officers and one who is a retired LTC, they continue their association through the National Guard. This long-standing relationship has paid large dividends.

The project pilot who is responsible for the Improved GUARDRAIL V has been involved in the development, testing and fielding of all the GUARDRAIL systems. Included in this was the actual use of the original GUARDRAIL concept (LAFFING EAGLE) under combat conditions in Vietnam when he was on active duty. This individual has an institutional knowledge that cannot be found anywhere else. He can address any facet of the RDT&E phases, and understands the test flight profiles to be flown and the significance of deviations from these profiles.

A wide ranging role

Not all testing is necessarily for piloted aircraft. A project soon to commence involves flight testing of a lightweight doppler system suitable for use in the **Remotely Piloted Vehicle (RPV).** Other tests involve antennas, seekers and other electronic oriented equipment.

EFTA also provides support for non-military projects. AVRADA and the FAA are continuing work on the **Microwave Landing System**

Q. What similar purchase have more than 12,000 Army Aviators made in the past 15 years?

A. They've purchased AAAA-endorsed flight pay insurance. As an active duty or or as a Reserve Component Army Aviator, don't you think you owe it to yourself to get the basic facts about this coverage which has returned more than $2 million in lost flight pay to claimants?

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Please forward me the pertinent details of the AAAA-endorsed flight pay insurance coverage.

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ADDRESS ______

CITY ______ STATE ______ ZIP ______

MY DATE OF BIRTH IS ______

(MLS) so as to collect data which will allow for the development and updating of criteria, standards and procedures for operation of helicopters within the National Airspace System. This MLS, mounted on a UH-1B, is the test bed for the MLS system and is the original of a system now on board the Space Shuttle.

In the area of technical modifications, a program recently concluded for AVRADA by EFTA involved rewriting a **Modification Work Order (MWO).** The UH-1V Medevac aircraft has as one of its instruments the ARN-124 DME. This DME could not be installed in aircraft built prior to 1966. Therefore, it was necessary for EFTA to rewrite the MWO.

Reaching out

In addition to supporting AVRADA, EFTA also supports the **Special Electronic Mission Aircraft (SEMA)** Product Managers, **Signal Warfare Laboratories (SWL), Electronic Warfare Laboratories (EWL),** the **Communications-Electronics Command (CECOM)** and the **Environmental Protection Agency.** Other ERADCOM agencies EFTA is supporting: the **Atmospheric Sciences Laboratory (ASL);** the **Combat Surveillance and Target Acquisition Laboratory (CSTAL); Electronic Technology and Devices Laboratory (EDTL);** the **Harry Diamond Laboratories (HDL);** and the **Joint Surveillance Target Attack Radar System (JSTARS)** Program Director.

Selected projects include the QUICK LOOK II Cockpit Display Product Improvement Program; the ABSNAP project mentioned earlier; and the Position Location Reporting System jamming tests. The Belvoir Detachment is in direct support of the **Night Vision and Electro-Optics Laboratory (NVEOL).** Among the more significant pieces of equipment produced by NVEOL were the Pilot Night Vision Systems (AN/PVS-5 and ANVIS) and the **Forward Looking Infrared (FLIR)** system.

EFTA support of the above organizations does not necessarily end with the conclusion of the RDT&E cycle. The FTD provides their expertise on new night vision devices to the field when these systems are being introduced into line units. EFTA continues to support the EH-1H **Standoff Target Acquisition System (SOTAS)** aircraft deployed in Europe, and still provides IPs to SOTAS detachments for recurrent and initial pilot qualification training. Maintenance representatives also accompany them to provide training in the maintenance arena.

EFTA consists of three branches and the FTD. The key branch is the Plans, Training and Operations Branch. It is here that future requirements are identified and present requirements are fulfilled. This office is the interface point between EFTA and all supported agencies. The Operations Officer is reponsible to the Chief of this branch for the accomplishment of daily flight requirements for aircrew training and **Operational Support Airlift (OSA).** The Budget office also falls under this branch.

The Maintenance and Supply Branch, the largest of the branches, is primarily concerned with the maintenance contractor and providing the Quality Assurance inspectors to ensure all work performed by the contractor is up to standards. This branch is also responsible for supply operations. The Administrative Branch is responsible for items such as correspondence, orders, travel, etc.

The FTD at Ft. Belvoir supports not only the NVEOL, but also other government agencies such as the FBI. In addition to conducting RDT&E flights for NVEOL, they also conduct training for advanced technology night vision devices for Army schools and major commands.

An exciting future

EFTA looks excitedly to the future. Systems being designed for the Airland Battle and Army 21 are now coming off of the drawing boards and are moving into the development and testing phases. EFTA stands ready to support these efforts in all phases of the RDT&E cycle.

EFTA is a service-oriented organization. We are dedicated to ensuring that electronic systems can be used and maintained by the soldiers in the field. We are committed to attaining a timely, responsive, positive attitude throughout the activity to ensure that you, the user, get the best product. This includes making available not only pilots to fly aircraft, but also the institutional knowledge of systems, such as GUARDRAIL, QUICKFIX, SOTAS, and the understanding of the criticality of flight test profiles that exists within this activity.

In a sentence, EFTA will produce a product that is useful to the soldier, usable by the soldier, and of proven reliability for the soldier. This dedication to excellence in support of the RDT&E community is what EFTA is all about.**IIIII**

Keep your Hellfire in Sight
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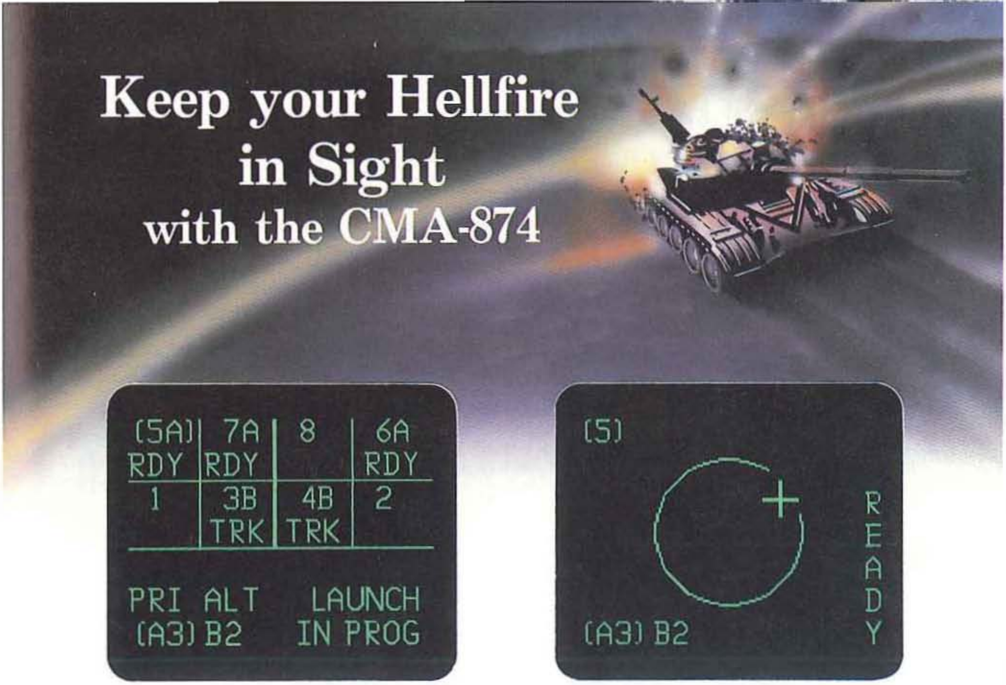

Modern weaponry such as the Hellfire Missile can now provide all-weather, day-and-night capabilities. But no level of sophistication can let you afford to lose touch with your weapons system — effective control can be half the battle, particularly on close air support missions.

The Canadian Marconi CMA-874 Hellfire Control and Display Subsystem keeps your Hellfire in sight. Suitable for the most demanding missions, the CMA-874 is lightweight and small enough to fit into today's crowded cockpit, right up front where you need it. It features sunlight-readability and full compatibility with the latest in night vision aids, without the need for 'quick fixes'. The displays are clean and organized, with the right display presented at the right time without the need to reselect from a multi-function display. Easy-to-read, comprehensive graphics and automatic adjustment of display brightness ensure that you get the information you need, every time.

For further information on how the CMA-874 Hellfire Control and Display Subsystem can keep your Hellfire in sight, contact:

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LHX may still be in advanced design, but the engine is already showing its metal.

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Because the turbofan version of the TSE109 was built to unparalleled military design and test criteria, it will set a new standard for performance, durability and safety. And because experience teaches that needs do change, Garrett is building the TSE109 with power growth capability to over 1500 SHP.

