United States Army
Aviation Digest

MARCH/APRIL 1995
(FINAL ISSUE)

Professional Bulletin 1–95–2 Distribution restriction. This publication approved for public release. Distribution unlimited.

"ARMY AVIATION...VANGUARD OF CHANGE!"

Aviation Digest

Professional Bulletin

1 – 95 – 2 • MARCH/APRIL 1995

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The ***U.S. Army Aviation Digest*** is an official Department of the Army professional bulletin (ISSN: 0004–2471) (USPS 415–350) published bimonthly under the supervision of the commander, U.S. Army Aviation Center. This publication presents professional information, but the views expressed herein are those of the author not the Department of Defense or its elements. The content does not necessarily reflect the official U.S. Army position and does not change or supersede any information unless otherwise specified. Include an OPSEC review (AR 530–1) with articles submitted for publication. Photos are U.S. Army unless otherwise specified. Use of the masculine pronoun is intended to include both genders unless otherwise stated. Material may be reprinted provided credit is given to the ***Aviation Digest*** and to the author unless otherwise indicated. Publication uses recyclable paper.

This medium is approved for the dissemination of material designed to keep individuals within the Aviation Branch knowledgeable of current and emerging developments within their areas of expertise to enhance their professional development. Articles, photos, and items of interest on Army Aviation are invited. Direct communication is authorized by writing Editor, ***U.S. Army Aviation Digest***, ATTN: ATZQ–PAO–AD, Fort Rucker, AL 36362–5042, or by calling either DSN 558–3619 or commercial 334–255–3619. Manuscripts returned only upon request.

Second class postage paid at Daleville, AL, and additional mailing offices.

Active Army, Army National Guard, and U.S. Army Reserve units receive distribution as outlined in DA Pamphlet 25–33. To complete DA Form 12–99–R, enter form number 12–05–E, block number 0014, and quantity. Also use DA Form 12–99–R for any change in distribution requirements. Army units submit the form to their publications control officer.

Personal copies of the Digest can be ordered from New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250–7954.

POSTMASTER: Send address changes to U.S. Government Printing Office, Superintendent of Documents, ATTN: Chief, Mail List Branch, Mail Stop: SSOM, Washington, DC 20402–9373.

MG Ronald E. Adams

Digest ceases publication

Sadly, this is the final issue of the ***Aviation Digest****. The reasons for its discontinuation are tied to constrained resources—people and dollars. The* ***Aviation Digest*** *has proudly served our aviation community since 1955, acting as a forum for debate, discussion, and resolution as well as for information sharing. I want to personally thank the members of the* ***Digest*** *staff—past and present—for their dedicated efforts in making this professional bulletin such a valuable tool over the years.*

The following article is the "branch address" I gave at the AAAA convention in Atlanta, 31 March 1995.

Army Aviation—the Vanguard of Change

Army aviation is in an exciting era on the threshold of a new century. We all know this new era is characterized by change—change in people, change in the environment, change in technology, and of course, change in our Army. It is an Army whose activities today are more demanding and more diverse than perhaps in any previous period.

General Sullivan has said, "The U.S. Army is a changed Army . . . Changed to meet the challenges of the twenty–first century." Secretary Togo West added, ". . . we are faced with the choice of "changing shape or shaping change—and we are smartly choosing the latter." We have done so by leveraging information technology to advantage the Army's quality people and by redesigning the fighting forces and sustaining base to better support these forces.

How has all this change affected Army aviation? Our doctrine, organization and force structure, sustainment, training, leader development, materiel, and soldier programs are changing to remain the foundation for our current force and a quality, winning force for the future. Our vision is broad but operationally focused to ensure that we meld the best our Army has to offer. Our goal is a balanced force with application across the entire operational continuum.

Since doctrine is the engine of change, it is evolving. It focuses not only on combat operations but operations other than war. We are

working hard to flesh out deployment and sustainment issues from lessons learned during operations in Haiti, Somalia, Northern Iraq and during relief efforts in southern Florida, to mention a few. We recognize that joint and combined warfare will be the norm rather than the exception and are rewriting aviation's own FM [Field Manual] 1–100 capstone document [***Doctrinal Principles for Army Aviation in Combat Operations***] to reflect that fact. We are incorporating lessons learned from these recent operations into this new manual to establish a basis for understanding the latest employment aspects of Army aviation. And although our missions are diverse, this effort will ensure Army aviation remains focused on combat . . . capable of decisive victory.

The recently published [United States Army] Training and Doctrine Command [TRADOC] Pamphlet 525–5, ***Force XXI Operations***, provides a twenty–first–century vision. That too will be embedded in FM 1–100.

And the how–to pieces of our doctrine are changing. For example, the coordinating draft of FM 1–140, ***Helicopter Gunnery***, has been issued to the field. It mandates annual live–fire qualification for all helicopter–mounted weapons system crews. It establishes objective scoring as the standard and training "gates" required for successful qualification of attack helicopter crews. We have initiated an aggressive program to upgrade our aerial weapons scoring system (AWSS) and added gunnery enhancements to the AH–64 combat mission simulator. The final version of FM 1–140 is scheduled to be printed in June. This product is the result of three gunnery conferences held at Fort Rucker, and a complete staffing across all major commands. Bottom line—we are committed to objectively–scored live–fire gunnery as a key component of our aircrew training program.

Our efforts in updating aviation's "how–to" manuals don't stop there. Our doctrine writers are putting the finishing touches on FM 1–112, ***Attack Helicopter Operations***, and expect to have if ready for worldwide distribution by May. Our assault helicopter operations manual is taking shape nicely. We have consolidated three other older manuals into a new more comprehensive FM 1–113. Similarly, FM 1–114, ***Air Cavalry Operations***, will consolidate three older manuals. That's change in the making.

The events of the past several years demonstrate the roles our Army will continue to play in the next century. We have been involved in missions to ***compel*** those who fight us to accede to our will [Operation Desert Storm], ***deter*** those who might oppose us from taking actions inimical to our interests [manning the DMZ—demilitarized zone—in Korea], ***reassure*** our allies by conducting those forward presence and peace operations that promote world stability and the betterment of mankind [operations in Rwanda, Macedonia, and Haiti], and ***support*** Americans at home providing relief and emergency assistance during numerous natural disasters. Army aviation was there playing its part.

The doctrinal tenets of Army operations—***agility***, ***synchronization***, and ***versatility***—were especially apparent during Operation Uphold Democracy. As the Aviation Brigade, 10th Mountain Division, performed its dramatic air assault of the division's 1st Brigade from the deck of the USS *Eisenhower* into objectives in Port au Prince [Haiti], the 82d Airborne Division's Aviation Brigade self–deployed an aviation task force from Fort Bragg [N.C.] through intermediate staging bases in Florida and the island of Inagua [in the Caribbean] to conduct a forced–entry air assault operation. These concurrent operations demonstrate the versatility of Army aviation in today's joint environment. That's relevance!

As doctrine changes, so too must our warfighting systems. We must integrate today's advanced technology into our systems to be able to meet the challenges of tomorrow. Aviation systems must be designed and capable of responding quickly—either through an enhanced self–deployment ability, or through ease in strategic deployment. They must be versatile in application—and lethal in effect. Recent experiences in Haiti demonstrate this fact. Our systems must feature attributes, such as global positioning system navigation and long–range communications, which are compatible regardless of the operational environment to support any mission assigned to Army Aviation.

And we are doing that. Aviation is leading the way in harnessing the information technologies required to operate on the Force XXI battlefield. MG [Dewitt] T. Irby, PEO [Program Evaluation Officer], Aviation, [Assistant Secretary of the Army (RDA)] and his folks are working hard to ensure that we have the right stuff to incorporate information technologies in our current warfighting systems. This has led to an important shift in the Army's modernization strategy. Through the seven aviation programs within the Army's digitization plan, we have developed essential connectivity to effectively command and control combat maneuver assets. Apache Longbow and Comanche will play

a pivotal role in the Army's battle command process. By mastering information, we can drive the operational tempo and control the environment, thus winning the information war.

We in aviation, PEO, ATCOM [U.S. Army Aviation and Troop Command], and the [U.S. Army] Aviation Center are working closely with the Intelligence School, the Army Digitization Office, CECOM [Army Communications–Electronic Command], and others to ensure we are coupled on this integrated battlefield by working eight critical linkages. These critical linkages help focus the advanced warfighting experiments we are supporting as part of TRADOC's Joint Venture plan. They will facilitate battle command through seamless connectivity with other members of the combined arms team to increase situational awareness and enhance synchronization.

With all this change in technology, clearly opportunities exist for restructuring. We are seizing the opportunity to reengineer our organizations to remain a relevant and versatile member of the combined arms team. The Aviation Restructure Initiative (ARI) provides commanders a more capable, sustainable aviation fighting force within today's resource constraints. We have nearly converted all of USAREUR's [United States Army, Europe's] aviation brigades to the pure fleet structure outlined in the Aviation Restructure Initiative. The fielding program has been successful. We have achieved nearly all of the FY [fiscal year] 95 objectives and are starting on FY 96. ATCOM provided us with an exceptional plan to execute cross leveling—ensuring our aviation units have the right equipment at time of conversion. And PERSCOM [U.S. Total Army Personnel Command] is working the personnel pieces. A new Attack Battalion and Company Mission Training Plan was written to support ARI. The two ARTEPs conducted by 11th Aviation Brigade demonstrated that ARI works.

Evolving doctrine, changes in our modernization strategy and resource constraints demand that we continually review ARI. We are tweaking it to stay relevant. We know that tailorability and modularity are somewhat lacking in our ARI design and that both are absolutely essential to future operations. As the Force XXI and its divisional organization and operational concepts drive the requirement for split–based operations, we must identify aviation deployment packages—capable of meeting requirements for operations other than war while simultaneously supporting a major regional contingency. Training and Doctrine Command Pamphlet 525–68, ***Concept for Modularity***, was released this January. Our Directorate of Combat Developments is following it very closely as we continue to work our Aviation Force XXI design to give us the versatility we seek.

As we continue to refine ARI, we will remember that armed reconnaissance operations are an imperative of Force XXI doctrine. We will also remember that aviation must have a balance between lift, assault, attack, and armed reconnaissance elements. Aviation assets can conduct reconnaissance and maintain surveillance of the enemy, if necessary fighting for information to "fill in the gaps." We will remember that aviation must have a real–time, reliable link to all members of the combined arms team so that we can help shape the battlefield and provide continuous information on where the enemy is and, sometimes more importantly, where he is not. All that will be captured in our Aviation Force XXI design work.

Throughout history, new concepts in warfare have forced changes in the way we sustain the fighting force—so naturally aviation logistics is changing. We have placed special emphasis on aviation maintenance with the inception of the aviation support battalion. Currently we have three such battalions in the Army with plans to fill each heavy division. Organic to the division support command—providing direct support to the aviation brigade—these aviation support battalions consolidate the aviation unit maintenance (AVUM) and aviation intermediate maintenance (AVIM) functions. Highly mobile forward support teams are attached to aviation battalions to provide comprehensive "user" maintenance in the battlefield area. In–depth repairs are performed by operational maintenance battalions and special repair activities (SRAs) collocated with the corps. Our aviation sustainment force structure must be modular and tailorable and robust enough to support multiple split deployment options if we are to remain relevant.

Colonel Tom Johnson and his folks at the U.S Army Aviation Logistics School [Fort Eustis, Va.,] are helping work those issues while producing technically and tactically proficient aviation maintenance leaders and soldiers. We are training over 1,500 resident Army, joint service, and allied nation maintenance technicians and leaders daily. U.S. Air Force H–1 and H–53 maintenance training will begin third quarter this year. This will increase the load by 200 students. The avionics mechanic MOS [military occupational specialty] training is being merged with aircraft electrician training at Fort Eustis in

FY 96. We are using state of the art computer training systems, such as the classroom system trainers (CSTs) and the advanced avionics maintenance trainer. The CST is a computerized Kiowa Warrior maintenance systems training device, which can simultaneously train 50 students. The CST will be expanded to support other airframe maintenance training as software is developed. The advanced avionics maintenance trainer is a two–person panel training system used to teach avionics and selected electrical/electronics system diagnostics, troubleshooting, and repair—doing great work, moving out into the twenty–first century.

The ability to conduct tough, realistic training will continue to be a challenge as funding constraints and environmental concerns impact on installation and unit training programs—so our training initiatives must optimize efficiency and effectiveness. Focused training to prepare aviation soldiers to fight effectively in joint and combined arms environments are an integral piece of the Army's overall Warfighting XXI training strategy. We have written an Aviation Force XXI Campaign Plan, which incorporates Aviation's participation in the Army's plan. Our primary emphasis is on TRADOC's "Joint Venture" effort to redesign the fighting force of the twenty–first century. A major part of this campaign plan focuses on a series of advanced warfighting experiments over the next two years. As part of these AWEs, we will rely on distributed interactive simulation (DIS), which revolutionizes our approach to training exercises. It creates synthetic environments by interconnecting geographically dispersed simulations. By using distributed interactive simulation we can simulate the battlefield for individual soldiers in the loop and units throughout the theater level, to include joint service and combined arms exercises. For example, last November we participated in the synthetic theater of war (STOW) portion of Exercise "Atlantic Resolve." We had eight AH–64 crews in linked simulators at Fort Rucker conducting attack missions against live armor forces maneuvering at the Combat Maneuver Training Center in Hohenfels, Germany. It was a major milestone in the distributed interactive simulation effort. This is truly the way ahead.

Future simulation training devices will help ensure a trained and ready force during a period of increased resource constraints. To this end, Army Aviation has recently completed a capstone simulation strategy. It consolidates aviator simulation training requirements to ensure cost and training effectiveness—while maintaining the achievability of the aviation combined arms training strategy and Force XXI training capabilities.

The aviation combined arms tactical trainer is the centerpiece of this strategy. Used in conjunction with constructive and live simulations, it will enable Aviation commanders to prepare for the multiple operations, environments, and organizational structures characteristic of Force XXI. It will allow commanders, staff, and aircrews to train as a unit on a common battlefield against a realistic threat—able to acquire and maintain the command and control, situational awareness, tactical decision making, and weapon system employment skills necessary to fight, win, and survive in the twenty–first century.

The Aviation Test Bed at Fort Rucker—supported by PEO Aviation and STRICOM [U.S. Army Simulation, Training, and Instrumentation Command, Orlando, Fla.]—is using constructive simulations to expand the virtual battlefield. It is exploring the increased warfighting capability of a digital aviation force through participation in advanced warfighting experiments to include—Focused Dispatch, Roving Sands, and Prairie Warrior. And, just as importantly, the Test Bed has a full–court press on to demonstrate the full capabilities of the Comanche, Longbow, and Kiowa Warrior. The Aviation Digitization Laboratory (ADL) effort, now underway, provides the electronic battlefield the ability to explore digital connectivity of the Combined Arms Team. Commanders and staffs in prototype simulations of the Army airborne command and control system (A^2C^2S) and the aviation tactical operations center (AVTOC) interact with aviators flying the Aviation Warfighting Cell Longbow and Comanche aircraft. Real–time, interactive JSTARS [joint surveillance and target attack radar system], unmanned aerial vehicle (UAV), and satellite intelligence models bring the battlefield of tomorrow to the soldiers of today allowing us to "jump start" Force XXI.

The Army Aviation training strategy continues to emphasize individual, crew, and collective training and includes initiatives to develop combined arms warfighters. One such initiative is underway at the Army Research Institute, a research and development activity and key member of the Aviation Center Team. Its simulator training research advanced testbed for aviation (STRATA) is a modular, reconfigurable research simulator, which can be made to emulate various training devices. Research goals are to

design a simulator for conducting piloting, navigation, gunnery, and unit collective task training, capitalizing on virtual reality for mission rehearsals. These methods provide quality training to ensure combat readiness at reduced costs.

In further efforts to reduce the cost of doing business, the aviation community is making fundamental changes in the way training is conducted. This includes examining two principles in a new systematic aviation training concept.

• First, simulation should be the primary training environment using the aircraft for skill validation and mission execution.

• Second, all but the most basic flight training should take place in a mission context, consistent with the digitized Force XXI battlefield.

Chuck Gainer and his Army Research Institute team are working with COL P.J. Penny's DOTDS [Directorate of Training, Doctrine, and Simulation], MG Irby's folks in St. Louis, [Mo.], and others on this strategy. They are also working the use of personal computers for procedural and cognitive training. This involves networking information resources to learn skills required to performing as an aircrew member in Force XXI. Access to rapidly changing data bases of information about mission requirements and procedures makes such tools mandatory. Visual image generators and display devices, such as the helmet–mounted displays, are becoming increasingly available at relatively low cost. They can provide an array of training systems, which will meet many of the training and skill integration needs of our aircrews.

We are continually seeking opportunities to reduce the cost of training. For example, the new training helicopter, the TH–67 Creek, has dramatically reduced operating and support costs. Army-wide, we want to get additional simulation into the hands of our warfighters—and we want to retire older airframes.

The inherent versatility of aviation dictates that we carefully grow and develop our young men and women to ensure we provide technically and tactically competent leaders for our collective future. What we do in the school house directly impacts the future successes of our Army. We must ensure we provide the best and most realistic training possible to our future leaders. As a consequence, our principle leader development courses continue to change.

The three–phased Officer Basic Course starts with core courses as a foundation for the new lieutenant to build upon. Phase II is the Initial Entry Rotary Wing [IERW] Course and Phase III, the capstone phase, builds upon individual skills learned in IERW, focusing on platoon and company collective training. Janus was recently incorporated into the syllabus, providing an introduction to the simulation training system.

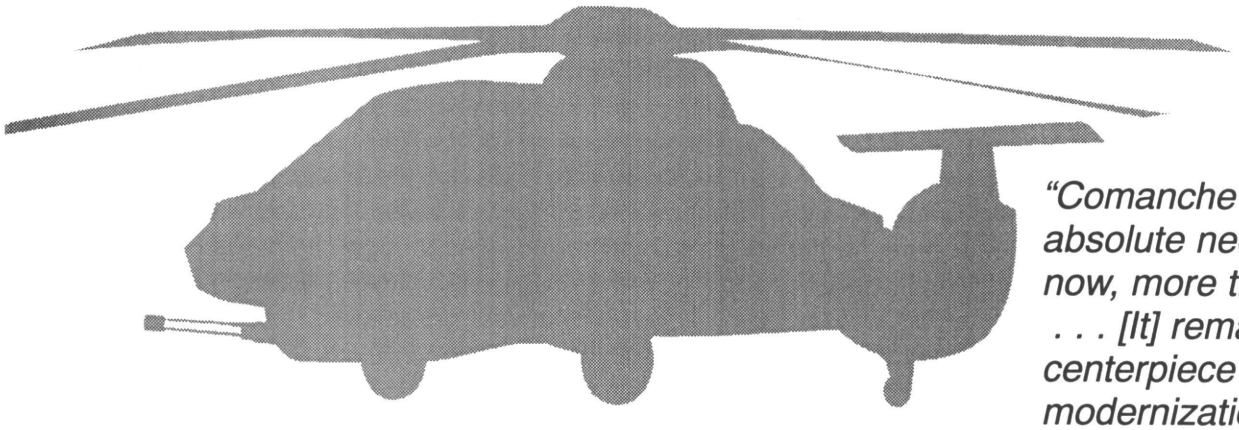
Similarly, the Aviation Officer Advanced Course has undergone several changes. We have fully embraced the small group leaders concept, with 81 percent of the course taught in this format. Our students focus on warfighting. Through Janus simulation, the student staff exercises all aspects of the tactical decision–making process at the battalion and brigade level. They are decisively engaged with every piece of the fight. From the command estimate through developing orders, fighting the battle, and conducting a Combat Training Center AAR [after–action review], our students do it all.

The Noncommissioned Officer [NCO] Education System remains the foundation of NCO training, providing Aviation Branch NCOs realistic training that prepares them to be technically and tactically qualified leaders and challenges them to lead by example.

All these aviation leader development courses are today using constructive simulations at the Aviation Warfighting Simulation Center. By applying brigade/battalion simulation and Janus, they are developing skills in situational awareness and synchronization. As we move to Force XXI, these constructive simulations will evolve into WARSIM 2000 and continue to provide essential training to the warfighter of the XXI century.

Quality people, of course, remain central to our vision. Aviation has fared well in its recruiting efforts to attract top–quality people. Our officer accessions for the past several years show that we are getting the top cadets from the USMA [United States Military Academy, West Point, N.Y.], ROTC [Reserve Officers' Training Corps] and OCS [Officer Candidate School]. Our warrant officer accession demographics are equally as impressive. They show our young warrant officer candidates are smarter and more experienced than ever before, and the same can be said of our young soldiers and noncommissioned officers. Clearly we are getting great young people!

Great people must be equipped with great weapons, tools, and systems. Our modernization plan is based on a strategy which divests the aviation fleet of aging aircraft and maintains only the required numbers of systems to support our warfighting missions. It reduces rotary–wing fleet from 10 different types to 4, and the fixed–wing systems from 26 to 4. We continue to need additional Black Hawks and are



"Comanche is an absolute necessity . . . now, more than ever. . . . [It] remains the centerpiece of our modernization effort."

looking hard at CH–47 [Chinook] follow–on or life extension. We will continue Apache modernization with the Longbow program. And we continue to count on Comanche.

Comanche is an absolute necessity . . . now, more than ever. We all understand the value of reconnaissance in battle. General Ulysses S. Grant once said, "The art of war is simple enough. Find out where your enemy is . . . ." At the National Training Center [Fort Irwin, Calif.], we have found a 95–percent correlation between successful reconnaissance and success in the fight. And Comanche in the armed reconnaissance role has no equal.

Secretary West has made a powerful case by saying, "Comanche is the only weapon system which contributes to all five tenets of the modernization overmatch: project/sustain, protect the force, win the information war, deliver precision strike, and dominate maneuver."

General Sullivan has said "... The Comanche is more than a helicopter . . . It is a twenty–first century weapons platform, and communication link for ground commanders . . . ."

Comanche clearly remains the centerpiece of our modernization effort.

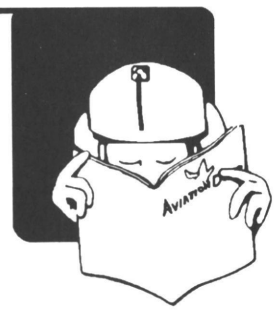
But modernization doesn't only mean new airframes. We are working on new aircraft survivability equipment, aviation life support equipment, and obstacle avoidance equipment because these core programs are essential to the readiness of the future force. Modern technology offers our warrior a never–before ability to see the enemy, to predict his moves, and to join the fight with decisive lethality. However, it is still the soldier who will carry the victory. It is important to remember that our efforts on risk management, safety, and quality–of–life programs protect our soldiers and preserve the force. We had a relatively good year, statistically speaking, in 1994 and got off to a good start in FY 95—but we can always do better. We must eliminate human performance error in aircraft mishaps . . . it's an insidious enemy that robs us of our warfighting assets. And as we talk about the impact of change, we should remember some things do remain constant. The importance of competent leadership and a commitment by officers and NCOs to take care of our soldiers and their families, the importance of pride in what we do, the reliance on basic values. All those contribute directly to preserving the force.

We should remember, too, that our senior leadership has a clear vision ". . . to remain trained and ready, serving the Nation at home and abroad, a strategic force capable of decisive victory . . . into the twenty–first century." And aviation is clearly a part of that vision.

Our chosen course is ambitious; yet, well–considered and achievable. Contingency operations responding to regional warfare is the way of the future, and aviation will play an ever–increasing role. Force XXI will drive the design of units and equipment. To remain relevant, aviation forces must be capable of rapidly shifting focus to meet new and diverse challenges; must be capable of conducting simultaneous operations; must effectively tailor, must have the ability to mass overwhelming combat power and integrate quickly into the joint team. Bottom line—Army aviation must be *versatile*! To ensure we remain versatile, we will continue to need quality people, coherent warfighting doctrine, a balanced mix of forces, world–class training, and world–class equipment too. And, collectively, we are working all that.

I am proud of our Army aviation team; I believe we are meeting the challenges of the future head on. To paraphrase our chief, we are moving out smartly on the twenty–first century—***at the vanguard of change***.

News and Views



Feedback on SEAD planning—lack of training is not the problem

After 18 months at the Joint Readiness Training Center (JRTC) as an aviation observer controller and having had suppression of enemy air defenses (SEAD) planning as one of my pet peeves while there, I would like to expand on the article written by CPT Curry and CPT Rice in the September/October issue of the ***Aviation Digest*** concerning SEAD ["Scrutinizing SEAD Planning," pages 14–17].

First, I agree with them when they say that SEAD is broken. SEAD is broken, though in my opinion not because of lack of training but because artillery, by itself, is not responsive enough to provide the type of support necessary for fast–paced aviation maneuver. That last statement is likely to raise the hair on the back of the neck of artillerymen everywhere. I say it not because artillery is ineffective; history has proven that it is extremely effective on the battlefield. I say it because aviation has outpaced it.

Artillery is not fast enough to keep up with helicopters maneuvering on the battlefield. Even at the relatively slower speeds of night vision goggle flight, helicopters can fly out of the range of all standard cannon artillery in only a few minutes.

I strongly agree with CPT Curry and CPT Rice when they say that SEAD planning receives a lack of attention. As a former observer/controller, I can verify that SEAD planning received cursory attention from most aviation units and none from the task forces that they support. This is a bold statement, but I will clarify it.

Most aviation units gave some attention to enemy air defense artillery (ADA) capabilities. Usually, the aviation intelligence officer (S2) would analyze products given to him by the task force they were supporting. The S2 developed his ADA picture, and the unit developed a plan to deal with the threat. These units asked for artillery support during the initial and subsequent major air assaults, and some got that support. The problem was that as the scenario developed, requested aviation support was no longer for major air assaults but for one, two, or three aircraft missions. The emphasis for artillery support shifted entirely to the infantry and became next to impossible for aviation units to get. An interesting observation to go along with this was that while some aircraft losses occurred during the large air assaults, the vast majority of aircraft losses occurred during the small—one, two or three—aircraft missions involving two or more lifts.

CPT Curry and CPT Rice say that "If SEAD is difficult to understand, Aviation made it that way." I take exception to that statement. The aviation advanced course devotes 16 hours of classroom study to fire support and includes it on every tactical practical exercise, focusing on how to employ it in support of aviation tactics. How much time do artillery courses spend on aviation and how to support it? To date there are no field manuals, field circulars, TTPs [tactics, techniques, and procedures], Department of the Army pamphlets, or handbooks dedicated to this very complicated tactical procedure. Granted, aviation should be involved in the development and preparation of this doctrinal base, but the responsibility for the preparation and development should rest with the Field Artillery School.

