UNITED STATES ARMY
AVIATION DIGEST
FEBRUARY/MARCH 1987

AIR COMBAT

NOTICE: This February/March issue will be the last *Aviation Digest* published until receipt of guidelines from Department of the Army for our resumption as a Professional Bulletin. Considering this and the time needed to prepare, offer for bid and award a printing contract, it may be July 1987 before the *Digest* is again offered to our readers. Thank you for your support. We hope to serve you equally well in the future.

FEBRUARY/MARCH 1987 • VOLUME 33 • NUMBER 2

1 **Army Aviation Testing . . . Getting Our Money's Worth,** MG Ellis D. Parker

2 **Air Combat, The Challenge Continues,** MAJ Michael L. Brittingham

8 **Air Combat, Aviation,** CPT Greg R. Hampton

13 **Terrain and Helicopter Aerial Combat,** MAJ Lawrence E. Casper

16 **Views From Readers**

18 **PEARL'S**

20 **Aviation Personnel Notes: Flying Duty Medical Examinations; UH-60 Black Hawk Pilot Distribution; Combined Arms Participation**

22 **DES Report to the Field: DES Checklist,** SFC Jeffery R. Buedel

24 **Aircraft Combat Maintenance/Battle Damage Repair,** MAJ Mark W. Warner and CW3 Charles H. Brady

27 **Maintenance Test Pilot and the Aircrew Training Program,** CW4 Ruffin Moore

30 **Helicopters and Turbulence,** Mr. Joe Mashman

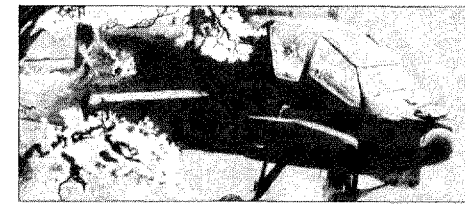
33 **A-JAAT,** LTC Kenneth R. McGinty and 1LT Eduardo Gutierrez

36 **Flight Data Recorders to be Installed in Army Aircraft,** MAJ John C. Mainwaring and Mr. Billy H. Adams

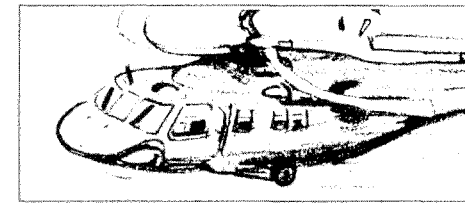
40 **Learn From My Mistakes,** CW2 Charles E. Butler

Back Cover: **ATC Action Line: FLIP Update,** Mr. Forrest H. Helfenberger.

Cover: **The helicopter's air combat capabilities: to protect our helicopters and to avoid enemy attack and disruption of our combined arms operations. Story begins on page 2.**



page 13



page 30

A-JAAT

page 33

Honorable John O. Marsh Jr.
Secretary of the Army

Major General Ellis D. Parker
Commander
U.S. Army Aviation Center

Brigadier General Rodney D. Wolfe
Assistant Commandant
U.S. Army Aviation Center

Richard K. Tierney
Editor

The mission of the *U.S. Army Aviation Digest* (USPS 415-350) is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

The *Digest* is an official Department of the Army periodical published monthly under the supervision of the commander, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. 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.

Articles, photos and items of interest on Army Aviation are invited. Direct communication is authorized by writing Editor, *U.S. Army Aviation Digest*, P.O. Box 699, Fort Rucker, AL 36362-5044, or by calling either AUTOVON 558-3178 or Commercial 205-255-3178. Manuscripts returned only upon request.

Use of funds for printing of this publication has been approved by the Secretary of the Army, 19 February 1985, in accordance with Army Regulation 310-1. Second-class postage paid at Daleville, AL, and additional mailing offices.

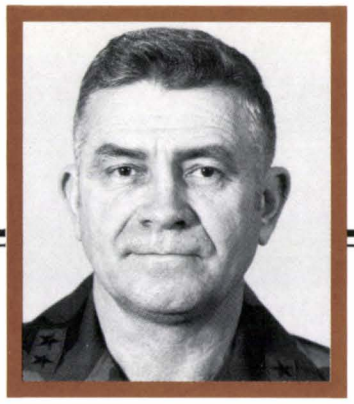
Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-2. Complete DA Form 12-5-R and send directly to CDR, AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220. For any change in distribution requirements, initiate revised DA Form 12-5-R.

National Guard and Army Reserve units under pinpoint distribution should submit DA Form 12-5-R. Other National Guard units submit requests through their state adjutant general.

Those not eligible for official distribution or who desire personal copies of the *Digest* can order the magazine from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

POSTMASTER: Send address changes to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Major General Ellis D. Parker
Chief, Army Aviation Branch



Army Aviation Testing . . . Getting Our Money's Worth

ONE OF THE greatest challenges that we face in Army Aviation is the fielding of concepts and materiel. The transition from "drawing board" to "fully operational" is a process that runs the gamut from smooth to rocky. We have been quite fortunate in the aviation community in that systems, components and end items have proven to be both durable and effective. In that same vein, new concepts in employment of aviation and aircraft maintenance have demonstrated their value. The common thread that ties all successful aviation programs together, regardless of their scope, is the operational testing done by the Army Aviation Board here at Ft. Rucker, AL.

Every new concept or piece of equipment that is fielded has undergone a rigorous evaluation to determine its suitability for incorporation into the Army Aviation community. We have no latitude when it comes to doctrine or equipment. When it gets to the field, it must work the first time and every time thereafter. It must be logistically supportable and maintainable. We must get 100 percent of our money's worth, and operational testing ensures that we will.

Last year was a busy one for aviation testing. It started with Part I of the Aircraft Survivability Equipment (ASE) Test. For the first time, all the onboard subsystems that enhance helicopter survivability in the threat environment were evaluated concurrently on the same AH-1 Cobra and AH-64 Apache airframes. Follow-on testing will look at groups of aircraft in various ASE configurations. The final electronics test of the year was Nap-of-the-Earth (NOE) Communications II Follow-On Test. This tested (high frequency) radios in the NOE environment in both the mountains and the desert.

Ground support equipment was tested for both new and veteran aircraft. The aviation ground power unit (AGPU), which was designed to support the AH-64, was tested at Ft. Campbell, KY, and at the National Training Center in California. In addition to the Apache, the AGPU also provides AC/DC electrical, pneumatic and hydraulic power in support of every other Army aircraft. The self-propelled elevated maintenance stand was tested with both CH-47 Chinook and CH-54 Tarhe aircraft at Hunter Army Airfield and Ft. Stewart, GA. Testing of a 10 kw generator began there late in the year and recently was completed. It is designed to provide continuous power for all 28-volt DC applications.

Aviation life support equipment and nuclear, biological and chemical protection received a great deal of attention last year. The AH-64 protective mask (XM-43) was evaluated at both Ft. Rucker and Hunter Army Airfield. A new chemical protective garment was tested near the end of the year. The "aircrew uniform, integrated battlefield," is not an overgarment but is a two-piece flight suit that provides chemical protection.

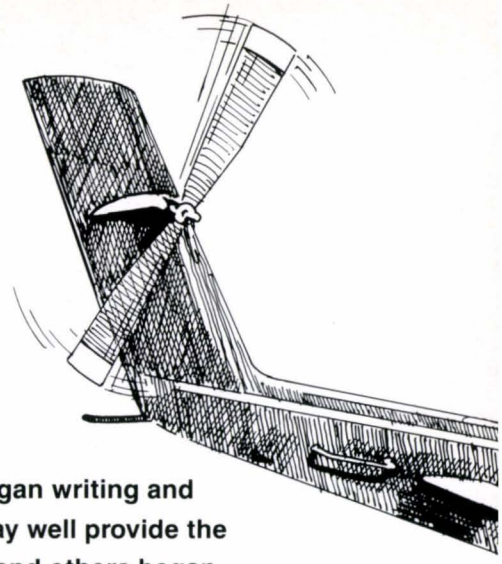
One of the most dynamic tests of the year was the air-to-air Stinger test conducted at Ft. Bliss, TX. For the first time, Army aircraft may have the means to autonomously defend against threat aircraft.

The last tests that I will mention involve concepts rather than "things." The Air-to-Air Combat I (ATAC I) test was conducted at Ft. Hunter-Liggett, CA, and addressed air-to-air combat in various mission scenarios. The lessons learned from this validate tactics and doctrine in FM 1-107, "Air-to-Air Combat."

The second concept is progressive phased maintenance (PPM), consisting of a series of simplified inspections at 10-hour intervals instead of major, more complicated inspections. Although PPM has been with us for some time in the CH-47 fleet, it has not been implemented with other tactical aircraft. If PPM proves effective, aviation commanders will have a powerful maintenance tool at their disposal.

Indeed, 1987 will be as intense as last year for the Army Aviation Board. New survival vests, satellite communications, personnel locator systems, mine dispensing systems and ATAC II are some of the scheduled tests. I hope that they are as productive and unbiased as their predecessors. The Army Aviation testing community has a huge responsibility to all of us who fly. With everyone's help, the challenge will be met.

AIR COMBAT



A Soviet general by the name of Reznichenko in 1973 began writing and speaking frequently and openly about how armed helicopters may well provide the decisive ingredient in war. At about the same time Reznichenko and others began theorizing the dynamics of helicopter warfare, and, not surprisingly, concluded that the best means of attacking and destroying a helicopter is with a better helicopter. Clearly, the Red Army leadership has heeded its own counsel, as its helicopter force today is formidable, and growing more so each year.

Our Soviet counterparts are convinced that properly equipped and trained attack helicopter forces can, if left unchallenged, devastate an armor force; they embrace a doctrine that places great emphasis on removing our attack helicopters from the battle equation. They propose to use any and all means to do so, including, and perhaps especially, their helicopters employed in an air-to-air role. As Major Mike Brittingham discusses in the article that follows, Army Aviation is moving with all due haste, not only to prevent their ability to kill *our* helicopters, but also to prevent their helicopters from being able to attack and disrupt our combined arms operations.

Understandably, Army Aviation will have to make the most out of limited resources available to us. Like every other modern army in history, ours will never enjoy the luxury of enough aircraft to be able to perfect platforms for single-mission use. We must, as we design our future aircraft, optimize the platform for the overall battlefield environment, and design in the ability to mount a variety of reconfigurable mission equipment packages. We cannot now afford special-purpose aircraft that can only do one thing. Of course, this is the design philosophy underlying the LHX (Light Helicopter Family) program.

We have just begun to mature our understanding of helicopter air combat's problems and solutions. Given a great deal of support from the Army Chief of Staff and the Training and Doctrine Command (TRADOC) chain of command, we have been able in the past 6 months to make more progress toward the Army air combat capability than was made during the preceding 10 years. Again, Major Brittingham's article outlines some of that progress, which shows no sign of slowing. On the contrary, the Army is fully committed to meeting the critical air combat challenge. Army Aviation has picked up the gauntlet; we will be prepared to fight and win the treetop air battle that promises to be an essential contributor to combined arms success.

Major General Ellis D. Parker
Commander, U.S. Army Aviation Center
Fort Rucker, AL

Air Fighting

General Considerations, Introductory Remarks

1. Air superiority over the enemy confers the greatest advantage and is one of the most important factors in the success of the operations of all arms in war.
2. It is achieved principally by the pursuit of a policy of relentless and incessant offensive against the enemy's air forces in the air and on the ground.
3. The struggle in the air takes the form, as in other fighting, of a series of combats, and it is by the cumulative moral and material effect of a sequence of successes that ascendency over the enemy is eventually gained.
4. It is therefore imperative, in order to prevent the enemy from gaining air superiority, that all aeroplanes, whether primarily designed and maintained for the purpose or not, should be armed for air fighting and their crews thoroughly trained in its principle and practice.