The TSE109. Before it ever came off the drawing board, we proved our know-how in nearly 50,000 production units. Including over 15,000 propulsion engines, like those aboard the OV-10A Close Support Aircraft. And we back up that technology with advanced production facilities, a nationwide vendor base, and an Integrated Logistics Support network. For detailed information, contact: Propulsion Engine Sales, Garrett Turbine Engine Company, P.O. Box 5217, Phoenix, Arizona 85010. (602) 231-1037.

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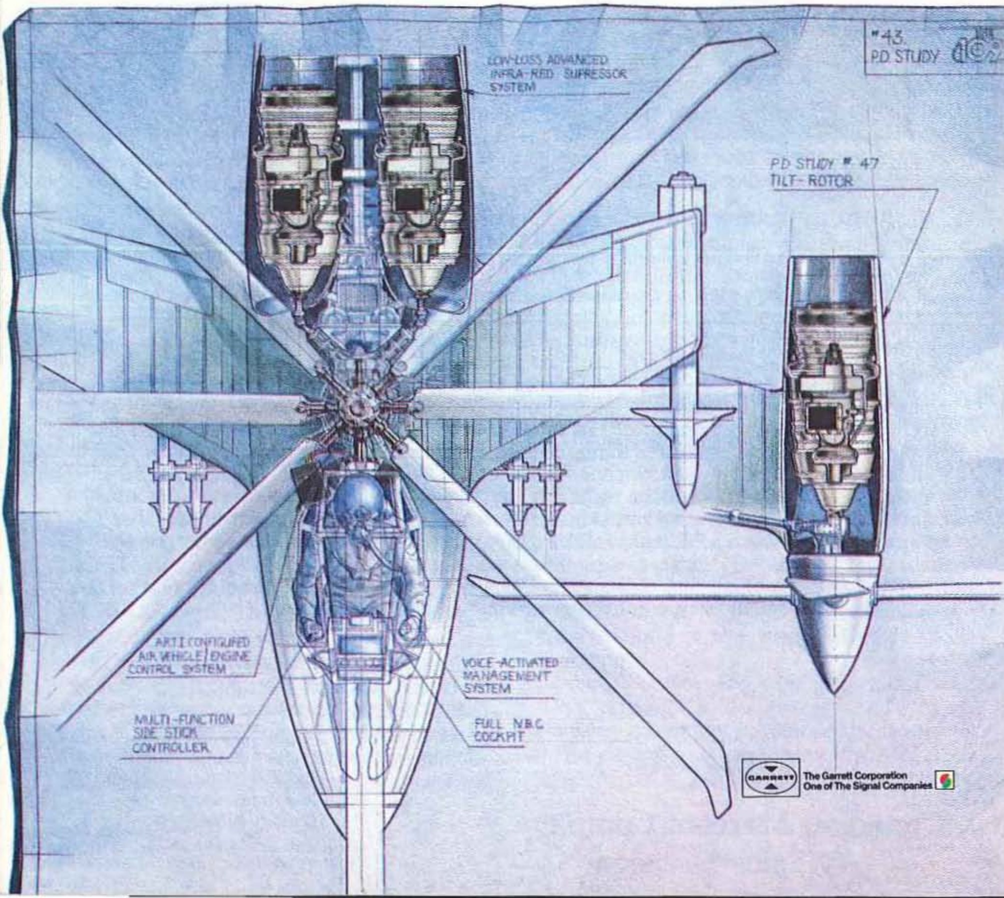

IMPS: MISSION PLANNING

BY NORMAN E. COLTEN

IN the constantly changing world of aviation, the need for good mission planning has never changed. It is quite possible that sophisticated equipment utilizing modern technology has made that even more important than ever.

In order to take full advantage of revolutionary equipment, such as the **Digital Map Generator (DMG),** the aviator must plan its use before he begins his mission. The complex requirements of night navigation and pilotage cannot be fully satisfied by merely installing the electronics equipment in the aircraft. The mission planning function must be addressed, particularly that planning that must be performed in order to properly and efficiently utilize the DMG.

The first step

AVRADA has taken the first step in addressing the problems that must be resolved to provide the mission planning capability that is required for optimum utilization of the digital map. Work was performed under contract by the Harris Corporation (Melbourne, FL) and Anacapa Sciences, Inc., (Santa Barbara, CA) on an **Integrated Mission Planning Station (IMPS).** Harris was responsible for the hardware and software development, while Anacapa Sciences performed the necessary human engineering. The result of that effort was a system that enables AVRADA to exercise the DMG as it is likely to be utilized by an aviator.

The heart of the IMPS is a DMG. The DMG is included so that the IMPS map display is an exact duplicate of the display that the aviator will see in the cockpit. The host for the IMPS software is a Digital Equipment Corporation VAX 11/780 computer. Special purpose graphics are provided by a De Anza image processor.

The equipment used for digitization of overlays and editing are a large Calcomp digitizing tablet and an Elographics touch-sensitive panel mounted on the face of the color monitor used in the system. Symbol generation and video mixing are performed by equipment that has been specially fabricated by AVRADA.

Formidable tools

The capabilities of the IMPS include all of the airborne functions of the DMG and those additional functions that are expected to be performed in a mission planning environment. These include the ability to produce tactical overlays, intervisibility patterns; and perspective views; edit old or incorrect data; generate mission plans; and perform simulated flights in the mission planning station.

Since the basic DMG was designed with only a computer-to-computer interface, it was necessary to provide the means for an aviator to interact with the DMG. The end result of this effort was the design of a **control/display unit (CDU)** and hand controller and the paging layout with which the aviator can interact. The pages appear on the CDU and the aviator performs the desired operation by use of a line-select key or entry of data. Then, the VAX 11/780 performs whatever computations are required and drives the DMG. The aviator is led through the appropriate pages and is prompted for inputs as they are required. The pages were developed after interviews with many Army pilots to determine their map information needs.

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MR. COLTEN IS THE PROJECT ENGINEER FOR THE INTEGRATED MISSION PLANNING STATION (IMPS) IN AVRADA'S RESEARCH AND TECHNOLOGY DIVISION.

Four map scales can be selected — 3km, 6 km, 12km, or 24km — to be the area shown across the face of the CRT display. The aviator can choose between slope and elevation shading of the terrain elevation information. A special mode of elevation shading is useful for terrain avoidance. In that mode, all terrain above the barometric altitude of the aircraft appears in yellow. At any time, the contour interval can be changed instantaneously or the contour lines can be removed entirely.

The center position of the map is selectable. The map display can be centered about the aircraft, any previously entered **Air Control Point (ACP),** or any other location for which the aviator enters the coordinates. The orientation of the map is also selectable with N, E, S, W, aircraft heading, aircraft track, any ACP, or any designated course at the top of the display. The display changes immediately after the aviator selects a new orientation.

Navigation updates

The system can easily be used to update a navigation system by allowing for update of position by coordinates, laser range and bearing, or resection. Also, any point can be easily annotated for future use or recognition by insertion of an alphanumeric symbol at the point of interest. The range and bearing to these annotated points can easily be obtained and displayed on the CDU with respect to either the current aircraft position or any other reference position.

The unique DMG capability that cannot be matched by any of the other map technologies (paper map, projected map, video disc) is that of selecting exactly what features appear on the display at any time. The aviator can determine his requirements and establish three presets for each map scale.

For example, Preset 1 could consist of coniferous forests, streams, paved roadways, bridges, railroads, and airfields. Preset 2 could consist of

ABOVE: A 6x6km MAP IS SHOWN WITH ALL TOPOGRAPHIC FEATURES SELECTED FOR DISPLAY.

BELOW: THE SAME MAP IS SHOWN WITH THE TOPOGRAPHIC FEATURES DE-CLUTTERED.

OPPOSITE PAGE: THREE OF THE MAP SCALES AVAILABLE FOR DISPLAY ON THE HARRIS DMG ARE SHOWN FROM TOP TO BOTTOM: 12x12km, 6x6km AND 3x3km. (24x24km IS NOT SHOWN).

hazards to flight (such as transmission lines), streams, railroads, and **forward area refueling and rearming points (FARRP).** Preset 3 could consist of tactical information only such as flight path, landing zone, enemy locations, FEBA, battle positions, etc.

With the simple push of a button, the aviator can switch from preset to preset, or he can choose to display all of the topographic information, all of the tactical situation information, all of his mission-specific data, or any combination of these three classifications. He also has the capability to add or delete one feature at a time until the desired display combination is achieved.

The system can also be used to extract feature information about any given point by moving a cursor over the point and hitting a button. Then, the information is presented to the pilot on the CDU. The pilot also has a special declutter button that can instantly remove all but the elevation data.

Flight planning data

The system can also be used to obtain useful flight planning information. **Air Control Points (ACP)** can be entered for use by the navigation system. Then, based upon the current aircraft position and speed, various calculations can be performed by the system. These would include required speed, required heading, or time remaining to a selected ACP.