Captains Curry and Rice also say that units, ground and aviation, tend to look at the battlefield as being linear. Units that have been to JRTC know this is not the case. I did not observe this to be a problem; however, I did see the opposite. Because the battlefield was not linear, units

had a hard time templating possible enemy ADA positions because there was no "line" to start from. The solution to this was to focus on known enemy positions, key terrain, and patience. Unfortunately, the patience meant waiting until the enemy began firing its ADA assets. Once it did, smart units knew that the enemy could not move very far or very fast in the light environment.

Captains Curry and Rice do an excellent job of defining suppression and outlining different means, including electronic warfare, of obtaining the results of suppression. They did, however, overlook the most effective and most timely means of suppressing, even killing, enemy ADA available to aviation commanders: the firepower of attack/cavalry aircraft organic to an aviation task force.

Attack/cavalry aircraft located with a flight or in overwatch positions along the flight route provide immediate direct fire support with either 2.75–inch rockets or 20–/30–millimeter cannon.

This is the first and most important key to SEAD—***immediate***. By being with the flight, attack and cavalry aircraft can see the missile fired and return fire to the base of the smoke trail where the weapon system is, one hopes, killing it. Granted, this is reactive SEAD as opposed to active SEAD. With a little luck, aircraft survivability equipment and flight techniques will prevent the first shot from being a hit. Employing attack/cavalry helicopters will prevent the enemy from getting another shot.

The second key to SEAD is the infantry. Yes, infantry, not artillery. Artillery, at best, will only suppress the enemy as long as it is going off on or very near him. The enemy knows this and will have well–prepared and camouflaged positions to hide in before and after firing. Unless the artillery lands right on top of him, he will survive to fight again. Therefore, infantry must go in and find SA–14 teams and their caches and destroy them. This will take away the enemy's ability to engage aircraft. The ADA teams and their caches will be around key terrain and key enemy positions and on terrain that provides good line of sight and fields of fire along known aviation routes.

Terrain that provides good line of sight/fields of fire can be identified using line–of–sight products such as terra base and visual area plot. An excellent resource available to help determine possible enemy ADA positions is the task force ADA officer. He has the same mission and thinks the same way as the threat ADA team. Aviation, artillery, and ADA planners—working together with S2/military intelligence assets—can predict a fairly accurate picture of how threat ADA may be employed. This picture is, at best, an educated guess. Any unit that uses it as fact is in for some nasty surprises.

In conclusion, am I saying that artillery should not be included in SEAD planning by aviation units? Certainly not. Artillery plays an important role in SEAD. All known and suspected ADA locations, identified through every means available, should be targeted by artillery assets that can range them. What I am saying is that aviation should not forget the key player in SEAD, the one that is the most effective and easiest for aviation to control. That is our own attack and cavalry aircraft. Combined with infantry, they are the most likely to kill threat ADA systems. This is especially true in the low–intensity environment—where fires will be restricted to positively identified targets.

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Executive Officer
Eastern Region Headquarters
Operational Support Airlift Command
Atlanta, GA 30336–1696

Feedback to "Are we soldiers first—or not?"

I would like to respond to CSM Brent H. Cottrell's letter in the September/October issue. The letter, titled "Are we soldiers first—or not?" [pages 3–6, ***Aviation Digest***] is concerned with an issue that is important to many in the Army aviation community—the "acceptance" of aviation as a true combat arms branch. Letters and articles on this subject appear in almost every issue—a trend that disturbs me.

Continued handwringing over acceptance does nothing to contribute to what is, in my mind, the hallmark of Army aviation: mission accomplishment. I, and the aviators I work with on a daily basis, feel no need to do anything extra to earn the approval of our combat arms brethren.

We employ a variety of complex aircraft and systems with great skill. We can find, fix, and destroy the enemy while providing unparalleled command/control and logistical support. We will continue to earn the ground commander's respect by being on time and on target and getting the job done.

The pace of life in Army aviation allows us no time to worry about issues that do not affect continued mission accomplishment. Please devote more space in your magazine to articles that will improve the collective skills of aviation officers, noncommissioned officers, and enlisted soldiers.

We will continue to serve the nation and the Army by being the consummate professionals we are, and the rest will take care of itself.

LT Charles R. Bowery Jr.
B Company, 3–229th Aviation (Attack)
Fort Bragg, NC 28307

Memorial for hero who tried to rescue helicopter crew

Plans are underway for a permanent memorial to honor fallen hero, MSG Gary Gordon, who with his wife and two small children made their home in Southern Pines, N.C., while MSG Gordon was stationed at Fort Bragg, N.C.

While serving as a member of the United States Army Special Operations Command, MSG Gordon gave his life last year as he fearlessly tried to rescue the crew of a downed helicopter in Mogadishu, Somalia. His bravery and conspicuous gallantry above and beyond the call of duty prompted the Army, in the name of the Congress of the United States, to bestow on him, posthumously, the Medal of Honor, the first since the Vietnam War. At the time, MSG Gordon was serving as Sniper Team Leader, U.S. Special Operations Command, with Task Force Ranger in Somalia.

The inscribed granite monument to honor MSG Gordon will be erected in a highly visible location at the entrance to city government offices in Southern Pines. Dedication services will be 23 May, the anniversary of the awarding of the Medal of Honor.

The memorial must be paid for by contributions. These may be made to Nations Bank, in care of Ms. Cheryl Gilmore, PO Box 1407, Southern Pines, NC 28388, or through the Special Forces Association, ATTN: MSG Gary Gordon Memorial, PO Box 414336, Fayetteville, NC 28389 (tax deductible). If any monies contributed exceed the costs of the memorial, the balance will go toward the Gordon children's education fund, previously established by the citizens of Southern Pines and Moore County, N.C.

Answers to questions about flight pay for aviators

By now, most aviators are familiar with the changes wrought by the Aviation Career Improvement Act (ACIA) of 1989. Effective 1 Oct 91, the National Defense Authorization Act for fiscal years 1990 and 1991 revised the entitlement requirements of Title 37, U.S. Code, regarding aviation career incentive pay (ACIP) eligibility gates and delegated to the service secretaries the authorization to establish and execute waiver procedures. Most aviators know that flight pay for aviators with more than six years of aviation service increased from $400 to $650 a month and that aviator gate requirements for continuous ACIP fall into three different categories depending on the aviation service entry date (ASED) as shown in Table 1.

Less understood, however, is when and how much flight pay decreases with years of service. For officers, flight pay begins decreasing at the eighteenth year of officer service. The ***Department of Defense*** (DOD) ***Pay Manual*** defines officer service as all active and inactive service as a commissioned, warrant, and flight officer. Decreases in flight pay also occur at 20, 22, and 25 years of officer service. After 25 years of officer service, ACIP ceases except for warrant officers. Officers (other than warrant officers) below pay grade 0–7 with more than 25 years of officer service who are qualified for aviation service and required by competent orders to perform operational flying duties are entitled to monthly (conditional) ACIP subject to the performance of established flying requirements. The flight pay reductions for years of officer service are depicted in Table 2.

Also frequently misunderstood are the criteria for executing the ACIP gate waiver procedures established by the Secretary of the Army. ACIA gate waiver authority and procedures are contained in a Department of the Army (DA) message dated 171738Z May 93, subject: Notice of Change to AR [Army Regulation] 600–105 [***Department of Defense Pay Manual***] Regarding Aviation Career Incentive Act (ACIA) Waiver Policy. According to this message, only aviation officers and warrant officers with an ASED of 1 Oct 79 or later and who have failed to meet the total operational flying duty credit (TOFDC) requirements for the new eligibility gates because of "needs–of–the–service" requirements are eligible for an ACIP waiver. Prerequisites include completion of no less than 72 months of TOFDC by the twelfth year of aviation service and submission of the request for waiver no earlier than 12 months before the loss of ACIP. In addition, aviation officers who have previously received an approved ACIP waiver are not eligible for subsequent waivers. Officers applying for an 18–year gate waiver are not eligible to receive continuous ACIP to 25 years of total federal officer service (TFOS). They are eligible to receive continuous ACIP to 22 years of TFOS only.

For ACIA waiver purposes, "needs–of–the–service" assignments, are defined as—

- DOD/joint duty in a designated critical billet.
- Army education requirements board schooling and utilization tour.
- United States Army Recruiting Command/Reserve Officers' Training Corps/United States Military Academy cadre assignment.
- Aviation officer position (coded 15 or 67J) on the table of distribution and allowances (TDA) of the Army Staff in the National Capital Region or major Army

Old System	Aviators with ASED prior to 791001	
12-year gate:	072 months TOFDC	Continuous ACIP to 18 years of aviation service
18-year gate:	108 months TOFDC	Continuous ACIP to 22 years of TFOS
	132 months TOFDC	Continuous ACIP to 25 years of TFOS
New System	Aviators with ASED on or after 851001	
12-year gate:	108 months TOFDC	Continuous ACIP to 18 years of aviation service
18-year gate:	120 months TOFDC	Continuous ACIP to 22 years of TFOS
	144 months TOFDC	Continuous ACIP to 25 years of TFOS
Transition	Aviators with ASED from 791001 to 850930	
As of 911001:	072 months TOFDC	Continuous ACIP to 18 years of aviation service
12-year gate:	072 months TOFDC	Continuous ACIP to 15 years of aviation service
15-year gate:	108 months TOFDC	Continuous ACIP to 18 years of aviation service
18-year gate:	120 months TOFDC	Continuous ACIP to 22 years of TFOS
	144 months TOFDC	Continuous ACIP to 25 years of TFOS

Table 1. Aviation career incentive pay eligibility.

command headquarters without assigned aircraft.

• Assigned when medically disqualified, but subsequently enabled to requalify for aviation service.

Requests for ACIA waivers are submitted through command channels to U. S. Total Army Personnel Command (PERSCOM), ATTN: TAPC–OPE–V (officers), –OPW–AV (warrant officers), –OPH–MS (medical service corps officers), or OPB–E (Acquisition Corps), as appropriate, for verification of the waiver criteria. PERSCOM will then forward favorably considered requests to Headquarters (HQ), DA, DAPE–MBI, for approval. These waiver procedures will be contained in the revised AR 600–105, ***Aviation Service of Rated Army Officers***, due for publication in the third quarter fiscal year (FY) 95.

ACIA waivers approved by HQDA will allow aviators a one–time extension of their 12–, 15–, or 18–year gate. The amount of this one–time extension is limited to the number of months that the officer served in an approved "needs–of–the–service" assignment. Officers must accumulate the required months of TOFDC required to meet their gate during this extension to qualify for continuous ACIP. An aviator who fails to accumulate the required number of months of TOFDC at the completion of the waiver period or next gate will have his or her ACIP terminated, with no recourse for additional ACIA waivers.

Years of Officer Service	Monthly Rate
Over 18	$585
Over 20	$495
Over 22	$385
Over 25	$250

Table 2. Monthly officer flight pay based on years of service.

Questions concerning the Aviation Career Improvement Act or DA waiver policy should be addressed to LTC Coughlin, DCSPER (DAPE–MBI), at DSN 227–2221, or MAJ Golden, PERSCOM (TAPC–PLT–A), at DSN 221–5098.

4th Battalion, 101st Aviation Regiment, reunion scheduled in May

The 4th Battalion, 101st Aviation Regiment, "The Wings of the Eagle," will be the host for a reunion of all former members of this historic unit—including all "Commancheros" of A Company and "Kingsmen" of B Company, who fought so valiantly during the 101st Airborne Division's tour of duty in Vietnam.

The activities will commence on Wednesday, 17 May, and conclude Friday evening, 19 May. Events planned are an open house, a static display of aircraft and equipment, an early bird social, local tours, a memorial service, and a reunion dinner with a guest speaker.

For more information on hotels, maps, a tentative schedule of events, and other activities, call CW2 Laura Smith or CW2 John Pruden at 502–798–3128/3189, or write to—

HHC
4–101 Aviation Regiment (Air Assault)
Fort Campbell, KY 42223.

United States Army Physical Fitness School has openings for staff

The United States Army Physical Fitness School (USAPFS) is seeking application packets from individuals interested in an assignment at the USAPFS.

The USAPFS is located at Fort Benning, Ga., and is the Army's proponent for physical fitness training and doctrine. The USAPFS also teaches several Master Fitness Trainer Courses throughout the year, which afford assigned personnel numerous opportunities to instruct.

The USAPFS has several officer, noncommissioned officer (NCO), and civilian (GS–6 through GS–12) positions. Interested individuals must submit a complete application to the Commandant, USAPFS. A complete application includes, but is not limited to, the following items:

- Department of the Army photo (or similar photo for civilian applicants).
- Last three evaluation reports—officer evaluation report (OER), noncommissioned officer evaluation report (NCOER), or performance appraisal.
- Officer Record Brief or 2/2–1 (NCOs).
- Three letters of recommendation from the individual's chain of command.
- One–page letter/memorandum expressing why you want to be assigned to the USAPFS.
- Any other pertinent information such as recommendation, transcript, evaluation, certification, or diploma.

Applications must be complete for individuals to be considered for a position. Upon acceptance to the school, individuals must serve a minimum of 24 months at the school.

Include full name, rank, social security number, unit, address, and daytime telephone number on all correspondence. For more information or to send in completed applications, write to—

Commandant
U.S. Army Physical Fitness School
ATZB–PF (ATTN: CPT Chancey)
Building 468
Fort Benning, GA 31905–5000.

SMART may reward suggestions

SMART (Supply and Maintenance Assessment Review Team) has received more than 13,000 suggestions, of which more than 1,800 have been adopted. Savings to the Army have been nearly $166 million, with nearly $745 thousand in cash awards identified for suggesters. Cash awards range from $25 to $25,000 (maximum authorized by law). The more your suggestion can save in Army money or resources, the greater the award.

Upon receiving your suggestion, we will send you an assigned SMART number. If you have sent SMART ideas in the past and have moved or been reassigned, send in your new address. Refer to the SMART number assigned to your suggestion.

Active Army, United States Army Reserve, National Guard, and Department of the Army civilians can submit SMART suggestions using an optional Department of the Army (DA) Form 5533 (***SMART Suggestion Form***), found in Maintenance Update and future editions of Supply Update). Or if the form is not available, plain paper may be used; in this case, provide information such as publication, end item identity, and model and national stock number (NSN) part number. Describe the current problem and your recommended improvement or change. Provide full name, military address (home address can also be provided), and duty phone number (DSN/commercial). If your address changes, send SMART your new address. Submit SMART ideas to—

PROJECT SMART
ATTN: ATCL CFI S
10500 A Avenue
Fort Lee, VA 23801–6000.

Army Aviation Medicine—Serving Army Aviation on Three Fronts

Colonel John M. Blough
Aviation Medicine Consultant to The Army Surgeon General and
Surgeon, U.S. Army Safety Center
Fort Rucker, Alabama

As Army aviation focuses on the future, Army Aviation Medicine supports the aviator today and will into the 21st century and beyond. It seeks to accomplish a diversity of missions on three fronts simultaneously: **clinical aviation medicine, operational and occupational medicine, and research and development.** These fronts are balanced through the flexibility and dedication of those professionals serving in all areas of Army Aviation Medicine. Their experience and training provide the Army with a wealth of knowledge with a multiplicity of applications to Army aviation.

The Army is changing, and Army aviation is adapting quickly to the changes with demands for a force capable of successfully promoting and protecting American interests anywhere or any time, worldwide. Our aviators must be optimally healthy, physically fit, and able to concentrate on the mission.

Army Aviation Medicine seeks to provide the daily clinical care of the aviator, ensuring each is prepared to fulfill his or her duties of flying. The flight surgeon (FS), center to this front, is supported by an outstanding team of professionals ranging from the medic or receptionist at the front desk to the pathologist in the laboratory analyzing the aviator's blood specimen. The team works together to ensure the human factor is examined as carefully as the flight plan or the aircraft.

Clinical Aviation Medicine requires the support of other specialties to further evaluate specific cases and recommend whether the aviator is able to fly with certain medical conditions. On occasion, it may be determined that an aviator's medical condition, or its required treatment, is increasing his or her risk of suddenly becoming incapacitated or unable to safely complete the flying mission. In which case, the FS must recommend the aviator duties not include flying. A physician who has studied Aviation Medicine and identifies with the aviation community finds these hard decisions.

Clinical Aviation Medicine must continue to evaluate the aviator from the initial flight physical through the retirement physical. Focusing on health, fitness, and wellness in the cockpit is the goal of clinical aviation medicine.

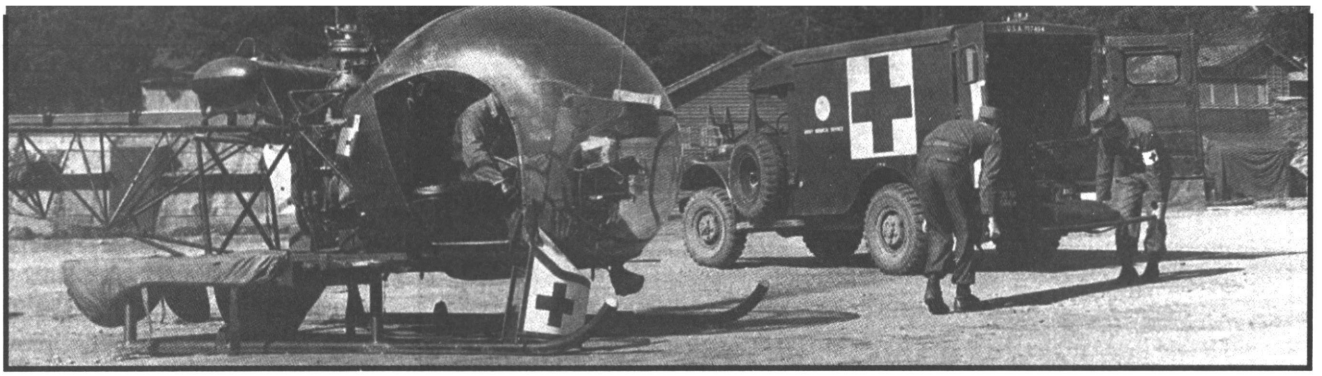
The operational or occupational aspects of Army Aviation Medicine are challenging and demanding. We plan for the area of operation based on where the aviation unit is directed. The health of the Army aviation unit is essential to completion of the mission. The FS, and supporting medical cast, prepare the unit through immunizations, training, and the knowledge gained by frequent flight line contact. Evaluation and experience outside the clinic is critical. The environment of the aviator is very important to understanding the total mission. Evaluation and recommendations for health hazard controls and improvement of the workplace are key to a healthy aviator or crewmember. The FS and other specialists in preventive medicine or industrial hygiene can impact on the health and safety of occupational areas wherever they are located.

The research and development front is changing to the research and acquisition of aeromedical technologies to enhance aviator performance. Continued efforts of Army Aviation Medicine to define, investigate, and develop technological advances for Army aviation and the aviator are important as we move into the 21st century. Encouragement and recognition for developments serving the aviator today are a must. The helmet and improvements to noise attenuation with its newer designs serve to decrease hearing loss in our aviators. The helmet–mounted devices aid in safety of flight and add a night dimension to mission accomplishment. Compilation of data from annual flight physicals provides a basis to recommend development of future programs to select, train, feed, and retain aviators. The continuing health of our aviators is effected through a study of their habits and behaviors over a career. We can note changes due to improved awareness of health effects caused by lack of: balanced diet, regular exercise, good stress management, appropriate rest cycles, and other preventive health measures.

Research and acquisition are essential. The technological advances we see today are the efforts of team discovery in laboratories like the U.S. Army Aeromedical Research Laboratory, Fort Rucker, Ala. The future will be based on the quality and application of research accomplished today. Moreover, Army aviators of the 21st century will fly because of the knowledge and experiences gained from today's research and acquisitions initiated now.

Army Aviation Medicine has served Army aviation over the past 79 years on three fronts. It has provided Army aviation with new developments for improvedhealth and safety during flight and preserved some of our senses into the retirement years. It has taught us that behavior modifications, such as exercising aerobically, can enhance our physical abilities and longevity.

Army Aviation Medicine personnel—past and present—have affected the lives of us all in Army aviation in a positive way. The future of Army Aviation Medicine depends on the continued quality and productivity of these personnel who have brought us safely and in good health to 1995. I am confident that the continued efforts of these professionals will significantly impact on aviation safety and health into the 21st century and beyond.



THE EARLY DEVELOPMENT OF ARMY AVIATION MEDICINE AND ITS IMPACT ON ARMY AIR OPERATIONS

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The effective employment of virtually all air assets in modern warfare depends on the combination of an aircraft and its pilot. This interface between man and machine is complex and requires both components to be in optimal working condition for the system to function properly. Logisticians and maintenance crews ensure that the aircraft operates at peak performance; the pilot's performance depends on the person along with the assistance of his/her physician. This physician must be aware of the unique environment of the pilot to provide a significant contribution to the operation of the aircraft. Understanding the milieu of the cockpit stems from developments in the field of aviation medicine. This article reviews the historical developments in aviation medicine in the U.S. Army. Highlighted are the implications for current Army air operations and procedures.

Man's first flight took place in the late 18th century in heated air balloons. On 9 January 1793, Jean–Pierre Blanchard agreed to a request by Dr. Benjamin Rush to examine the state of his pulse during his aerial voyage. Rush also documented the aeronaut's discomforts at high altitudes and later recorded impressions and data from other balloonists of the period. Because of these initial investigations into the physiologic effects of altitude on man, Benjamin Rush has been called the "Father of American Aviation Medicine."[1]

American aviation medicine progressed little during the 19th century. The heavier–than–air flying machines developed at the beginning of the 20th century brought many new stresses to the pilots flying them. During World War I, all efforts were focused on increasing the speed and mechanical efficiency of the airplane; little attention was paid to the effects of these changes on the pilot.

Pilot selection early in the war was not based on any physical or fitness standards, but rather on whether the soldier merely had the courage to fly. Policy, in fact, dictated that only men who were fatigued by more difficult work in the infantry or field artillery were to be placed in the Aviation service.

Soon our allies in Europe began to realize that men who were physically fit for more traditional military service on the ground were not necessarily fit for duty as pilots. In view of these findings, the United States Army, in 1916, formed a board consisting of one Medical Corps officer and two Signal Corps officers to examine and determine the fitness of soldiers applying to the Aviation Section of the Signal Corps (to which Army aviation was initially attached) to become pilots. The following year on 6 September, Colonel Thomas C. Lyster was designated the first Chief Surgeon of the Aviation Section. He established 67 physical examination units in the larger cities of the United States to examine the nearly 100,000 applicants for the Air Service. He also tasked medical officers to the organized units of the Air Service. However it soon became apparent that these early "flight surgeons" were not adequately trained in the special medical problems of flying.[2]

The Aviation Section officially established a Medical Research Board on 18 October 1917. Its functions were as follows:

"1. To investigate all conditions which affect the physical efficiency of pilots.

"2. To institute and carry out at flying schools, or elsewhere, such experiments and tasks as will determine the ability of pilots to fly in high altitudes.

"3. To carry out experiments and tests at flying schools, or elsewhere, with a view to obtaining suitable apparatus for the supplying of oxygen to pilots at high altitudes.

"4. To act as a standing medical board for the consideration of all matters relating to the physical fitness of the pilots."[3,4] To accomplish these tasks, the Board initiated actions to establish a Medical Research Laboratory at Hazelhurst Field Mineola, Long Island, N.Y., which began operations in 1918.

After conferring with our allies in Europe, now Brigadier General Lyster designated three general categories of medical problems of aviation which the Medical Division of the Aviation Section should study. These areas were as follows:

1. The selection of those suitable for flying.

2. Their classification from a medical stand point for duty with observation squadrons, flying squadrons, or day or night bombing squadrons.

3. The maintenance of each aviator

at his maximum efficiency.[5] Their purpose was to send a maximum number of pilots over to the war, in the best physical condition required to accomplish the mission.

A major impetus for improving the education and training of physicians in the field of aviation medicine was based on an analysis of Great Britain's casualty list at the end of the first year of the war. "Out of every 100 fliers killed, 2 had met their death at the hands of the enemy, 8 from some defect in their planes, and 90 on account of some individual deficiency... Of these 90 fatalities, 60 were found to be due to some physical defect."[6] As a result, the British established a special service to care for the flier. Fatalities due to physical deficiencies consequently fell from 60 percent to 12 percent within 2 years.[7] Similar findings were reported in the United States, though accident figures due to physical defects of the pilots were never as high as in Britain. Based on these results, flight surgeons were assigned to American aviation units early in the war.

After pilots were selected and then classified, the maintenance and care of their fitness and efficiency were entrusted to the flight surgeons (FSs). The FS's duty was to keep the pilots in condition to fly and to return those temporarily grounded to flight status as soon as possible. The flight surgeon had to have a knowledge of the physical factors that affect pilots and the responses of the body to flight stresses; he also was to know each flier individually, to have made frequent flights (as a passenger or as pilot himself), and as a result of this knowledge, to advise his commanding officers of possible means to prevent accidents.

The field of aviation medicine thus rose from an obscure, ill–defined area of concentration to an important sustainment function for the aerial war effort in World War I. It became a separate specialty devoted to the support of aviation and developed specialized medical research to study the effects of flying on pilots. Finally, and most importantly, a concept of aviation medical support, organic to aviation units, emerged and was found to directly impact on the performance and preservation of these units.[8]

Since these early stages of development, aviation medicine has continued to meet the needs for selection, classification, and maintenance of the flier. Most changes in the field since World War I have been technological, related to the advancement in the medical sciences. The many physiologic changes pilots endure and the study of these changes is beyond the scope of this article. In short, with increasing complexities and capabilities of modern aircraft, the field of aviation medicine has necessarily expanded to place healthy and competent pilots in these aircraft. Furthermore, the field has also expanded to support manned space flights.

Administratively, since World War I, several significant events have occurred. With the formation of the Air Force in 1947, most Army Air Force medical officers transferred to the Air Force. After being temporarily without a defined mission, Army aviation medicine resurged along with Army aviation during the Korean War. The need for organic medical support emerged when Army aviation units were positioned in forward areas with tactical commands, separated from Air Force facilities and their medical support. Also during the Korean War, aviation medicine began to explore the medical needs and support for aeromedical evacuation.