Royal Air Force Air Publication 928,
February, 1933

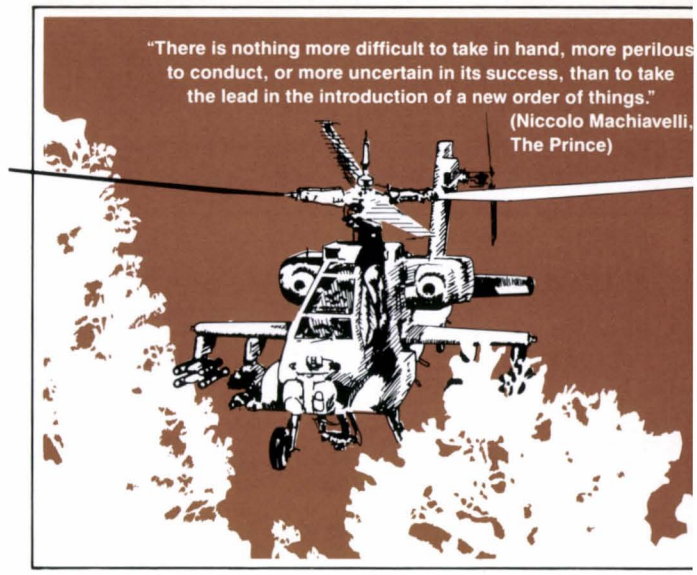
ARMY AIR COMBAT

The Challenge Continues

Major Michael L. Brittingham
Chief, Air Combat Division
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

WE ARE ALL at least occasionally frustrated by the sheer immensity of the Army bureaucracy. Turning projects, programs and ideas into usable products for the fielded Army always will be easier said than done. But we all can take heart from one generalization that has seemed to hold up well over the years: good ideas almost always become reality sooner or later. Fortunately, for the sake of combined arms effectiveness, such has become the case for Army Aviation air combat.

Nearly 75 years ago, the first airplanes met in air combat above the battlefields of World War I. Fixed wing air combat has been a fundamental ingredient of most 20th century wars. But only recently has there been *serious* discussion of helicopter air combat and all its implications. This article does not cover the history of air combat, but it is interesting to note that there was test work done as early as 1973 to develop fixed wing tactics needed to engage helicopters; this was followed in 1977 and 1978 by the J-CATCH (Joint Countering of Attack Helicopters) series of tests that attempted (as the name implies) to develop joint Air



Force/Army tactics, techniques and requirements for countering an enemy attack helicopter threat that was at the time only beginning to be understood.

Of course, that threat has continued an unabated growth in both quantity and quality. Improvements to older helicopters, completely new helicopters, shifts in tactics and organizations, and a good deal of open-source writing all indicate that the Soviets are serious about their capability to mount an effective helicopter threat against combined arms forces. And of course, the antiarmor helicopter is an important part of the combined arms equation. The Soviets intend and are preparing to use their helicopter forces to help strip the helicopter from the combined arms force, both to negate our tank-killing capability and to enable their tank-killers to operate without effective aerial opposition.

General John A. Wickham Jr., Chief of Staff of the U.S. Army, has provided the vision and decision that will lead us ultimately to solving the air-to-air problem. Early in 1986, in a speech to the Army Aviation Association of America, General Wickham enjoined the Army Aviation community to "think through the doctrinal, tactical and materiel challenges" of dealing with the ever-increasing threat, and he stated the need to develop "defensive and offensive guns, missiles and acquisition systems" to aggressively meet and defeat enemy air. Not stopping there, in June, General Wickham formally tasked TRADOC to "take the lead and aggressively develop the concepts, doctrine and combat development initiatives to afford the Army this new [air-to-air] capability."

And so, in July 1986, the Air Combat Division (ACD) of the Aviation Center's Directorate of Combat Developments, became a reality and opened its doors for business. See page 21, *Aviation Digest*, September 1986.

It is both form and function of ACD to provide the management focus needed to bring about an integrated air combat development program in the shortest possible time. At present, the efforts at ACD are centered around four major vectors:

Tactics/Doctrine

With the full assistance of the Aviation Center's Directorate of Combined Arms Tactics, as well as total cooperation and help from the Air Defense School, ACD is working to draw together a combined arms doctrinal foundation that will nurture the continued development of Army air combat initiatives. As part of the routine doctrinal revision process, Army Aviation field manuals and field circulars (most of which already contain at least some air combat subject matter) will continue to expand the doctrinal perspective from which we view Army air combat. We should emphasize the continuous process embodied in this doctrinal evolution. As we get smarter and more experienced in air combat matters, and as technology continues its inevitable changes and advances, we will make whatever doctrinal adjustments are appropriate to accommodate the lessons we have learned. We hope that learning process never stops.

Tactically, we recognize that air combat places new and different demands on our aircrews and units. We have thought through the problem and have examined it thoroughly in tests and analyses, as well as through the eyes of the other services in context of their air combat experiences. We have concluded that the air combat mission clearly brings with it some added tactical imperatives, if there is to be any hope of success in future helicopter combat. The process of changing current attitudes and perceptions will take time, to be certain, but those changes are underway.

Also, it is clear that our tactical doctrine for air combat, just as for other combat, must use the night as a combat multiplier. In consequence, one of the most important near-term challenges ACD faces is the "how-to" of night air combat.

The urgent need to develop an Army air combat capability presents complex and difficult training challenges. But at the same time, training success will net an air combat mission capability valued far in excess of the investment made.

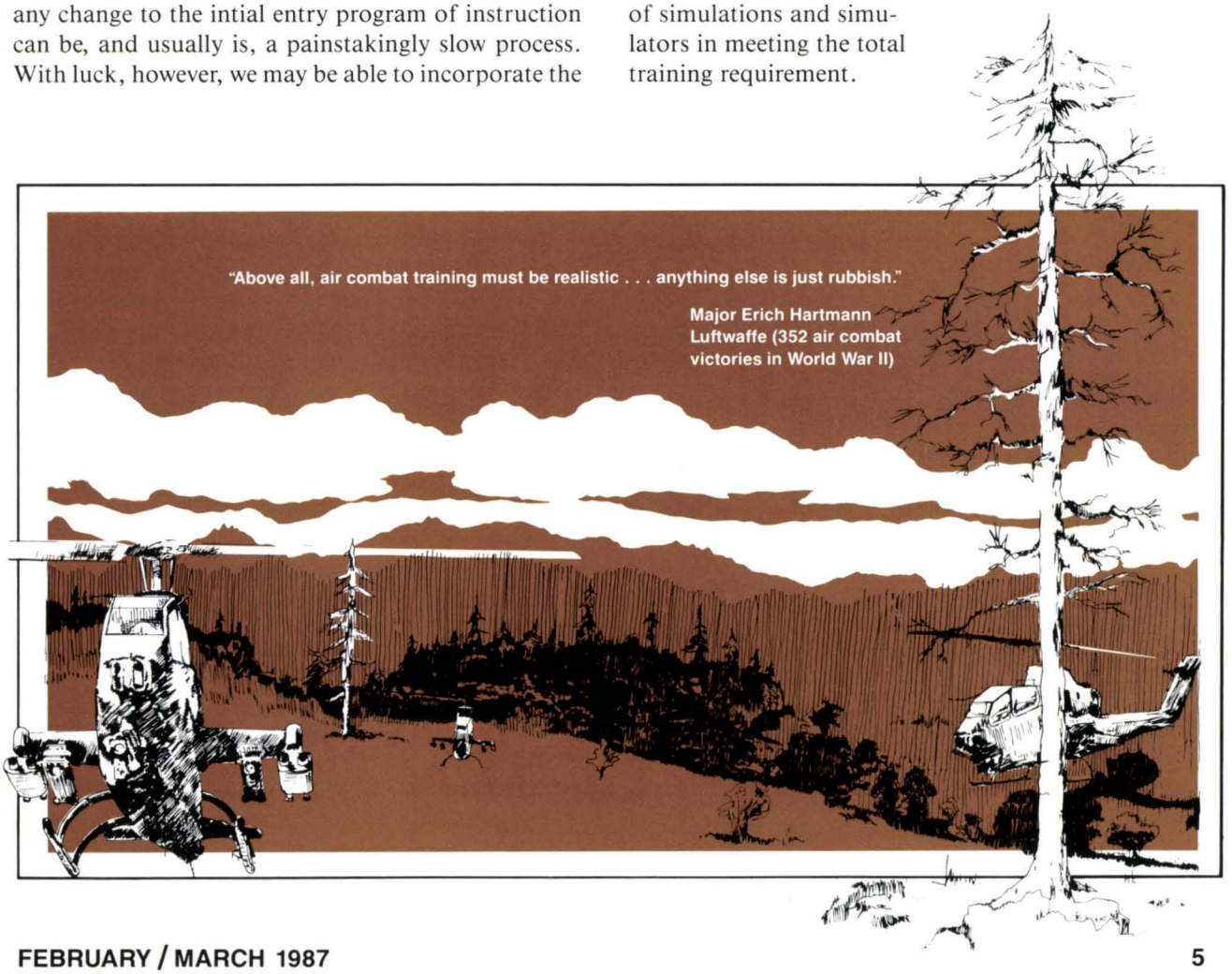
There will be three major elements to the training solution: initial air combat qualification for individuals in fielded units; development of required modification to initial entry flight training to include appropriate training tasks at the undergraduate level; definition and implementation of the most cost effective way to achieve unit air combat proficiency and to sustain that proficiency on a continuing basis.

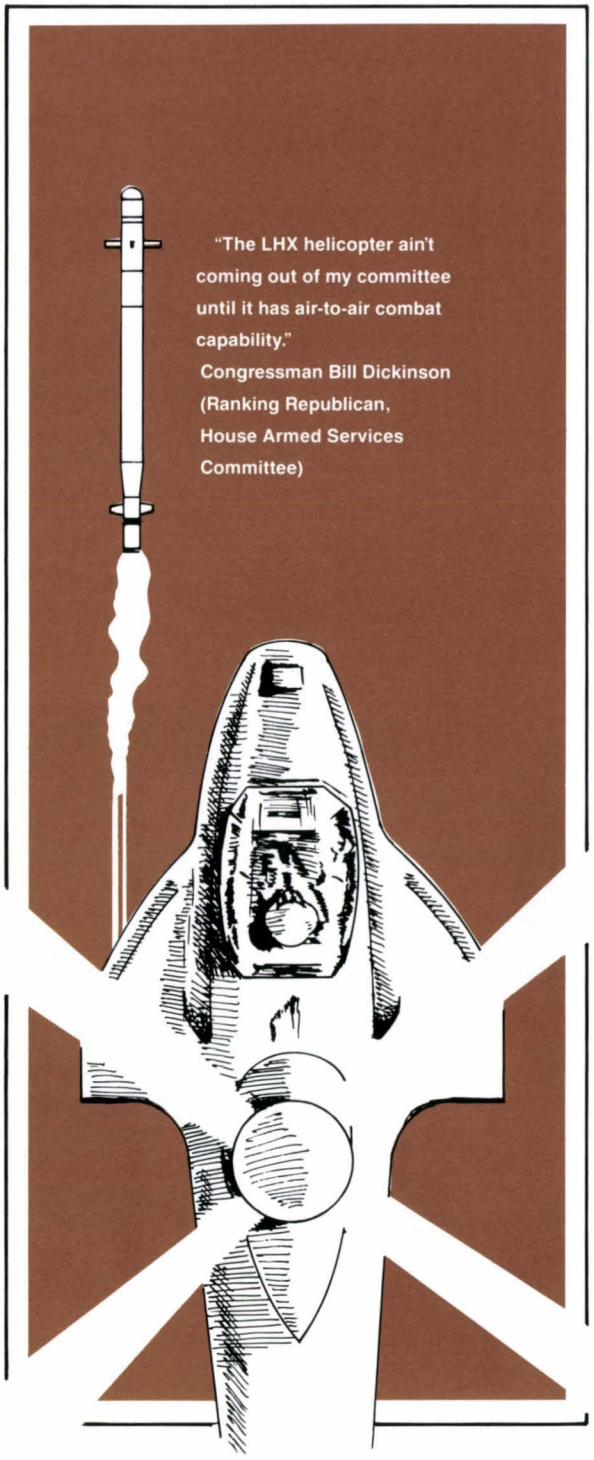
Plans are nearing completion for implementation of the initial individual training program. A mobile training team will be assembled, perhaps as early as spring of 1987, and sent on the road to instruct unit instructor pilot cadres on how to conduct individual air combat training.