A critical piece of information for successful mission planning in the high threat environment is the location of areas that are covered by enemy air defenses. In the IMPS, the enemy weapon locations, ranges, fields of view, and heights are entered. Then, after entry of a particular flight altitude of interest, calculations are performed indicating what areas are visible to the enemy weapon and which are not. These intervisibility plots can be stored on the tape cassette and taken into the aircraft for retrieval at the discretion of the aviator.

Tactical overlays can be entered in the IMPS. There are several ways that this can be accomplished. The simplest procedure, and the one most likely to be used if acetate overlays have already been prepared and are merely to be entered into the system, involves use of a digitizing tablet. The overlay is placed on the tablet and the CDU is used to enter the scale of the map and the locations of the overlay registration points, which are then marked on the tablet.

After the aviator designates the overlay type, the overlay is traced. When it is entered into the system, it is displayed on the color monitor against the map background as it will appear after it is stored on the tape cassette. If the overlay is to be created in the IMPS, a map may be placed on the digitizing tablet, and the overlay can be drawn on the map while simultaneously being entered into the data base.

There is a touch-sensitive screen on the IMPS monitor. It is possible to utilize this for entry of overlays "directly" onto the map. In either case, the results are the same — the aviator can see the overlay against the map and store it if it is correct or delete it if it is unacceptable.

Three-dimensional views

The plan view presented by traditional maps and the DMG does not provide a three-dimensional view of the terrain that quickly presents the lay of the land. In IMPS, it is possible to generate perspective and isometric views of the terrain. The aviator enters the viewing position, view direction, viewer height, vertical exaggeration, and view type (perspective or isometric). The views are generated for immediate viewing and can be stored for recall at a later time.

The pilot can utilize the IMPS to perform many of his preflight planning procedures. The generation of flight plan lines and points that ordinarily are written on a paper map or overlay can be generated in IMPS and are then written on the tape cassette for later recall. The beauty of the DMG is that this data will be available when desired, but will not clutter up the map when it is not required. In addition to the mere entry of the flight plan lines, useful information such as leg length and cumulative flight path length are calculated for the aviator as the lines are entered.

The information contained on the cassette is very dynamic and is expected to change on a daily basis. A means must be provided to enter new data and delete or modify the old data that has been placed upon the tape cassette. The IMPS contains an editing procedure that will enable the aviator to edit the tape cassette in a simple and straightforward manner.

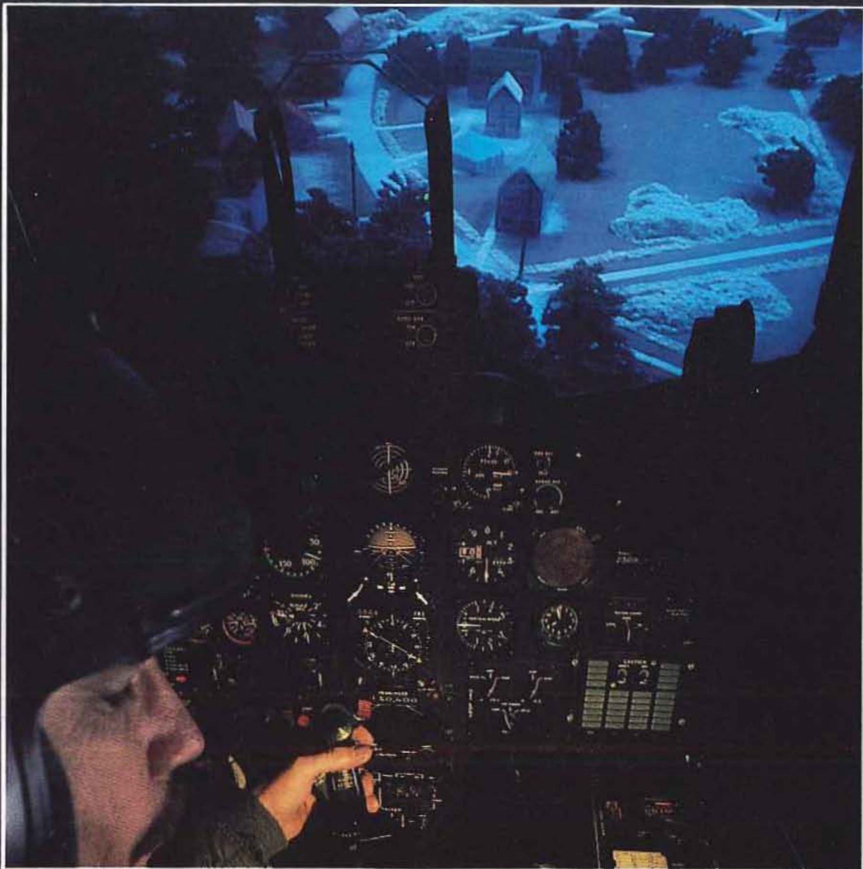
The edit area is presented to the aviator on the CRT and he selects which items are to be deleted by use of the touch-sensitive screen placed over the IMPS monitor. Entire linear features (such as FEBA or routes of flight) can be removed with a single touch. Then, after removing the unwanted data, the aviator can add new data by "drawing" on the face of the monitor. After several iterations of this process, as required, the tape cassette is rewritten.

Mission simulation

After the tape cassette is completed, the aviator may then review what has been placed upon the cassette. A special mode of IMPS allows the aviator to perform a simulation of what would appear on the map if he were actually in flight. The map will follow an entered flight path, move from ACP to ACP, or move as directed manually by use of a joystick. This enables the aviator to become familiar with the appearance of the map as it would be if he were to fly the expected flight plan. As he goes through the simulated flight, he will discover what information he has omitted in his editing procedure and he can add that before his actual flight.

After the aviator has finished in the mission planning station, he has a tape cassette with all of the current tactical and mission data that he can take to the aircraft for his flight. While in flight, he will annotate the map with additional tactical information which will be stored upon the cassette. After his flight, he can re-edit the cassette in IMPS as the cycle starts all over again.

This article has described the current state of the **Integrated Mission Planning Station (IMPS)** development in order to provide some familiarization with the revolutionary developments forthcoming in the area of digital mapping and mission planning. The next phase of IMPS activity will be a two-year simulation effort to determine what modifications may be required prior to initiation of advanced and engineering development programs. **IIIII**



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GPS: GLOBAL POSITIONING

BY IRVING LEVINE

THERE used to be a time when Army Aviators flew and conducted missions with only a general idea of where they were at any given moment. Modern warfare won't let these aviators get away with "rough" navigational procedures. The aviator must know his location precisely to be able to position weapon systems accurately. To do that, navigation must be exact and not performed by "gut feel". Even the Doppler, which is the best thing to come to Army Aviation since the RMI, doesn't do the job well enough. Fortunately, the solution is almost here. It's called the **NAVSTAR Global Positioning System (GPS).**

A dream come true

The NAVSTAR GPS is a satellite based radio system which will provide extremely accurate position and navigation information. Navigating by satellite is about to come true! The overall GPS concept consists of space, ground control, and user equipment segments.

Current plans call for a constellation of 18 navigation satellites in a 12 hour orbit at an altitude of 10,900 nautical miles. As of today, there are six GPS operational satellites already in orbit. With the 18 satellite constellations, there will always be from 4 to 7 of the satellites within line of sight of an aircraft.

The way GPS works is fascinating. Each satellite transmits on the same two-frequencies, but each has a unique signature to separate it from its neighbors. The signature is a satellite specific waveform and an exact timing of the signal. From the aviators view, the satellites can be considered as known points in space which the aircraft receiver "ranges on" in order to compute a position. It takes four satellite signals to give the receiver an accurate three dimensional position. That is why there will always be from 4 to 7 satellites' in direct line of sight.