By 1954, the Army finally recognized a distinct aviation medicine military occupational specialty (MOS). For this new MOS, Army schooling into the medical aspects of pilot selection, training, and maintenance, as well as medical evacuation improved with the creation of a Medical Aviation Section, Office of The Surgeon General (OTSG) in 1952 (which eventually became the Department of Aeromedical Education and Training in 1963 at Fort Rucker, Ala., and later in 1984, the U.S. Army School of Aviation Medicine).[9] In addition, specific medical research into the aviation problems of acoustics, vision, crew workload and stress, vibration, impact, and life support technology were instituted with the formation of the U.S. Army Aeromedical Research Laboratory, also at Ft. Rucker, in 1962. Although concerned primarily with the impact of these problems on aviators, extension of the research has been applied throughout most military systems and operations.[10]

Thus far, this article has reviewed many aspects of the historical development and progresses of aviation medicine in the U.S. Army. However, what contributions has this field of study made to air operations in the Army? Already reviewed were dramatic benefits witnessed by the British in World War I. More recently in Vietnam, the FS proved to be a valuable asset to Army aviation units. If for no other reason than their background in primary care medicine, their presence was much needed. For instance, assigned to the 1st Aviation Brigade, with a strength of no greater than 25,000, were 50 flight surgeons who provided primary care on an area basis to more than 35,000 troops.[11]

As aviation medical specialists, the primary assets of FSs were in their contributions to specific problems related to flight. In August 1968, for example, the Command Health Report noted that about 70 percent of aircraft accidents was the result of pilot error, and that pilot fatigue contributed to a significant number of these accidents. FSs thus identified a significant problem and, through logging pilots' hours and periodic examinations, recommended to commanders ways to alter schedules or change other aspects of the lives of pilots (such as living conditions or extra duties) that could improve pilot efficiency and, thereby, aircraft safety.[12]

Another example of the impact of FSs was in their evaluation of aircrew wounds. Most helicopter crashes due to enemy fire were found not to be the result of injury to the pilot. Such aircrash investigation supported the need for continued use of seat armor and furthered the case for body armor, for most fatalities that did occur from wounds involved the head and upper torso.[13]

In summary, then, the development and progression of aviation medicine have not only improved our basic sci-

entific knowledge on the medical aspects of flight, but also, have positively contributed to the operational employment of aircraft. Most important to today's pilots is their access to a dedicated physician who personally knows them and their family, who understands their mission and their needs, and who actively seeks to support them in their desire to fly.[14] E.G. Siebert summarized this need for specialized medical care and supervision of today's pilots in 1919 when he noted:

"Aviation is a new field of man's endeavor. The physiologic changes that are developed by the great changes in man's environment have such a profound effect upon his physical and mental efficiency that makes it absolutely needful that he have this special supervision. When he has it, improved efficiency and prolongation of the flyer's ability to make good have again and again been demonstrated as a result of its application. Where he does not have it, experience has shown that the ultimate result is disaster and death. A flying service demands it."[15]

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11. Spurgeon Neel, Medical Support of the U.S. Army in Vietnam 1965–1970, (Washington, D.C.: Dept. of the Army, 1973), p. 99.

12. Ibid., pp. 100–101.

13. Ibid., p. 104.

14. LTC Karen Lloyd, AV, and LTC Donald Scherbinske, USAF, personal interview, 3 Apr. 1992.

15. E.G. Seibert, "Activities of the Medical Research Laboratory," Transactions of the American Laryngological, Rhinological, and Otological Society, vol. 25 (1919), p. 200.

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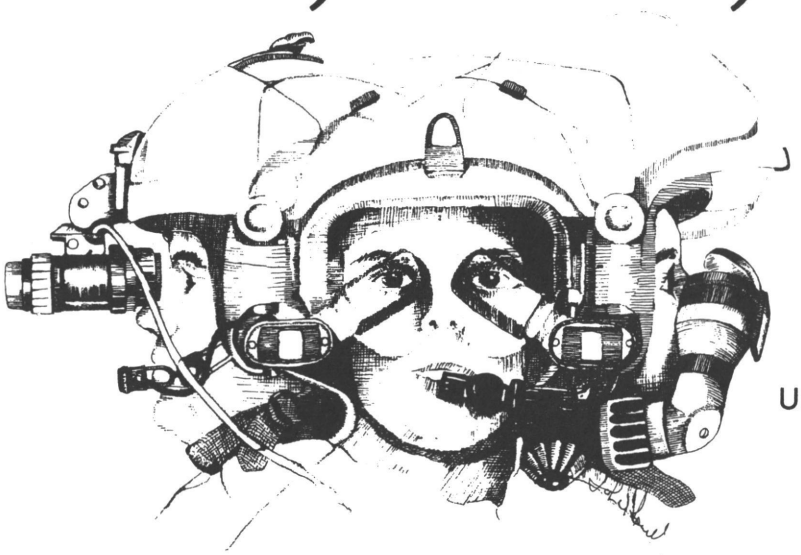
Helmet-Mounted Displays: Past, Present, and Future



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U.S. Army aviators are relying increasingly on helmet-mounted displays (HMDs). Since the early 1970s, tens of thousands of flight hours have been acquired flying with either the AN/PVS-5 night vision goggles (NVG) or the newer Aviator's Night Vision Imaging System (ANVIS) AN/AVS-6. Both of these systems use two separate, head-mounted image intensifier (I^2) tubes, which are sensors that are based on the principle of light amplification. Light from natural and artificial sources emanates from or is reflected off of objects and the background. The light is gathered by the collective optics and converted into electrons inside of the I^2 tubes. Special materials inside the tubes increase the number of electrons (amplification), which strike a phosphor screen that converts them back into light which then enters the eye (**figure 1**). In both of these I^2 HMDs, the I^2 sensors are independent and mounted on the helmet, one in front of each eye. An optical system that provides **two** visual inputs from **two** sensors, which are separated horizontally in space, is known as a **binocular** system. Therefore, NVGs and ANVIS are considered to be **binocular** HMDs. While NVGs and ANVIS are the most common HMD design, the most unusual is the HMD used on the AH-64 Apache. NVGs and ANVIS have the sensor

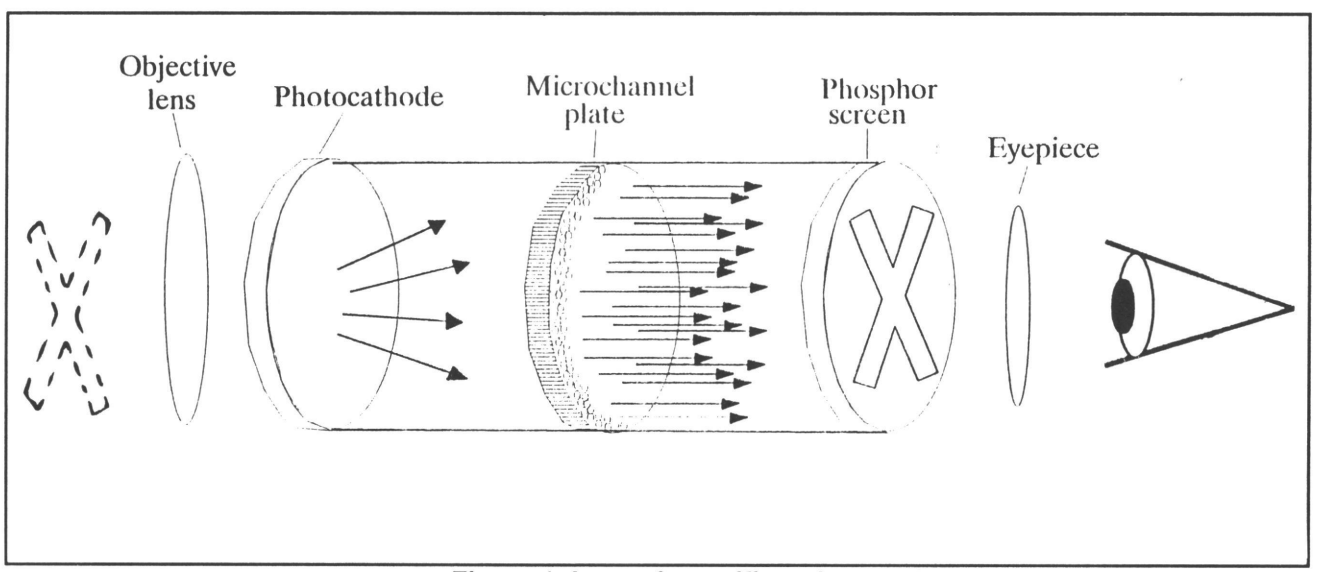

Figure 1. Image intensifier tube

and display all in one package mounted on the head, whereas the sensor and display are separate packages on the Apache.

The sensor used on the AH–64 does not depend on the amount of available light, but rather on infrared (IR) radiation emitted by objects and their background. This sensor is designed to "see" radiation in the 8– to 12–micron spectral range. All objects radiate measurable amounts of energy in this spectral range. The amount of radiated energy depends on temperature and type of material. This type of sensor is a thermal sensor.

The AH–64 uses separate thermal sensors for both pilotage and targeting. The targeting sensor system is known as the Target Acquisition and Designation System (TADS) and the pilotage sensor system is known as the Pilot Night Vision System (PNVS). The PNVS provides imagery to an HMD called the Integrated Helmet and Display Sighting System (IHADSS) (**figure 2**, left). Both the TADS and the PNVS thermal sensors are mounted on the nose of the aircraft (**figure 2**, right).

The IHADSS is an integrated HMD because it consists of both the helmet and the display itself. The display is the Helmet Display Unit (HDU). It consists of a barrel containing a prism and several lenses, a miniature 1–inch diameter cathode ray tube (CRT), and a beamsplitter (**figure 3**). The beamsplitter often is called a combiner because it combines the image of the outside world, which passes through it, and the image on the CRT, which after passing through the lenses, reflects off of it.

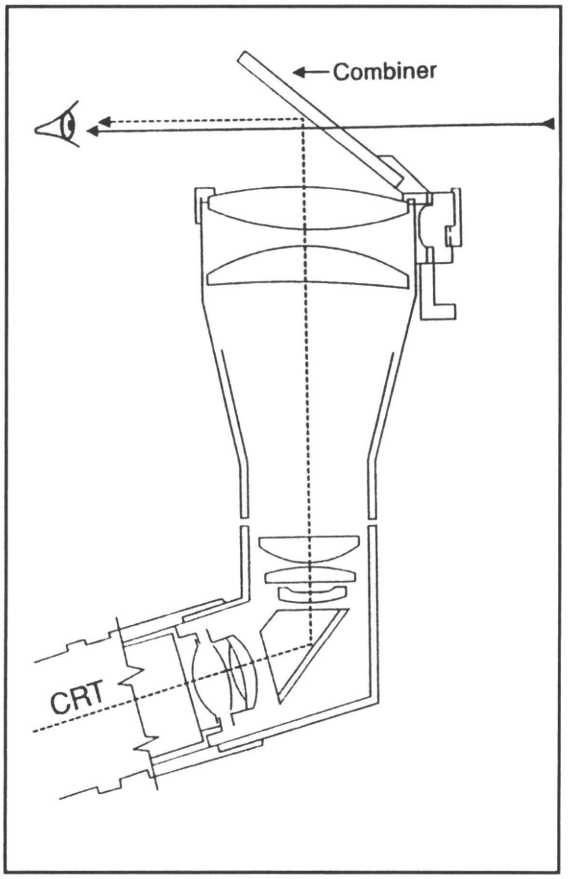

Figure 3. The HDU consists of a miniature CRT, relay optics, and combiner.

In the IHADSS, the visual input comes from one sensor, the PNVS on the nose of the aircraft. This input is presented monocularly (to only one eye—the right eye). Optical displays providing imagery from one visual input to one eye are called **monocular**.

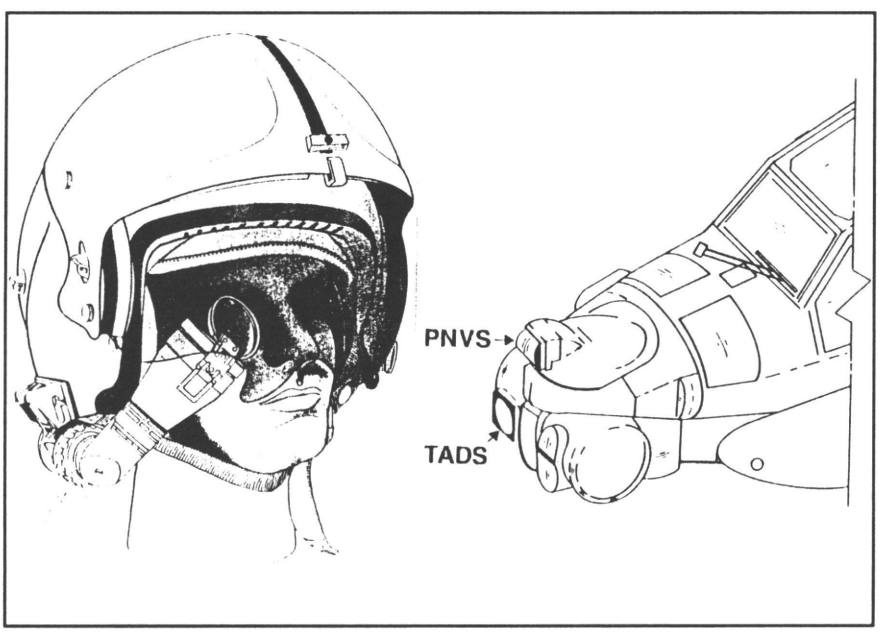

Figure 2. IHADSS (left), TADS, and PNVS thermal sensors mounted on the nose of an Apache (right)

Both monocular and binocular HMDs offer certain engineering and human factors advantages. Monocular designs have lower weight, provide greater look–around vision, and are easier to implement. Their major disadvantage is the shift in the center–of–gravity resulting from the one–sided display. Also, as with the preference of handedness, humans show for certain tasks such as writing, there is a preference for one eye over the other for certain visual tasks, such as sighting a rifle. Therefore, the design of the IHADSS for use on the right eye only may be resulting in some degradation in performance for those aviators who exhibit left–eye dominance for some tasks. However, currently there is insufficient evidence to confirm

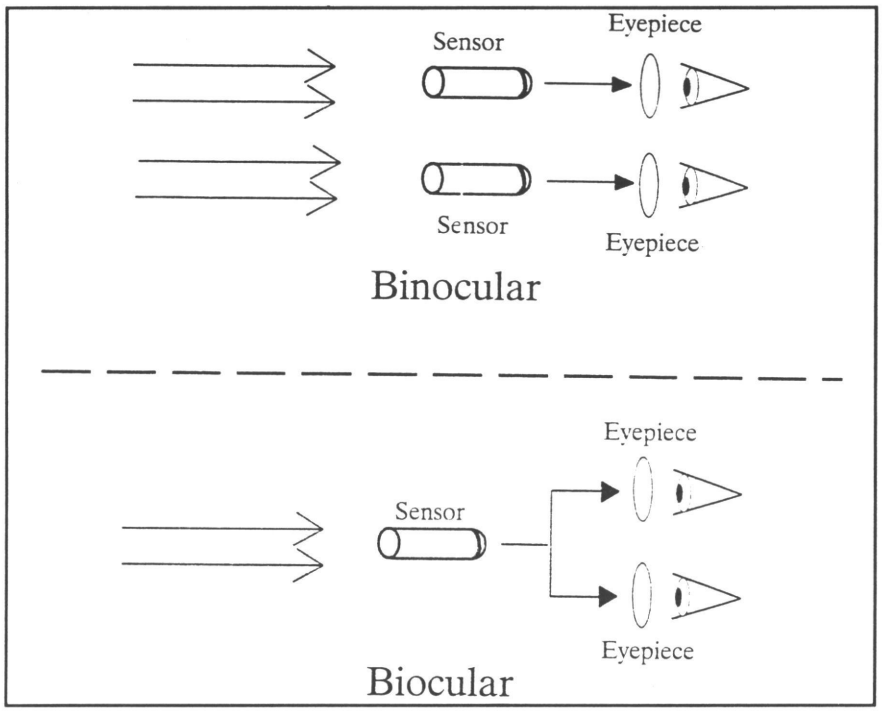

Figure 4. Binocular (top) versus biocular (bottom) displays

this degradation.

Binocular HMD designs have one advantage that is very important in aviation. This is the operational (and safety) advantage of redundancy. Having two separate tubes, each providing its own imagery, greatly reduces the probability of total system failure. A second advantage of binocular displays is stereopsis, which is depth perception resulting from the difference in the images presented to the two eyes. There are additional advantages of binocular displays over monocular displays in terms of visual performance. Some tasks can be performed better with two eyes than one. These include tasks involving visual acuity, form recognition, reaction time to light flashes, and target detection at low luminances and contrasts. The practical disadvantages of binocular displays include greater weight and increased complexity of the HMD and the potential problems resulting from misalignment of the images presented to the two eyes.

The U.S. Army presently is developing the helmet–mounted display, called the Helmet Integrated Display Sight System (HIDSS) for the RAH–66 Comanche. The HIDSS is a **biocular** HMD design. A **biocular** HMD differs from a **binocular** HMD in that, a binocular display provides two slightly different images of the outside scene to each of the two eyes—the difference is due to the separation distance between the **two** sensors—whereas a biocular display provides the same image of the scene (from a single sensor) to both eyes (**figure 4**). In the present plan for the Comanche, a single nose–mounted sensor provides the view of the outside world, which is presented as identical images to the two eyes; this is a biocular HMD design.

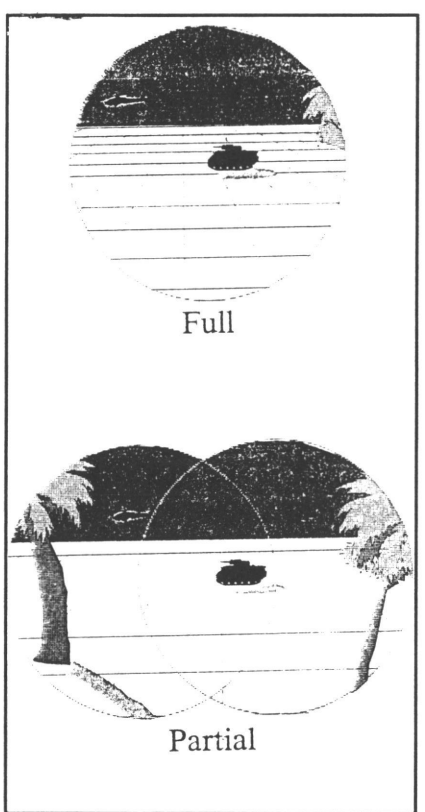

Figure 5. Full (top) and partial (bottom) overlapping

The simplest biocular display design is one in which the sensor's view of the outside scene is presented fully to each eye. That is, the entire portion of the visual world, as provided by the sensor, is present in both images. In this case, the display's available field–of–view (FOV) consists solely of a common, or fully overlapped, region (**figure 5,** top). This is the optimal design approach. However, as sensor design has increased available field–of–view, a corresponding growth in the size of the display optics has been limited by factors of weight, size, and image quality. Therefore, the entire available FOV cannot be presented to each eye.

To overcome this display–induced limitation and use all of the available sensor FOV, a technique of partial overlap is being employed. This technique involves sharing the larger sensor FOV between the two eyes; each eye sees a part of the total scene. The central portion of the scene is seen by both eyes and each eye also sees an additional portion of the visual world not seen by the other eye. Thus, as with normal human vision, the visual world is divided into three regions—a common, central overlap region and two monocular side regions, one seen only by the right eye and one seen only by the left eye (**figure 5**, bottom).

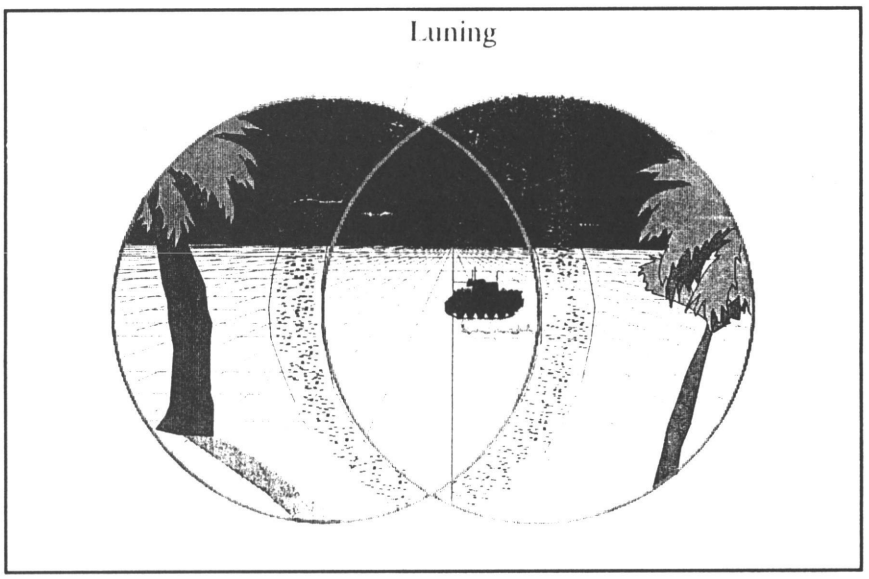

Figure 6. Luning in partial overlap displays

Overlapping, while allowing larger FOVs to be seen, presents new visual problems. Among these are **luning, fragmentation**, and **reduced visual sensitivity** to targets. Luning is the subjective darkening that can occur in the monocular side regions near the boundaries of the overlapped region (**figure** 6). Luning is so named because of the moon–like shape of the darkened regions. Luning can cause the FOV, as a whole, to lose its visual continuity, resulting in fragmentation—the appearance of the FOV as three distinct regions. The problem of reduced visual sensitivity manifests itself in a decrease in the aviator's ability to detect small, low contrast targets in the monocular regions.

Partial overlap displays can be presented in one of two ways, based on how the left and right images are viewed by the respective eyes. Typically, one might expect the left side of the sensor's FOV to be presented to the left eye and the right side to the right eye, as shown in the top of figure 7. This type of display is said to be a **divergent** design. If, as shown in the bottom of **figure 7**, the left side of the sensor's FOV is presented instead to the right eye and the right side to the left eye, the display is said to be a **convergent** design. This latter approach requires some sophisticated manipulation of the sensor's output imagery to present the correct image to each eye.

The current RAH–66 Comanche HIDSS HMD is a partial overlap, divergent biocular design. This approach provides new advantages for the 21th century aviator. It also presents new research and development issues that require investigation. Before completing the final Comanche display design, several research questions will have to be answered. These include—how much of an overlap should be used, the choice of divergent or convergent approaches, and the performance effects of luning, fragmentation, and the other possible visual issues associated with a biocular display design. Investigations into these questions are being conducted at the U.S. Army Aeromedical Research Laboratory, Fort Rucker, Ala.

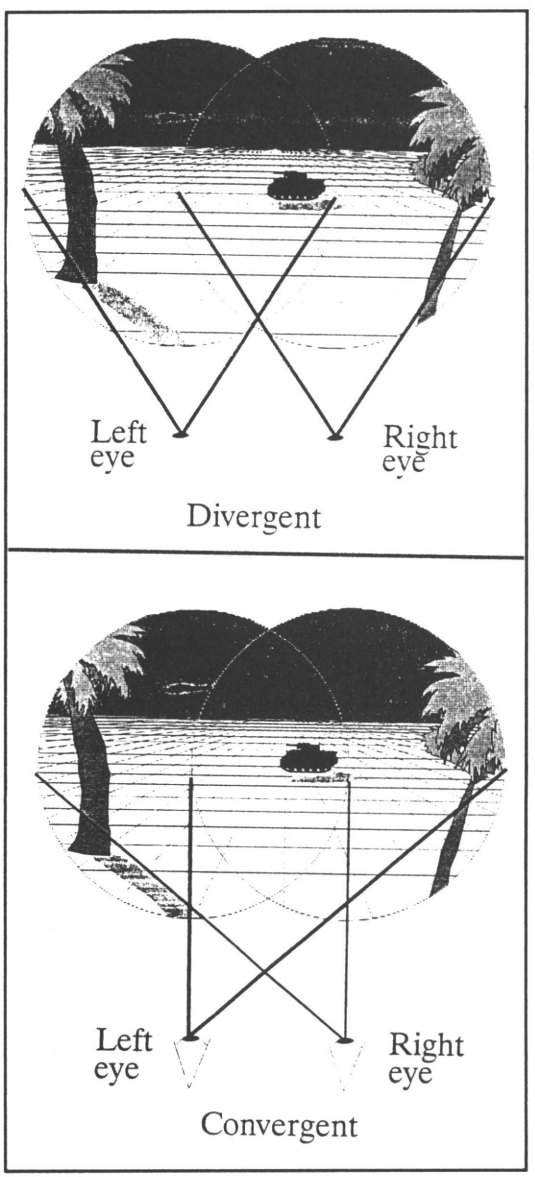

Figure 7. Divergent (top) and convergent (bottom) displays

CEP and ANR: Hearing Protection Technologies for Air Warrior

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The U.S. Army Aeromedical Research Laboratory (USAARL) took part in developing and testing two emerging hearing protection technologies for Army aircrew members: CEP, communications earplug; and ANR, active noise reduction. Air Warrior is a program to develop the next generation, integrated, aircrew life support and combat protection ensemble. CEP or ANR may be part of the Air Warrior hearing protection strategy.

Do not confuse CEP with another ear communications device, the ER–2™ Tubephone (Etymotic Research). ER–2™ was a soft plastic tube curving over the top crease of the ear lobe and around into the ear canal. Even though ER–2™ Tubephone was not designed for use with helmets, it was tried in the RAH–66 Comanche development program. The device was very uncomfortable when worn under an earcup within an aircrew helmet. A signal conversion device about the size of a match box was attached to the back of the test helmet. USAARL found the ER–2 concept unusable in Army helmet systems.

The prototype CEP (figure 1) was developed by USAARL's small business, innovative research program. CEP is a small earphone inside a foam earplug. It is slightly larger than the yellow foam E–A–R™ plugs we use routinely in Army aviation. When soiled, the foam earplug on the CEP is easy to replace. Two small wires are connected to the end of the CEP earphone. On the other end, the CEP wires connect directly into an adapter placed between the helmet communications connector and the aircraft intercommunications system (ICS) receptacle. The adapter permits easy connection of the prototype CEP to current Army aircraft ICSs for testing.

The ANR system, composed of electronic components and earphone, is built into a helmet earcup. It continuously measures sound in the earcup. The ANR system filters and reverses the phase of the measured sound. ANR processed sound waves are emitted into the earcup. These processed sound waves combine with the ambient sound waves resulting in attenuated sound levels in the earcup. This is similar to tuning the amplitude and frequency of two waves sets on the ocean traveling toward each other, or overtaking each other, so that they reduce or cancel each other out when they meet.