As far as initial entry training is concerned, making any change to the intial entry program of instruction can be, and usually is, a painstakingly slow process. With luck, however, we may be able to incorporate the air combat modifications beginning in 1989, at the same time the total multitrack qualification program is implemented.

The third element, unit training and sustainment, may well be the most difficult, just as it has been for other combined arms team members. Limited home station training areas; lack of realistic opposing forces for training; need for high fidelity training instrumentation; and in fact, all those reasons why the Army built (and continues to build) large-scale dedicated training facilities like the National Training Center (NTC) for armor and infantry units, also apply (and probably more so) to air combat training. Surely we will be able to overlay some, perhaps all, of the unit training requirements onto the NTC and other similar facilities. But much front-end study is needed before we come close to having all the answers.

As a final note, ACD will ensure that all of our air combat training efforts make the maximum appropriate use of the obvious utility of simulations and simulators in meeting the total training requirement.





Materiel

In terms of materiel, the ACD is working toward goals which include making sure the LHX meets no opposition from Congressman Dickinson, as well as formulating plans and programs for improvements to currently fielded aircraft.

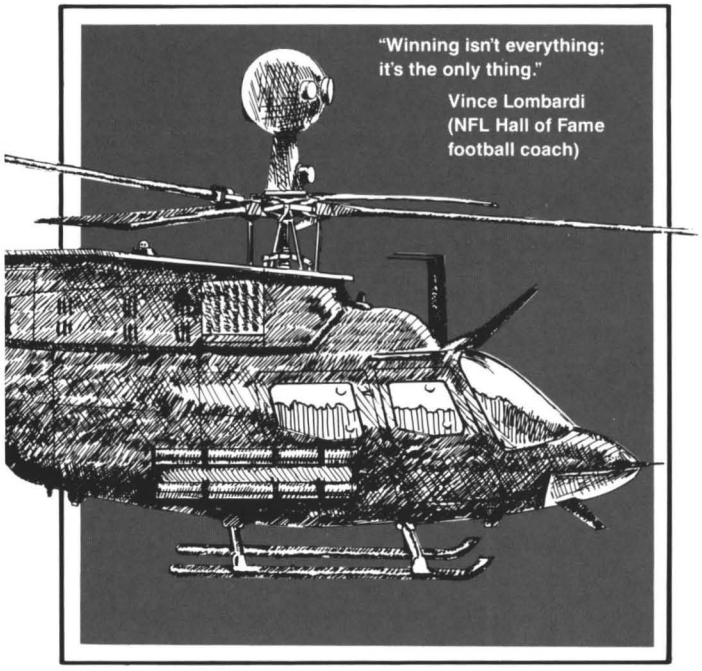
To be fielded in 1988, the air-to-air Stinger (ATAS) will add the fire and forget missile dimension to Army air combat. Eventually, more than 2,000 ATAS systems will be installed on OH-58, AH-64, AH-1 and UH-60 aircraft.

Similarly, engineering programs are ongoing to improve cannon accuracy and lethality for the AH-1 and AH-64. Accurate, lethal, off-axis cannon engagements across a variety of flight conditions will be a major measure of success in helicopter versus helicopter air combat. In addition to the work ongoing, we have conceptual plans for a number of other air-to-air weapons and fire control improvements for current aircraft.

There are, as well, a number of excellent opportunities to improve AH-1 and AH-64 air combat effectiveness by making their cockpit environments more "user-friendly." Reductions in switchology density and difficulty are possible in both aircraft.

Planned as a potential replacement for ATAS late in the century, the Combined Arms Multipurpose Missile System (CAMMS) is on the drawing boards now. CAMMS will be jointly developed by the Army Aviation and Air Defense communities, and will achieve maximum commonality of components commensurate with both air-to-air and surface-to-air mission requirements. As yet another example of the strong Air Defense-Aviation handshake, we recognize and fully endorse a two-way "plug" between Army Aviation air combat and the forward area air defense (FAAD) command, control and intelligence (C^2I) architecture.

In the interest of saving space, it isn't possible to discuss every planned materiel enhancement in this article. Suffice it to say that there are lots of irons in the fire.



Test, Evaluation And Studies

In the entire world, there has been only very limited combat experience in helicopter air combat, and while we have captured those actual lessons learned, a good deal of our empirical data base will be an outgrowth of an orchestrated test, evaluation and study effort.

Phase I of the Air-to-Air Combat Evaluation (ATAC I) was completed early in 1986, and represented the first "crawl-before-we-walk-before-we-run" field test effort. Results of ATAC I have convinced us that the general thrust of our doctrine is correct, and that the scope and content of our exportable individual training program is on target.

Extensive computer-modeled sensitivity excursions, based on tactical data from ATAC I field trials, are underway at this time. The flexibility and versatility of computer modeling will continue to be an invaluable tool as we continue the process of getting smarter about air combat.

ATAC II, scheduled to begin in September 1987, will continue and expand our test and evaluation process. Whereas ATAC I involved only AH-1 and OH-58C aircraft in day-only trials, ATAC II will look at the AH-64 and OH-58D aircraft in night, as well as day trials. Also during ATAC II, we will actually integrate aviation with FAAD, both doctrinally and through hardware and C^3I connectivity. Comptuer modeling and analysis will play an even larger role before, during and after the field trials in ATAC II.

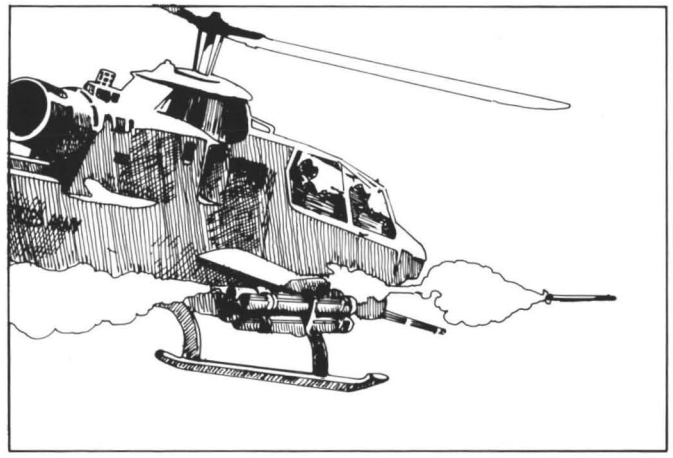
Where To Now, Boss?

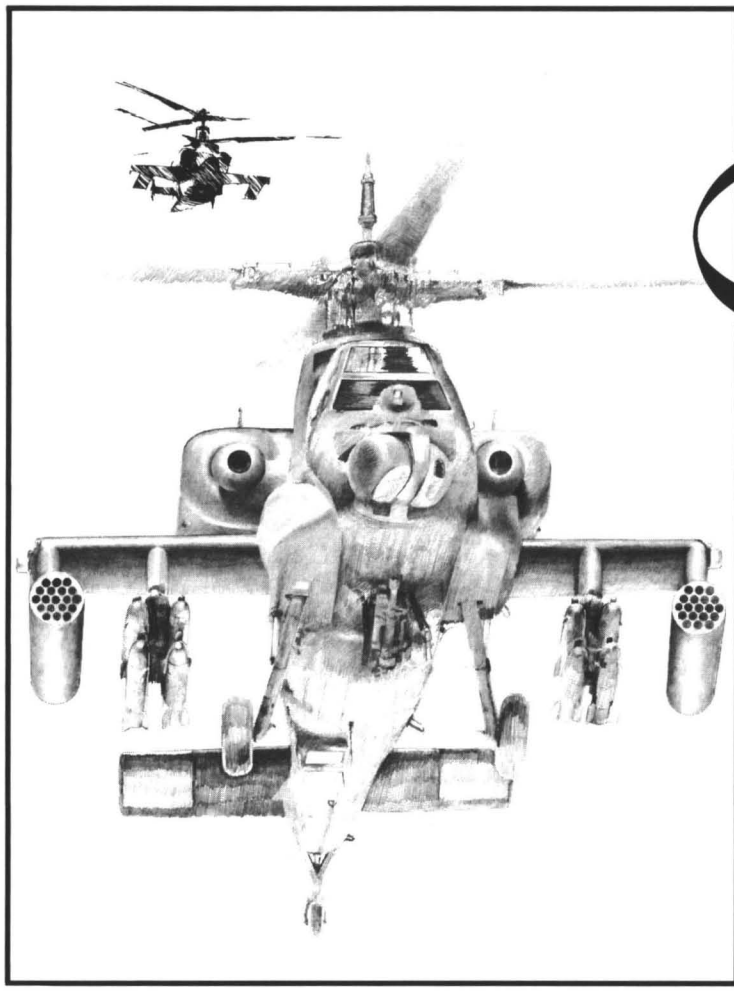
It is simply impossible to list in this forum every little piece of the air combat puzzle, but it should be readily apparent that the train is on its way. The ACD is committed to keep it on track, and keep it going as fast as it makes sense and is safe to do so.

Following a 29 January 1987 update briefing on air combat initiatives, the Army Chief of Staff reiterated and reinforced his earlier position that aggressive, offensive action (both in programs and in tactical concepts) would be required to meet the air combat challenge. General Wickham pointed out that successful U.S. Army helicopter air combat may well provide an important, if not vital contribution to the overall success of the combined arms air-land battle. He encouraged Army Aviation (as well as the rest of the Army) to "take the blinders off" and consider unconventional approaches as we work to answer the tactical, training and materiel questions surrounding our air combat initiatives.

The Aviation Center, the Directorate of Combat Developments and the Air Combat Division are committed to making it happen. Exciting changes—changes that will allow Army Aviation to make ever-greater contributions to the effectiveness of combined arms warfare—changes of mind and heart as well as materiel—are taking place. The Air Combat Division, with the continued support of the Army leadership, will provide the catalyst for those changes to take place.

Army Aviation will meet the air combat challenge head-on. A failure to overcome that challenge now may well have disastrous effects in any future conflict. The challenge is great; the stakes are high. We must press on.





AIR COMBAT AVIATION

Captain (P) Greg R. Hampton
Air Combat Division
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

WITHIN THE course of human conflict, there is an almost predictable tendency of like weapon systems to migrate toward each other on the field of battle. Common logic normally prevails and holds that due to the relative technological parity, the most effective way to counter a particular weapon system is to confront it with a similar weapon.

- Ancient Greek Hoplite Infantry were countered by Persian Immortals.
- Medieval knights met similar armored men of honor on the battlefields of Europe.
- In all eras, cavalry had a unique way of finding and engaging opposing cavalry.
- Tanks are used to fight against tanks.
- High performance aircraft are used to attack high performance aircraft.

Just as the inevitable clash of the first wood and canvas covered airplanes over the stalemated trenches of World War I was entirely predictable, opposing helicopters are destined to meet in the first battle of the next war.