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Tracking and receiving

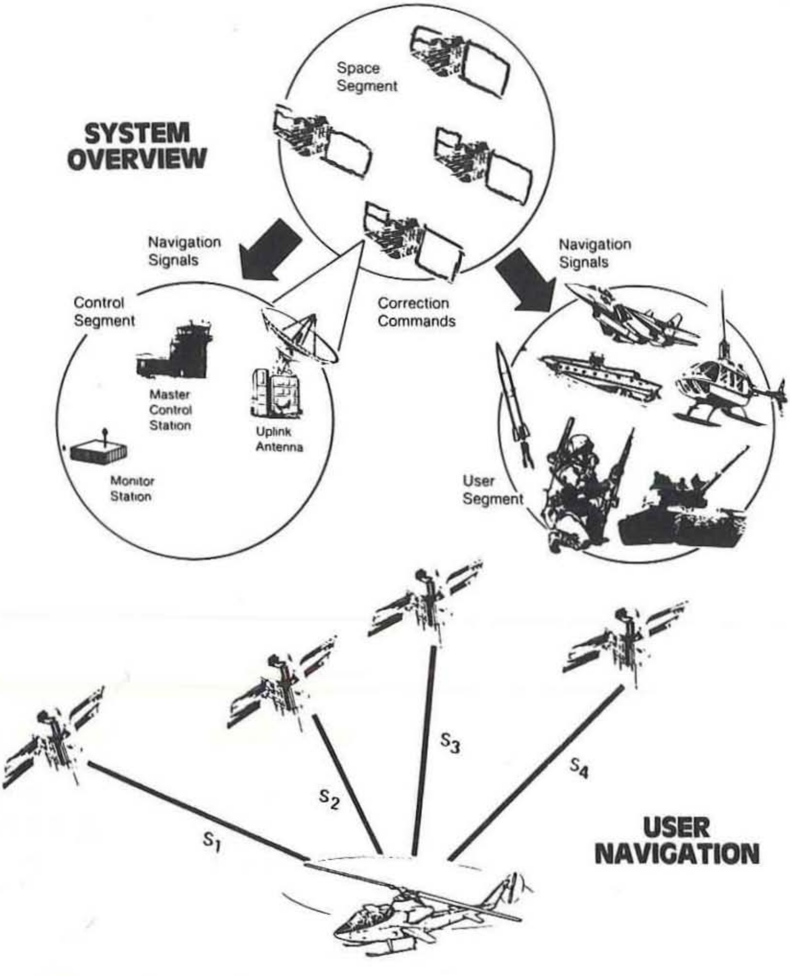
Ground control stations will track the satellites and update their position coordinates and timing signal. Simply stated, for the satellite to provide the receiver with an accurate position it must in turn know exactly where it is in space. The ground control portion of the system will have several dispersed unmanned monitor stations, a control station, and several upload stations. The monitor stations passively (by only listening to a signal) track the satellites and then feed this information to the control station. The control station computes the 18 satellite positions as well as recalculating the satellite timing signals.

This information is then sent to the upload stations which in turn transmits the information to the individual satellites. The satellites then transmit their positioning data to the aircraft receiver which can be thought of as the final link in a pretty complicated chain.

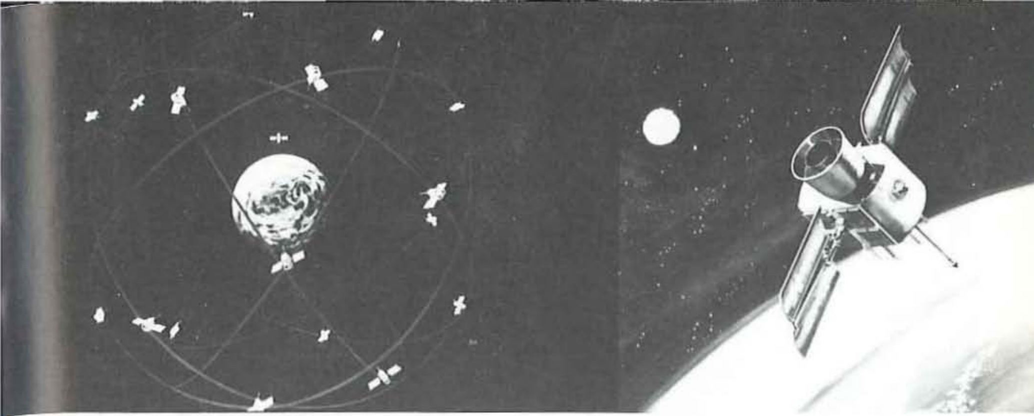
The receivers (User Equipment) for the GPS system are being developed to serve a wide range of needs. They will be used on land, at sea, and of course in the air. The Army is planning to use two types of receivers, one is for Manpack/Vehicular application and the other for aircraft application.

The satellites will interact with the aviation user by transmitting their coded signals to the receiver installed in the aircraft. The aircraft

NAVSTAR GLOBAL POSITIONING SYSTEM:



- **RECEIVE SYNCHRONIZED SIGNALS FROM SATELLITES**
- **MEASURE APPROXIMATE RANGE AND DOPPLER TO EACH**
- **COMPUTE THREE COORDINATES OF USER POSITION AND USER CLOCK BIAS, AND DETERMINE VELOCITY**



receiver locks onto the satellite code and measures the range to each of the 4 transmitting satellites. Based on those measurements, the aircraft receiver can calculate a three-dimensional picture of where it is and the velocity at which it is travelling. The receiver then sends this information to the proper navigation instruments in the cockpit for display.

From the aviator's view, the GPS is not only a highly accurate navigation system but it is also passive, meaning it does not require the aircraft to transmit any signal.

The Army is currently using the AN/ASN-128 Doppler Navigation system as the standard self-contained navigation system. The Doppler system is not passive because it transmits microwave energy toward the ground in four beams. It then measures the frequency shift of the return signals from which it generates navigation information. One of the limitations of the Doppler system is that it requires position updating to limit its position error.

The best of both worlds

Combining the GPS system and the Doppler system is an ideal way to complement the strengths of both systems. The GPS can be used to position update the Doppler while the Doppler will reduce the GPS Jamming vulnerability and aid the system during line of sight satellite blockage. If the aircraft loses the GPS signal because of a severe maneuver or jamming, the Doppler not only maintains navigational information but aids the GPS receiver in re-acquiring the satellite signals.

One of the more interesting aspects of the GPS system is that it provides the pilot with three-dimensional information. That means **Mean Sea Level (MSL)** altitude as well as the normal steering information. Because of the GPS altitude, the GPS can be used as a landing approach system. How precise the landing information will be remains to be evaluated during DTII/OTII. But the probability is high that the Integrated GPS/Doppler system will provide the Army with a fairly good landing approach capability in a field environment without requiring the use of ground based beacons or transmitters.

ABOVE: An artist's rendering of NAVSTAR Global Positioning System (GPS) satellites orbiting the earth.

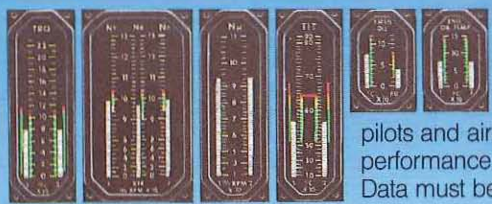
Putting it in the air

The Army has two UH-60 aircraft equipped with the Integrated GPS/Doppler systems. The **Avionics Research and Development Activity (AVRADA)** performed tests to make certain that the integrated GPS/Doppler system functioned properly without interfering with the remainder of the aircraft avionics equipment. AVRADA then evaluated the performance of the systems through test flights at Lakehurst Naval Air Station using pilots from the **ERADCOM Flight Test Activity (EFTA)**. So far the test results have exceeded many of the program goals.

Testing has also begun at a laser instrumented range. AVRADA is presently developing the Integration to allow a combined satellite and self-contained navigation system (Doppler or Inertial) to be installed in the AHIP, AH-64, CH-47D, and other Army aircraft.

The bottom line is that the NAVSTAR GPS will provide the Army aviator with navigational accuracies not available in any aircraft in any service. ▮▮▮▮▮

Monitor performance, quickly, clearly and accurately



The assault helicopter's role as a sophisticated weapons delivery platform puts a great demand on pilots and aircraft systems for optimum performance and operational readiness. Data must be presented quickly and accurately, with displays human engineered for many visibility and environmental conditions. AMETEK instrument specialists, with over 50 years aircraft experience, design solid-state reliability, liquid crystal and other integrated display and sensor technology into systems for all types of applications. Contact Military Marketing Manager, AMETEK Aerospace Products, Sellersville, PA 18960. (215) 257-6531. Telex: 84-7445.

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ADAS: DIGITAL AVIONICS

BY MAJOR ROBERT E. BRITT AND RAYMOND F. CLARK

THE **Army Digital Avionics System (ADAS)** Program combines the following control and display functions for an Army BLACK HAWK helicopter flight crew: flight; navigation; engine/transmission/fuel/rotor; caution/advisory; secondary systems; ASE; CEOI; checklist; and emergency procedures.

This is done using four **Cathode Ray Tube (CRT)** displays, two **Keyboard Terminal Units (KTU),** and digital hardware and software, which eliminates most of the wiring, circuit breakers, dedicated controls and displays.

Easing the workload

The largest and most exciting benefit of ADAS is a reduction in flight crew workload, which greatly expands the flight crew's mission capabilities. In this article, we will discuss some examples of checklist procedures with ADAS, as well as some emergency procedures.