Table 1 compares the advantages and disadvantage of CEP and ANR. Figure 2 compares the sound attenuation capabilities of the HGU–56/P helmet (next generation Army aircrew head gear), HGU–56/P with E–A–R™ foam earplug, HGU–56/P with CEP, and HGU–56/P with one of the best ANR systems available today (DAT–DRA–SPH4–4B, developed by the Defense Research Agency in Great Britain).These comparisons are based on USAARL's controlled laboratory and flight testing of these devices accomplished as of July 1994.

During initial CEP testing at USAARL, some Army aviators used CEP during normal flying duties. The aviators did not want to give the prototype CEP devices back. They claimed remarkable improvement in speech in-

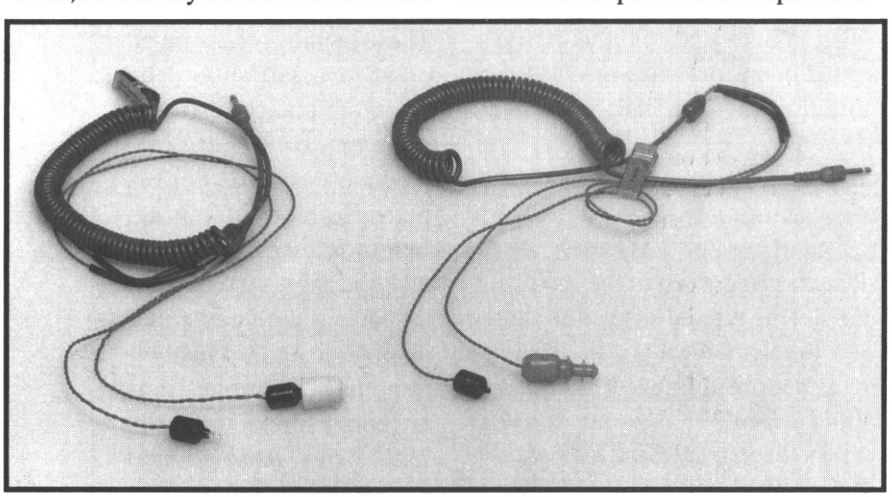

Figure 1. Prototype USAARL communications earplug

Table 1. Comparison CEP and ANR	
CEP	**ANR**
CEP advantages: **1. Speech intelligibility better than standard aircrew helmet alone, helmet with foam E–A–R™ plugs, and ANR systems.** **2. Hearing protection better than standard aircrew helmet alone, and as good as ANR.** **3. Light weight.** **4. Requires no power sources, works off standard aircraft communication system.** **5. Ten times less expensive than ANR.** **6. Noise protection is not affected by wearing glasses.** **CEP disadvantages:** **1. Device must be actively placed in the ear by aircrew member.** **2. Soiled foam tips must be actively replaced or cleaned by aircrew.** **3. Need to integrate a miniature microphone system with CEP to reduce number of wires used by current CEP prototype.**	**ANR advantages:** **1. Passive system, aircrew members simply put on their helmets to use ANR.** **2. Speech intelligibility better than standard helmet alone, or helmet with foam E–A–R™ plugs.** **3. Better hearing protection than standard aircrew helmet alone.** **ANR disadvantages:** **1. Speech intelligibility not as good as CEP.** **2. Noise protection decreased by wearing glasses or poor earcup fit.** **3. Heavy weight, weight is at a premium in modern vision-coupled aircrew helmets.** **4. Requires new power source not available in current aircraft communication systems.** **5. Ten times more expensive than CEP.** **6. Current ANR systems degrade the crashworthiness of Army aircrew helmets.** **7. Component reliability in operational environment is unknown.**

telligibility. USAARL is conducting CEP comfort and speech intelligibility tests in all age groups and genders of aircrew members in the last half of fiscal year (FY) 94.

USAARL is taking CEP to the next design phase, which integrates CEP into a standard helmet system. USAARL is designing new approaches to helmet communications. One idea is to integrate CEP and a miniature microphone at the end of a moldable, small diameter, plastic microphone boom into a comfort cap. One standard communications wire with connector plug would exit from the back of the comfort cap for connection to the aircraft ICS. Later, the aviator would don the helmet to provide impact and additional hearing protection.

The earcup holding the ANR system must offer the same crashworthiness as the HGU–56/P earcup or better. ANR must provide better speech discrimination over a greater range of noise frequencies for use in rotary–wing aircraft. The weight of current ANR systems must be reduced significantly. Helmet weight is at a premium in future Army aviator head gear ensembles. Engineers must modify existing avionics to power ANR devices. ANR costs need to be reduced significantly.

Army aircrew members who have design ideas or who want to volunteer to test these devices may contact Mr. Ben Mozo, Aircrew Injury Branch, USAARL, Fort Rucker, AL, 36362, Comm (334) 255–6804/6906/6825, DSN 558–6804/6906/6825.

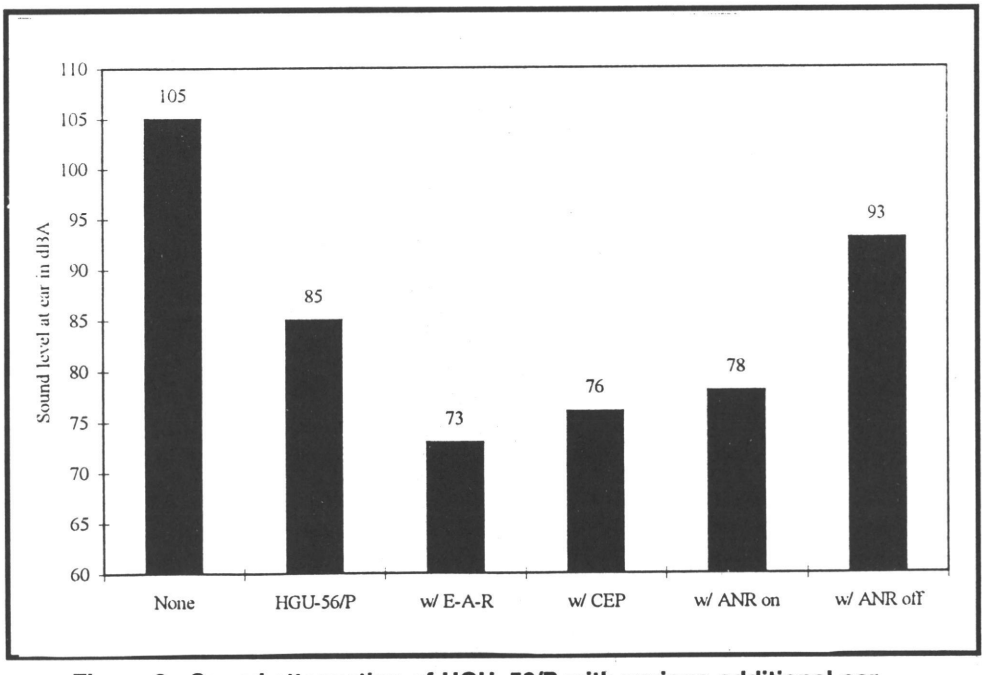

Figure 2. Sound attenuation of HGU–56/P with various additional ear devices in a simulated UH–60 Black Hawk noise environment

Otoacoustic Emissions, A New Tool for Hearing Conservation Testing

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U.S. Army Aeromedical Research Laboratory (USAARL) scientists are investigating a revolutionary hearing test called otoacoustic emissions (OAEs). With OAE testing, your annual hearing test will be reduced to listening passively to a few tones for a few seconds. And no more button pressing!

It is time for your annual hearing test. You sit in a booth. The air is stale and stuffy. You put on the familiar earphones, making sure you've got the red one on the right ear. You grab a button in your hand and wait for tone pulses. You get the attention of the tester, "Wait, I'm tangled in these wires." There it is, a tone, and you press the button. Darn, somebody just moved . . . was that a tone? The tones get fainter and fainter. Click, click. You are straining to hear that very distant tone. Beep, beep, beep. Bang, somebody kicked the booth. You think to yourself, "I missed that tone. Boy, it is getting hot in here. I can not believe how loud that high–pitched whine is getting in the background. Is that the machine or me? This is not going so well." Minutes go by. Click, click. Finally, it is over. Okay, you passed!

OAE method

An OAE ear piece is placed comfortably in the ear. It has a miniature sound source that emits two tone pulses of different frequencies (f1 and f2) into the ear canal. These are conducted to the inner ear (cochlea). The inner ear is stimulated by the tones and generates a third tone called a distortion product. The distortion product tone is a biomechanical emission of acoustic energy from the inner ear; hence the name otoacoustic emissions (ear sound emissions). With hearing loss, the inner ear loses its ability to produce the distortion product tone at affected frequencies.

A miniature microphone in the OAE ear piece detects the stimulation tones and the distortion product tone. In a few seconds, many stimulation tones of varying frequencies are sent into the ear, generating various distortion product tones. Aircrew members do not have to listen for tones and push a button. They just relax, sit still, and the test is over in less than 2 minutes.

A computer measures the original stimulation tones and the distortion product tones. The computer makes a two–axis graph. Background noise is plotted on the graph by amplitude in decibels and by frequency in Hertz (Hz). The amplitude of the distortion product tone is plotted at the frequency of the second stimulation tone (f2) that caused the distortion tone. Audiologists examine the shape of the plotted curves. They measure the difference between the background noise and the distortion product amplitudes. Figure 1 shows an aircrew member with normal hearing. In contrast, Figure 2 shows an aircrew member with hearing loss. Note how the distortion product curve and the background noise curve approach each other above 3,000 Hz in the patient with abnormal hearing. The inner ear is not responding properly to stimulation tones at and above 3,000 Hz, producing OAE with reduced amplitudes compared to a patient with normal inner ear function.

Advantages

Current pure tone testing stations can be upgraded readily to measure OAE. Table 1 shows the advantages of using OAE testing instead of the traditional pure tone testing.

Table 1. Advantages of using otoacoustic emissions compared to standard pure tone testing
1. Simple, passive, automated measure of hearing.
2. Provides objective results.
3. Provides frequency–specific measure of inner ear function.
4. Results are highly reproducible between examinations.
5. Reliable indicator of noise–induced hearing loss.

Validation Tests

USAARL is conducting validation OAE tests. We are testing aircrew members of all ages and genders, with a broad range of hearing capabilities. Volunteers will undergo standard audiometric testing, speech discrimination tests, and OAE tests during short sessions. Data will be examined to find out if new hearing conservation program standards can be based on OAE testing instead of pure tone testing. If you are interested in testing this new technology as a volunteer, contact MAJ Ribera at DSN 558-6823/6804 or COMM (205)255-6823/6804.

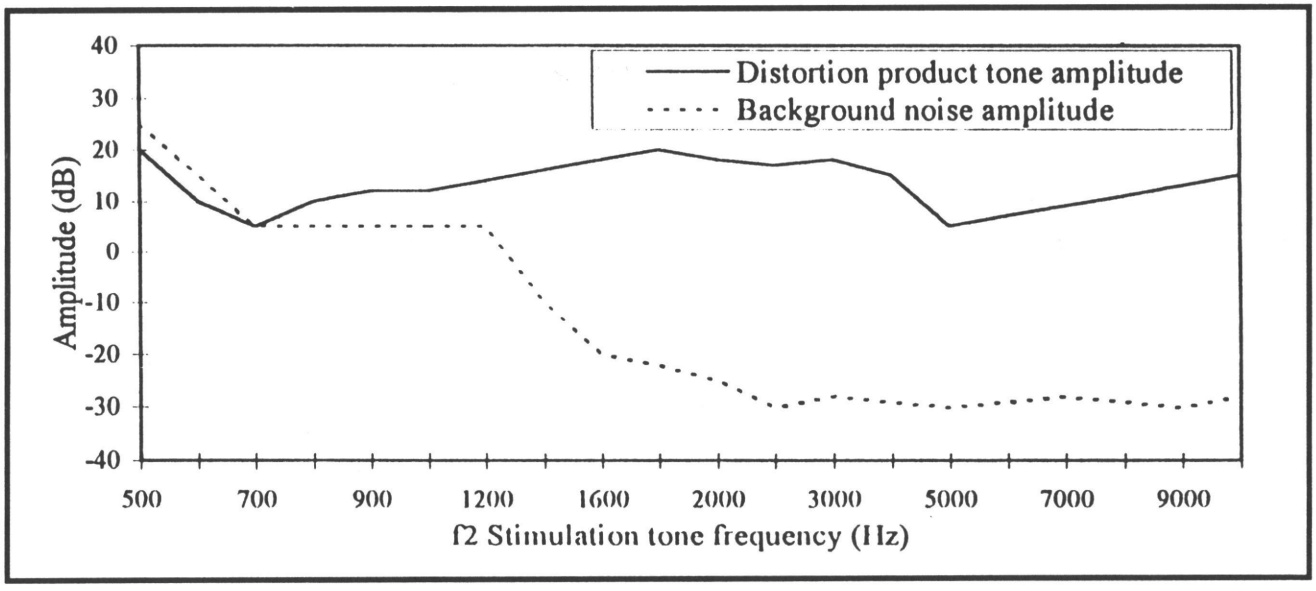

Figure 1. Otoacoustic emissions in an aviator with normal hearing.

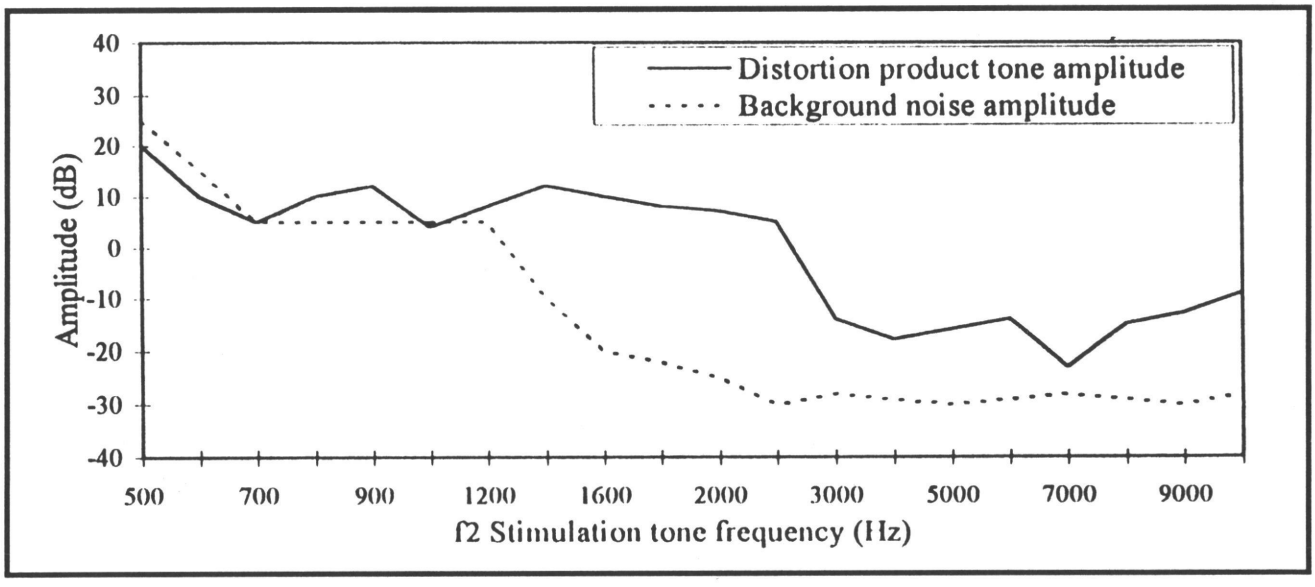

Figure 2. Otoacoustic emissions plot in an aviator with abnormal hearing at and above 3,000 Hz.

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CREW REST IS NOT A DIRTY WORD

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Few policies are more resented outside the aviation community or more misunderstood within it than aviator crew rest. This is unfortunate because crew rest makes sense. Crew rest is a combat multiplier, not a peacetime training distractor. It aids a commander in making correct decisions regarding risks resulting from sleep deprivation. The damaging misconceptions surrounding crew rest can be corrected through understanding the process and adopting manageable policies to implement it.

The Facts

No one doubts that performance is degraded by sleep deprivation. Reaction times slow, attention spans shorten, and judgment deteriorates. The nature of flying demands the highest standards of performance in these very abilities. The slightest error or briefest lapse can result in an accident. Given the catastrophic nature and extremely high costs associated with aviation accidents, very few would argue the wisdom of a crew rest requirement.

The Problems

Resentment results from the perception that crew rest somehow exempts aviators from the rigors of military duty. Duty demands our willingness to place our lives on the line and, if necessary, to make the ultimate sacrifice. American standards of leadership require every effort be taken to minimize the risks involved, but military duty and law demand orders be followed even if the probability of survival is nil. The very idea that crew rest would excuse aviators from this most sacred obligation of military service, just because they are tired, discredits the Army Aviation Branch.

Do not take this to mean that crew rest does not apply in combat, quite the opposite. A properly engineered and applied crew rest policy is as consistent, supportable, and enforceable in combat as it is in peacetime operations. In fact, during combat crew endurance is most likely a factor and, therefore, when a crew rest policy is most needed.

Unfortunately, individual and collective abuses of crew rest have further aggravated the situation. Crew rest policies have been abused to avoid undesirable missions. Poorly conceived policies have resulted in mission cancellations when increased risks were not actually a factor. Leaders grappling with these affronts to their common sense and mission urgency have sometimes resorted to undue and ill–advised command pressures. These factors combine to undermine the credibility of the concept as well as the credibility of the practitioners. Evidence of these difficulties is found in the rather dubious advice of the Aviation Center's own Liaison Officer (LNO) Handbook, "Crewmembers sometimes use the crew endurance policy selectively. Ensure that if an aviation commander wants to use crew endurance as a reason to not perform a mission, he should be the one to tell the ground commander."[1]

Risk Management

Crew rest is the aspect of risk management that deals with sleep deprivation and fatigue. It is a warning system that forces decisions to accept high–risk missions up the chain of command. It requires an assessment be made for each flight mission of the level of risk due to sleep deprivation and fatigue. If certain thresholds of risk are reached, the decision to accept the risk and execute the mission must be deferred to the appropriate level of command. The higher the risk, the higher the level of command. The commander will base his decision on the criticality and value of the mission relative to its risk.

Two key points are widely missed or misunderstood. First, crew rest is a decision making process, not just the mechanical application of a strict set of duty and flight time limits. Crew rest policies should prescribe objective, unambiguous limits against which each crewmember is assessed; this much of the process is mechanical. The decision of what to do when one of these limits is reached is not. No policy could satisfactorily accommodate the infinite variety of situations, missions, and individuals. The purpose of the policy is to ensure that the potential hazard is identified and referred to the commander for action.

Does the mission warrant the risk? The commander makes a conscious decision based on his knowledge of

the mission, the crew, and his experience. He may determine that the mission does not warrant the risk and cancel or modify it. He may determine that it was a false alarm, that no crew endurance hazard or only a slight one exists, and authorize the mission. He may decide that, in spite of an elevated risk due to crew endurance, the mission is so important as to warrant the exposure. The commander's decision is recorded on the mission brief sheet and he is accountable for it.

The second point is that the decision rests with the commander, not the individual crewmember. The reasons for this should be obvious in light of the previous discussion, but this is a difficult point for some to accept. The danger here lies in the potential for misuse or abuse by an overzealous or weak commander ordering crews into the air when the situation does not warrant it. There would be an equivalent danger from overeager or overconfident crewmembers if the burden of responsibility was theirs. The truth is, there is no procedural way to eliminate all potential for conflict. We charge our leaders to be competent, involved, and ethical; we have to trust them to be so until they prove otherwise.

The commander makes the decision, but he should consider the recommendations of his crews. Short of combat or the preservation of life, there is no mission in which it would be justified to order a crewmember into the air when he feels unfit to fly. As a safeguard, crew rest policies can be written to prohibit this or require these decisions be elevated to a higher commander. Combat alone would not be sufficient justification; the potential benefits of the mission still have to outweigh its risks.

The Solutions

The single most important change needed in unit crew rest policies is to clearly define the decision making aspects of the program. Unfortunately most policies, including the guide found in Army Regulation (AR) 95–3, fail even to hint of the possibility. This omission leaves no choice but to regard the limits as absolute. There is no legal alternative when the mission, situation, and common sense dictate otherwise. Units have the power to correct this by writing a decision making process into their crew rest programs.

Three other suggestions to simplify and clarify are eliminate the regressive scale for duty day limits, reduce the number of environmental factors, and prescribe a minimum rest period between duty days.

The theory of the 1–, 3–, 7–, 30–, and 90–day regressive scale of duty day limitations is to allow for a surge at the beginning of strenuous operations. The problem is that limiting duty days is complicated to track and the theory does not lend itself to ease of scheduling to avoid conflicts. The usual solution is to "pass the buck" by delegating the tracking responsibility to individual crewmembers.

The regressive scale is an unnecessarily complex. A single duty day limit that is sustainable indefinitely would be equally sensitive in alerting the commander on possible high–risk situations. Such a scale would be easier to understand, track, and schedule. If it sounds the alarm during the beginning of a high–tempo operation, consider the situation and make a command decision.

Eight environmental factors found in AR 95–3 define fatigue–producing ratios among different modes of flight calculated to the tenth of an hour. These ratios are estimates at best. In actuality, they will vary from individual to individual and from mission to mission. They could be consolidated and rounded off without any loss of efficacy. Roughly speaking, night and goggle flight is about twice as tiring as day flight, and mission–oriented protection posture flight is about three times as tiring.

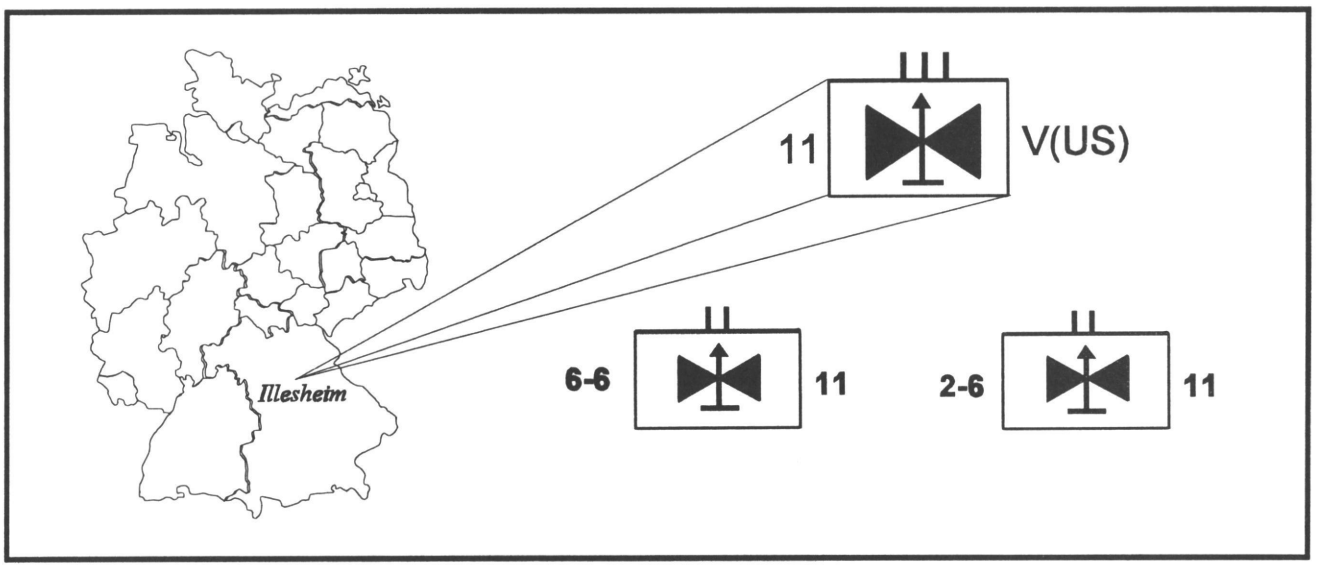
One important limitation every crew rest policy should have is a minimum rest period. An obvious crew rest hazard is created when two strenuous duty days are separated by an inadequate rest period. This hazard would not be detected if only the length of the duty days were checked.

Notes: [1] USAAVNC LNO Handbook, p. 88.

Conclusion

Crew rest is not a dirty word. It does not relieve aviators of the rigors of military duty nor does it limit command authority. It aids commanders in accomplishing the mission and protecting the force. Changing the name to "crew endurance" or "fighter management" does not fool anybody or solve the problems shrouding it. The solution rests in educating both the aviation and ground communities and in adopting manageable policies to meet the true intent.

ARI Transition— A Report from the Field



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INTRODUCTION

The Aviation Restructure Initiative (ARI) conversion is just around the corner for virtually every aviation unit in the Army. United States Army, Europe (USAREUR) and V Corps began ARI implementation in 1994. Recently, the 11th Aviation Regiment became the first AH–64 Apache brigade/regiment to complete the ARI transition.

This article provides the plan by which the 11th Aviation Regiment executed ARI, and the lessons learned in the process. We do not intend to debate the merits of ARI. ARI was a mission assigned to the regiment, and we have executed that mission. Also, we do not regard our methodology as the "best" or the "only" way, but merely one method.

Background. The 11th Aviation Regiment is a major subordinate command assigned to V Corps in USAREUR. During the late summer of 1993, the regiment was notified that we would transition our subordinate attack squadrons to the ARI Modified Table of Organization and Equipment (MTO&E) in the summer and fall of 1994. The timelines provided to us required the 11th to transition 6–6th Cavalry commencing May 1994 and 2–6th cavalry commencing August 1994 (figure 1). Besides this ARI transition, 4–229th Advanced Attack Helicopter Regiment (AAHR) was directed to execute a Conventional Forces, Europe required drawdown commencing January 1994.

Planning. With this broad planning guidance in hand, the regimental commander and staff set about gathering information. We rapidly determined there was no "how to" transition documentation available to assist us. We established our written transition plan around the following phases:

Phase 1—Cross–level. We opted to internally "jump start" ARI earlier than programmed by cross–leveling personnel and equipment from our drawdown unit (4–229th) to our transitioning units (2–6th and 6–6th).

Phase 2—Preparation. Immediately after this cross–leveling phase, we decided to "shed" non–ARI personnel and equipment to reduce turmoil and distraction during the trainup phases. Also units would execute individual training during this phase.