Current forces comprising the North Atlantic Treaty Organization (NATO) and the Warsaw Pact both have realized the importance of attack helicopters. Formidable numbers of these rotary wing platforms

> "New conditions and new weapons require new and imaginative methods for solution and application. Wars are never won in the past."
>
> General Douglas MacArthur
> *Reminiscences*

exist in both camps and will be employed simultaneously in offensive and defensive scenarios.

Noted military authors on each side of the Iron Curtain have quoted the published test results from exercise after exercise that have shown the high helicopter versus tank exchange ratios in mid- to high-intensity combat situations. The forces of the Warsaw Pact must view the expected loss of 19 of their tanks to 1 NATO attack helicopter with an obvious amount of chagrin. NATO, on the other hand, sees an ominous threat to its ability to maneuver because numerous threat helicopters, carrying hefty ordnance loads, seem to be proliferating Warsaw Pact forces. Simultaneous rotary wing combat operations by these potential warring parties will be the rule in any armed conflict, and due to the immediate impact that these machines have upon maneuver forces in general, it is evident that he who controls the terrain flight environment will also rule the field of maneuver.

Attack helicopters and their crews represent a true paradox on the modern battlefield. In many ways, they are analogous to medieval archers and their bows. Both are relatively unprotected, being vulnerable to weapons of all types, necessitating the use of cover, concealment, stealth and the principle of mass to engage the enemy. Yet each possesses relative combat power to dominate its own battle environment.

In 1415 at Agincourt, France, longbows appeared on the battlefield and dominated knights on horseback. Today we are witnessing the emergence of attack helicopters that dominate tanks. To do this, they operate in a unique flight maneuver environment lying between and including two dimensional maneuver units and also that of most fixed wing aircraft. Like two dimension maneuver units, helicopters use terrain, vegetation and man-made objects for cover and concealment. But, due to their unique ability to hover and fly at extremely low altitudes, they are not hampered by terrain and man-made obstacles.

Helicopters operate in airspace extending from the battlefield's surface to an altitude of perhaps 100 meters. Inside this envelope, NATO attack helicopters function as elements of maneuver while the Warsaw Pact's are employed in a fire support role. The fielding of some of the world's most lethal air defense assets on both sides have forced helicopters into this narrow region, where terrain and vegetation usually prevent air defense systems from acquiring and engaging helicopters. Pilots of high performance aircraft have great difficulty locating and engaging helicopters in tree-cluttered airspace and are actually at great peril fighting properly armed rotary wing systems mano-a-mano. As a result, helicopters usually have only one effective countermeasure to contend with—another helicopter.

The concept of a flying air-combat helicopter system is by no means revolutionary. The notion of pursuit type helicopters has been raised in military circles and publications before. Colonel M. Belov (now a major general of the Soviet army) wrote in 1979 that "a future war between well-equipped armies is bound to involve helicopter battles"[1] and that "helicopters are the most efficacious means of fighting helicopters."[2] He further stated that such helicopters optimized for pursuing and destroying rotary wing targets must be light, high-speed, very maneuverable and armed with cannon and air-to-air missiles.

The Soviets, knowing the need to protect their antiarmor investment, airmobile operations and the vulnerable flanks of their massed armor formations from helicopter attacks, have apparently developed a pursuit helicopter. Known as the Hokum (figure 1, page 10), it has no western counterpart and, as stated in *Jane's Defence Weekly*, "will offer a genuine air-to-air combat capability."[3]

Indeed, the concept of an air combat system, be it rotary or fixed wing, found its characteristic base many years ago. In 1909, an Italian soldier and writer, Giulio Douhet, began thinking seriously about the impact of aircraft on future battlefields. His theories about aviation

1. Colonel M. Belov, "How to Fight Helicopters," *Soviet Military Review #9*, 1978, p. 14.

2. Ibid.

3. John W. R. Taylor, "Combat Helicopters in Close-up: Havoc and Hokum," *Jane's Defence Weekly*, 1 February 1986, p. 153.

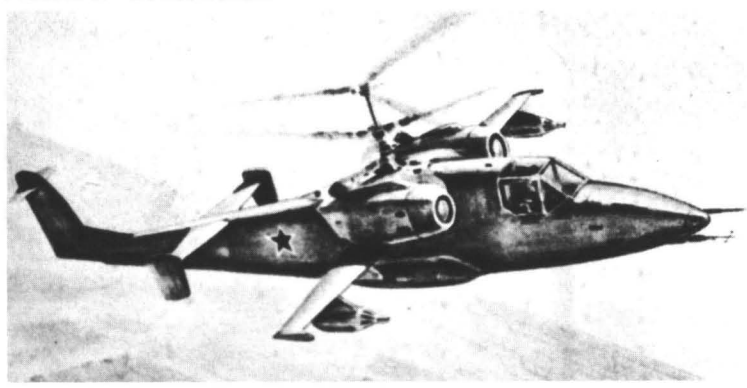
were years ahead of his time. In 1921, he published his treatise, "The Command of the Air," in which he laboriously outlined the nature of modern aerial warfare and proposed the organization of pursuit, attack and bomber aviation. Douhet wrote, "the function of pursuit planes is to seek out other types of enemy planes and to protect their own planes from enemy pursuers."[4]

Pursuit aircraft, in Douhet's estimation, had to be faster than their principal opponents—possess greater maneuverability, firepower and armor protection, and be employed en masse in order, "to clear enemy aerial opposition out of the way of bombing units intent upon carrying out definite missions."[5] Four years later, Brigadier General William "Billy" Mitchell, in his book "Winged Defense," added to Douhet's thoughts on pursuit aviation when he wrote, ". . . pursuit aviation . . . has to hover over the locality and engage any hostile pursuit aviation that may attempt to dive on the attack ships while engaged in destroying their targets."[6] General Mitchell's foresight was eventually proved correct. It is interesting to note that in 1925 he saw a military role for the helicopter: "We believe," he wrote, "that, from a military standpoint . . . the helicopter eventually will be of great value."[7]

The parallels are strikingly clear today. A fighter helicopter, a complete helicopter air combat system, is needed to protect our attack, transport and assault helicopters and to complement air defense artillery in the air-land battle. The air combat helicopter's role on the battlefield is a marriage of common doctrine: to aggressively seek out the enemy in the terrain flight environment; to secure the flank of the vertical dimension of maneuver; and to preserve the force as a whole. The planning and developmental effort for a multimission aircraft that can fill this need (underway at the United States Army Aviation Center, Ft. Rucker, AL, and the Army Materiel Command) is centered around the variant of a new family of light helicopters, collectively known as the Light Helicopter Family. LHX is the acronym used to describe the family of light, highly maneuverable, multipurpose rotorcraft to be fielded in the 1990s.

The LHX series of aircraft will replace the aging fleet of OH-6 Cayuse, OH-58 Kiowa, UH-1 Huey and AH-1 Cobra helicopters and will greatly enhance Army Aviation operations into the 21st century. They will incorporate designs that emphasize simplicity, small size and lightweight. Two versions are now being planned: a scout/attack (SCAT) helicopter and a light utility helicopter, both sharing common components and many design features. Some of the proposed designs for the SCAT variant are shown in figures 2 and 3. They are roughly the size of the OH-58, with a mission gross weight of from 9,000 to 9,500 pounds. Performance will be one of the key selling points of the LHX SCAT. High agility and maneuverability will be inherent in the winning design, and high airspeeds will afford the system the capability of being able to

FIGURE 1: Soviet Hokum



positively dictate the terms of any aerial encounter.

The LHX will incorporate the technology necessary for single-pilot operation in even the worst battlefield environmental conditions. Simplified flight controls and a preprogramable automatic pilot will free the pilot to concentrate on situational awareness and weapons employment. Armament and fire control systems under consideration include turreted, lightweight cannon, multipurpose air-to-air and air-to-ground missiles and directed energy devices coupled with automatic target recognizers and acquisition devices. In short, the LHX will embody the qualities needed to execute the low altitude air combat mission.

No matter how potentially effective a particular weapon system may be, it and its operators must be effectively organized, properly employed, guided by forward-looking doctrine, and trained to a fine edge to exploit full combat value. History is replete with examples of commanders who have not been able to visualize the effect of weapons when employed in other than previously accepted roles. Billy Mitchell wrote, "The great captains were those who thought out new methods and put them into execution. Anybody can always use the old methods . . . they can never get out of a rut, but always go into a war with the methods of a former war and consequently they are sure to be whipped whenever they come up against an elastic-minded, constructive leader on the other side."[8]

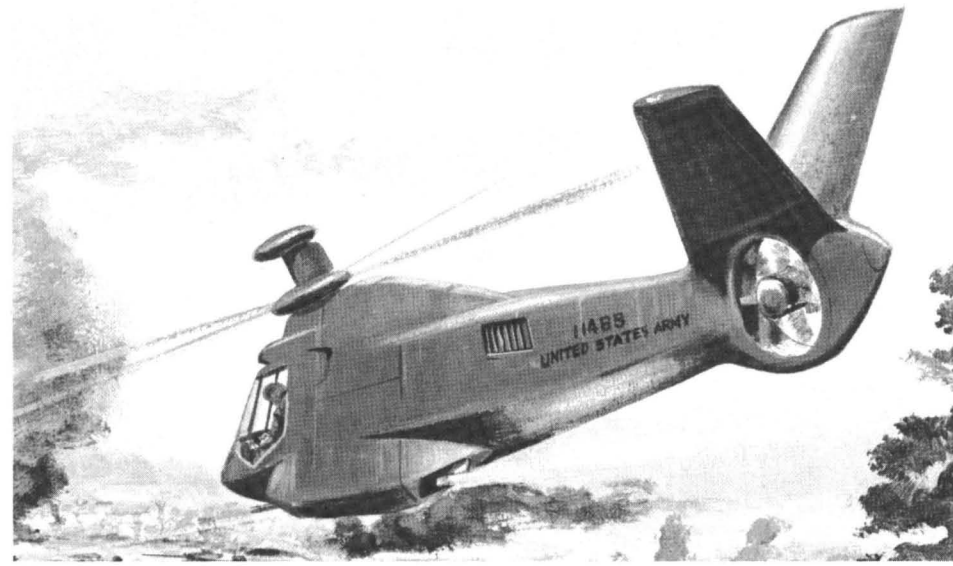


FIGURE 2: Scout/attack helicopter concept from Boeing/Sikorsky.

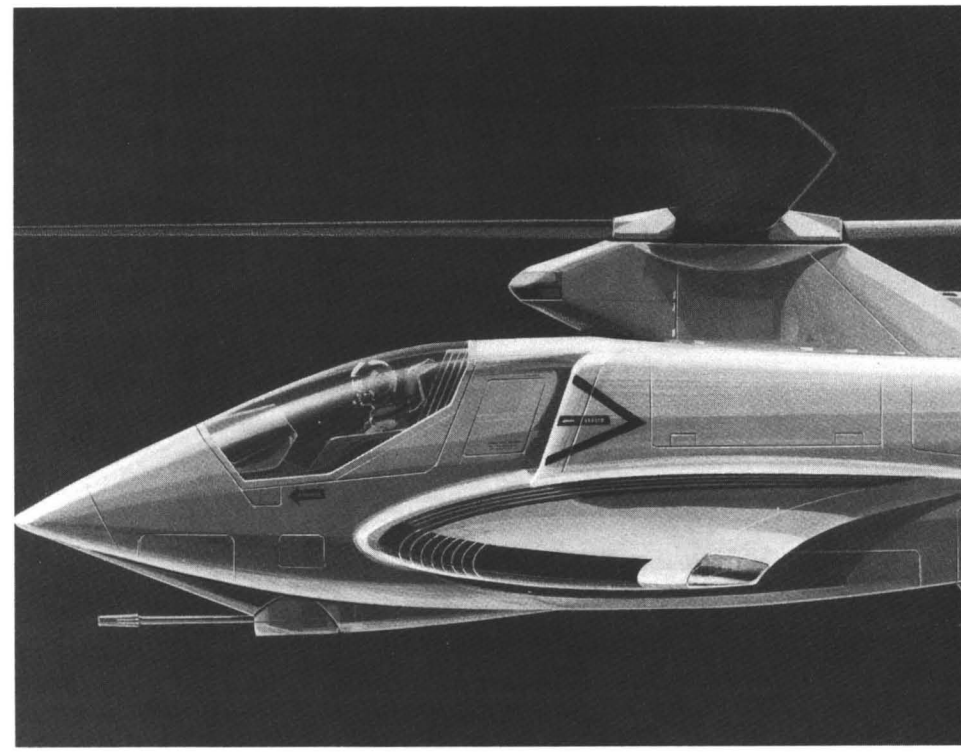


FIGURE 3: Scout/attack helicopter concept from McDonnell Douglas/Bell Textron.