One of the top-level function keys on each KTU is CHECKLIST. Pressing this key calls up the CHECKLIST MENU and displays it on the inboard CRT. Through the use of the line keys adjacent to each CRT, and/or a dedicated switch on each collective, the crewmember is able to advance to the next line in the checklist (or go backward), and to set/enable/disable the associated secondary system(s), as required by that checklist step. All this is accomplished without the hand-held paper checklist and without a myriad of knobs, dials and switches. A few subsystems, such as STABILATOR CONTROL, are not included because of their impracticality, the need for dedicated access, and/or for safety-of-flight reasons.

In a typical example of a checklist item, the active checklist step (such as "POSITION LTS - SET AS REQ'D") is displayed to the flight crew in inverse video. The crew can always see where they've been and where they're going in the checklist because the previous step and next step are also shown. By depressing the line key to the left of the inverse video line, the next checklist step is displayed.

This new page, too, has its own secondary system control and the crewmember can perform the required procedure by simply depressing the appropriate line key on the upper half of the CRT.

Once that command is given and the action is complete, ADAS displays that condition to the crew by inverting the video for the current condition of that secondary system.

Automatic presets

It is interesting that when ADAS is first turned on, it automatically presets many other secondary systems to the condition required by the checklist (such as "VENT BLOWER - OFF" or "BACKUP HYD PUMP - AUTO"). Also, certain checklist steps are grouped and displayed on one "page", such as BEFORE TAKEOFF, AFTER LANDING etc.

Another key benefit of ADAS is that all emergency procedures are part of the system. For all practical purposes, this means that the need to memorize a large volume of information (much of which can be easily forgotten or confused under conditions of stress, fatigue, or actual battle) disappears, along with the cumbersome paper checklist — except, of course, the

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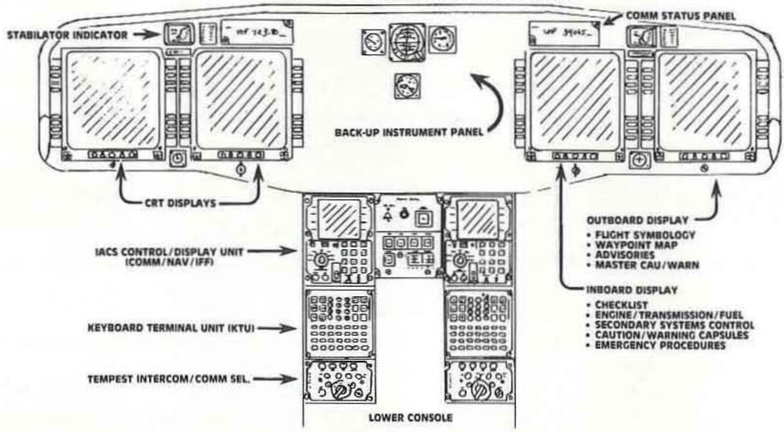
ARMY DIGITAL AVIONICS SYSTEM (ADAS)

INSTRUMENT PANEL AND LOWER CONSOLE FOR UH-60A BLACK HAWK



one which will follow if you lose your ADAS!

With ADAS, all emergency procedures are immediately available for display on the CRT's, either by manual selection from the EMERGENCY PROCEDURE MENU PAGES or **automatically.** The automatic feature allows cautions, warnings, and their associated emergency procedures to be triggered by existing on-board sensors and switches. Instead of illuminating a segmented light on the caution/advisory panel, as occurs now when one of the sensors detects an emergency condition in an Army aircraft, the plain text caution/warning legend is displayed on the inboard CRT and a master caution/warning legend on the outboard CRT.

Automatic displays

If the condition is a warning, the associated emergency procedure is automatically displayed to the pilot on the inboard CRT. For a caution condition, once the caution is acknowledged (by pressing a cyclic switch) its emergency procedure is automatically displayed on the inboard CRT. Also, ADAS contains a voice synthesizer to alert the crew by a voice warning such as "WARNING — #1 ENGINE OUT".

This allows the crew to minimize their division-of-attention and to remain "outside" the aircraft while completing the procedure. The line keys can still be used to set/enable/disable secondary systems to accomplish the emergency steps called for in the caution capsule.

When multiple cautions occur, the system automatically prioritizes them, and if they are related, combines them. All unacknowledged cautions are displayed on the inboard CRT(s) and automatically handled in priority order. An example of several related cautions would be the failure of the #1 and #2 hydraulic pumps at the same time. The failure of the #1 hydraulic pump by itself has been assigned a certain priority which would call for an associated emergency procedure.

Urgent priorities

However, the simultaneous failure of #1 and #2 pumps is assigned a much higher priority and calls for emergency procedures which are different from those required for the failure of the #1 pump alone. The automatic display to the pilot of the highest priority emergency procedure required for the current condition is a significant reduction to workload during a period of high stress. At anytime, all active cautions can be recalled and displayed via the KTU "CAU" button.

In addition to enhancing the flight crew's ability to do its assigned mission, other very important benefits accrue. These include a reduction in aircraft system weight and cost, an improved ballistic tolerance because of reduced wiring bundles and harnesses, an increased redundancy in the monitoring and displaying of aircraft faults and failures, and the automation of many routine "housekeeping" chores. ▮▮▮▮▮

ILS: INSISTING ON SUPPORTABILITY

BY ROBERT WILLIAMS

ARMY Regulation AR 700-127, "Integrated Logistic Support" states in part that "ILS is the unified and iterative approach to the management and technical activities needed to:

(1) **Influence** operational and materiel requirements and design specifications.

(2) Define and support requirements best related to materiel system design and to each other.

(3) Develop and acquire the required support."

The same regulation further states: "Planning, management, design, and refinement of the support system will start **early** in the life cycle **and be continuous throughout a materiel acquisition program.**"

The policy emphasis on starting the logistics efforts in the earliest phases of equipment development is visible in the quotations above and in the thrust that ILS must influence operational and materiel requirements.

The cart before the horse

Unfortunately, some people believe that supportability planning cannot start until there is a describable piece of equipment for which to develop support plans.

Such is not the case since, from the logistician's point of view, the fact is that once the design is established, the required support is essentially fixed. After all, once a set of basic choices is made (such as type of technology to be used) and the partitioning of the system into modules is accomplished, then the nature and approximate complexity of the modules is set. Already, the key parameters which determine support requirements and costs — such as reliability, complexity, and module size — have to a great degree determined the cost and size of the modules and of the total equipment.

Even though there is not an executed design at this point, the variables which generally determine the nature of the best support approach (throw-away, 2-level, 4-level, etc.) are no longer independent variables. It **still** remains possible to generate a poor design or a good design; but if one assumes good design practice, then the resulting equipment will have a profile of support requirements largely determined **even before** the detailed design effort begins.

The above rationale describes the basis for the generally accepted concept that by the end of the Program Initiation/Concept Formulation Phase over 65% of future expenditures on a program are already committed. It is also well established that support costs far exceed acquisition costs in avionics systems.

Logistics Engineering

Therefore, it follows that to minimize life cycle costs, supportability considerations **must** help determine operational and materiel requirements **and** the basic design starting at or before program initiation as stated in AR 700-127 quoted above. This activity is best defined as Logistics Engineering.

Logistics Engineering as practiced in supportability planning is an emerging technology. The tools are **Logistic Support Analysis (LSA), Maintenance Plan Analysis (MPA), Maintenance Engineering Analysis (MEA), Reliability Centered Maintenance (RCM),** Availability Driven Spares Computation Techniques, **Life Cycle Cost Analysis**

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LOGISTICS ENGINEERING BY PROGRAM PHASE

Program Initiation / Concept Formulation
- Supportability and Trade-off Studies
- Establish and modify supportability baselines

Engineering Development
- Assist design team to incorporate supportability features into the equipment and software design.
- Aim for design simplicity, ease of maintenance, testability, reduction in required skill levels and training, and ease of verification of performance.

Production and Deployment
- Develop, distribute and execute the **Materiel Fielding Plan (MFP)**
- Follow-up with accepting units to uncover and correct support problems.

(LCCA), and custom designed trade-off studies. Professional practitioners capable of using these tools and integrating the results are in short supply but are increasing in numbers and can be found.

To achieve the objectives of minimal life cycle cost and supportability, R&D budgets and schedules must include the funds and time to do the analysis and trade-off studies that will establish the requirements and design for a supportability baseline very early during the concept formulation phase or advanced development phases.

Department of Defense Directive 5000.1 states that "Logistic supportability shall be a design requirement as important as cost, schedule and performance." In the future, if current trends continue toward appreciation of the critical need to do supportability — performance — hardware configuration studies **before** physical hardware design begins, budgets on new starts will be required to reflect a reasonable balance between logistics planning activity and equipment development activity to be accepted. Also, as programs progress, logistics items will not be permitted to be the first items cut to finance hardware design overruns or to replace funds lost through budgetary cuts.