Phase 3—6–6th trainup/validation. We entered the formal 6–

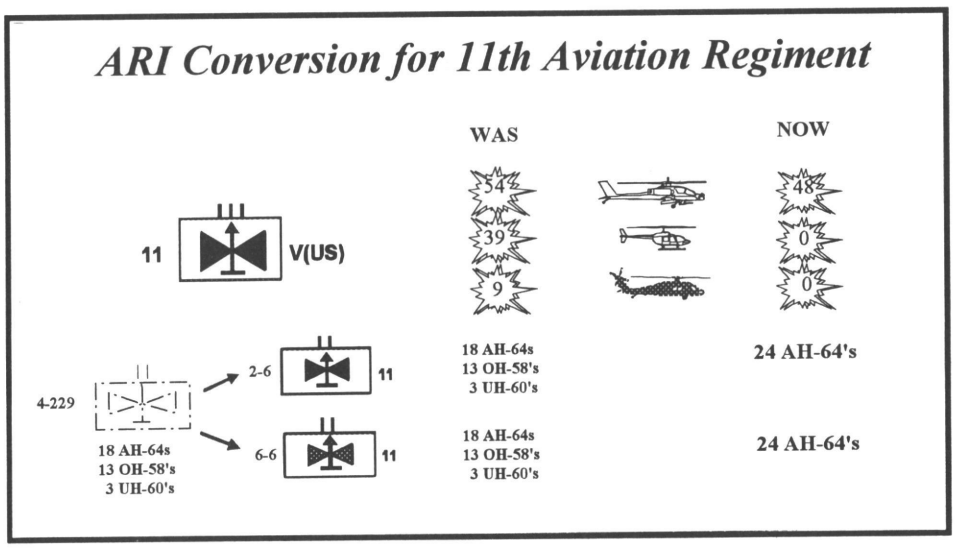

Figure 1. ARI Conversion Background

month ARI execution window with units that were able to focus primarily on collective training. We composed a comprehensive, progressive 6–month training program that ended with an external evaluation Army training and evaluation program (ARTEP).

Phase 4—2–6th trainup/validation. Same as 6–6th trainup/validation.

We then presented these phases and other highlights of our transition strategy to our Corps Deputy Commanding General (DCG) and Commanding General for approval.

As we continued planning, others became involved in the process. USAREUR formed a material redistribution team (MRT) to deal with the mounds of equipment required to be moved by ARI. The USAREUR team later added a personnel expert to their staff to work the many personnel issues associated with ARI. The Corps headquarters formed an ad hoc organization chaired by the Corps G–3 (Avn). Transitioning units and the Corps staff met monthly to solve ARI issues. The Corps DCG provided command oversight and assistance.

The following sections outline our plan and relate our experiences with the logistical, personnel, and training subsets of ARI:

LOGISTICS

From the logistical perspective, the ARI conversion process was greatly facilitated by one of three battalion–sized elements being designated as a drawdown unit about the same time the other two units went through the conversion process. Early on, we moved a significant amount of equipment and resources to the transitioning units by lateral transfers. This minimized turmoil and ensured the two transitioning units a level of fill sufficient to maintain a high equipment on hand rating. A key point here is that the squadrons could report using the ARI MTO&E as soon as the unit commander decided the unit more closely resembled the new MTO&E, and the switchover did not degrade overall readiness. Finally, the drawdown allowed us to transfer the newest and most modern equipment to the transitioning units. While this complicated the conversion, the long–term benefits are obvious.

It is highly advisable to try to obtain a copy of your unit's ARI MTO&E well in advance. This will enable you to determine shortages, and excesses, as well as items that should have been included, and items that should not. If you can identify your nonforce modernization shortages early on, you can then start working these with the Material Management Center. Nonstock funded shortages can be ordered immediately, provided the requisition validation (REQVAL) data base has been modified to reflect the ARI MTO&E. Stock funded shortages need to be ordered as soon as the budget allows.

It will astound most commanders to learn that over 1,000 pieces of equipment must be moved or change hands for an Apache battalion to convert. This is because 65 percent of the line item numbers on the MTO&E are affected by the conversion in one way or another. During our conversion, one important lesson we learned early was to phase our OH–58 Kiowa/UH–60 Black Hawk prescribed load list (PLL) turn–in. Initially, we turned it in together. This was easier, but not smarter. As a result of this bulk turn-in, we exceeded a 5–percent zero balance rate. Figure 2 illustrates this mistake, and how to avoid it.

During our conversion, the USAREUR MRT helped resolve numerous issues. The MRT ensured our REQVAL/continuing balance system extended data bases reflected the ARI MTO&E, so that our requisitions for valid ARI shortages were not "thrown out of the system." The MRT assisted us with aircraft transfers, to include transfer waivers. They helped to locate a home for aviation specific excess, since there was not always an established claimant readily identifiable. The MRT assisted the unit by tracking ARI shortage requisitions. And, finally, the team inspected and inventoried kits that were missing items (which often wind up at Defense Reutilization and Marketing Office), in an attempt to redistribute equipment in short supply that may have

just been missing minor parts.

Excess can be a monster during the conversion. Pure excess, or equipment available for turn–in immediately upon entering the ARI window, should be processed early on. Conversion excess, or items such as OH/UH aircraft, may need to be phased out in conjunction with associated personnel. There may be excess that units wish to retain. This should be processed by request for TO&E change (Department of the Army (DA)) Form 2028, MTO&E change (DA Form 4610–R) or through a request for command retention ARI makes collection of excess very easy. Commanders must carefully weigh requests to retain excess against your ability to maintain the excess, budget considerations, warfighting need, etc.

Although ARI conversion is "low cost," some budgetary impacts need to be considered (figure 3). On the training side, units must program flight hours to convert gun pilots and crews to scouts. We used about 30 hours per crew for the trainup. New or changed crews may dictate gunnery tables VII/VIII qualifications sooner than planned. This required additional flying hours and ammunition. Field training exercises (FTXs) and situational training exercises (STXs) for the trainup were not an issue with us because they were already programmed into the budget. Our experience indicates that the cost per battalion ARTEP is about $470,000. Units may incur temporary duty costs for schooling if there are personnel shortages that cannot or will not be filled. On the logistics side, aircraft that do not meet transfer criteria can be a resource drain. Transferring excess by unit vehicles translates into increased operational time. Finally, if stock funded shortages cannot be filled by lateral transfers, the total cost per AH–64 battalion for these will equal $158,000.

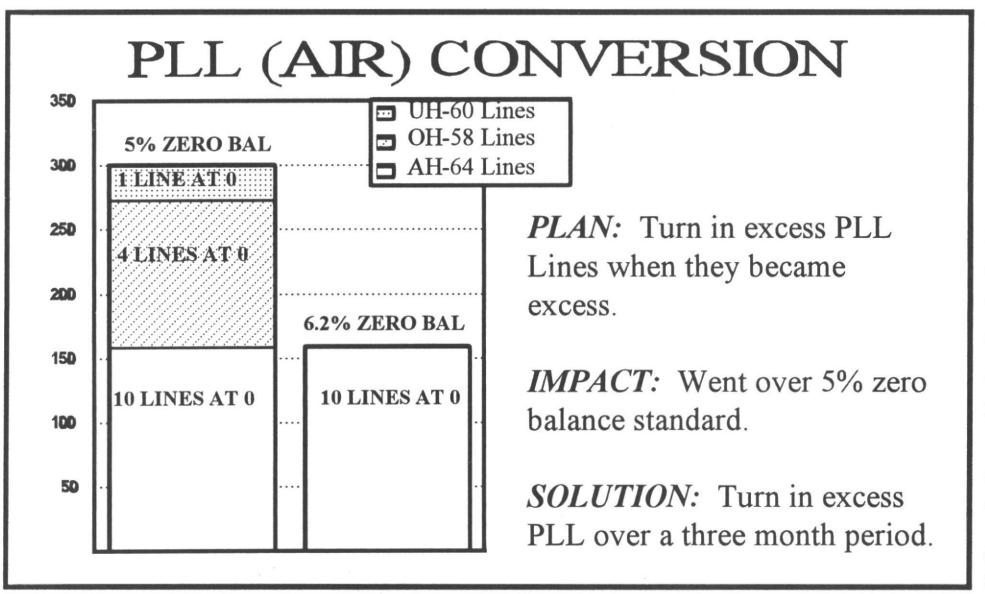

Figure 2. PLL (AIR) Conversion

PERSONNEL

Personnel issues associated with ARI generally fell into two categories: reassignment of personnel not required by the ARI MTO&E and filling the holes created by the MTO&E conversion. As with logistics, an MTO&E scrub done early on will yield significant insight to potential future problem areas for your particular unit.

The most striking or dramatic personnel increase due to the new MTO&E was the increase in 68X (AH–64 Armament Repairer) and 93P (Aviation Operations Specialist). We started reporting these large fill requirements on our Unit Status Report (USR) well before entering the 6–month window. Even with drawdown personnel and Foreign Service Tour Extensions (FSTEs) included, we did not reach a high fill until almost the end of the conversion cycle for both unit (figure 4).

Another large increase created by the MTO&E was that almost all officers were required to be AH–64–qualified. There were simply not enough Apache–qualified officers available in theater, or enough school slots available to fill our requirements, no matter how early we reported these projected needs. The regiment was driven to retain 19 non–AH–64–qualified lieutenants and captains to fill a variety of positions across the regiment, including troop command.

ARI displaced 83 OH–58 and 31 UH–60 personnel within the regiment. The guidance we received instructed us to curtail those personnel with less than 1 year at execution date. Those with more than 1 year retainability kept their original date eligible for return from overseas and received an intertheater transfer (ITT). We linked the departure of the OH–58 and UH–60 personnel to the aircraft transfers. The exceptions to this rule were the OH–58/UH–60 lieutenants and captains mentioned above. One final issue associated with displacing personnel from transitioning units is the concern that OH–58 personnel have about their futures. We approached this by mentoring and counseling those concerned case–by–case.

TRAINING

Armed with a draft aircrew training manual and mission training plan (MTP) manual, we analyzed how and what we needed to train to emerge successfully at the conclusion of our transition window. We then developed a progressive, five–phase training program that ended with out–of–country external evaluations (EXEVALSs) for each unit.

Phase 1—Scout training. We began our training program by changing a few mindsets. We knew that the AH–64 systems (optical, weapons, video) would make it a more capable aeroscout than the OH–58A/C. We had to learn how to develop and exploit best these capabilities and apply them to the reconnaissance (recon) and security missions. To start this, we implemented aeroscout academic training for every AH–64 pilot. This enabled us to create a pool of AH–64 scouts to draw from. We then designated three crews per troop as scouts. This phase concluded with crew–level, STX, lane–type training. Aerial gunnery tables VII/VIII were executed out of sequence (during the collective phase) because of previously locked in gunnery dates.

Phase 2—Team training. This training phase was conducted using the same STX lanes as phase 1. However, now multiple aircraft were organized into teams. Much emphasis was placed on premission planning. This premission planning also doubled as a review to academic training. The squadrons organized their portion of the local helicopter training area into multiple STX lanes so that several teams could execute simultaneously. The teams learned to fire and maneuver together,using the wing man concept. They also learned how far they could operate apart, yet still provide security. OH–58s (still in the units) flew to the rear of the teams as observer and controllers.

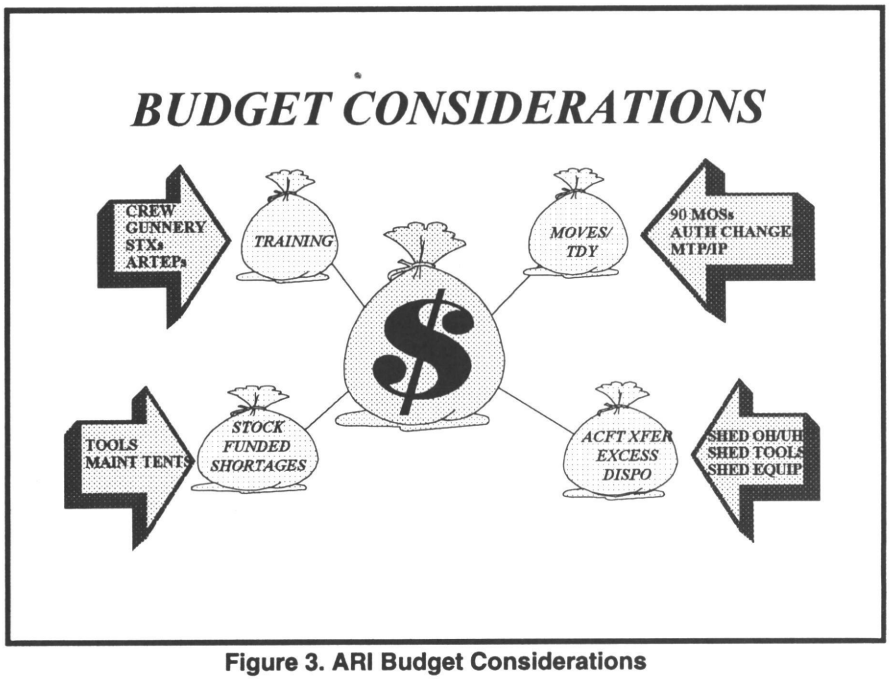

Figure 3. ARI Budget Considerations

Phase 3—Troop training. The recon and security missions we selected as mission essential task list (METL) subtasks for our troops were screen, route recon, and zone recon. We started with the route recon, progressed to the zone recon, and ended with the screen. Again, each troop was given an STX lane and accompanying mission to execute. Also, during this phase the troops executed other METL training such as assembly area operations and deep attacks. This phase concluded with troop EXEVALs.

Phase 4—Squadron training. During this phase, the squadrons used squadron STXs and FTXs as the vehicles to hone their skills on cavalry operations, while also sustaining their skills on their other METL tasks. Staff training was a critical topic during this phase. The squadrons used map exercises; tactics, techniques, and procedures seminars; JANUS; and UCATTS to practice their skills. The squadrons also spent a lot of time with the new draft MTP. At the conclusion of their FTXs, the squadrons were ready for their EXEVALs.

Phase 5—Squadron EXEVAL. During this phase, we deployed each squadron by air, ground, and rail to the POLYGON electronic warfare range complex in France. We used external evaluators from the other aviation brigades in Germany to

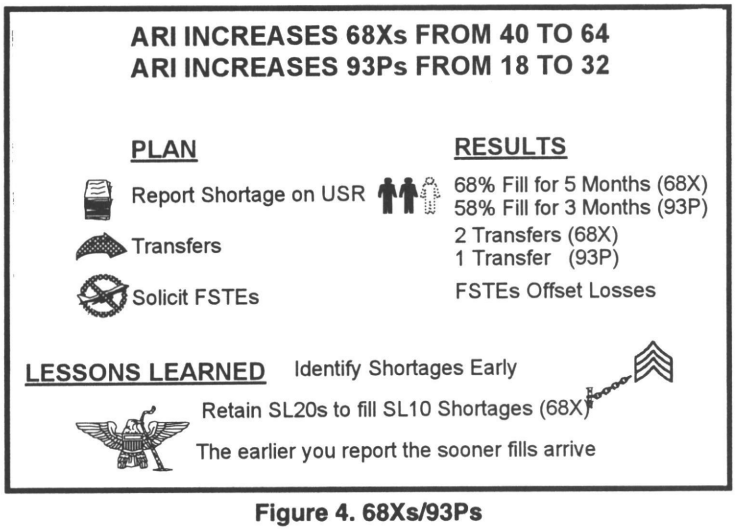

Figure 4. 68Xs/93Ps

conduct a 4–day evaluation, using the draft MTP as our assessment tool. We also deployed a supporting cast from across the Corps to assist us—UH–60s, Medical Evacuation, Signal, Military Police, Combined Arms Support Command, Infantry, Air Traffic Control, etc. Figure 5 provides a graphic illustration of our "Road to War" in execution of this EXEVAL.

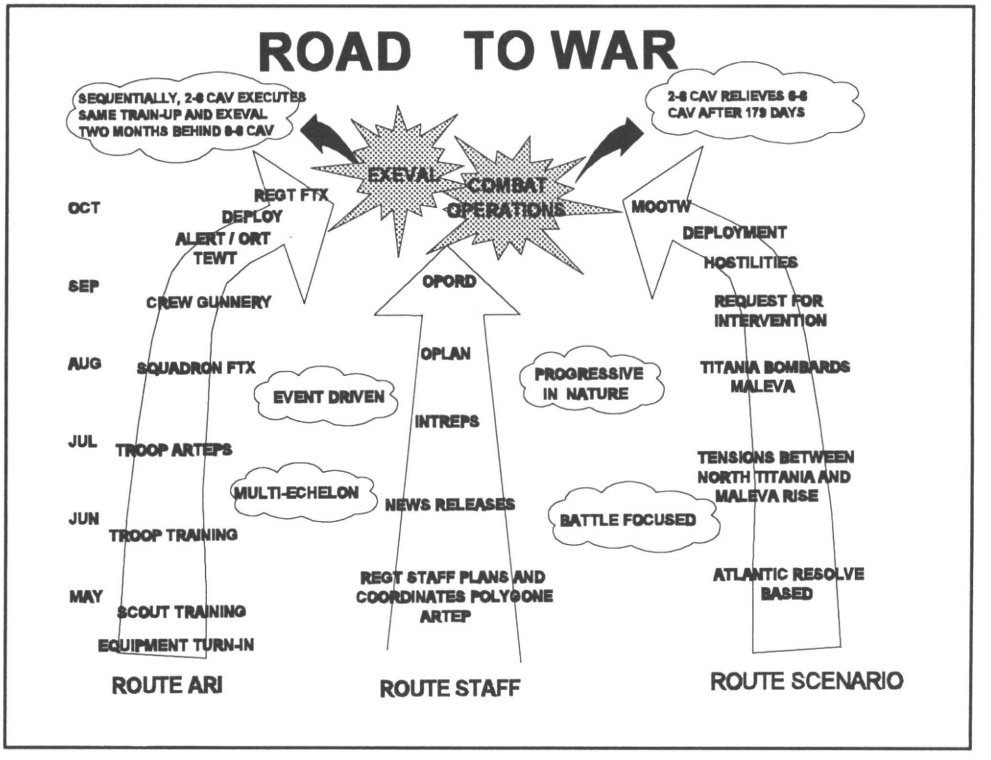

Figure 5. The Road to War

CONCLUSIONS/LESSONS LEARNED

To conclude this article, we have selected nine overall lessons learned to highlight.

•The drawdown of 4–229th AAHR created a tremendous opportunity for the regiment. We were able to fill internally many ARI requirements before entering the 6–month conversion window. Other transitioning units may not have this luxury.

• Starting early is not a panacea. While we were able to fill many personnel and equipment needs before entering the 6–month execution cycle, DA and USAREUR support did not come on line until entering the formal 6–month cycle. So, while starting early is appealing, be ready to wait for resources you cannot fill. As more units enter the ARI transition cycle in the future, competition will become even more scarce for critical personnel and equipment resources.

•To brief and involve the chain of command is critical. These personnel may **not** know what ARI is or what help you need to execute it.

•Caring for soldiers is essential. The ARI conversion and the loss of jobs related to the OH–58A/C creates tremendous anxiety for the soldiers involved. Soldiers are our most precious asset!

• Begin working projected personnel needs early on with your G–1/Adjutant General/major Army command/DA. Believe it or not, these guys do listen. The biggest problem areas we experienced were 68X, 93P, and 15L.

• ARI creates a tremendous amount of equipment that needs to be moved to and from your units. Be ready!

•Scouting is a mission, not a platform. You can scout by foot, horseback, vehicle, or aircraft. We do not need to get hung up on the platform used.

•The removal of the UH–60 requires you to "rent–a–hawk" every time an AH–64 battalion/squadron goes out. This task organizing is not impossible, but it sure complicates things.

•The world continues to turn while you conduct your transition. Distractions are many and frequent, and it requires innovation to protect valuable transition time.

In summary, ARI is not mission impossible. We firmly believe a little sweat and planning up front will pay you significant bonuses down the road. The staff of the 11th Aviation Regiment stands ready to provide any further information or assist you in any way desired as you transition to ARI.

Good luck!

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THE TROUBLE WITH TEAC!
TEAC BY THE BOOK TWO

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Introduction

As you can tell, we are still having trouble with turbine engine analysis checks (TEACs) in the field. This article is a rewrite of "TEAC By The Book," published in the **U.S. Army Aviation Digest**, March–April 1992.

TEAC is the maintenance test flight (MTF) task that causes the most confusion for—

. UH–1 Iroquois and AH–1 Cobra maintenance test pilots (MPs).

. Maintenance test flight evaluators (MEs).

The UH–1 and AH–1 MEs assigned to the Maintenance Test Flight Standardization Division (MTFSD), Fort Rucker, Ala., feel this confusion can be traced to two common causes.

First, many MPs have not taken the time to analyze the basic theory of the TEAC. Second, many MPs do not follow the instructions concerning TEAC completion and computation given in the Technical Manual (TM) 55–2840–229–23–1, Department of the Army Pamphlet (DA Pam) 738–731, the UH–1 and AH–1 MTFs, and proper aircrew training manuals (ATMs). This article clarifies the theory of the TEAC and addresses the specifics of how to complete the TEAC.

The T53–L–13B turbine engine is designed to produce 1,400 shaft horsepower (shp) on a standard day at sea level; the T53–L–703 is designed to produce 1,485 shp. The TEAC was developed to allow units in the field to verify this performance with the engine installed in the aircraft, thereby eliminating the requirement to use an engine test stand.

The topping portion of the TEAC is a flight maneuver that determines the maximum engine power output (torque) when maximum fuel flow is demanded from the fuel control. Remember, topping is only 1 of 11 steps required to complete a baseline TEAC. When a test stand is used to verify that a specific T53–L–13B engine is capable of producing 1,400 shp, this general procedure is used: The engine is placed in a test stand and connected to a waterbrake. Under standard–day (15 degrees celsius, sea-level) conditions, the engine is operated under increasing power loads until the waterbrake records 1,125 foot–pounds of actual output shaft torque, without exceeding gas–turbine speed (N1) or exhaust gas temperature (EGT) limits. The torque indicated in the test stand is recorded and becomes the data plate torque (DPT) for that specific engine.

On a standard day at sea level, this specific engine will produce at least 1,400 shp (1,125 foot–pounds torque measured at the output shaft), and the engine torque measuring system will indicate DPT. All DPTs must fall within the range of 61 pounds plus or minus (±) 3 pounds (58 to 64 foot–pounds).

The UH–1 powertrain is incapable of absorbing and using 1,400 shp. In other words, the UH–1 is airframe limited to some amount of horsepower less than 1,400 shp. Under standard–day, sea–level conditions, the UH–1 is limited to about 1,135 shp or 50 pounds of calibrated torque. Using the DPTs of 58 pounds to 64 pounds (61 ±3), engineering analysis has determined that the 50 pounds of calibrated torque can be converted to a maximum allowable indicated torque by subtracting a specific constant from each DPT.

The constant is 11 pounds of all DPTs up to 63 pounds. For DPTs between 63 and 64 pounds, the constant is 11.5. For a DPT of 64 pounds, the constant is 12. This adjusted torque becomes the torque red line for a specific engine in a specific aircraft. For example, if the DPT on the engine installed in UH–1 72–15123 is 58.5, the red line on the torquemeter gauge in the cockpit must be set at 47.5 pounds. Under standard–day conditions, when increasing power in that aircraft until the cockpit gauge reads 47.5 indicated torque, the pilot is at the airframe horsepower limit. Extra power is available; however, the use of this power may damage the drive train (overtorque).

How can we routinely determine if 1,400 shp is available from our T–53–L–13B engine; if use of this amount of horsepower may damage the aircraft? The answer is TEAC.

Checks Before Topping

TM 55–2840–229–23–1 (para 1–117) lists nine checks to be completed before performing the topping portion of the TEAC. These checks are indicating systems checks to ensure you have accurate information when recording engine data during the topping check. In addition, these checks are performed to help maintenance personnel identify a problem before flying the aircraft. With the exception of the torquemeter system, these checks are straight forward and self–explanatory. The torquemeter system check, however, often is being performed incorrectly throughout the Army.

Most units in the Army are performing this check by simply connecting the MP1 tester to the transmitter/transducers, pumping the tester up to the required value, and comparing the MP1 tester indication against the cockpit indication. If the gauge in the cockpit is within the required tolerance, the units feel this is a complete check. Only the indicating system of the airframe is checked when you do the system accuracy procedure in this manner. It does nothing to check the engine portion of the torque indicating system.

The engine manual refers us to troubleshooting procedure Number 22. This procedure says nothing about testing the system with the MP1 tester. Troubleshooting procedure Number 22 requires two separate checks. First, as described in steps one through four, accessory drive gearbox pressure must be subtracted from torquemeter pressure, using two direct reading pressure gauges connected to the engine with "T" fittings in the accessory drive gearbox and torquemeter pressure lines that run to the torquemeter pressure transmitter. Second,

torquemeter boost pump pressure at 91 percent N1 and above with Power Turbine (N2) of 6,000 revolutions per minute (rpm), must be checked, with a direct reading pressure gauge, to ensure that the torquemeter boost pump is producing at least 120 pounds per square inch (psi) of oil pressure. When both portions of troubleshooting procedure Number 22 are satisfactorily completed, proper operation of the torquemeter system is assured. *NOTE*: This procedure is currently under revision.

Steps one through nine must be done before topping if a baseline TEAC is being performed. Normal TEACs require starting at step nine. For a normal TEAC, all you are required to do is determine engine DPT, perform a topping check according to the appropriate MTF, and evaluate and record the data. Although technically not required, MTFSD recommends checking throttle rigging, bleed band closing point, and variable inlet guide vane (VIGV) begin to open point before conducting the topping check during a normal TEAC.

The UH–1 and AH–1 MTFs explain the conduct of the topping maneuvers for such aircraft. MPs must know and heed the cautions relating to exceeding engine limit, the possibility of exceeding velocity never exceeded (VNE), and the possibility of inducing compressor stalls with rapid collective reduction.

Recording and Evaluation of Topping Data

DA Pam 738–751 (para 3–15) outlines the proper procedure for recording data on the DA Form 2408–15/DA Form 2408–19–1. Some of the common problems associated with filling out this form are as follows:

. Entries are recorded by unauthorized personnel. DA Pam 738–751 (para 3–15c(3)) requires the form to be filled out by the unit or activity maintenance officer or test pilot. The possibility of transposition or calculation errors increases when someone other than authorized personnel enters this information on the form.

. Entries are omitted or incorrect information is entered. DA Pam 738–751 (fig 3–16, item 4 (Note)) states: "Columns 5a through 5i are used to show actual and required engine performance data." This note means all columns must have an entry. *Example*: Actual N1 for a baseline TEAC for a T53–L–703 engine also becomes the required N1. This required N1 will never change until a new baseline is established. This value will be entered in the required column of each succeeding TEAC, unless you establish a new baseline. Another common entry error deals with what value goes in the outside air temperature (OAT) column. DA Pam 738–751 (fig 3–16, item 5d) states: "OAT, Enter the actual outside air temperature (OAT). Do not enter compensated OAT."