4. Giulio Douhet, "The Command of the Air," Office of Air Force History, Washington, DC. 1983, p. 42.

5. Ibid, p. 44.

6. BG William Mitchell, "Winged Defense," Kennikat Press, Alexandria, VA, 1925, p. 190.

7. Ibid, p. 156.

8. Mitchell, *Memoirs of World War I*, Random House, NY, NY, 1928, p. 112.

The failure of the French Army to realize the value of massed armor in 1940 in World War II is a classic example of this dictum. We must not allow ourselves to fall into the same type of trap in regard to helicopter air combat doctrine.

Today, and in the future, the Army will conduct operations along the lines of complete combined arms integration. The airland battle doctrine cannot work without a fully synchronized effort on the part of the entire combined arms team. The Army Air Defense (AD) Branch has adopted this concept fully in its approach to the forward area air defense mission. Now it is time for AD to fully approach the use of the helicopter. As the battlefield grows more dynamic throughout all four dimensions, the mobility and maneuverability of combat systems targeted against enemy air will become the critical discriminators in counterair operations. The utility of ground air defense is unquestionable, and in light of the vast unexplored doctrinal and tactical possibilities of the armed helicopter over the battlefield, it is reasonable to enhance the AD capability by having rotary wing assets task organized under the air defense commander to fight the air battle at the top of the trees. Army Aviation maneuver elements currently interface with ground maneuvers to conduct a vast array of missions primarily oriented around the destruction of armored and mechanized targets, but this relationship currently does not exist with air defense to destroy helicopters in the terrain flight environment. This doctrinal concept needs to be written and employed if we want to fully exploit the capabilities of the LHX.

The wide gambit of possibilities involving the mission of Army helicopter air combat points directly to the employment of armed helicopters to facilitate control of the vertical dimensions of maneuver. The Army's operational concept for helicopter air combat operations states that army air combat forces must:

- Possess weapons systems that can destroy or nullify all types of air targets, commensurate with the associated threat and Army helicopter air combat mission.
- Be capable of surviving detrimental battlefield and environmental effects through nuclear, biological and chemical; conventional; and climatized hardening of all equipment.
- Be able to "see the enemy" to quickly react to counter his actions.
- Be strategically deployable and possess sufficient operational mobility and tactical versatility to move with and protect the supported force.
- Have the capability, durability and reliability to operate for sustained periods during continuous combat operations.
- Have the capability to receive, assimilate, correlate and rapidly transfer helicopter air combat battle information to air and ground users throughout an entire theater of operations.

Army helicopters possess these qualities and, with the development and fielding of the LHX, will provide a quantum leap in the ability of a rotorcraft to aggressively promulgate air combat operations. "The tactics for employing the LHX are very likely to change from those used by today's aircraft, just as tactics were changed by the introduction of the crossbow and later the machinegun."[9] A helicopter air combat mission role task organized under the command of the air defense commander may indeed be a viable option for the LHX.

The evolution of the use of the helicopter in maneuver warfare closely parallels the development of armored and mechanized forces. With the widespread use of helicopters in airspace immediately above the ground forces, it is inevitable that the terrain flight environment will become a major battle area in the future. Warsaw Pact forces know it and they will attempt to dictate the terms of helicopter air combat battle by employing a new generation of terrain-hugging rotorcraft. By developing a helicopter air combat system, coupled with combined arms doctrine and aggressively facilitating its employment in combat, we can ensure supremacy in the low altitude environment. Simply stated, the force that dominates the vertical plane of maneuver will also rule the battlefield of the future. Helicopter air combat operations have arrived, in time for the LHX!

9. Dr. Lewis Feaster, "LHX—Light Helicopter of the Future," *Aviation Digest*, May 1981, p. 11.

Terrain and Helicopter Aerial Combat

Major Lawrence E. Casper
Army Aviation Representative
Army Development and Employment Agency
Fort Lewis, WA

WITH THE realization of the increase in threat and friendly rotary wing aircraft occupying the airspace above any future battlefield, the thought of a helicopter fighting another helicopter is not only accepted as probable, but also is receiving attention from the highest levels of Army leadership. The Army Aviation Center's total commitment to the philosophy is reflected by the 1984 publication of FM 1-107, "Air-to-Air Combat," and the creation in 1986

of the Air Combat Division, a staff agency within the Directorate of Combat Developments at the Aviation Center. It is chartered to act as the focal point for all Army Aviation air combat activities.

Despite the Armywide support for Army Aviation air combat, the methods of fighting a helicopter against another helicopter are as diverse and controversial within the aviation community as the issue of crew size for the light helicopter family (LHX). The spectrum of opinion spans from the belief that current attack helicopter tactics and employment techniques are adequate to counter a heliborne threat, to the opposing extreme of high speed-maneuvering, mirroring the execution of tactics flown by the fixed wing aerial combatant.

An attempt was made in January through March 1986 to derive the best method of combating helicopters during the Army Development and Employment Agency (ADEA) and the Aviation Center's cosponsored Air-to-Air Combat Test I (ATAC I), conducted at Ft. Hunter-Liggett, CA. The innovative test evaluated individual aircraft and aviation team aerial encounters occurring during a variety of air-land battle scenarios. Although validating portions of FM 1-107 and providing the basis for future modification of the manual, the instrumented aerial combat was conducted in a sterile environment. The test included airspace absent of friendly and hostile ground air defense or maneuver units. As a result, the aviator during the test entered the fight without the fear of detection and potential destruction by enemy air defense, or fratricide by friendly weapon systems. ATAC II, a follow-on test scheduled for fiscal year 1988, will duplicate the ground battle and further explore the issue of how best to counter rotary wing aircraft.

I believe an air-to-air engagement will be fought and won by the aviator who consistently remains in the environment conducive to terrain flight. But, there are other aspects of the aerial combat arena that ensure success.

Maneuver is obviously a key component in the aerial engagement, but is often misunderstood. Maneuvering is the ability of the aircraft to initiate a series of changes in direction and position for a specific purpose. A Boeing 747 can replicate many of the maneuvers performed by an F-15 interceptor. The discriminator in the performance of a maneuver is agility—defined as the ability of the aircraft to maneuver with quickness, ease and grace. Therefore, maneuverability and agility are inseparable in a successful air-to-air engagement. These aerial confrontations are destined to occur in the heat of the ground battle.

Analyses of the modern battlefield reveal armies embattled in a series of violent, far-reaching exchanges with struggles characterized by fierce combat and soldiers inundated with exploding ordnance. For the warrior, it offers an environment that may swiftly deteriorate into a state of confusion and uncertainty. Superimpose this notional battlefield on any conceivable terrain, and the combat would not be any less intense or destructive.

This is the environment in which Army aviators will confront their most lethal adversary, the helicopter. They will face rotary wing craft that in many instances are more heavily armed, and as suggested by unofficial sources, a Soviet helicopter termed the Hokum that may possess a significant air-to-air capability. It is this threat, coupled with the inexactness and perplexity of combat, that many Army Aviation air combat advocates believe the helicopter will enter into, resulting in a close-in fight with another helicopter—about every bit as colorful and dynamic as an F-15 blasting away with 20 mm cannon in hot pursuit of a MiG 29. Be it an aviator's mind set or his fantasy, any attempt to neutralize the enemy by duplicating a fixed wing "dog fight," may result in the aviator's indelible imprint on the floor of the battlefield.

Army doctrine and commonsense dictate that a helicopter flight profile that exceeds treetop height is subject to an awesome array of ground fire. Everything from small arms fire and tank main guns, to

ZSU-23-4s (self-propelled automatic antiaircraft guns) and SA-8s (surface-to-air missiles) will fill the air. Even confrontation precipitated by a chance encounter—a meeting when initially neither has the advantage and both are apt to flee the fight—an adjustment in altitude anyway but down can expose the helicopter to many unseen ground threats. The exception would be an aviator who must perform air combat maneuvers to break the plane of security in order to shake an unexpected entangled enemy. The consequences of violating this airspace should convince the skeptics that heliborne aerial combat at altitude is fatal. An aviator who places his aircraft outside the protection of terrain to do battle with another helicopter will quickly conclude the enemy aircraft is only one of his worries.

An essential element to heliborne air-to-air combat is the use of terrain. FM 90-1 defines terrain flight as:

> The tactic of employing aircraft in such a manner as to utilize the terrain vegetation, and manmade objects to enhance survivability by degrading the enemy's ability to visually, optically or electronically detect or locate the aircraft. . . . Terrain flying, of necessity, involves flight close to the earth's surface and includes the tactical applications of low level, contour and nap-of-the-earth flight techniques. . . .

The ability of helicopters to transcend the third dimension of the battlefield provides mobility unmatched by any other branch of the Army. But, the application of terrain in helicopter aerial combat is no different than its use by the myriad of ground and airborne systems in existence today. The aviator who places terrain between himself and the threat aircraft will be able to maneuver and gain the advantage—regardless whether the action is defensive or offensive in nature.

Envision the analogy of an Air Force interceptor. The F-15 pilot's battlefield during an intercept mission over the Sea of Japan has an absence of terrain to obscure his presence, but he incorporates compact formations, radar jamming and other electronically generated deceptive measures to deny the enemy knowledge of his location. There is no physical obstruction to block threat acquisition, but the outcome is the same. He is afforded the opportunity of surprise and the ability to engage the enemy at the maximum effective range of his weapons.

Although in the final analysis, mission, enemy, troops, terrain and time will determine how air battles are fought, there is nothing magical about helicopter air-to-air combat. Acceleration is important, but speed is not a prerequisite, nor is an aircraft that can perform loops and rolls. But, the need does exist for an agile platform with a 5 to 7 kilometer acquisition range—an essential capability that allows the aviator to acquire the threat first, and thus engage at the maximum distance. Second, there is a requirement for a direct link into the Forward Area Air Defense Command and Control and Intelligence network to furnish aviators with timely information, ensure situational awareness, and provide them the capability to cue other air defense systems of an impending air threat.

Evolution of air combat systems will proceed, but the proper use of terrain always will enhance the odds for an aerial victory. Despite this fundamental approach, conjecture will continue to be the norm in the search for the optimum aircraft and employment techniques for successful helicopter aerial combat. This reinforces the importance of thorough planning and the allocation of sufficient resources for the conduct of ATAC II—a test that will examine the combined arms approach to countering a hostile air threat; it should confirm the importance of terrain flight and provide the necessary operational insights into Army air combat.

The results of ATAC II and subsequent evaluations will eliminate the controversy of helicopter combat and will be the basis for providing Army aviators with the necessary tools and tactics to defeat the heliborne threat.

VIEWS FROM READERS

Editor:

I am working on my M.A. in Vietnamese history at the University of Hawaii. Also, I'm a second lieutenant in the U.S. Army National Guard.