To implement the concept described above, program management should:

(1) Include logistics engineering capability on the management and planning team from the beginning.

(2) During the earliest possible phase, request that supportability alternatives be proposed and that trade-off studies be made between each of these and equipment design considerations. Select the tentative results which appear to give the best balance between supportability, performance and LCC as the basis for proceeding.

(3) As the design concept develops, revisit and update these studies to increase the visibility of the trade-offs to be made. Remember this is an iterative process.

(4) Make certain these studies involve the whole design and management team. They must be interdisciplinary, including logistics engineering design, testability, **Reliability, Availability, Maintainability (RAM)** and the program management members.

(5) Develop and maintain a good **Integrated Logistic Support Plan (ILSP)** which delineates the maintenance concept in such terms that design decisions can be made in support of the plan. Be prepared to alter some aspect of the concept when new studies indicate the need for a change, but keep it current.

(6) Watch for opportunities to innovate. Don't be bound by support approaches used for yesterday's technology. For instance, if the opportunity arises to achieve very high reliability and availability as a result of the new technology, and this can justify 2-level maintenance and considerable module throw away, then plan it and fight for it. The analysis tools to justify such new approaches are coming of age.

Summary

The basic responsibility of the materiel acquisition community to develop equipment providing maximum performance and readiness at minimum life cycle cost requires that supportability considerations must help dictate both operational requirements and equipment design. To do this logistics engineering must participate as a full partner from the earliest phases of program planning through the entire acquisition process. This concept is now adequately reflected in DOD and Army policy. Personnel competent to carry these responsibilities are in short supply but are becoming increasingly available.

Initial program planning must include funding and schedule consideration of the need for supportability considerations during all phases of the program. Also, the program manager should actively pursue guidance from the entire design team through trade-off studies to develop a tentative maintenance concept which can be used as a basis for design decisions. This maintenance concept is also subject to changes in the iterative process of successive refinement of the plan.▮

AVIONICS ON THE GROUND

BY CHRISTOPHER LUCAS

VERY often people are surprised to learn that the Avionics Activity of the U.S. Army at Fort Monmouth, NJ, is the responsible Army materiel developer for land vehicle navigation systems. They can't see the avionics connection. However, this apparent incongruity is better understood when it is realized that land navigation heading sensors are often a spinoff from aircraft navigation systems.

Operational scenario

The U.S. Army has a need for a family of low cost navigation aids for ground combat vehicles such as tanks, combat support vehicles (ammo re-supply, etc.) and combat service support vehicles (medical evacuation). The operational scenario for these vehicles anticipates an environment in which electronic countermeasures will be extensively utilized. This would then require a self-contained navigation system that can function without using radio type transmitted signals. The operational need for a navigation set is expected to be greatest during periods of reduced visibility (mainly nighttime).

Other threat conditions include extensive use of smoke and other obscurants. In addition, the vehicles will be exposed to artillery fire and the possible utilization of **nuclear, biological and chemical (NBC)** weapons. This will result in closed hatch and gas mask operational conditions which will further stress the duties and navigation functions of the crew. Thus, it can be seen that several operational threat scenarios support the need for land navigation aids.

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The state of development of airborne navigators is more advanced than that of ground navigators because of the greater importance of navigation to aircraft. The affiliation of ground guidance systems and airborne avionics is not peculiar to the Army since private industry also follows this same association.

For example, land vehicle navigators are being designed and produced by aviation oriented companies that include Litton Guidance and Control Division, Lear Siegler, and Singer Kearfott, just to name a few. In addition, some land navigation manufacturers even have aviation related words in their names such as Sperry Flight Systems, Marconi Avionics, and Aviation Electric LTD. Thus, it can be seen that the avionics industry is a major supplier of land vehicle navigation systems. This expertise will once again, in the near future, be called upon to provide equipment that will enable the Army to accomplish its ground mission.

Primary objective

Our primary objective in developing land vehicle navigation aid systems is to achieve low cost per unit. This means different things to different people but, in general, we would like to aim for costs of less than $2,500 for a heading device and less than $5,000 for a heading and position location system. These costs are three to five times lower than the cost of equivalent types of aircraft navigation equipment.

The low cost requirement is vital because of the Armys' desire to put a heading device into every combat vehicle. Even if this is not affordable, the goal of fitting the ground vehicle fleet with a widespread heading (and position) capability, makes low cost paramount.

The typical self-contained Land Navigation System utilizes the principle of dead reckoning navigation. This principle is very simple and requires only two types of data generated from within the vehicle itself: (1) the heading direction, in angular measure, of the vehicle with respect to a reference direction; and (2) a simultaneous continuous measure of distance traveled in the associated heading direction. This data then defines a vector in polar form, and hence it is only necessary to continuously resolve and integrate these vectors into Cartesian components. Therefore, for the Army application, the equipment will be required to resolve these vectors and update **Universal Transverse Mercator (UTM)** position coordinates from the originating known starting coordinates.

Mechanization

The four major functional components of a self-contained land vehicle navigation system are: (1) Heading Sensor; (2) Distance Sensor; (3) Computer; and (4) Display/Controls.

The common state-of-the-art heading sensor utilizes tried and true heading devices to provide the required directional data. These sensors include a north finding gyroscope, a directional (displacement) gyroscope, or a fluxgate type of magnetic sensor. New emerging technology heading sensors include laser gyros, gas rate gyros, fiber optic gyros, and fluidic devices. The heading sensor is the most critical component of the navigator and further discussion will be provided in concluding paragraphs.

The second major functional component of the navigator is the distance sensor which provides distance traveled data. This data is commonly provided by a simple device that is driven from the vehicle power train in the same way as an odometer. It outputs a finite number of electronic pules per revolution which can thus be processed to provide distance traveled data.

The third major component in the typical system is the computer, which receives and processes the heading and distance data into north and east position location displacements to maintain the vehicle's current position coordinates. Thanks to revolutionary advances during the past several years in microcomputers and integrated circuitry, the computer function can be reliably accomplished in a small package and at a low cost.

The fourth and last major functional component concerns display and controls. Again, this area will certainly be effected by major changes in technology that could result in packaging and cost benefits. From the Army's viewpoint, special attention must be given to the display / controls in terms of man / machine interface, other crew duties, the vehicle environment, and the problem of compatibility with night vision goggles.

Key requirements

It is anticipated that the Army's forthcoming **Vehicular Navigation Aids System (VNAS)** requirements will specify a family of interchangeable modular building block components. The VNAS initial basic building block sets may consist of two or three different "Heading Reference Sets" with each having a different performance envelope. Heading accuracy is the most significant performance difference between the sets.

Each of these sets could be required to have a discrete accuracy that may range from a low accuracy of ± 10 degrees to a high accuracy of ± 1 degree. Two of the three Heading Reference Sets will further be required to expand into a position location set. Each set may have a distinctively different accuracy capability that ranges between 2% to 9% distance travelled (CEP).

In addition to the different Heading Reference and Position Location Set configurations, the Army may require add-on display capabilities which could include a second heading indicator unit or a second heading and position location display unit. This would allow Army vehicles, such as a tank, to be equipped with navigation displays in both the Drivers Station in the tank's hull and the Commanders Station in the turret.

The challenge

The challenge for industry is to produce a low cost self-contained "Vehicular Naviation Aids System" that can meet the Army's performance requirements. The key thrust to lowering system cost is to reduce the cost of the heading sensor which is the most expensive VNAS component. However, the heading sensor is not only the highest cost element: it also governs the performance, capability, and limitations of the entire system. Because of this characteristic, extreme care must be taken to pursue the development

(Ground Navigation — Continued on P. 70)

PDSSC: SOFTWARE SUPPORT CENTER

BY RONALD KUROWSKY

WHAT exactly is a Post Deployment Software Support Center, where does it live, and what does it do for me?

The understanding of Post Deployment Software Support doctrine has suffered due to a lack of a focal point where that doctrine could be viewed in action. That missing focal point is provided by the advent of the **Post Deployment Software Support Center (PDSSC).** The PDSSC is more than just a two dollar title/acronym combination. The PDSSC is the activity where software support doctrine becomes real. By viewing the function of the PDSSC throughout a software product's life cycle, the entire concept of life cycle software support may be seen in action and understood.

Understanding the process

Our traditional means of understanding the hardware manufacturing process has centered around factories, which millions of grade school children have learned are based upon Eli Whitney's invention of interchangeable parts, and Mr. Ford's invention of the assembly line. That process of learning about hardware concepts is further reinforced throughout our lives by the ownership and maintenance of automobiles. But where do we see and under stand the software life cycle in our everyday lives?

The role of the PDSSC in the software life cycle directly corresponds to the role of the factory in the hardware life cycle. The PDSSC is the focal point for software support, it is a facility, it is a capability, and it is a staff of software support personnel.