. Interim and deferred checks are entered on the overprinted side of the form. TM 55–2840–229–23–1 (pp. 1–302 and 1–303) lets you perform these checks if you cannot top the engine because of ceiling limitations or ambient weather conditions. Neither of these checks is a completed topping check. Therefore, this information is entered on the reverse side of the DA Form 2408–15/DA Form 2408–19–1.

Evaluation of the data recorded during the topping portion of the TEAC is the most important aspect of the entire check. If the maintenance officer/test pilot does not know how to interpret the data, the TEAC has no value.

To properly understand the information you are working with, you must first distinguish between a baseline and a normal TEAC. TM 55–2840–229–23–1 (para 1–117, item 14) outlines the procedures for baseline computations. Item 15 outlines the procedures for a normal TEAC computation. It is imperative that you use the proper reference when computing these data.

T53–L–703 engine computations are simple because there is no adjustment factor for turbine gas temperature (TGT). This is not the case with the T53–L–13B engine. The most common error associated with baseline TEAC for the T53–L–13B engine is in EGT computations. This information is stated clearly in the TM 55–2840–229–23–1 engine manual, but MPs often do not do a very good job of reading the manual. All TEAC computations are performed using TM 55–2840–229–23–1 (chap 1–117).

EGT adjustments should be done as stated in this example: A baseline topping check is being performed on UH–1 72–15123. During this maneuver, the engine is topped and these instrument indications are noted at an altitude of 5,000-foot pressure altitude (PA): +24 degrees OAT, N1 99.5 percent, 45 psi torque (TQ), and a 580 EGT. DPT is 61.0. Required torque for this example is 42 psi (from TM 55–2840–229–23–1, p. 1–311) so torque is within parameters.

We now need to compute our baseline EGT. Using the EGT adjustment factor of TM 55–2840–229–23–1(para 1–117, item 14), enter the chart at the nearest compensated OAT, which in this example is +25 degrees (+24 degrees +3 degrees compensation equals 27 degrees C. The nearest value on the chart is +25 degrees C).

Using the baseline TEAC column, we determine that the adjustment factor is –10 degrees. Subtract 10 degrees from the actual recorded value at 5,000-feet PA (580 degrees). This provides the required baseline EGT of 570 degrees. This value will be entered in the required block (5h)/(12) of the DA Form 2408–15/DA Form 2408–19–1.

Six months later, aircraft 72–15123 is coming out of phase and due a normal TEAC. The engine is topped at an altitude of 6,000-feet PA; the following instrument indications are recorded: +18 degrees OAT, N1 99.6 percent, 45 psi TQ, and a 580 EGT. DPT is still 61.0. Required torque is 43.5 psi, so torque is again within parameters. The N1 is within the specified tolerance of ±1 percent. The next step is to compute the required EGT for this normal TEAC. Again using the EGT adjustment chart in TM 55–2840–229–23–1 (para 1–117, item 14), enter the chart at the nearest compensated OAT, which in this example is +20 degrees. Using the normal TEAC column of the chart, EGT adjustment factor is +5 degrees. Add 5 degrees to the baseline EGT of 570 degrees. This results in a required normal EGT of 575 degrees. The actual EGT of 580 degrees must agree within ±20 degrees of the required EGT, in this example 575 degrees EGT.

The other computation that may be required deals with N1 speed. This computation applies to both the T53–L–13B and the T53–L–703 engines. TM 55-2840–229–23-1 (para 1–117, item 14) states: "for a baseline TEAC if the compensated temperature at test altitude (OAT +3 degrees C) is +30 degrees C and above, or –20 degrees C and below, add 0.5 percent to the N1 speed recorded in flight." This then becomes your required (baseline) N1 percent and is recorded on the DA Form 2408–15/2408–19–1 as such.

For a normal TEAC, the compensated temperature at test altitude (OAT +3 degrees C) is +30 degrees C and above, or –20 degrees C and below, subtract 0.5 percent from the baseline required N1 speed. This then becomes the required N1 percent for that normal TEAC and is recorded on the DA Form 2408–15/DA Form 2408–19–1 as such.

Interim and Deferred Topping Checks

Two procedures in TM 55–2840–229–23–1 allow units to use aircraft for normal mission training when it is impossible to complete the topping portion of the TEAC. These procedures (TM 55–2840–229–23–1, pp. 1–302 and 1–303) are explained as follows:

Interim check. When the weather precludes topping because of ceiling and visibility limitations, the aircraft may be released for normal mission flights until climatic conditions improve. To release the aircraft, you must be able to achieve maximum torque available without exceeding any engine limit. Maximum torque will be determined from the proper –10 operator's manual, based on existing or predicted pressure altitude and temperature for that flight period. In addition, the aircraft must produce this torque without any N2 bleed or exceeding any engine limit. Completion of the check will be recorded on the reverse side of the DA Form 2408–15/DA Form 2408–19–1, according to DA Pam 738–751 and TM 55–2840–229–23–1.

This procedure is not authority to defer TEAC completion; rather, it is an interim check pending TEAC completion. The TEAC required entry on the DA Form 2408–13–1 will remain open until actual completion of the TEAC. The maintenance officer/test pilot will ensure that the TEAC procedure is completed at the earliest possible date.

Deferred check. If ambient conditions at maximum topping altitude do not allow us to use the power chart because of low temperatures, we may defer the topping portion of the TEAC until the conditions become better suited for completion of the topping procedure. (Temperature is at least –15 degrees compensated at 10,000–feet PA for T53–L–13B or +5 degrees compensated for a T53–L–703 engine at 11,000–feet PA). Between the temperature of –12 to –15 compensated, the engine may not top because of the allowable torque –0 to +3 above required torque which may exceed indicated red line. The aircraft can be released for normal mission flights if the engine, as a minimum, produces required torque from the proper power chart in TM 55–2840–229–23–1, and no other limits are exceeded. The maintenance officer/test pilot will ensure this deferral is not used as a means of deleting the topping requirement. Deferring the TEAC should be used as a maintenance management tool to minimize aircraft downtime that would otherwise result from unfavorable atmospheric conditions.

When a baseline TEAC is deferred, the test pilot must ensure a "temporary baseline hit" is established according to TM 55–2840–229–23–1 (para 1–116). *NOTE*: Aircraft will be allowed on deferred status for no more than 50 aircraft flight hours. After 50 flight hours, an attempt to top for minimum/maximum power available will be made. If a TEAC is deferred and TEAC is not performed within 12.5 hours, the prechecks are required before topping.

When To Do a Baseline Versus Normal TEAC

According to TM 55–2840–229–23–1 (para 1–117), a baseline is established when the engine is newly installed, overhauled, or when any maintenance is performed that affects fuel flow, air flow, or gas path. This baseline TEAC will establish the N1 speed and EGT/TGT indication at which the installed engine produces rated power. These indications will be the standard performance for a particular engine installed in a particular aircraft.

During visits to the field, MTFSD has noted that many MPs have completed a baseline TEAC when actually a normal TEAC is required. Anytime a baseline is established, prior historical data and its relationship to engine performance are lost. Consequently, any loss of engine performance will take longer to notice. Obviously, anytime the military trim screw is adjusted, a baseline TEAC must be performed. A common occurrence is to establish a baseline TEAC when a hot–end inspection has been completed. When a hot–end has been inspected and found to be serviceable, nothing has changed that requires the establishment of a new baseline TEAC. Completing a normal TEAC also may tell you if the hot–end went back together correctly. When parts have been changed or maintenance has been performed that does change gas path, a baseline TEAC is appropriate. When instruments have been changed, such as the free–air temperature (FAT), N1, or torque gauge, there is no reason to establish a new baseline. A normal TEAC can be performed; however, it is not required. Performing maintenance on the EGT indicating system does no change the engine performance parameters. Replacing the gauge or adjusting the resistance to the proper settings only resets the indicating system to acceptable limits.

A normal TEAC shall be performed whenever installed engine performance degradation is suspected or as part of a general test flight. A normal TEAC cannot be performed if baseline TEAC data are not available. Normal TEAC data are compared to the baseline data, and the troubleshooting chart in TM 55–2840–229–23–1 (para 1–117, item 20) is used to lead you to the problem area or the specific problem. Over a period of time, comparing normal TEAC data with the baseline TEAC data shows the trend in engine performance.

Checking the performance and trends of T53–L–13B and T53–L–703 engines is not as complicated as most maintenance officers make it. The essential rule is to follow the guidance published in TM 55–2840–229–23 and the UH–1 and AH–1 MTFs.

Any question relating to maintenance test flight procedures or MP standardization issues should be directed to the Maintenance Test Flight Standardization Division (MTFSD), Director of Evaluation and Standardization (DES), Fort Rucker, Ala., DSN 558–9229/1018 (commercial (334) 255–9229/1018). There are answering machines to both MTFSD phone lines that remain on line 24 hours a day. Please leave a message with both your commercial and DSN phone number. The MTFSD will return your call the next duty day.

Performing maintenance by the book is the mark of an aviation maintenance professional.

Let's be professional when it comes to TEAC.

Lessons Learned at the Joint Readiness Training Center:

Air–Ground Coordination in the Hasty Attack

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During a recent rotation at the Joint Readiness Training Center (JRTC), Fort Polk, La., a scout/weapon team was given the mission to launch immediately to conduct a hasty attack in conjunction with an infantry company that was attempting to seize an enemy supply point. The infantry company was conducting a movement–to–contact under the cover of darkness when it came under heavy enemy fire. When the OH–58 Kiowa/AH–64 Apache attack team arrived on station, its task was to immediately suppress the westernmost area of the objective to allow the infantry unit leader to break contact with the enemy and reposition his platoons. The AH–64 aircrew had difficulty distinguishing enemy from friendly units on the ground. Throughout the mission, there were no air–to–ground radio communications. The crew engaged what it thought was the enemy's western flank with 75 rounds of 30–millimeter high explosive (HE) and four 2.75–inch rockets. The results were catastrophic: eight friendly killed in action and two wounded in action, with only three enemy casualties.

Effective coordination between light infantry and attack aviation can maximize the capabilities of attack helicopters while minimizing the risk of fratricide. We will discuss some techniques and procedures for enhancing the effectiveness of coordination between light infantry engaged in close combat and attack helicopters conducting hasty attacks in the same area. The insights presented here are based on JRTC observer/controller (O/C) observations of training since the autumn of 1993. This article will benefit air and ground maneuver commanders alike.

The key to success for enhancing air–ground coordination and the subsequent execution of the tasks involved begins with standardizing techniques and procedures. The end state is a detailed standing operating procedure (SOP) between air and ground maneuver units that addresses hasty attacks in a close combat situation.

In this article, we will cover—

- The coordination required between the attack team and the infantry brigade, battalion, company, and most importantly, the lowest–level unit in contact.
- The night–vision capabilities of the attack team. This includes the forward–looking infrared (FLIR) system, the thermal imaging system (TIS), and night vision goggles (NVG).
- Techniques for the infantry to mark its positions, particularly during periods of limited visibility.
- The effects of the weapons employed by the attack team.

To achieve victory on the modern battlefield, we must apply overwhelming combat power to defeat the enemy. This strategy demands the effective integration of all available assets into the ground maneuver plan. However, at the JRTC—in operations other than war scenarios—infantry and aviation units often close with the enemy in unpredictable situations. Planning and coordination are often minimal. Because of the urgency of the situation, aviation and infantry units often execute hasty attacks after having been afforded only minutes to plan and coordinate. Although aviators are frequently at a readiness condition status that facilitates quick reaction, this measure is not enough. The results of insufficient planning by either unit cause enemy battle

damage assessment (BDA) rates and incidents of fratricide to move in the same direction as illustrated in the opening scenario.

When enemy BDA rates are high from attack helicopters, fratricides also tend to be high because ground troops are dispersed near enemy troops. Conversely, when BDA rates are low, fratricide rates are also low because of overly restrictive fire control measures placed on the aviation attack team.

These situations occur when leaders fail to coordinate effectively. The following contribute to inadequate or ineffective air–ground integration:

- Aircrews do not understand the ground tactical plan or the ground maneuver commander's intent.
- Common control measures that allow both air and ground units maximum freedom of fire and maneuver are not established.
- Aircrews cannot differentiate between enemy and friendly forces on the ground.

In any case, the firepower, agility, and speed of the attack aircraft are substantially diminished and the opportunity for infantry and aviation unit leaders to seize the initiative and shape the engagement is jeopardized.

Effective integration of air and ground assets begins with the ground maneuver brigade. When the aviation task force receives a mission to provide assistance to a ground unit engaged in close combat and planning time is minimal, the initial information provided by the brigade should be sufficient to get the aviation attack team out of its own assembly area and into a holding area that may be in the sector

AVIATION DIVISION

JOINT READINESS TRAINING CENTER

of the infantry battalion involved in close combat. The holding area must be a concealed position that allows for final coordination between the attack team leader and the infantry unit leader before the attack begins. It is located within frequency modulated (FM) radio range of all units involved. Alternate holding areas, along with ingress and egress routes, must be designated if occupation is expected to last longer than about 15 minutes.

The brigade (see Figure 1) provides the location of the holding area—along with an air axis, route, or corridor for entry and exit through the brigade and battalion sector. The brigade also provides the call signs and frequencies or single channel ground and air radio system (SINCGARS) Hopsets and communications security (COMSEC) information regarding the battalion in contact. If the unit is SINCGARS–equipped, the attack team must also have the common "time," which may be taken from global positioning systems (GPSs). In addition, the brigade provides the general location of the objective or engagement area.

En route to the holding area, the attack team leader contacts the infantry battalion on its FM command net to verify the location of the holding area and to conduct additional coordination.

The attack team leader (see Figure 2) receives information from the infantry battalion on the enemy and friendly situations. The battalion also verifies communications information regarding the unit in contact. By this time, the infantry battalion has contacted the infantry unit leader to inform him that attack aviation is en route to conduct a hasty attack.

- √ **Holding area**
- √ **Ingress/egress routes**
- √ **Call signs/frequencies**
- √ **SINCGARS time hack**
- √ **Objective area**

Figure 1. Brigade to aviation task force coordination.

- √ **Enemy situation**
- √ **Friendly situation**
- √ **Call sign/frequency verification**

Figure 2. Infantry battalion to attack team coordination.

Upon receiving the required information from the infantry battalion, the attack team leader drops to the infantry company's FM command net to conduct final coordination before launching his attack. Coordination begins with the infantry company commander and ends with the leader of the lowest–level unit in contact.

Regardless of which key leader the attack team leader coordinates with, the infantry company command net (see Figure 3) is the only suitable net on which both air and ground elements can conduct the operation . It allows all key leaders on the ground—to include the fire support team (FIST) chief and the attack team leader and his attack crews—to communicate on one common net throughout the operation. Operating on the command net also allows the attack team to request responsive mortar fire for either suppression or immediate suppression of the enemy. The AH–64 and the AH–1 Cobra are limited to only one FM radio because of the aircraft configuration. The OH–58 is dual–FM capable, which gives the attack team leader the capability to maintain communications with the infantry company as well as its higher headquarters or a fire support element.

The attack team leader (see Figure 4) provides the infantry unit leader with his present location, which is normally the attack team holding area; the composition of the attack team; the armament load and weapons configuration; total station time; and the night vision capability of the attack team.

The composition of the attack team includes all aircraft types and numbers, to include scout observation aircraft. The armament load includes the types of weapons on board and the number of rounds available. The infantry key leaders consider the effects of these various weapons carried by the attack aircraft. Normally, the attack team will engage enemy forces during a hasty attack with area fire systems. These include the gun systems and the 2.75–inch rockets. These area fire weapon systems pose an extreme danger to friendly soldiers who may be in the lethality zone of the rounds or rockets.

When the AH–64 engages a target with the 30–millimeter chain gun, the high explosive rounds create a lethality zone based on the burst fragmentation and round dispersion (see Figure 5). For example, when the AH–64 engages a target at 500 meters using the stabilized gunner's sight, it creates a circular lethality zone of about 177 meters in radius. The 2.75–inch rocket also produces a lethality zone (see Figure 6), depending on the type of warhead used and the mode of flight in which it was fired. The Multipurpose Submunition High Explosive (MPSM HE) warhead, which provides improved lethal effectiveness against area targets—such as light armor, wheeled vehicles, and personnel—creates an oval–shaped lethality zone of 70 by 31 meters when fired from a range of 1,000 meters. To minimize the risk of fratricide, friendly ground personnel must exercise extreme caution when entering the lethality zone when the aircraft is firing.

Tube–launched, optically tracked, wire–guided (TOW) and Hellfire missiles are point–target weapons systems carried by the attack helicopters. Normally, these systems are employed against high–payoff targets only. As such, they will not normally be fired against dispersed enemy infantry forces.

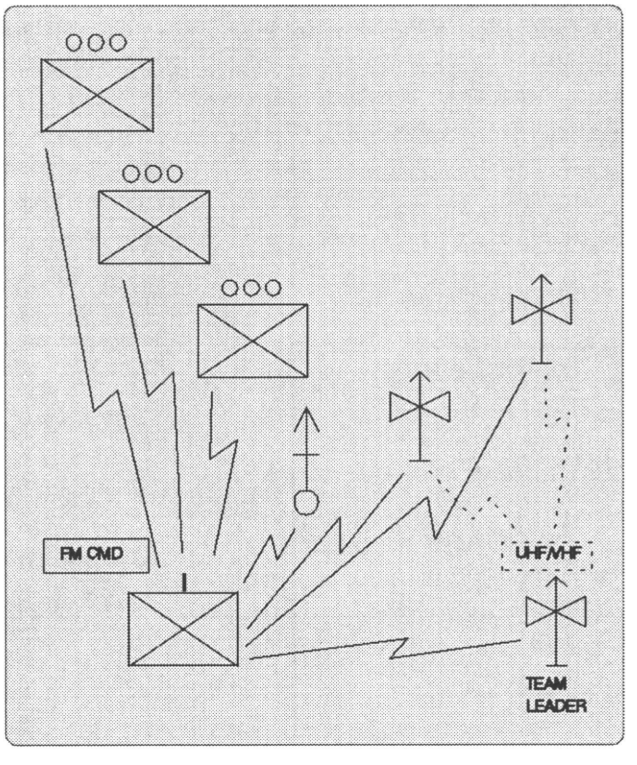

Figure 3. Communications network.

- √ Location
- √ Composition
- √ Armament load/weapons configuration
- √ Station time
- √ NVG capability

Figure 4. Attack team leader to infantry unit leader coordination.

Stabilized gunner's sight not used		Stabilized gunner's sight used	
Helicopter firing range (meters)	*Lethality zone radius (meters)*	*Helicopter firing range (meters)*	*Lethality zone radius (meters)*
500	204	500	177
1,000	257	1,000	204
1,500	311	1,500	230
2,000	364	2,000	257

Use applicable range safety fans during actual training.

Figure 5. Lethality zone of AH–64 30–millimeter chain gun.

The attack team leader also informs the infantry unit leader of his night vision capability. AH–64 copilot–gunners may elect to use either the FLIR radar system or NVG, based upon ambient light conditions. The FLIR system detects only thermal or heat sources while NVG enhance visible light. Normally, AH–64 copilot–gunners use the NVG for en route, heads–out navigation—then make the transition to the FLIR system for target acquisition, identification, and weapons delivery once in the battle position. While using the FLIR, the aviator flips the goggles up on the helmet visor in a standby position. The TIS on the OH–58D Kiowa Warrior is similar to the FLIR system on the AH–64 in that it detects heat sources. The aircrew also uses night vision goggles but can look under the goggles when viewing the thermal imaging system and immediately make the transition back to NVG, if necessary. The AH–1 aircrews rely solely on the use of NVG because the aircraft has no thermal imaging system. Understanding the night observation capabilities of the aircraft is imperative to the ground unit because it will eventually assist in determining the method of marking friendly locations, either through the use of visible light markers or infrared markers.

The infantry unit leader, in turn, succinctly provides the attack team leader with his maneuver plan (see Figure 7). This includes updates on the enemy composition, disposition, and the most recent activities, particularly the locations of air defense weapons. He also provides an update on the friendly situation—to include the composition, disposition, and location of his forces and supporting artillery or mortar positions. He then provides the attack team leader with a brief mission statement and concept of maneuver regarding the ground tactical plan.

The infantry unit leader also describes his method for marking his friendly positions. The ability of the aircrews to easily observe and identify ground signals is a critical factor in reducing fratricide and maximizing responsive aerial fires. The signal or combination of signals is based on items commonly carried by the infantryman, must be

Helicopter firing range (meters)	*Lethality zone*	
	Length	*Width*
1,000	70	31
2,000	58	30
3,000	52	30

Figure 6. Lethality zone of 2.75–inch rocket with M261 multipurpose submunition high explosive (MPSM–HE).

- √ **Enemy situation**
- √ **Friendly situation**
- √ **Infantry mission/concept of maneuver**
- √ **Method of marking friendly positions**
- √ **Target description, location, and marking**

Figure 7. Infantry unit leader to attack team coordination.

acquirable by the night vision or thermal imaging systems on the aircraft, and must be recognizable by the aircrew.

The signals used by light infantry soldiers include chemical (chem) lights, laser pointers, and various other innovative devices. These devices have been used successfully at home station and the JRTC by a number of aviation and infantry units. Some of the more commonly used signals are described as follows.

When the attack team is using thermal imaging systems, one of the most practical and readily available signals is the meal, ready–to–eat (MRE) heater. This heater, which is slightly larger than a common sandwich bag, is carried by most light infantryman and can be acquired by thermal imaging out to nearly four kilometers. To further improve this signature, the infantryman can tie a rope to the heater and twirl it in a circular motion, making it even more distinctive.

Another excellent thermal signal is the heated space blanket. The blanket itself is a common item carried by medics. It has an olive–drab green outer shell with a reflective inner shell. A soldier can wrap three or four MRE heaters inside the blanket with the reflective side facing out. The blanket radiates the MRE–generated heat outward and provides an easily identifiable thermal signal.

Heat–producing items may not be available in the unit. The only thermal signature is the body heat of the individual soldiers. If this situation occurs, a single soldier or group of soldiers may simply take up a "scarecrow" position by holding their arms outward to provide a recognizable thermal signal. The scarecrow position is especially useful as a last–resort signal.

A variety of visible and IR light signals provide NVG–equipped aviators with an excellent means of identifying friendly positions as well as marking enemy positions. When using visible light signals, key leaders consider the possibility of compromising their positions as they attempt to provide an identifiable signal to the attack team. IR signals provide an alternative, in that they offer a greater degree of protection to the soldier on the ground because they can be seen only if night vision devices are used. Our forces presently have the technological advantage in the employment of night vision devices. However, if the enemy has NVDs, use of these IR signal–producing devices may be negated. These devices should, therefore, be treated as an additional weapon or tactic to be used at the appropriate time and place and may not be suited for all combat environments.

Chem lights, both visible and IR, are commonly carried by infantrymen and are easily acquired with night vision goggles. Like the MRE heater on a rope, a chem light on a string twirled by an infantryman provides a very distinctive signal to an aircrew using NVG.

Another use of the space blanket includes illuminating the reflective side with an IR light source such as the IR light from a set of PVS–5 or PVS–7 night vision goggles or an IR chem light. While two soldiers hold the blanket in position, a third illuminates the blanket so that the IR light source reflects toward the aircraft.

The SDU–5/E is an emergency distress pocket strobe carried in aviation survival vests. The device provides a distinctive and easily identifiable signal and can be procured through normal supply channels. It comes with an IR filter, which is interchangeable with colored filters. With the IR filter, the strobe can be acquired out to nearly two kilometers.

Though not yet available in the Department of Defense (DOD) supply sytem, the Phoenix IR Beacon is a codable IR beacon that provides an excellent signal. The unique IR coding system allows any sequence of flashes up to four seconds long, including Morse code, to be programmed into the unit by the user. The beacon can be seen from as far away as 2 kilometers. The biggest advantage is the ability to code one or many beacons, enabling any one device to be distinguished in a group. The device uses a common 9–volt battery and weighs less than 2 ounces.

One of the most effective signals is produced by the hand–held laser pointer. Three of the more common pointers are the GCP–1A Ground Commander's Pointer, the LPL–30 Leader's Laser Pointer, and the AIM–1 Weapon Mounted Laser Aiming Device. The GCP–1A has an ouput power of 30 milliwatts and a range up to 5 kilometers. Its beam may be adjusted by the user from a pencil beam to a floodlight. The system weighs 4.5 ounces and uses two AA batteries. The LPL–30 and AIM–1 are similar, small, lightweight laser pointer devices. Both systems have an output power of 20 milliwatts and can be used for distances up to 4 kilometers. All three devices are extremely effective at marking friendly locations and identifying enemy targets.

Battlefield conditions and moon illumination weigh heavily on the effectiveness of these devices. Ambient light from nearby towns, the impact of munitions, and environmental obscurants—such as haze, sand, and smoke—also must be considered. The same variables that affect NVDs will have an effect on the ability to see IR signals. Generally, greater illumination provides better visibility for aviators but tends to reduce the brightness of the IR devices. Lower illumination

reduces visibility but increases the effectiveness of the lower–power output devices.

During daylight, colored smoke or aerial pyrotechnic devices—such as star clusters or flares—provide excellent signals. Infantry leaders must exercise caution when employing these types of signals. Like the visible light markers used during darkness, such pyrotechnic signals can also be seen by the enemy. Leaders on the ground may prefer to identify their positions using terrain reference points or by referencing from easily identifiable terrain features.

Other methods are available to the infantryman for signalling aircraft. The secret is to find what works best in your unit.

The infantry unit leader then provides a concise description of the target and its location. If necessary, the ground unit uses geographical terrain features and smoke rounds from artillery or mortars, ordnance already impacting on the target area, illumination or tracer rounds, or other ground fires to provide a reference mark on the target.

The attack team leader then informs the infantry unit leader of the battle position, attack by fire position, or the series of positions his team will occupy that provides the best observation and fields of fire into the engagement or target area (see Figure 8). The battle position or attack by fire position is a position from which the attack aircraft will engage the enemy with direct fire. It includes a number of individual aircraft firing positions. It may be preplanned or established as the situation dictates. Size will vary depending on the number of aircraft using the position, the size of the engagement area, and the type of terrain. The battle position or attack by fire position is normally offset from the flank of the friendly ground position. This ensures that rotor wash, ammunition casing expenditure, and the general signature of the aircraft do not interfere with operations on the ground. The offset position also allows the aircraft to engage the enemy on its flanks rather than its front and lessens the risk of fratricide along the helicopter gun target line.

The attack team leader then provides the infantry unit leader with his concept for his team's attack on the objective.