Currently I am conducting extensive research for my thesis; the subject deals with an analysis of the formation, organization, training and leadership of the 3d Army of the Republic of Vietnam (ARVN) Infantry Division in late 1971 to early 1972 in Quang Tri Province, South Vietnam; and the subsequent operations of the 3d ARVN Division during the 1972 Easter Offensive.

I would appreciate hearing from and talking to all MACV, XXIV Corps/FRAC, USARV and other unit people who participated or took any part in the discussion, planning and implementation of the decision to organize and equip the 3d ARVN Division in the latter part of 1971 and early part of 1972. I would also like to hear from all U.S. Army advisors who served with MACV Advisory Team 155 (3d ARVN Division's U.S. advisory team) from fall 1971 to fall 1972.

Howard C. H. Feng
1342 8th Avenue
Honolulu, HI 96816
Phone: 808-735-6958

Editor:

With the great help of hundreds of vets I've interviewed, I've written three books about the Vietnam War. I'm starting a fourth proposed book involving: a) the actions 29 March to 1 April 1970 when 2/7 Cav was attacked in its LZ; 2/8 Cav was overrun at LZ Illingworth; and the commanding general, 199th Inf Bde was killed, and b) the 1 May to 30 June 1970 incursion into Cambodia by elements of the 4th, 9th and 25th Inf Divs, 1st Air Cav Div, 101st Abn Div, 11th Arm Cav Regt, and 199th Inf Bde. Veterans please call or write anytime to arrange an interview: 220 Kingsville Court, Webster Groves, MO 63119 or call 314-961-7577.

Keith William Nolan

Editor:

The Kansas Army National Guard recently activated the 135th Aviation Battalion and the 435th General Support Aviation Company. The activation of these organizations doubles our requirements for warrant officer pilots. We need 40 part-time warrant officer pilots forthwith. We fly the UH-1H and OH-58 helicopters. Local refresher training is available.

We do not intend to rob the Active Component of pilots. But, we realize that some Army pilots are departing the Army for their own reasons. Most of the pilots in the 135th Avn Bn and 435th GSAC started as Active Duty aviators. You may be leaving the Army to continue your education. Kansas has several universities that offer undergraduate, graduate and professional education, all within convenient driving distance of the 135th Avn Bn and 435th GSAC.

We in the National Guard have the same flight hour requirements and standards as the Active Components. Our warrant officer pilots normally get 100 plus hours annually, on weekends and during 2 weeks annual training.

We are well paid. You may anticipate drawing 100 days base and flight pay for a typical year.

If you would like to explore our program and receive further information, contact 135th Avn Bn, P.O. Box 19086, Topeka, KS 66619-0086, by writing or call Commercial 913-862-0774 or AUTOVON 720-4210. Point of contact is CPT Gene T. Roles or 1LT Walt Frederick.

Lieutenant Colonel Charles R. Rayl
Battalion Commander
Kansas Army National Guard

Editor:

In the November 1986 issue of *Aviation Digest,* BG Rudolph Ostovich III published an article, "Air-Land Battle—PART I: Dramatic Changes in Emerging Aviation Doctrine." Having just returned from a KPUP training session at the NTC (National Training Center), I have a deep appreciation for the general's observations and implied concerns. It seems to me that three major endeavors stand between us and the Army of Excellence:

1. Training aviation commanders and staff to think and perform as a combat maneuver element as well as CS (combat support) and CSS (combat service support) for themselves and ground units.

2. Training the aviators and aviation personnel in their new roles.

3. Training U.S. Army commanders, lieutenant colonels and above, how to employ the combat aviation brigade (CAB) on the battlefield.

This publication normally addresses subjects regarding aviation concerns such as "1" and "2" above. As a newly assigned CAB S3, it is relatively simple to see that these two endeavors will be accomplished through the METL driven training programs and schedules. This program will be difficult and time consuming, but doable. Concern "3" above, however, is a different matter.

During our visit to the NTC we were presented with the maneuvering brigade's plan of attack. The mission was to conduct a deliberate attack into OPFOR defenses, seize and maintain control of an objective several klicks behind the OPFOR defensive position. Assets for the attack included a tank battalion, a mech battalion, a 155SP battalion, some 8-inch GS (general support) reinforcing, an attack helicopter battalion and 10 sorties of A-10 CAS (close air support) aircraft.

The plan included using the A-10's CAS on call. The attack helicopter battalion was to be employed as an overwatch force to destroy any repositioning OPFOR. The weather was terrible (no-fly) during the planning time and it was forecast to deteriorate during the night. That forecast may have been the reason for such planning of the third dimension assets, but shame on us. The "Hinds" (Mi-24 Soviet attack helicopter) flew for the OPFOR on the morning of the attack! Can you guess what happened to the two dimensional U.S. forces?

The purpose of the NTC is to train us in the most realistic combat environment possible. Execution of the plan, command and control, CS and CSS truly get a rigorous workout during the training rotation. The afteraction reviews are conducted after the mission and no punches are pulled. The program is outstanding.

We were permitted to observe the afteraction review of the deliberate attack which we observed in the morning. It took the chief controller 1 hour and 35 minutes to mention aviation. No mention was made of the fact that the Hinds were flying and that we had not committed our aviation assets. A golden opportunity existed to hammer home the air-land battle concept and was missed.

Training to fight under all conditions is not the same as training to win. My observation at the NTC is that the OPFOR is training to win and the United States is training to fight. To get the absolute maximum benefit out of this training, the thrust of the training, including the afteraction review, should be toward winning the air-land battle.

It appears to me that commanders believe if they execute the doctrine well they will win. The NTC experience demonstrated to me that the commanders must believe they can win and should use the doctrine until it fails, then we must deviate boldly. New doctrine and doctrine updates come from such experiments. The CAB provides the maneuver commander with a force that can be deployed boldly.

Using such outstanding publications as this one in leader development training programs may help raise the awareness levels of commanders. Concern "3" is a serious weakness in our training system. If it is not addressed emphatically, we will lose. The NTC proves it every day.

CPT D. K. Miner
PAARNG
28th Combat Aviation Brigade
Harrisburg, PA

Editor:

In response to Captain Brumbalow's comments in your September 1986 issue, *Defence Helicopter World* is a professional publication for the people who fly, maintain, design and build military helicopters. Those people are anything but naive.

Articles by experienced front-line commanders bring important operational concepts to American and Allied helicopter operators, and they help shape future combat rotorcraft. We have run articles by and interviews with American, British, West German, Spanish, French and other senior commanders. In no case are these leaders or their services "exploited." Their messages are important to our readers, and we're proud to have them.

There may be legitimate security concerns about the contents of *Defence Helicopter World,* but those have to be considered by the services before publication. Obviously, the Soviets see *Defence Helicopter World.* They also see *U.S. Army Aviation Digest, Army Aviation, Aviation Week* and every U.S. Army field manual they can get their hands on. There is a balance to be found between effective communication and giving too much away. Official publications can do only part of the job of communicating, and they rarely reach other countries who share U.S. interests.

Obviously, *Defence Helicopter World* is in business to make money; so is *Army Aviation, Aviation Week,* and most nongovernment publications. That does not make the information in the magazine any less valid, nor does it lessen the prestige of the contributors. *Defence Helicopter World* has only respect for its readers, and that includes a great many U.S. Army aviators stationed around the world.

Frank Colucci
North American Correspondent
The Shepard Press
Columbia, NJ

Editor:

Please print the following in the *Aviation Digest:*

Wanted! A lot of good men for activation of the Vietnam Helicopter Crewmembers' Association. This is being organized with the help of the Vietnam Helicopter Pilots' Association (Mike McDonald, president). If interested, contact me at 201 Apache St., Huachuca City, AZ 85635; or telephone (602) 456-9561.

SFC George H. Ecker (Ret)
Huachuca City, AZ

*Articles from the **Aviation Digest** requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, **U.S. Army Aviation Digest**, P.O. Box 699, Ft. Rucker, AL 36362-5044.*

PEARL'S

Personal Equipment And Rescue/survival Lowdown

PEARL'S Observations

We need an exportable aviation life support specialist course for USAREUR and other applicable areas. Although the command continues to train ALSE personnel regularly, the courses taught do not meet the requirements of AR 95-17, "The Army Aviation Life Support Equipment System Program." Is there a shortage of ALSE trained personnel in USAREUR?

We are having a problem in the training and ALSE qualification area. Our greatest hope to resolve this issue is the action being taken to establish ALSE MOSs (a career field). A practical interim solution would be an Exportable Aviation Life Support Specialist Course, such as Course No. 600-ASI Q2 funded by the U.S. Army Aviation Logistics School. The school/course would have to be funded by TRADOC and approved by Department of the Army. This action would certainly be a step in the right direction. The problem must be resolved early.

Problems with short-dated ALSE items in survival kits/vests continue to plague ALSE personnel/commanders. Items are being received that may only have 3 to 6 months service life left. Medical items have been the biggest problem, and emergency rations to a lesser degree. Is something being done to resolve this issue?

It will definitely take time but we have been successful in some areas. We need everyone's support in this area to resolve this frustrating problem. We don't have the solution yet, but certainly are aware of the need to minimize inspections and to work toward longer-life items.

Joyce Free photo by Dennis W. Thompson

Within the past several months we have heard about one aircraft crash and two aircraft emergency landings. One PRC-90 survival radio was found to be inoperative because of apparent corrosion and therefore could not transmit. Two aircraft were able to transmit to control towers, which enabled the aircrews to effect safe landings. Why are we faced with these problems?

Perhaps we can best answer it this way. Our hats are off to the aircrew of the latter two aircraft for having the knowledge and displaying the capability to effectively use the PRC-90 survival radio to contact the control towers and effect safe landings. The corrosion problem should certainly have been found prior to departing for the flying mission. We must have ALSE military occupational specialties with qualified, trained ALSE specialists/technicians if we are ever going to resolve these problems. And, we are

pushing toward that end. We need your help; let us know your problems in the field. It certainly is better to be safe than to be sorry. Point of contact is Mr. Harlyn H. Hubbs, AMCPM-ALSE-L, AUTOVON 693-3215/3817.

Why isn't there an ALSE supervisor's course at Ft. Eustis?

There is a supervisor's course at Ft. Eustis. The course is open to officers/warrant officers, and latest information has it that it is being expanded to include senior noncommissioned officers. We do not know what the designations will be but we will let you know.

What does one do when they find "fire-ants" in their helmet?

Before we delve into this one we will relay firsthand experience of what did happen and how CW4 Roger Rensvold, U.S. Army Aviation Development Test Activity, resolved his dilemma. The story unfolds—on a recent TDY trip to Florida, his helmet bag was left on the floor in a corner of the hangar. There was no other place to store the helmet—the area was clean, dry and secure—or so he thought. The next morning, the helmet bag and helmet were infested with fire ants! He sprayed the bag with insecticide but did not use it in his helmet for fear of eye and skin irritation. Several attempts to blow the invaders out with an air hose were futile; more of them just came out of hiding. What to do? The maintenance folks had a cylinder of dry nitrogen used to pressurize struts. The helmet was placed in a plastic trash bag, and as much air as possible was squeezed out. The bag was then inflated with nitrogen, and then repeated twice more to thoroughly purge the bag of air. The bag was then tied shut and it was left to sit overnight. (An hour probably would have been long enough.) The next morning dozens of fire ants (asphyxiated) were shaken out of the helmet—problem solved. The example identifies what can happen to you and the ingenuity of one crewman to solve this dilemma.

Open Letter to Captain Dale W. Clelland

We sincerely appreciate your excellent article, "Cold Weather Threat" (September 1986 *Aviation Digest*). The article should be reread several times by all of Army Aviation, as it contains many "messages" for ALSE users that certainly will enhance their survival. We look forward to more such articles.