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In order to better understand what the PDSSC consists of, and what it really does, a more detailed analogy between the software life cycle and the hardware life cycle can be used.

Hardware activities in factory

The factory is the best vantage point for understanding the life cycle of a hardware product. In general, the factory participates in the following aspects of a hardware product life cycle.

- The product is designed.
- Prototypes are made.
- Product is tested.
- Parts are ordered.
- Assembly line established.
- Production run is made.
- Product is fielded.
- Product is updated/modified.

We can see the hardware life cycle in our lives, but the software life cycle remains invisible. Participation of factories in the life cycle of hardware is almost universally understood by Americans, because every aspect of it is exposed to us in our daily experience. The design features of the latest automobiles are touted to us in advertising. Each year, Government testing of production automobiles for fuel economy becomes a common center of conversation. How many Americans are not aware of the long arm of automobile product recalls, as product deficiencies are found after fielding?

But where do we find similar everyday experiences which make the software life cycle understandable to us? Advertising of personal computer software products is directed toward a relatively small audience. Testing of software products is not a well defined activity within the industry, and even if recognized software standards did exist, not many of us would have any reason to care about the results of relative software product ratings. More importantly, although software and microprocessors are components of many day-to-day products, we remain unaware of their existence. For example, most people do not know that an Intel 8086 microprocessor is used to control fuel injection within many Ford automobiles. When the car's engine will not start, we do not stop to think that there may be a bug in the processor's software.

What would happen if thousands of such failures occurred? Obviously, the factory needs to maintain a software repair capability equal to the complexity of the software and the likelihood of needed changes to the software.

"The software repair shop"

The Army has established the AVSCOM PDSSC, co-located with the US Army **Avionics Research and Development Activity (AVRADA)**, as the agency for repairing and modifying the software of aviation **Mission Critical Defense Systems (MCDS),** and for insuring that newly procured MCDSs are based upon efficiently supportable software. In this role, the PDSSC is more like a repair shop than a factory. However, many of the analogies to factory operations still lend themselves to an explanation of the PDSSC Concept and how it improves the acquisition and support of software.

The design department

The PDSSC possesses the software expertise and system engineering expertise to identify cases where the existing software can be modified to support improved hardware, instead of requiring the Government to buy completely new software.

Additionally, the expertise of the PDSSC on earlier similar systems will allow them to assist procuring program managers, by insuring that design and product specifications eliminate software deficiencies of the types noted in the earlier system. The PDSSC will be particularly helpful in this regard because, not only will it be familiar with the previous system, but it will also be familiar with all of the software interfaces which the improved product must be designed to meet, if it is to replace an existing assembly.

When Eli Whitney first experimented with the assembly of US Army rifle parts from standardized interchangeable parts, he certainly never envisioned standardized software modules as a commodity to which his technique could be applied. However, many instances now present themselves where the PDSSC as an agency and facility for software support can help the Army take advantage of the existence of software modules within its own inventory, instead of requiring it to purchase or develop new software.

The assembly line

The PDSSC is the repository for all of the software and hardware tools which make up a software support environment. The software development environment is the assembly line upon which software repairs and software modifications are made. Just as a capital expenditure is required to establish a hardware factory, so is a significant base of hardware and software packages required to perform software repair/modification. In cases where it is possible, the use of the same software support environment tools for more than one MCDS will mean considerable cost savings.

A computer system is the core of the PDSSC concept for providing software support. Modifications to MCDS software and the performance of MCDS test and validation procedures are performed with this computer system. Test cells, in support of each assigned MCDS, are maintained as repositories for the actual MCDSs in which tests are carried out. Ten such cells presently exist.

Staff of the PDSSC

The PDSSC Staff is the most important element of the PDSSC capability, both in terms of cost savings and in terms of the quality of services provided. The cost of maintaining trained software personnel throughout the life of an MCDS can rival the purchase cost for the actual MCDSs themselves.

By aligning its staff to specialize in a particular type of MCDS or in MCDSs which are based upon particular microprocessors/programming languages (thus allowing one staff to support many MCDSs) the PDSSC can reduce staffing levels required to provide software support for systems after fielding. This economic use of the PDCCS Staff is a key to the cost savings envi-

(Software Support — Continued on P. 70)

AVRADA: NEW JERSEY TO ST. LOUIS

BY PETER BOXMAN

ONE of the most important missions of the **Avionics Research and Development Activity (AVRADA)** is to support the St. Louis aircraft Project Managers during aircraft development, product improvement, and production. AVRADA's geographical location at Ft. Monmouth, New Jersey, places it where it can maintain close coordination and contact with the Army's research and development efforts in the electronic world.

Unfortunately, this also means that AVRADA is half a continent away from the aircraft PMs who depend on AVRADA's services. Recognizing that face-to-face contact with the PM offices is essential to its mission, AVRADA maintains an office in St. Louis only a few feet away from the PM offices.

Working together

AVRADA's St. Louis office works closely with Fort Rucker, the PMs, and, of course, all of the AVRADA Divisions at Ft. Monmouth. Here are some of our recent accomplishments:

- Coordinated with the Army community the concept that avionics must be looked at as a total system, not simply as an autonomous collection of radios, navigation equipment, fire control, and cockpit instruments, etc. This approach is essential to capitalize on new technologies, especially in the area of computers and, as such, is the key to further enhancing aircraft capabilities. A requirement document has been drafted by the Army's Aviation Center, called the **Integrated Digital Avionics System (IDAS)** to embrace this concept. This draft requirement promises to be a significant leap forward in the way avionics are developed and integrated into our aircraft of the future.
- Developed a research and development program in response to this draft requirement. This program is also called IDAS and is essentially an avionics system validation facility to develop and verify that all the avionics systems work together in a dynamic simulated environment prior to implementation in a new or product improved aircraft program.
- Developed a program to standardize avionics, taking full advantage of both DOD and Industrial technologies as they appear, and to become more responsive to the needs of the individual aircraft PMs.
- Gained user and customer support to develop product improvements to make the AN/ARC-186 and 164 (VHF and UHF) radios as well as the AN/APX-100 transponder multiplex compatbible.
- Developed and contracted for an improved cockpit and avionics system for Joint STAR/OV-1 that is interchangeable with AHIP avionics.
- With coordination from the Aircraft Survivability Equipment PM, determined feasibility, cost, and schedule for integrating ASE equipments with AHIP and JSTAR avionics.
- Developed plans to provide alternatives to keeping the UH-1 avionics operating for the full length of the fleet life. This program is in response to the Army's need to maintain the UH-1 fleet until at least the year 2,000 and the fact that most of the avionics installed in today's UH-1 fleet will become increasingly difficult to keep operating as time goes on.

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AVRADA St. Louis
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- Prepared and published the Army portion of a tri-service Avionics Data Base. This data base, now being automated, allows aircraft managers instant access to information about any avionics item within the Army, Navy and Air Force.
- AVRADA St. Louis has been fortunate to be a part of the AHIP team by preparing the avionics section of the AHIP Request For Proposal; being a part of the Source Selection Evaluation Board; chairing the avionics section review during both the Preliminary Design Review and the Critical Design Review; and by representing the AHIP PM at various technical reviews.

The AVRADA St. Louis office provides daily engineering support to AVSCOM and DARCOM aircraft managers. Support includes developing **Product Improvement Programs (PIPs)** as well as working on improvement programs for the UH-60 and the AH-64.

The challenge of supporting the aircraft PMs is a daily, unending effort. AVRADA is fortunate to be able to provide support both from a laboratory site as well as from just outside of the PM's door. It is a unique and responsive system and one that AVRADA is proud to be a part of. The AVRADA St. Louis office takes great pride in its ability to provide for its most important AVSCOM mission, supporting the PM, at his own doorstep. IIIII

Ground Navigation
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of only those potentially low cost sensors that can provide the required performance and technical capabilities.

Once developed, the sensor can then be coupled to the other presently available low cost system components which include the distance sensor, the computer and the display / control unit. Therefore, it can be seen that the key to the VNAS challenge lies in the development of promising heading sensor concepts that have the low cost potential and necessary technical charactertistics. IIIII

Software Support
(Continued from Page 68)

sioned by the Army in the implementation of the PDSSC concept.

The payoff from the Army's commitment to bring software costs under control is realized within the PDSSC. The PDSSC provides the Army with the physical, professional, and organizational resources to implement its software policies. Whenever the provision of cost-effective BAS software is discussed, the PDSSC is the primary vehicle for realizing the Army's goals. In short, the PDSSC is the activity which allows the Army to procure high capability MCDSs and employ them without spending the entire National Defense Budget on MCDS software. IIIII

Second AAAA ASE Symposium Planned

The 2nd Annual Aircraft Survivability Equipment (ASE) Symposium to be sponsored by the Army Aviation Association of America, in cooperation with its industry member firms, will be hosted by E-Systems, Garland Division, in Dallas, Texas, on 7-8 November 1984.