Only upon completion of the coordination with the lowest unit in contact does the flight depart the holding area for the battle position. As the attack team moves out of the holding area, it uses nap–of–the–earth (NOE) flight to mask itself from ground enemy observation and enemy direct fire systems. The attack team leader maintains FM communications with the infantry unit leader while he maintains internal communications on either his very high frequency (VHF) or ultra high frequency (UHF) net.

In summary, when an attack team is committed to execute a hasty attack, mission success requires detailed coordination between the attack team and the infantry unit already engaged in close combat.

• The maneuver brigade provides the aviation task force with the information available on locations, routes, and communications before the attack team's departure from its assembly area.

• The holding area is a concealed position where final coordination is made with the infantry unit in contact before the attack team launches its hasty attack.

• The attack team coordinates directly with the lowest–level unit in contact on the infantry company FM command net.

• The infantry leaders must understand the ground effects of the attack team's area fire weapons systems.

• Final coordination with the infantry unit includes agreeing on a method of identifying the friendly and enemy positions.

• The means of identifying friendly positions should take advantage of the FLIR, TIS, and NVG capabilities of the attack team.

• The battle position or attack by fire position should be offset from the infantry unit to maximize the effects of its weapons and to minimize the risk of fratricide.

Successful integration of Army attack aviation and light infantry requires considerable coordination and communication. The key to success begins at home station with intense, realistic training focused on developing and testing a variety of techniques and procedures. These techniques and procedures will differ from unit to unit, given the differences in personnel and equipment, as well as the mission of the units involved. Once established, these techniques and procedures must be standardized as unit–level battle drills and trained to standard on a regular basis. Only in this way will the integration of attack aviation assets with light infantry units maximize the capabilities of both elements to defeat the enemy on today's battlefields.

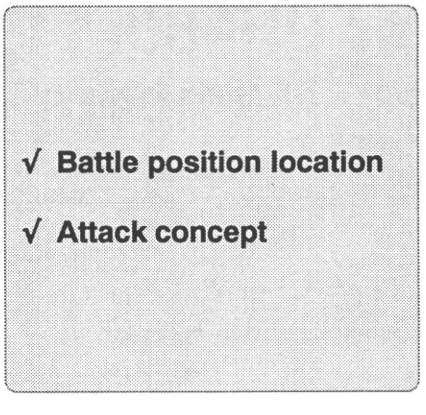

Figure 8. Attack team leader to infantry unit leader final coordination.

Aviation Warrant Officer Career Pattern Update

CW5 Clifford L. Brown
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As with other recent columns, this column's spotlight focuses on aviation warrant officer (AWO) career pattern changes that have occurred as a result of the Warrant Officer Management Act (WOMA) and the Warrant Officer Leader Development Action Plan (WOLDAP). This issue will focus on AWO structure deficiencies that still remain and what action is being taken to correct them.

Of the four chief warrant officer 4 (CW4) positions that were supposed to be on each attack, assault, and command aviation battalion staff, only three will be documented on base table(s) of organization and equipment (TOE). The standardization officer position was deemed unnecessary and, therefore, dropped.

Of the four CW4 positions that were supposed to be on each cavalry squadron staff, none will be documented on base TOE. Approval has been obtained to add a CW4 aviation safety officer (ASO) position on modification tables of equipment (MTOEs), provided billpayers can be identified.

TOEs in the Aviation Restructure Initiative series, as in L–series TOE, do not have an ASO position in an aviation intermediate maintenance company. Approval has been obtained to add a CW4 ASO position on MTOEs, provided billpayers can be obtained.

Of the four CW5 positions that were supposed to be on each aerial exploitation battalion staff, none have been documented on base TOE. Action by the military intelligence (MI) branch proponent is ongoing to establish these positions.

These CW4 structure issues listed above will create a bottleneck of authorizations at the CW4 level and reduce promotion rates to that grade. While the CW4 grade structure imposed by the Deputy Chief of Staff for Personnel (DCSPER) is limited to 13.4 percent of authorizations, the above deficiencies reduce CW4 structure to less than 13.4 percent.

Three sequential solutions exist to remedy this grade structure imbalance. The first is to use warrant officer (WO) positions as billpayers. This action would convert pilot authorizations to staff officer authorizations and increase promotion rates to CW3. The second is to use commissioned officer captain authorizations as billpayers. The third would be to compete for authorizations through the total Army assessment process.

Army National Guard Offers Opportunities for UH–60 Black Hawk Crew Members

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In late 1993, the Army Vice Chief of Staff approved a plan that transfers all United States Army Reserve (USAR) UH–60 Black Hawk aircraft to the Army National Guard (ARNG). Part of this plan requires the ARNG to actively recruit trained USAR UH–60 pilots. The ARNG is working hard to make this transition go smoothly; however, each state has legal latitude in pilot selection. The following quote is from an ARNG memorandum, dated 6 October 1994: "States are encouraged to use Assignment Advisory Board (AABs) in situations where the number of qualified soldiers exceeds the number of positions available. The AAB may be composed of Active Component, ARNG, and USAR soldiers at the discretion of

the State Adjutant General." Not mentioned in the memorandum but included in the aircraft migration plan is that states are expected to accept all qualified applicants where positions are available. Not enough ARNG UH–60 aircraft qualification course (AQC) training seats are available to invest in filling units that migrate from the USAR.

If you are a USAR UH–60 aircrew member and are considering migrating to the ARNG, you must apply to the ARNG through the State Adjutant General in the state where you wish to be assigned. The USAR has been tasked to notify every displaced crew member of the application procedures. However, if you have not been notified, you should check with your USAR troop program unit or the state aviation office where you desire assignment.

Use Additional Skill Identifier G7—or Lose It

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Any Army aviator may face permanent medical disqualification. For the aviation warrant officer (AWO), medical disqualification could mean career termination. The U.S. Total Army Personnel Command (PERSCOM) has three options. The first is to reclassify affected AWOs into a military occupational specialty (MOS) within the Aviation Branch, normally MOS 151A, nonrated aviation maintenance officer. The second is to reclassify into an MOS outside the Aviation Branch. The last is to eliminate the officer from active duty. For senior AWOs who have built their careers around aviation maintenance, becoming a nonrated aviation maintenance officer is a viable option. But for senior AWOs career tracked in safety, operations, or training, MOS 151A is a poor option. For all AWOs, obtaining reclassification into another branch is nearly impossible because long–term experience, knowledge, and skill are required. Warrant officers in other branches are accessed from the NCO ranks based on experience and leadership skills in certain enlisted feeder MOSs; no programs exist to retrain senior AWOs to fill senior warrant officer positions in other branches.

New warrant officer career patterns, as established by the Warrant Officer Management Act (WOMA) and the Warrant Officer Leader Development Action Plan (WOLDAP), require that warrant officers be used at higher levels as they advance in rank.

To preclude using MOS 151A as a "dumping ground" for medically disqualified aviators and to retain valuable expertise, additional skill identifier (ASI) G7 was approved for use for medically disqualified chief warrant officer 4 (CW4) and CW5 aviators and tables of distribution and allowances (TDA) positions. Use of this ASI allows the Aviation Branch to retain highly knowledgeable and skilled AWOs and place them in positions that require their expertise but do not require maintaining flying proficiency. The key to the process is that the commanders must agree to recode the TDA position to allow it to be filled with ASI G7. The PERSCOM is the approval authority for applications from medically disqualified AWOs. Request for award of ASI G7 must be accompanied with a commander's statement of intent to recode the position to ASI G7.

The ASI G7 recently appeared in AR 611–112, ***Manual of Warrant Officer Military Occupational Specialties***, and has only been available for use for a few months; however, in that time, no commander has agreed to recode any TDA positions. Aviators who are not medically disqualified from aviation service may occupy a position coded with ASI G7. When that occurs, they do not accrue operational flying duty credit. This should not be an issue because nearly all CW4s and CW5s have already met their "gate" criteria. If ASI G7 is not used within the next 12 months, it will be deleted.

Aviation Proponency

Readers may address matters concerning aviation personnel to—
Chief, Aviation Proponency
ATTN: ATZQ–AP
Fort Rucker, AL 36362–5000,
or call DSN 558–2359 or commercial 334–255–2359/3423.

Interoperability on the Digital Battlefield: Testing the New Command and Control Vehicle With the AH–64 Longbow Apache

Mr. Nat Dell
Public Affairs Office
U.S. Army Test and Experimentation Command Experimentation Center
Fort Hunter Liggett, California

Digitization of the future battlefield and Force XXI concepts became reality with an experiment involving the AH–64C/D Longbow Apache in the air and the Army's new Command and Control Vehicle (C2V) in the remote California field laboratory of the U.S. Army Test and Experimentation Command (TEXCOM) Experimentation Center (TEC), Fort Hunter Liggett.

The events of the Longbow Apache Force Development Test and Experiment (FDTE) and an experiment involving the use of the C2V were combined for a unique blending of operational testing and Advanced Warfighting Experiment (AWE). The experimental trials examined interoperability between the Longbow Apache and the C2V on a potential digital battlefield.

The C2V is being developed as a survivable, armored, tracked command–post vehicle to enhance future command and control mission functions during mobile combat operations on the battlefields of the twenty–first century. The C2V uses a modified M993 multiple launch rocket system chassis and a modified enclosure to provide support to command and control on the move and its associated modular command, control, communications, computer, and intelligence (C^4I) equipment.

In May 1994, the commander of the U.S. Army Operational Test and Evaluation Command (OPTEC), Fort Hood, Tex., directed an effort that sought opportunities to integrate experiments with modern digital systems into ongoing Longbow FDTE planning. A unique partnership—involving the OPTEC test teams, the U.S. Army Training and Doctrine Command (TRADOC) Battle Labs, and the program managers of the C2V—developed an experiment that focused on the digital interfaces between the Longbow Apache systems and the C^4I systems carried in the mission module of the C2V.

"We were able to make an initial evaluation of the C2V's interoperability with the Longbow Apache to rapidly exchange data with battle staffs on the ground and in the air," said LTC Terry L. Kennard, chief of the Test Team of TEXCOM's C^3 (Command, Control, and Communications) Test Directorate at Fort Hood.

He also pointed out that by piggybacking the AWE with the Longbow FDTE, "the Army realized substantial savings" because Apache helicopters and force–on–force ground forces were not brought in for a separate C2V experiment.

The C2V experiment showcased the capabilities of the TEC to support future experiments envisioned for both Force XXI and Army digitization efforts.

U.S. Army Test and Experimentation Command

Readers may address matters concerning test and experimentation to—
Headquarters
TEXCOM
ATTN: CSTE–TCS–PAO
Fort Hood, TX 76544–5065.

The command and control vehicle (C2V) has been tested at Fort Hunter Liggett, Calif., for interoperability with the AH–64 Longbow Apache on a potential digital battlefield.

U.S. Army Class A Aviation Flight Mishaps

Fiscal Year	Number	Flying Hours	Rate	Military Fatalities	Total Cost (in millions)
FY 94 (through 28 February)	10	496,015	2.02	4	29.9
FY 95 (through 28 February)	3	468,951 (estimated)	0.64	1	11.4

Laser Hazards

Mr. Lingiam Odems
Air Traffic Control Specialist
U.S. Army Aeronautical Services Agency
Fort Belvoir, Virginia

The laser—light amplification by stimulated emission of radiation—is a light beam powerful enough to cut through metal or delicate enough to perform microscopic surgery. Apart from their scientific and medical uses, lasers are increasingly being used to produce spectacular, crowd–pleasing light shows at concerts, fairs, theme parks, and casinos. A number of recent pilot encounters with laser flashes have prompted this article on laser hazards.

In the United States, commercial laser light demonstrations are regulated by the Food and Drug Administration (FDA) through its Center for Devices and Radiological Health. The Federal Aviation Administration (FAA) uses FDA–supplied information to develop power restrictions for laser use in navigable airspace. The most explicit restrictions define a horizontal and a vertical "eye–safe" distance for each display, depending on the type and intensity of lasers used. Exposure to laser beams any closer than this distance is potentially injurious to pilots' or passengers' eyes.

A more widespread problem associated with laser shows is flash blindness. A sudden light flash from a laser or any other bright light causes a spot or "halo" to remain at the center of the visual field for a few seconds, or even a minute, rendering a person virtually blind to all other visual input. At night, a flash destroys the eye's adaptation to the darkness; partial recovery of this adaptation is usually achieved in 3 to 5 minutes. But full adaptation typically requires 40 to 45 minutes or more.

A pilot flying near Miami at night reported just such an experience to the aviation safety reporting system (ASRS): "At 10,000 feet, about eight miles from downtown, a green laser was being used for a laser light show. The laser flashed directly into my eyes. I was blinded for about 2 seconds. I had trouble with near focus for about 15 seconds. My eyes "hurt" for about two minutes. All normal post–incident."

Loss of night vision can be particularly dangerous for a single pilot, who has no one else in the cockpit to provide assistance while initial recovery of night vision begins.

"The Strip," Las Vegas, Nev., seems to be a hotbed of laser activity. One crew departing Las Vegas got more than the "eyeful" usually associated with the Strip; on takeoff, "at approximately 500 feet AGL [above ground level], a laser beam of green light struck through the right side of my cockpit striking the co–pilot in the right eye and blinding both him and me for approximately 5–10 seconds due to the intensity of the light beam. I immediately notified the tower controller [who said] that this had become a recurring problem with the laser show coming from the top of the [hotel] in Las Vegas.

"We were very fortunate, because this could have been a much more serious situation had the laser struck [me] as well as [my co–pilot] at a more direct angle, severely blinding both of us and endangering the lives of my passengers and crew."

Forewarned is forearmed. Technological advances may someday provide aircraft systems that can interrupt a laser's beam before it strikes the aircraft. In the meantime, one of a pilot's best defenses against laser flashes is knowing where to avoid them. The locations, dates, duration, and eye-safe distances for approved displays in the U.S. are published in [FAA's] ***Airport Facility Directory*** (***AFD***) for each region. Locations of light shows that are approved after the publication of the AFD may be available only through flight services stations.

Another defense against laser flashes is to avoid looking at them, if possible. Just as automobile drivers are advised to avoid looking directly at oncoming headlights, one airline's safety representative has recommended, "If you see the laser coming toward you, don't look right at it."

Solutions in progress. The Society of Automotive Engineers (SAE) G–10 Committee, chaired by Captain Bill Connor (Delta), created a Laser Subcommittee earlier this year to deal specifically with the problem of inadvertent cockpit illuminations by outdoor lasers. This SAE Subcommittee determined that there are 13 important outdoor laser safety issues.

1. **Communication**:

Currently, there is no established chain of command for contacting the proper agency about outdoor laser safety hazards. Two agencies—the FDA and FAA—are involved, with unclear authority over commercial ventures. Most critical.

2. **Communication electronic**:

No electronic network is in place to handle air safety concerns or hazards because of improper operation of laser into navigable airspace (intermittent beams in navigational airspace). Most critical.

3. **Educational programs**:

No educational program is presently being offered to inform air crews, FAA managers, airport air traffic control, and operators of the risks associated with operating lasers in close proximity to airports.

4. **Define operational hazard distance (OHD)**:

Presently, FAA Order 7400.2D only addresses NOHD (nominal optical hazard distance). The operational hazard in military use and commercial used airspace and in particular rotorcraft operations do not have a definition or measurement guidelines for flight safety zones.

5. **Airport laser charting**:

Safety zones are not depicted on approach plates, standard instruments departures (SIDs), and standard instrument approaches (SIAs) to inform crews of potential exposures. These potential laser areas need to be displayed for commercial, military (Department of Defense), general aviation, and rotorcraft.

6. **Terminated and unterminated laser beams**:

There are no procedures or guidelines that establish laser beam termination restrictions. In addition, unterminated laser beams are penetrating into navigational airspace and traffic patterns of both civil and military facilities.

7. **Adverse weather conditions**:

There are currently no guidelines on environmental weather conditions to shut down laser operation. It is unknown what effect low visibility, fog, and cloud layers have on laser beam refraction and reflection characteristics.

8. **Define acceptable irradiance levels**:

There are no measurements that define at what distance from the source point that flashblindness, after image, and glare do not cause temporary vision loss (TVL), might result in crew distraction or temporary crew incapacitation.

9. **Peak traffic periods**:

During peak arrival and departure periods, the potential for multiple laser illumination increases as well as the illusionary effects of aircraft proximities.

10. **Uncontrolled airspace**:

There are currently no guidelines for laser activities in uncontrolled airspace. Safety zones need to be structured for this airspace.

11. **Airspace safety zones**:

Safety zones need to be identified for civil and military facilities. This would include restricted areas where laser beams would not be allowed. Beam divergence into any airspace must not cause flashblindness, after image, or crew distraction during critical phases of flight.

12. **Regional (local) laser safety teams**:

Currently, in the United States, there are no regional laser safety teams of qualified parties (such as FAA, FDA, and military) that could assess the potential operational safety hazards of new application for outdoor laser activities.

13. **FAA Order 7400.2D**:

FAA Order 7400.2D does not address the safety concerns beyond NOHD in the short term. Definitions for OHD flashblindness, after image, and glare should be a part of the short–term guidelines. FAA Order 7400.2D is critically out of date for today's technology.

As a result of these safety issues, the SAE Subcommittee has developed a proposed rewrite of FAA Order 7400.2D, which will contain the agency criteria on outdoor laser shows. Also, flight safety hazard distance (FSHD) interim guidelines (FAA is in the staffing and coordinating process).

Captain Connor presented the subcommittee's finding and proposed rewrite to the Air Traffic Procedures Advisory Committee (ATPAC), in which the Army has membership and presently chairs. ATPAC supports the subcommittee proposed interim guidelines and has asked the FAA to expeditiously publish and promulgate these efforts and also clarify the lines of federal authority and responsibility as they relate to the enforcement of regulations governing these activities, which are now shared with the Food and Drug Administration.

Pilots are encouraged to submit reports of laser flash incidents to the National Aeronautics and Space Administration (NASA) ASRS and the U.S. Army Aeronautical Services Agency, 9325 Gunston Road, Suite N319, Fort Belvoir, VA 22060–5582, DSN 656–4863 and DSN fax 656–4409, or commercial fax 703–806–4409. Reports will assist the FAA in getting control of laser hazards.

Adapted with permission from NASA ASRS's ***Callback****, October 1994;* ***The Society of Automotive Engineers (SAE) G–10 Subcommittee Report****, December 1994; and* ***Airline Pilot****, December 1994.*

U.S. Army Aeronautical Services Agency

USAASA invites your questions and comments and may be contacted at DSN 656–4871 or commercial 703–806–4871; or write to—
Commander
U.S. Army Aeronautical Services Agency
ATTN: MOAS–AI (Bldg 1466)
9325 Gunston Road, Suite N319
Fort Belvoior, VA 22060–5582.

A Future Tactical Air Traffic Control System: The Mobile Tower System

SGM Richard D. Wessel
Senior ATC Specialist
United States Army Air Traffic Control Activity
Fort Rucker, Alabama

The new mobile tower system, (MOTS) will round out the Army's family of four new tactical air traffic control (ATC) systems that provide valuable airspace information across the battlefield. Formally called the forward area shelterized terminal, the MOTS will contribute a full range of air traffic services (ATS) to support tactical Army aviation operations within division, corps, and echelons–above–corps centers of air activity. The ability of MOTS to orchestrate the safe and expeditious flow of this high operations tempo (optemo) helicopter traffic will provide the force multiplier of safe air operations and yet will allow aircraft continuous all–weather access to Army air terminals. The MOTS will further enhance air traffic movement by providing terminal area navigational assistance (working with the new precision approach radar), integrating joint force air traffic, and coordinating Army airspace command and control procedures. Operations other than war present another vital mission. The MOTS will be used to establish or reestablish ATC service in areas where existing ATC facilities have been destroyed or otherwise rendered unusable.

The MOTS, designed to succeed both the AN/TSW–7A, ATC Central, and AN/TSQ–70A, Aircraft Control Central, will be a highly mobile ATC system. Mounted on the high–mobility multipurpose wheeled vehicle (HMMWV), the MOTS will be capable of continuous operation for extended periods (six months or more), yet its design will allow it to be completely operational in 60 minutes following air delivery by C–130 Hercules, or larger, military cargo aircraft.

The MOTS communications package will be self–contained and state–of–the–art. The radios will provide jam–resistant and secure ground–to–air and ground–to–ground communications. Radio and telephone communications equipment will provide voice and data communications compatible with Comanche–era fleet aircraft, other ATS facilities, and other ground units.

The MOTS will use built–in test/built–in test equipment (BIT/BITE) to determine when a component is going defective (prognostics) or to determine which component is defective (diagnostics). Some faulty components will be replaced by the operators while other more complicated maintenance procedures will still require a maintenance technician. The built–in test equipment will be able to fault–isolate maintenance problems 95 percent of the time.

These sophisticated maintenance techniques mean preventive maintenance will be simpler and easier. It will take only15 minutes to repair a component at organizational level and only 30 minutes to repair a component at the intermediate level.

Unfortunately, it will take some time to get this new system. To meet all of the development and testing criteria, the MOTS will not be seen in the field until the year 2002. The MOTS—a sophisticated, yet simple–to–operate ATS system—will be a true combat multiplier to Army aviation.

U.S. Army Air Traffic Control Activity

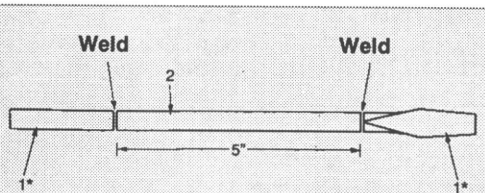
Readers may address matters concerning air traffic control to—
USAAVNC
ATTN: ATZQ–ATC
Fort Rucker, AL 36362–5265.

Update on Maintaining Night Vision Goggles

CW4 Art Estrada
UH–60 Standardization Instructor Pilot
Directorate of Evaluation and Standardization
Fort Rucker, Alabama

Many units have not complied with the requirement to fabricate a special tool (screwdriver), which is necessary to properly torque purge ports on the AN/AVS–6(V)1 and AN/AVS–6(V)2 night vision goggles (NVG). Instead of the required fabricated tool (see Figure 1), the Directorate of Evaluation and Standardization (DES) has found maintenance personnel using standard screwdrivers, pocketknives, and other utensils—resulting in the distortion and disfigurement of purge port screws.

The root problem is that some NVG maintainers did not post the changes to Technical Manual (TM) 11–5855–263–23&P, ***Aviation Unit and Intermediate Maintenance Manual, Including Repair Parts and Special Tools List, AN/AVS–6(V)1 and AN/AVS–6(V)2***, as required by Technical Bulletin (TB) 1–1500–346–20, ***Updated Information on Night Vision Goggles***, paragraph 8e(3), dated 5 January 1994. However, the reference to the changes was omitted when the new TB 1–1500–346–20, dated 20 January 1995, was distributed. A new TM 11–5855–263–23&P is to be distributed soon and will incorporate these changes. Here are the changes as they appeared in paragraph 8e(3):



*Screwdriver blade bit cut in half

Cut the shank of the screwdriver bit (1) in half, and then weld 5 inches of 3/32–inch stainless steel rod (2) between the two halves.

Figure 1. Fabricated tool.

(3) TM 11–5855–263–23&P shall be changed to include the following corrections. Implement these corrections immediately:

(a) *Tools and test equipment, Appendix B, Section III.* Torque wrench, NSN [national stock number] 5120–01–618–4433 replaces item number 16. It is used to perform tasks on the AN/AVS–6 using the tube retaining wrench with the 1/4 inch drive.

(b) *Tools and test equipment, Appendix B, Section III.* Soldering iron NSN 3439–01–183–4623 replaces the currently listed NSN.

(c) *Page C–2–1, item 2 (Part 1–1/2 SC).* The correct NSN for "eyepiece lens cap" is NSN 5340–01–058–5930.

(d) *Page C–2–1, item 11.* The correct NSN for "objective lens cap with Light Interference Filter (LIF) adapter" is NSN 5340–00–558–4962. Change part number listed to EC–23.

(e) *Page C–2–1, item 11.* The correct NSN for "objective lens cap without Light Interference Filter (LIF)" is NSN 5855–01–152–5849. Change part number listed to SF–10. This part must be altered before use by cutting out the inside ridge. This is authorized at the unit level.

(f) *Appendix E.* Add the fabricated tool to use as the screwdriver bit to accomplish the torque of the AN/AVS–6 inside the purge ports: "Fabricate screwdriver blade bit (NSN 5130–00–021–2015) by cutting the shank in half and welding 5 inches of 3/32 stainless steel rod between the two halves."

(g) *Page 2–36, paragraph 2–14.* This paragraph describes the AN/AVS–6 power pack test. Clarification is required for the low battery indicator test. The –G1 P/N [part number] 66868–300680 version power packs cannot be tested using this method on the TS3895A/UV (not the TS3895/UV) for test set serial numbers 1001–1999. For these power packs, use the alternative power pack test, listed in paragraph 2–15, page 2–39, during the 180 day service. TS3895A/UV with test set serial numbers 2000 and subsequent can be used to test any power pack.

As mentioned above, the required tool is to be used to accomplish the torque of the AN/AVS–6 inside the purge ports. Figure 1 may help with the local fabrication and will appear as Figure E–3 in the soon–to–be–distributed TM 11–5855–263–23&P.

Questions about maintenance of night vision goggles can be directed to any of the points of contact listed in paragraph 16 of the current TB 1–1500–346–20.

Directorate of Evaluation and Standardization

DES inquiries may be called into commercial 334–255–3504 or sent to—
Commander
USAAVNC
ATTN: ATZQ–ES
Fort Rucker, AL 36362–5208.

Moving into the Future: Computer–Based Training

SFC Donald D. Dunnigan
Senior Instructor Writer
United States Army Aviation Logistics Agency
Fort Eustis, Virginia

The military budget reductions and downsizing have forced us to be smarter with training. Today's technology allows us to provide better training and receive a greater bang for our bucks. One way to do this is with computer–based training (CBT)—the way of the future. The U.S. Army Aviation Logistics School (USAALS), Department of Aviation Trades Training (DATT), Electrical and Electronics Division (EED), Fort Eustis, Va., has looked at new technology required to support and further the development of CBT.

When developed in the 1980s, the electronic information delivery system (EIDS) was a totally different approach to the delivery of Army doctrine, training, and technical information. Using interactive videodiscs (IVDs), EIDS takes advantage of recent state–of–the–art advances in microcomputer and visual information. The basic system consists of a video disc player, microcomputer subsystem, monitor, and user input devices.

EIDS is a general–purpose training system that does an excellent job of training electronic troubleshooting procedures. The basic system is used as a personal work station to train individual soldiers. It also can be used in a classroom by adding a large projection screen or additional monitors.