NOMENCLATURE	SIZE	NSN	MATERIEL OBLIGATION RELEASE DATE
Boots, Flyers Leather Black	9D	8430-00-819-9314	Nov 86
	10D	8430-00-820-3659	Nov 86
	11D	8430-00-820-3583	Nov 86
	11E	8430-00-820-3584	Nov 86
	11EE	8430-00-820-3585	Nov 86
	11½EE	8430-00-820-4676	Nov 86
	12C	8430-00-820-4680	Nov 86
	12D	8430-00-820-4681	Nov 86
	7½E	8430-00-822-5334	Nov 86
Coveralls, Flyers	32R	8415-01-043-8377	Jan 87
	36S	8415-01-043-8380	Jan 87
	38S	8415-01-043-8383	Jan 87
	38R	8415-01-043-8384	Jan 87
	38L	8415-01-043-8385	Jan 87
	40S	8415-01-043-8386	Jan 87
	40R	8415-01-043-8387	Jan 87
	40L	8415-01-043-8388	Jan 87
	42S	8415-01-043-8389	Jan 87
	42L	8415-01-043-8390	Jan 87
	44R	8415-01-043-8392	Jan 87
	44L	8415-01-043-8393	Jan 87
	46R	8415-01-043-8395	Jan 87
	48L	8415-01-043-8398	Jan 87
	42R	8415-01-043-9529	Jan 87
Jacket, Flyers Nomex, Lt Wt	M-L	8415-00-217-7221	Nov 86
	L-R	8415-00-217-7229	Nov 86
	L-L	8415-00-217-7233	Nov 86
	XL-L	8415-00-217-7236	Nov 86

Materiel Release Dates for Items in Short Supply

Post and Screw Assembly (For Helmet Flyer's, SPH-4)

Effective 1 October 1986, the Defense Personnel Support Center (DPSC, RIC S9T) began accepting funded requisitions for the post and screw assembly, NSN 8415-01-092-5290. The unit price is $1.00 and unit of issue is EA.

The post and screw assembly is an organizational item. It is used to attach the chin strap, NSN 8455-01-057-3502, to the earcup retention assembly of the helmet, flyer's, SPH-4, NSN 8415-00-144-4981/4985.

If you have a question about personal equipment or rescue/survival gear, write PEARL, AMC Product Management Office, ATTN: AMCPM-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-3817 or Commercial 314-263-3817.

AVIATION PERSONNEL NOTES

Flying Duty Medical Examinations

Since 1 June 1986, and continuing through 30 June 1987, all initial and periodic Army aviator flying duty medical examinations (FDMEs) are including head and linear anthropometric measurements.

The purpose is threefold. First, linear measurement standards assure physical compatibility with Army aircraft. Second, head measurements of all Army aviators will determine those who can be fitted for the AH-64 Apache integrated helmet and sighting system. The third purpose is to obtain a complete database for all Active Army aviators by July 1987.

The linear and head measurements will assist the U.S. Army Aviation Center, Ft. Rucker, AL, and the Military Personnel Center, Alexandria, VA, to select aviators for transition training in scout and attack aircraft. Head measurements are not critical to initial aviation selection, but to ensure a complete database, they are being performed on all initial entry rotary wing students at the Aviation Center. So, head measurements are not required on Class 1 and Class 1A FDMEs at other locations.

Linear anthropometric measurements consist of leg length, total arm reach and sitting height. The linear selection standards for initial entry into Army flight training are:

- Minimum Total Arm Reach, 164.0 cm.
- Minimum Leg Length, 75.0 cm.
- Maximum Sitting Height, 102.0 cm.

Failure to meet these standards will result in medical disqualification from Class 1 and 1A flight status for anthropometric incompatibility.

Just for the record, anthropometry is defined as "the study of human body measurements, especially on a comparative basis."

Combined Arms Participation

Army Aviation Branch Chief MG Ellis D. Parker has continually stressed the need for aviation to be a fully integrated member of the combined arms team. Recognition by other branches of such critical aviation roles is evidenced by positions "outside" the Army Aviation Branch occupied by aviators. Here are examples of some such positions:

COL (P) Terence M. Henry	**Chief of Staff, 2d Infantry Division, Korea**
COL Robert A. Goodbary	**Military Assistant to the Deputy Secretary of Defense**
COL Jack L. Turchek	**Chief of Staff, 24th Infantry Division, Ft. Stewart, GA**
COL Robert S. Frix	**Chief of Staff, 1st Cavalry Division, Ft. Hood, TX**
COL Jerry W. Childers	**Chief of Staff, 101st Airborne Division, Ft. Campbell, KY**
COL Norman M. Bissell	**Executive Officer to the Assistant Secretary of the Army for Research, Development and Acquisition**

As Army aviators, we must be technically and tactically proficient in both our branch and the combined arms arena. Such proficiency is attainable, as evidenced above, and is essential to our warfighting prowess.

UH-60 Black Hawk Pilot Distribution

Due to two aircraft groundings in fiscal year (FY) 1986, the Army experienced a shortage of qualified UH-60 pilots. As of first quarter FY 1987, all major commands have sufficient pilots to operate assigned UH-60s. But the total solution is still to be completed because the current fill has required the maximum use of trained pilots.

Part of the solution has been achieved by using field grade officers to substitute for pilot shortages in company grade and warrant strengths. For the near term, most field grade officers assigned to UH-60 positions, along with all qualified company grade commissioned and warrant officers, will remain in Apache flight billets. This means that company grade commissioned officers and warrant officers will remain in flight billets rather than serve in branch immaterial or functional area assignments. Schooling will be delayed temporarily for some of these officers.

Captains will continue to fill back-to-back UH-60 assignments while lieutenants and warrant officers will receive UH-60 qualification allocation priorities at Ft. Rucker. To ensure the maximum availability of UH-60 trained aviators, General Maxwell R. Thurman, vice chief of staff of the Army, has directed that the number of UH-60 qualified pilots attending school (captains through warrants) not exceed 100 through the summer of 1987. This, coupled with deferring branch immaterial and functional area assignments for these junior officers, will assure an increase in the readiness of the aviation force and develop more technically proficient combat aviation leaders for the future. To maximize these initiatives, UH-60 pilot projections will be reviewed quarterly during FY 1987.

$2.5 Million *More* for Museum

The Army Aviation Museum Foundation board of directors announced that a military construction reprogramming request has been approved by the House and the Senate. This action allows for the expenditure of $2.5 million under the military construction program for the new Army Aviation Museum at Ft. Rucker. Details on how these funds will be administered have not been determined. The Office of the Chief of Engineers at Headquarters, Department of the Army, is working to develop these procedures.

To use the $2.5 million now available from the military construction program it will be necessary for the museum foundation to raise and have available $2.5 million in private matching funds. To date the foundation has raised more than $2.15 million in cash and pledges. We will need to raise the additional $350,000 before construction of the new facility can begin.

The response to our appeal for contributions has been excellent, but we would like to remind those who have not contributed to act now to help us to preserve our history and heritage. Though our goal is large, every amount helps in achieving success. Contributions may be made to the Army Aviation Museum Foundation, P.O. Box 610, Ft. Rucker, Al 36362. To all of you who have contributed, a heartfelt thank you. Your support and interest in the Army Aviation Museum Foundation is most gratifying.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours	Rate	Fatalities	Total Cost (in millions)
FY 86 (to 28 February)	15	593,001	2.53	8	$28.7
FY 87 (to 28 February)	12	625,335*	1.92	17	$34.2

*estimated

DES Checklist

Sergeant First Class Jeffery R. Buedel
External Evaluation Branch
Evaluation Division
Directorate of Evaluation and Standardization
Fort Rucker, AL

IN THE FEBRUARY 1986 *Aviation Digest* the "DES Report to the Field" column was entitled "Flight/ATM Records Checklist." It discussed the development of the checklist about to be used with Aviation Standardization and Training Seminars (ASTS) and Department of the Army evaluation visits. Since then, use of the checklist was implemented and a follow-up survey has been conducted.

The checklist is a guide used to help identify and correct deficiencies noted during courtesy inspections. Six different areas make up the checklist, each referring to a specific Army regulation, field manual, etc. Each of the six areas is further broken down into items evaluated during an inspection. The 1986 article also told units in the field how to get a copy.

When the checklist had been in use for 6 months, a telephone survey was made to evaluate its effectiveness. Each unit that had requested a copy was surveyed.

The survey revealed that the checklist is an excellent guide for screening flight/ATM records and also can be used as a training tool. The areas in which most units required assistance were individual flight records folder and crewmember/noncrewmember flight status. All other areas addressed by the checklist are being maintained without major difficulty.

Because of the numerous requests for the checklist, a copy is provided at right.

Questions should be forwarded to DES, ATTN: ATZQ-ESE, Ft. Rucker, AL 36362-5216 or call AUTOVON 558-4691/6571.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362-5000; or call us at AUTOVON 558-3504 or Commercial 205-255-3504. After duty hours call Ft. Rucker Hotline, AUTOVON 558-6487 or 205-255-6487 and leave a message.

1. Publications:

- ___ AR 95-1, "General Provisions and Flight Regulations," w/appropriate supplement
- ___ AR 600-105, "Rated Army Aviators"
- ___ AR 600-106, "Nonrated Army Aviation Personnel"
- ___ AR 310-10, "Military Orders"
- ___ FM 1-300 w/Ch 1, "Flight Operations"
- ___ DA Pam 738-751, "Army Maintenance Management System"
- ___ TC 1-210, "Commander's Guide"
- ___ "Military Pay Manual," Part Two, Chapter 1
- ___ Unit SOP

2. Individual Flight Records Folder (IFRF):

a. IFRF Aviator—Right Side:

- ___ Ensure the most current closeouts (DA Form 759 and 759-1) are posted on top of the previous closeouts and are in sequence.
- ___ Ensure all DA Forms 759, block 8, are signed and dated.
- ___ Ensure at least 6 months are shown in section II.
- ___ Ensure that all of the times on the DA Form 759 are rounded off in section II.
- ___ Ensure up and down slips, Senior/Master Wings, etc., have been annotated in block 17.
- ___ Ensure DA Form 759-1, block 2, has the proper sequence number. If more than one DA Form 759-1 is needed for a closeout, the additional sheets will be numbered in sequence.
- ___ Ensure that when making entries on the consolidated sheet (DA Form 759-1) a space is left between each month.
- ___ Ensure that in block 7 of DA Form 759-1 the proper sequence number is brought forward from previous closeouts.

IFRF Aviator—Left Side:

Flight

- ___ If flight records are closed out before birth month, DA Form 759 and 759-1 will be filed under the DA Form 201A marked "flight."

Medical

- ___ DA Form 4186 will be filed under the DA Form 201A marked "medical."

NOTE: CW4 Douglas V. Joyce should have been credited as author of the December 1986 DES Report to the Field, "FC 1-219, A Publication Without a Future?"

INSPECTION CHECK LIST

___ Ensure current DA Form 4186 is filled out correctly.

___ Ensure annual DA Form 4186 does not need an extension from previous DA Form 4186.

___ Ensure that copies of waivers or medical suspensions are posted.

___ Ensure commander's concurrence/ nonconcurrence is marked in Section D, lines 23, 24, 25 and 26 of DA Form 4186.

Orders

___ Ensure that copies of aviation service/flight status orders and aeronautical designation orders are filed under the DA Form 201A marked "orders."