The 1984 ASE Symposium, which will explore active jamming and decoying technology and developments at the SECRET level, is open to all interested AAAA members from NATO/ABCA countries who possess the appropriate level clearance.

Please contact Lynn Coakley at the AAAA National Office, at (203) 226-8184 if you would like information about registration or housing.

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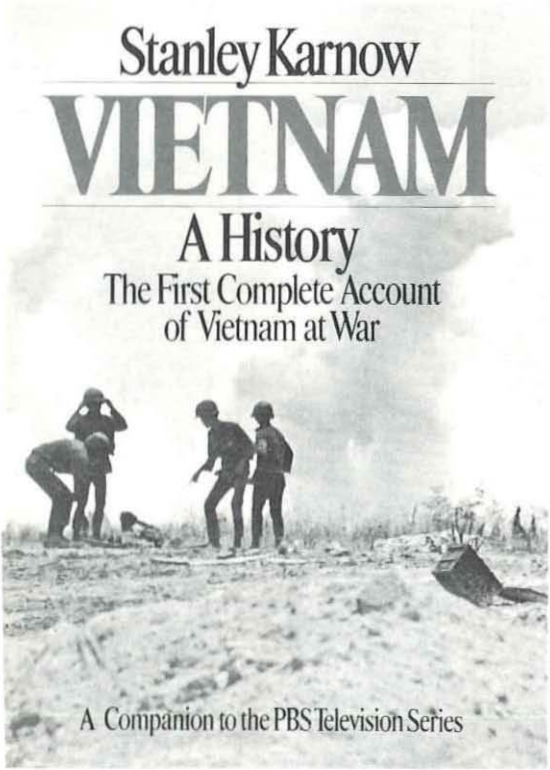

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The 1985 National Convention of the Army Aviation Association of America will be held in St. Louis, Missouri, from Wednesday, March 27, through Sunday, March 31, at the Cervantes Convention Center and the Sheraton, St. Louis.

We look forward to a great gathering in the heart of America!

MANY THANKS FOR A JOB WELL DONE!

• Major Cornelius J. "Cor" Westerhoff, Research and Development Coordinator for AVRADA (and author of two articles in this issue) also served as the point of contact and behind the scenes coordinator for this special issue of **Army Aviation**. We appreciate his fine work.

NEXT MONTH IN ARMY AVIATION:

• Our next issue will carry a special report on the current status of the U.S. **Army Helicopter Improvement Program (AHIP).**

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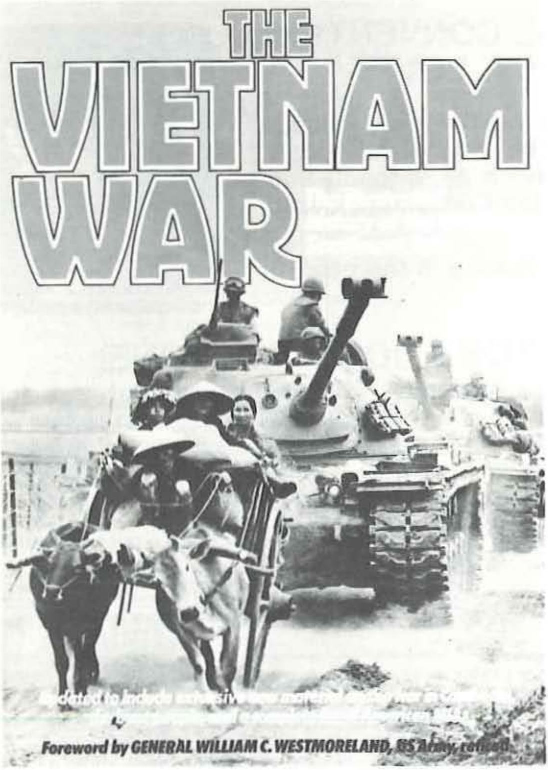

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A MAJOR PLEDGE — William F. Paul, (left) President of Sikorsky Aircraft, United Technologies Corporation, recently presented a letter of commitment to Marvin Lewis of the Army Aviation Museum Foundation Board of Directors at a special ceremony in Dothan, AL, pledging to donate $100,000 over a three-year period toward construction of a new museum building at Ft. Rucker, AL. The current museum building and grounds are no longer adequate to house the many historic helicopters and fixed-wing aircraft already in the museum's possession.

Pentagon View
(Continued from Page 11)

The ACATT will have a Computer Generated Imagery visual system that will have the ability to provide each individual aircraft (module) its own visual perspective of the same scene during all NOE flight and team training. Likewise, the system will allow for aircraft peculiar weapons effects and mission equipment packages, and will be able to simulate friendly and interactive threat conditions. The Army plans to procure 11 ACATTs, the first to be fielded at Ft. Rucker in 1989 and the last to be fielded in 1994. Recognizing that neither tactics nor Army Aviation will stand still between now and then, the ACATT requirement calls for expandability in the future.

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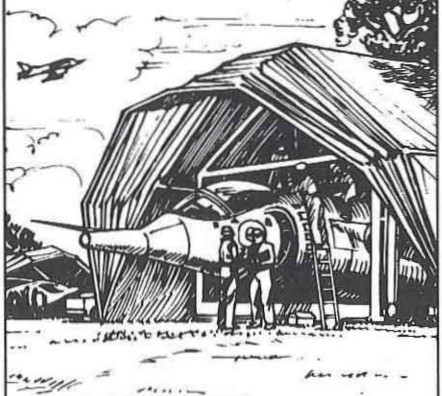

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AAAA CALENDAR

JUNE 1984

■■JUNE 22. Pikes Peak Chapter. Professional Meeting. COL Hernan Morales, Deputy Commander for Clinical Services, U.S. Army Community Hospital, guest speaker. Officers' Club, Ft. Carson, CO.

■■JUNE 23. Checkpoint Charlie Chapter. Summer Picnic. TCA Picnic Area.

■■JUNE 27. Taunus Chapter. Professional-Social Meeting. Guest Speaker. 97th General Hospital Off. Club.

■■JUNE 28. Southern California Chapter. Professional Meeting. The Space Shuttle Landing in conjunction with American Helicopter Society. Edwards Air Force Base, CA.

■■JUNE 28. Bonn Area Chapter. Professional-Social Meeting. Presentation by Dieter Wurster Sel. Bad Godesberg American Embassy Club.

■■JUNE 28. Connecticut Chapter, AHS Stratford Chapter. Professional Dinner Meeting. COL Frank H. Mayer, U.S. Army TRADOC Systems Manager for Utility/LHX Helicopters, guest speaker. Hillandale Club, Trumbull, CT.

■■JUNE 30. Lindbergh Chapter. Scholarship Golf tournament and Tournament Awards Dinner. Clubhouse, SLASC Golf Course.

JULY 1984

■■JULY 5. Fort Hood Chapter. Professional Luncheon Meeting. LTC Byron Smith, Cmndr, 227th Avn. BN., guest speaker. Minidome, Ft. Hood.

■■JULY 18. Corpus Christi Chapter. Professional-Social Meeting. Officers' Club.

■■JULY 19. Fulda Chapter. General Membership Meeting. Fulda Community Club.

■■JULY 20. Coastal Empire Chapter. Professional Meeting and Election of Officers. Hunter Army Airfield Officers' Club.

■■JULY 31. Lindbergh Chapter. Happy Hour to welcome AIMI conference members. Rafferty's .

AUGUST 1984

■■AUGUST 2. Fort Hood Chapter. Professional-Social Meeting. BG Charles E. Teeter, guest speaker. Minidome, Ft. Hood.

■■AUGUST 2 Lindbergh Chapter. Professional Luncheon Meeting. "Farewell to Colonel Leslie H. Weinstein". Marriott Hotel (D&E Room).

■■AUGUST 22-23. Monmouth Chapter. AAAA Sport Days and Clam Bake. Fort Monmouth Tennis Club and Old Orchard Country Club.

■■AUGUST 24. Hanau Chapter. Family Picnic. Ballfield Behind POL at Airfield.

■■AUGUST 26. Chicago Chapter. Annual Golf Tourney. Ft. Sheridan Golf Course.

SEPTEMBER 1984

■■SEPT. 5-9. Hanau Chapter. Farnborough Airshow. London, England.

MARCH 1985

■■MARCH 28-31. AAAA National Convention. Cervantes Convention Center (Professional sessions and exhibits); Sheraton St. Louis (Convention Hotel). St. Louis, MO.

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Approved by the AAAA National Executive Board at an August, 1975 meeting, a **Life Membership Program** involves some 300 members today. At the same time, the Board directed that the details of the Program be brought to the members on an annual basis.

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