Development of EIDS for the Electrical and Electronics Division began in 1989. Lessons for the AH–1G Cobra and UH–60 Black Hawk were developed, concentrating on the electrical and instrument systems. Delivery and validation of the final product was completed in February.

EIDS adds a third dimension to training. It is used with the conference portion of training. After completion of their training, the soldiers advance to the actual aircraft for hands–on troubleshooting. The skills and knowledge learned with EIDS enhance the soldiers' troubleshooting skills.

EIDS has improved training effectiveness and reduced conference time by 30 percent. It holds the students' interest in a way that most instruction cannot. It provides uniform and consistent training of the task or tasks being trained. Finally, it provides reinforcement and sustainment training for the National Guard and Reserve.

At the current configuration, EIDs is expensive to buy and maintain because of the pressing of video discs. With the added convenience of devices such as the projection panel and in combination with any 486 or above IBM–compatible computer, CBT can be interfaced with a videocassette recorder (VCR); camcorder; compact disk, read–only memory (CD–ROM) reader; and scanner. All information stored or created on the computer or through any of the interfaces can be projected directly onto a screen to enhance training. Limited only by the computer used, the projection panel can update aircraft configurations immediately, using a camcorder or CD–ROM reader.

This equipment allows savings to be realized in several areas. First, fewer man–hours in are used in setting up the classroom. Second, the cost of developing 35–millimeter slides is saved. Third, other equipment—such as 35–millimeter projectors, overhead projectors, televisions, and sound equipment—does not need to be purchased. Finally, the new equipment tremendously reduces the need for storage space. One system does it all.

As we outgrow our need for current EIDS training devices through force modernization, CBT can be updated at a lower cost using off–the–shelf hardware supported by in–house–developed courseware.

U.S. Army Aviation Logistics School

Readers may address matters about aviation logistics to—
Assistant Commandant
U.S. Army Aviation Logistics School
ATTN: ATSQ–LAC
Fort Eustis, VA 23604–5415.

Command Sergeant Major Marvin E. Horne

Twenty–First Century Training Technique Is the Air Cavalry Standard

SFC Elbert L. Grayson
Master Trainer
C Company, 1st Battalion, 14th Aviation Regiment
Fort Rucker, Alabama

The mission assigned to the Air Cavalry School—C Company, 1st Battalion, 14th Aviation Regiment, Fort Rucker, Ala., is training the best armed reconnaissance pilots in the world. Charlie Company's responsibility to train the Army's air cavalrymen to fly is paramount. The academic training has evolved to meet the demands of a highly complex, technologically advanced cockpit. This is the mission of the OH–58D Kiowa Warrior academic platoon. The academic element of Charlie Company conducts training for the spectrum of aviator experience—from graduate–level aviators to the flight instructors who conduct the flight training.

As the OH–58A of the 1970s has evolved, so have our training methods. The development of the OH–58D(I) provides the commander with advanced technical capabilities for superior armed reconnaissance operations throughout the 1990s and beyond. Our systematic interactive training program has set a new standard for Army rotary–wing aircrew member training.

Students receive academic training with our desktop personal–computer–based devices. The classroom system trainers (CSTs) provide the student with instruction in basic aircraft systems, the control and display system, communications, navigation, mast mounted sight, airborne target handover systems, aircraft survivability equipment, and all four aircraft weapon systems—the Hellfire Missile System, air–to–air Stinger, Hydra 70 rockets, and the .50–caliber machine gun.

The hardware of the CST is the latest in personal computer technology. Courseware is easily updated via modem as the OH–58D(I) continues to develop and grow. This interactive video disc training system gives the student current system operation and component location and function instruction.

The CST instructional suite consists of 40 computer terminals for students and four instructor terminals, all networked. Thus the instructor has exceptional flexibility in managing the classroom. Students can absorb the materials presented to them at their own pace. They review lessons or portions of lessons as often as needed. Student receive identical instruction from start to finish so that an unavoidable appointment does not force the student to miss out on critical information. The entire curriculum is progressive, using the building–block technique. The interactive aspect of the CST instruction increases student retention.

Cockpit procedural trainers (CPTs), built by Flight Safety International, are collocated with the CSTs. These devices support academic training by simulating cockpit operations and aircraft system responses. The cockpit simulation of the Kiowa Warrior allows students to become completely familiar with the symbology, switchology, and system operations before they get to the aircraft. CPTs reinforce the instruction that students have received from the CSTs. Academic instructors teach at a two–to–one student–to–instructor ratio. They manage the cockpit environment while tutoring the students on system operations. Each CPT is equipped with an instructor operator station (IOS), used to regulate training scenarios. The CPT is cost effective. It saves 40 to 50 percent of academic training hours versus stand–up instruction. Aircraft run time and operating costs are minimized because of the familiarity students have with cockpit procedures before coming to the flight line. Students learn from their mistakes in the simulated cockpit and are less likely to repeat those mistakes in the aircraft.

As with the CST, the CPT has to remain current with the rapidly developing technology of the 1990s. Our devices must not become obsolete because of technological advances. The CPT can be easily updated without extensive changing of the hardware.

As the twenty–first century draws near, the role that the OH–58D(I) Kiowa Warrior plays in Army aviation will continue to expand. We will continue to provide Kiowa Warrior students with the finest equipment and the most professional instruction so that they can become the best reconnaissance pilots in the world.

PRAIRIE WARRIOR '94: AVIATION LESSONS LEARNED

Captain Rodie P. Chunn
Directorate of Training, Doctrine, and Simulation
U.S. Army Aviation Center
Fort Rucker, Alabama

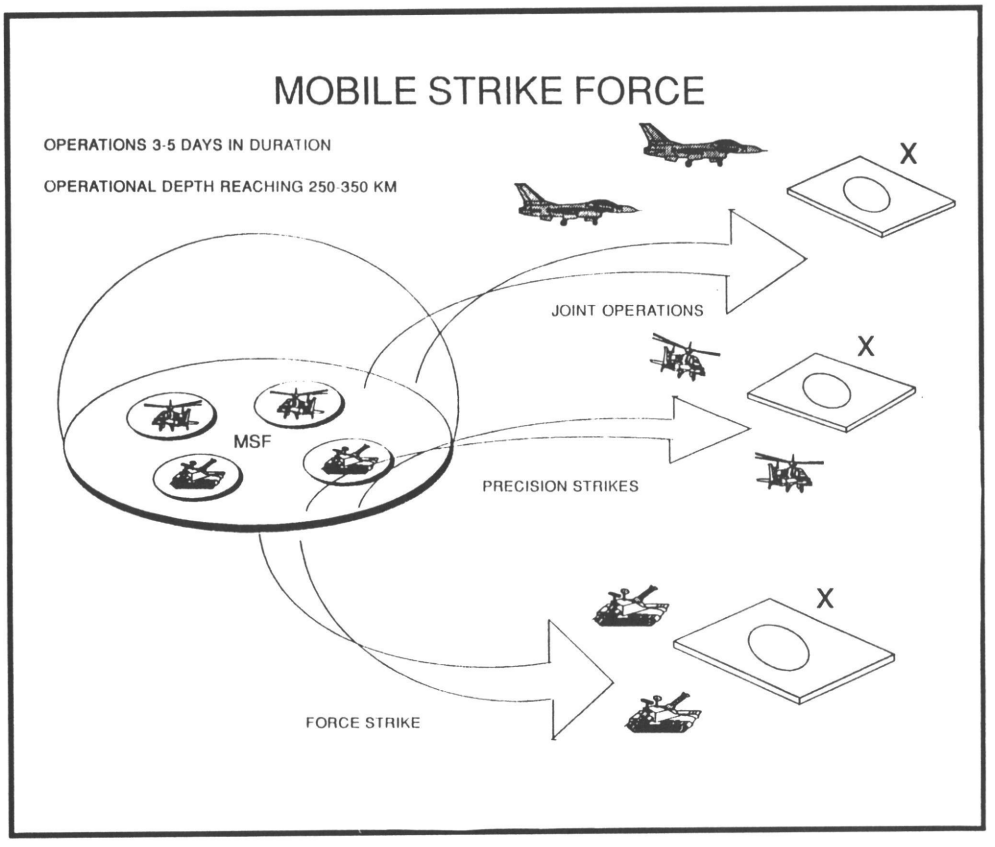
During July 1993, Army aviation took an undeserved hit when the *Army Times* published "Wargame Offers Insights into 21st Century Warfare." Published after the annual Command and General Staff College (CGSC), training exercise at Fort Leavenworth, Kans., known as Prairie Warrior (PW) 93, the article misinformed readers as to the capabilities of the RAH–66 Comanche and the AH–64D Apache Longbow. It identified shortcomings of the Comanche and the Longbow instead of the "modeling" shortcomings of these aircraft within the simulation.

During May 1994, the Comanche and Longbow were used in another constructive simulation training exercise, PW94. With improved replication of the Comanche and Longbow, this exercise proved very useful to the CGSC students, beneficial to Army aviation, and important to the development of a future 1998(+) force or Mobile Strike Force (MSF).

One of the objectives of the PW exercise was to provide Battle Command Training Program (BCTP) experience for CGSC students so they might apply the doctrinal lessons learned throughout the school year. In addition, since the majority of students, upon graduation, are assigned to a corps, division, brigade, or battalion staff, they are given the opportunity to become familiar with the Corps Battle Simulation (CBS). CBS is a constructive computer simulation used to train corps and division commanders and staffs using a force–on–force scenario.

PW94 grew extensively in purpose and scope. Its purpose included all the objectives of PW93. PW94 was used as Phase III of the Chief of Staff of the Army (CSA) exercise, General Headquarters (GHQ) 94. This phase consisted of the warfight in Southwest Asia (SWA) and subdivided into Phase IIIa (January-May '94), consisting of force reception and onward movement and Phase IIIb (May '94), the actual CGSC warfight consisting of a theater offense. The exercise players consisted of over 1,000 CGSC students representing all the service branches and some foreign countries.

Aviation center involvement began in fall '93 with the model design review of CBS version 1.5. This version supported its first major exercise during PW94 and showed the most aviation enhancements ever.



The Aviation Center at Fort Rucker began planning for PW94 in January. The school quickly mustered a team of experts led by the Director of Training, Doctrine, and Simulation. The team members included subject matter experts from Doctrine, Simulation, Aviation Battle Lab Support Team (ABLST), Comanche Early Operational Capability (EOC), Longbow EOC, and Kiowa Warrior.

The PW team charter ensured that specific aircraft, and Army aviation in general, were modeled correctly in the simulation. In addition, the team ensured that the CGSC students understood how to employ and "fight" new systems (Comanche and Longbow) in the simulation.

Early in February, the Aviation Center took part in CBS 1.5 testing at Fort Leavenworth. With PW94 fast approaching in May, the Aviation Center PW team sponsored a video–teleconference (VTC) for key aviation student leaders on the capabilities and employment of the Comanche and Longbow aircraft.

The final task for the Aviation Center team was to ensure the success of the PW "rehearsal." With the PW exercise less than 3 weeks away, the Fort Rucker team traveled to Fort Leavenworth with one focus — ensure both the RAH–66 Comanche and AH–64D Longbow were correctly portrayed in the simulation.

The Jet Propulsion Lab (JPL), Pasadena, Calif., is the primary contractor for CBS. Although the JPL did not model future unfielded systems, senior army leadership wanted to explore the use of future systems to include the Comanche and Longbow. Items, such as maximum effective ranges (MERs), were reviewed and subsequently changed to their correct ranges. To the Comanche "icon," a stealth coefficient was added so that enemy radar would have difficulty acquiring the aircraft.

The Aviation Center team verified all the capabilities and other modifications to the aircraft by conducting dry run missions. In one mission, a team of four Comanches and four Longbows were sent on a deep attack, with a 2–minute separation between air-

craft types. Mission: to destroy elements of an enemy armor brigade. The target priority for both aircraft was armor. All Longbow aircraft were destroyed by 2S6 antiaircraft weapons, and the Comanche aircraft, though undetected, were forced to abort the mission because of the loss of the Longbow aircraft.

On the next mission, using the same parameters as on the first mission except for target priorities, the aircraft launched. Comanches were given a target priority of air defense artillery (ADA) and the Longbows were given a target priority of armor. During the mission, the Comanche selected and destroyed ADA sites on the deep attack route, thus clearing the route for the Longbows. The mission was a success. These dry runs in simulations tell a lot about how to employ future systems and develop tactics, techniques, and procedures (TTPs) for live training and combat.

During the PW rehearsal, the Aviation Center team made changes to the Comanche and Longbow replications in the CBS 1.5 software. These changes caused higher "fidelity" in the aircraft so it could be depicted realistically—more like the actual aircraft during the exercise. At the end of the rehearsal, the Fort Rucker team left Fort Leavenworth confident that specific aircraft, and Army aviation in general, would perform to standard during the upcoming PW94 exercise. In addition, the changes made to the aircraft during the rehearsal answered many questions about a future force structure, an MSF that would be the centerpiece of PW94.

The MSF was first used in a large–scale simulation in PW93. PW94 showed how the MSF would operate as part of a corps with two other divisions. In January 1994, General Franks, Commander, U.S. Army Training and Doctrine Command (TRADOC), developed an intent for the MSF that would be used during PW94. This intent was based on the formation of an operationally decisive force that will lead to the development of Force XXI. The two distinguishing features of the MSF are its purpose and design. The purpose of the MSF is to act as a highly mobile, lethal, and survivable force capable of maintaining an extremely high operational tempo. It could sustain itself for 3 to 5 days while it "punches" deep into enemy territory, some 250 to 350 kilometers, to destroy the enemy's rear echelons.

"The design parameters of the MSF included developing a force in such a way as to allow the design to form the basis for further experiments while assuring the design would be feasible in an experimental 'live' force," according to the 15 Apr 94 Requirements Statement for MSF. The MSF would be a combined arms division consisting of about 10,000 soldiers using systems such as Comanche, Longbow, M1A3, and a combination of mechanized and air assault infantry.

The essence of this force is digitally linked, highly mobile, tactical units that achieve increased lethality through better communications and improved probability of kill (pk) and probability of hit (ph) inherent in the systems reaching the field in 1998. In addition, this force will be more survivable as a function of speed, lethality, digital communications (IFF capable), and improved passive means including better battle command.... The key limiting factor of this force will be human endurance rather than either logistics or the capability of weapons systems— MSF Requirements Document, 15 Apr 94.

PW95 in May 1995 will grow further in purpose and scope. PW95 may include virtual simulation, such as that found in Fort Rucker's Aviation Test Bed (AVTB), and live simulation, such as the National Training Center (NTC). Further experimentation will "open doors" to new doctrine and TTPs and answer more questions on future force design and new systems.

PHASE III GHQ '94

CSA GUIDANCE:

- DON'T TIE INTO ANOTHER CinC EXERCISE
- LOOK AT PRAIRIE WARRIOR AND A CORPS LEVEL EXERCISE
- HAVE ARSTAF ALLOCATE SCARCE RESOURCES
- HAVE ARSTAF LOOK IN TWO DIRECTIONS
- EXPERIMENT WITH NEW FORCES
- INCORPORATE LESSONS LEARNED FROM GHQ '93
- INCORPORATE LAM ISSUES

PW 94: Aviation Lessons Learned

- In CBS, Comanche and Longbow are highly effective as a team when Comanche has target priority of ADA.
- Higher fidelity modeling of Comanche and Longbow is required to evaluate their contributions.
- Constructive Simulation is a powerful analytical tool in designing a future force's TTPs in relation to AirLand Battle.
- Comanche and Longbow are the most lethal combat platforms in CBS—even with low fidelity modeling.

In summary, the Comanche and AH–64D Longbow performed extremely well in PW94 and are expected to do even better in PW95. PW94 proved beneficial to the CGSC students, beneficial to Army aviation, and provided insights on a possible future 1998(+) force or MSF.

U.S. Army Aviation Digest History

Publication of the ARMY *AVIATION DIGEST* is another mark of progress in the Army's efforts to achieve a more mobile and versatile fighting force. The vital importance of organic aviation has been proven on the battlefield. The principles governing its application are being constantly evaluated in order to assist the soldier to carry out his vital task of enhancing the security of our Nation. I am confident that the ARMY *AVIATION DIGEST* will be of great value in stimulating professional military discussion and disseminating information concerning the increasingly important role of Army Aviation. —(February 1955)

Matthew B. Ridgway
General, United States Army
Chief of Staff

In June 1961, the ***Aviation Digest*** was writing a comprehensive history of Army aviation. Research included a truck full of documents belonging to then retired Brigadier General Carl I. Hutton. Among the documents was his diary. It stated that, in 1952, the Department of the Army (DA) directed the Aviation School, then at Fort Sill, Okla., to recommend some tangible actions to offset a rapidly rising Army aviation accident rate. General Hutton recommended an accident prevention board and a professional aviation periodical. Both were approved. The board became USABAAR [U.S Army Board for Aviation Accident Research], then USAAAVS [U.S. Army Agency for Aviation Safety], and later USASC [U.S. Army Safety Center]. The periodical evolved into the ***U.S. Army Aviation Digest.***

The Aviation School's recommendation to DA ran headlong into a request from the Transportation School and Center at Fort Eustis, Va., for a periodical on Army aviation. DA consolidated the two requests and set the policy of having only one periodical to cover all of Army aviation. It also charged the Aviation School with putting the product together but classified it as an Armywide periodical with publication (printing) and distribution proponency to be retained at DA level where it remained until 17 July 1987.

The ***Aviation Digest*** was published first in February 1955. Its internal organization, management, etc., were developed by the Aviation School, which also submitted periodic requests for renewal of approval to publish.

In September 1958, the Aviation School requested an increase in the size and format of the ***Aviation Digest***. While pure aviation safety was cited as a foremost purpose of the ***Digest***, the correspondence emphasized, "but equally important to the mission is the distribution of related information..."

The expansion of the ***Digest*** was necessary to accommodate an increase of USABAAR input without sacrificing the existing scope of coverage. A meeting was held at DA to consider the Aviation School's request. Attendees included representatives from the Aviation School and USABAAR. This group set the policy of a separate portion of the periodical for USABAAR material.

The ***Aviation Digest*** was not given the extra pages requested, but the page size was increased from 6 by 9 inches to 8 by 10 1/2 inches. The meeting with USABAAR and DA also resulted in the elimination of some types of material such as book reviews. DA felt that an elimination of certain types of material, along with the increased size in page format, would provide the additional space needed for USABAAR's material without sacrificing coverage of other required topics.

On 11 October 1961, DA gave the ***Aviation Digest*** permission to expand from 36 pages to 48 pages plus covers to keep abreast of Army aviation's rapid expansion in new hardware; and increasingly complex problems in materiel, air traffic control, aviation medicine, flight training, and emerging airmobile tactics in support of the combat arms. In 1963, the ***Aviation Digest*** was placed under pin-

point distribution to facilitate worldwide distribution.

In 1964, USABAAR requested its own periodical devoted exclusively to aviation safety. However, DA (the Assistant Chief of Staff for Force Development (ACSFOR)), restated its position that aviation safety and accident prevention should be disseminated through the ***Aviation Digest*** and the Army should have only one periodical devoted to Army aviation.

Continuing pressure from USABAAR, coupled with rapidly expanding Army aviation programs, resulted in DA authority in January 1967 to increase the ***Digest*** to 64 pages plus covers. The Aviation School and USABAAR agreed that USABAAR should have the last 28 pages of each issue to devote to aircraft accident and flying safety subjects.

Thus, DA reaffirmed the position it had taken twice before: Army aviation should have one publication with about one–third of the product being reserved for input from USABAAR. The rest would be devoted to tactics, maintenance, research and development, aviation medicine, training, etc.The ***Digest*** had been in existence 12 years at that time. It had grown from a 6,500 monthly distribution to a circulation of almost 40,000 copies.

When the ***Aviation Digest*** was reduced by DA, The Adjutant General Office's AD Hoc Committee on Periodicals, from 64 to 48 pages in 1974, the USAAAVS (USABAAR) portion was correspondingly reduced to 18 pages. Effective with the March 1978 issue, USAAAVS advised the ***Digest*** that it no longer would furnish 18 pages of material per issue, but that it would be a contributor on an "as–needed" basis.

The transfer of the ***Aviation Digest's*** mission and functions from HQDA to the U.S. Army Training and Doctrine Command (TRADOC), Fort Monroe, Va., came on 17 July 1987 as a result of an earlier Secretary of Defense directed reduction of 55 percent in the Department of Defense (DOD) periodicals program. On 16 July 1987, professional bulletins (PBs) were established as a new official Departmental publication media. In turn, the HQDA Periodicals and Review Committee determined that the ***Aviation Digest*** met the criteria for the new media.

In September 1988, a review of the ***Aviation Digest PB*** with the other (TRADOC) PBs indicated that the ***Aviation Digest***, other than the ***Military Review***, was the only TRADOC PB that published monthly. It had the widest readership and the greatest number of copies printed per year (493,500). A comparison of costs of all of the PBs indicated that the costs of the ***Digest*** per copy ($.88) were less than all other PBs. However, overall costs, because of frequency of publication and number of copies printed, were greater.

In keeping with fiscal demands, TRADOC requested the ***Aviation Digest*** to cut its overall total costs by going bimonthly with a combined July/August 1989 issue. It expanded pages from 48 to 64 and changed its page size from 7 7/8 by 10 1/4 inches to 8 1/2 by 11 inches. In 1989, there were more than 41,000 readers—including 27,300 Active Army; 8,500 Army National Guard; 3,000 U.S. Army Reserve; 1,300 civilians; 165 DOD activities, 72 Marine Corps, 60 non-DOD; 32 Air Force members and 400 miscellaneous. In 1993, to cut costs, the readership was reduced electronically by 25 percent (10,000 copies) for those accounts receiving more than 10 copies. In 1994, pages were reduced from 64 to 48 to 52. For this March/April 1995 issue, individual account holders were 4,547 with 25,305 total copies printed.

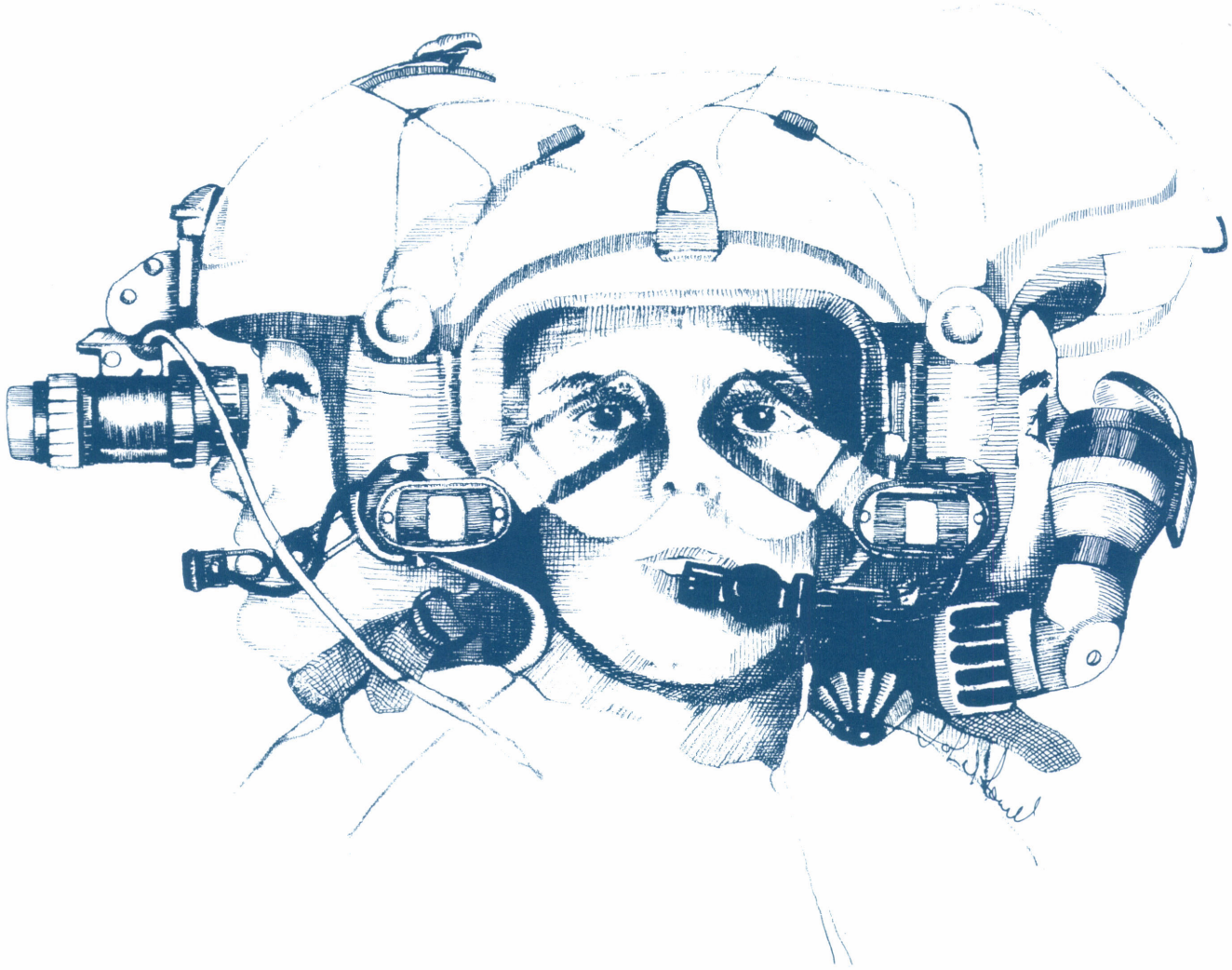
The Aviation Digest has served the Army aviation community as a valuable source of professional, pure safety, and accident prevention information for 40 years.

12th Anniversary of the Aviation Branch

On 14 April 1983, Secretary of the Army John O. Marsh, Jr., announced his approval of the establishment of Aviation as a separate branch of the Army. In addition, Secretary Marsh had approved the centralization of proponency, or responsibility, for Aviation matters at the U.S. Army Aviation Center, Fort Rucker, Ala. GEN Meyer earlier had approved the two actions in concept as a result of a requirements study conducted by TRADOC.

In approving the centralization of Aviation proponency, GEN Meyer noted that, "Voids in Aviation training and training development, piecemeal development of Aviation doctrine and force structure, and the education and training requirements generated by equipment advances mandated single responsibility for Aviation matters."

New battle doctrine for Army Aviation had broadened its role as a combat maneuver element. That doctrinal development and personnel management considerations, according to General Meyer, made formation of a separate Aviation Branch necessary.



U.S. Army Aeromedical Research Laboratory

Army's Vanguard for Helmet-Mounted Display Research

See pages 16–19

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