___ If aviator is an IP, SIP, IFE or MTFE, ensure his/her initial and current orders are posted.

b. IFRF Crewmember/Noncrewmember—Right Side:

___ DA Form 759-1 is not required.

___ Ensure the most current closeouts (DA Form 759s) are posted on top of the previous closeouts and are in sequence.

___ Ensure DA Form 759s, block 8, are signed and dated.

___ Ensure at least 6 months is shown in section II.

___ Ensure all times are rounded off in section II.

___ Ensure all up and down slips, Senior/Master Wings and so on have been annotated in section 17 of the DA Form 759.

IFRF Crewmember/Noncrewmember—Left Side:

Flight

___ If flight records are closed out before birth month, DA Form 759 and 759-1 will be filed under the DA Form 201A marked "flight."

Medical

___ DA Form 4186 will be filed under the DA Form 201A marked "medical."

___ Ensure current DA Form 4186 is filled out correctly.

___ Ensure annual DA Form 4186 does not need an extension from previous DA Form 4186.

___ Ensure that copies of waiver or medical suspensions are posted.

___ Ensure commander's concurrence/ nonconcurrence is marked in Section D, lines 23, 24, 25 and 26 of DA Form 4186.

Orders

___ Ensure that termination/perform flight status orders from previous and present units are posted.

___ If termination/perform flight status orders from present unit are not posted, check to see if RFO has been initiated.

3. Crewmember/Noncrewmember Flight Status:

___ Ensure crewmembers are placed on flight status IAW AR 600-106, section II, paragraph 9.

___ Ensure noncrewmembers are placed on flight status IAW AR 600-106, section II, paragraph 10.

___ Ensure that any orders cut under section II, paragraph 11 of AR 600-106 are sent to HQDA for approval.

___ Ensure flight slots are being filled with the authorized grade and MOS.

___ Ensure a minimum of 4 hours each month are flown to qualify for flight pay. Flying time to qualify for entitlement to flight pay must be a product of the performance of duties which required the person to be placed on flying status orders.

___ Ensure flight time is not rounded up to equal the 4 hours required for flight pay.

___ Ensure 120-day notice is given IAW AR 600-106, section II, paragraphs 14 and 15.

4. DA Form 2408-12:

___ Ensure DA Form 2408-12 is filled out IAW chapter 3 of DA Pam 738-751.

___ Ensure nonaviators on flight status that are temporarily suspended from flight duties are not credited for time that is flown during suspension. The time flown during suspension will not be credited toward flight pay or time flown that month.

___ Ensure certified true copies of DA Form 2408-12 are completely filled out and signed.

5. Monthly Exception Certificate:

___ Ensure flight pay certificates are filled out and submitted IAW AR 37-104-3.

6. Individual Aircrew Training Folder (IATF):

___ Ensure DA Form 3513s are filled out and maintained IAW section VI, TC 1-210.

Aircraft Combat Maintenance/Battle Damage Repair

Major Mark W. Warner
CW3 Charles H. Brady
U.S. Army Aviation Logistics School
Fort Eustis, VA

QUITE SOON AFTER the introduction of aircraft to modern warfare, combat leaders identified the need to quickly repair combat damage and return the aircraft to battle. This factor was (and is) critical to maintain effective combat power.

Commanders at all levels quickly realized that crew chiefs, flight engineers or maintenance officers who could repair a damaged aircraft with string, paper clips, a little magic and considerable luck were highly valued commodities. These imaginative people developed numerous methods to repair damaged aircraft and to sustain acceptable operational readiness rates during the Vietnam War. Such methods were never captured in writing, and for the most part never received any engineer analysis for safety or flight worthiness. They were passed from generation to generation of repairer by word of mouth or simple observation of how it was done. Most of these procedures were never formalized and usually endured as "war stories," generally told at late hours during social functions.

To provide a modern means of sustaining required levels of aviation assets during critical time periods, the U.S. Army Aviation Logistics School (ALS), Ft. Eustis, VA, is developing the aircraft combat maintenance/battle damage repair (ACM/BDR) program. It is a series of manportable repair kits and manuals that will allow trained personnel to assess and repair damage to structures, electrical systems, hydraulics and fuel cells well forward in the combat area. Strictly speaking, it is formalizing (with engineer approval) the field expedient means and meth-

LEFT: The wire repair kit is a stand-alone, self-contained repair system. Included are all the tools and materiel necessary to repair 12 through 24 gauge wire, twisted pair wires, coaxial cable and electrical connectors.

BELOW: The test kit box, a portion of the ACM/BDR wire repair kit, contains all the test equipment, spare parts and adapters required to perform troubleshooting associated with electrical damage and repair.

ods previously used and providing legitimate repair methods, coupled with the latest technology, to maintain the highest operational ready rate possible during combat.

ACM/BDR consists of three phases: *assessment, deferment and repair.*

Assessment is the evaluation of damage and determination of suitable repair procedures, allowing for constraints of time, materiel, the tactical situation and operational requirements. Necessity, as determined by the mentioned constraints, will determine if the ACM/BDR quick fix repair methods will be applied to the aircraft or if an alternative of evacuation, cannibalization for usable repair parts or destruction will be pursued. Assessment of damage is the critical step in repairing and returning damaged aircraft to service.

Deferment is simply putting off, until time allows, services and repairs not critical to accomplish the mission. Scheduled and unscheduled maintenance, such as repairs of systems that have adequate redundancy or are not mission critical, may be deferred if safety of flight is not significantly degraded. As an example, unacceptable leak rates for seals in peacetime may be acceptable during combat operations. Battle damage to noncritical structures or to critical structures with adequate reserve strength are likely candidates for deferment until the situation permits repairs. Deferment of some repairs and some of the repairs in the ACM/BDR system will place modified operational limits on the aircraft, i.e., reduced bank angles, lower airspeeds and lower gross weights. Although the aircraft may not be *fully* mission capable, it will provide some capabilities to the commander.

The *repair* phase is the work intensive phase of ACM/BDR. The purpose of these quick fix repairs is to restore sufficient strength and serviceability to an aircraft to permit its use for additional operational missions or to permit at least partial mission capability. An additional purpose is to enable aircraft damaged beyond unit repair capability to make a one-time flight to a repair facility. ACM/BDR repairs are designed to be quick fixes using the latest in technology, capitalizing on off-the-shelf hardware, and disregarding any cosmetic criteria.

The repair kits are the essence of the ACM/BDR program. They will be suitcase size, man portable, stand alone systems. Everything, including the tools, adhesives, connectors, sleeves, plugs and rivets will be included. Instructions for their use will be in aircraft specific repair manuals. The repair kits and associated software will allow aircraft repairs to be made as far forward as the tactical situation permits.

The repair kits are being developed by the Aviation Applied Technology Directorate in conjunction with the Directorate of Combat Developments at the ALS. Current efforts are centered around the acquisition of the *electrical repair kit.* The materiel fielding plan puts this kit in the field in September 1987. The *fuel cell repair kit,* the *fluid line kit* and the *structures repair kit* also are in various stages of development. It is anticipated that the ACM/BDR program will be fielded and reach an initial operational capability in September 1990. As a side note, during the engineering development of the ACM/BDR repairs, the procedures are continuously evaluated by the U.S. Army Aviation Systems Command, St. Louis, MO, for inclusion in the daily maintenance procedures. Numerous repair methods have been adopted for daily use for inclusion in the ACM/BDR concept.

ACM/BDR REPAIR KITS

The aircraft combat maintenance/battle damage repair program will include the following repair kits:

STRUCTURES. The efforts in this program are nearing completion (winter 1986–7) with the development of both hardware (the repair kits) and software in advanced prototype. Through contracts with Sikorsky, repair handbooks for the UH-60A Black Hawk have been developed and are in final draft format. Similar efforts are underway at Corpus Christi Army Depot, TX, for the AH-1 Cobra. The actual repair kits are of a nondevelopmental nature and take advantage of off-the-shelf, state-of-the-art repair techniques that are not new, and for the most part are used daily in industry. The method of application and the combination of tools and hardware are the keys to the usability of the kit.

FLUID LINE/CONTROL TUBE REPAIR. Expeditious repairs for fluid lines, control tubes and drive shafts are being developed using shape memory alloy (SMA) couplings. These are metal alloys mechanically deformed at a relatively low temperature and returned to their original shape once heated past their transition temperature. The Aviation Applied Technology Directorate has developed couplings of a copper based alloy called betalloy that have proven extremely successful in all testing to date. Current milestones place these kits in the hands of the user in the 4th quarter of fiscal year 1987.

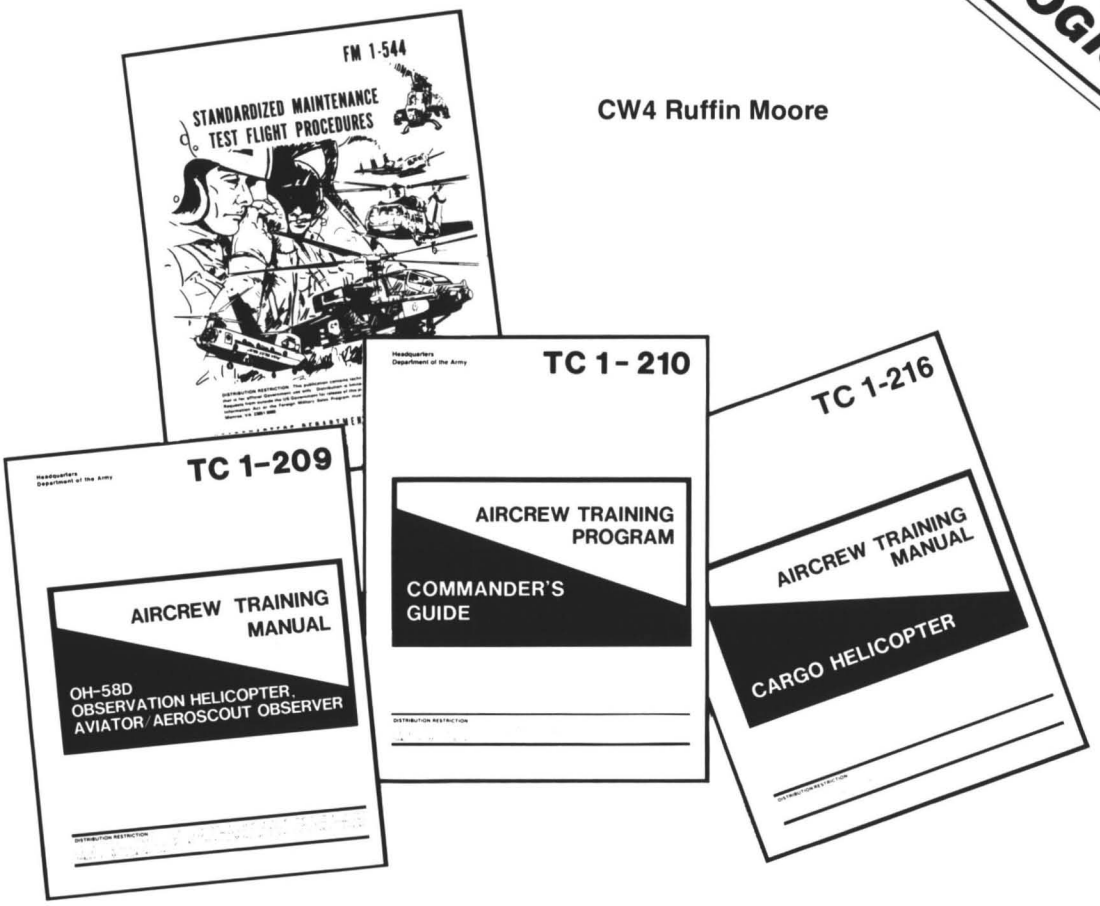
WIRING REPAIR. It is anticipated that repairing damage to wiring and couplings will be the major man-hour consumer in the ACM/BDR program. The soon to be fielded wire repair kit is designed to significantly reduce the number of man-hours required to complete these types of repairs. The wire repair kit employs an environmentally sealed wire splice that can be crimped or heat shrunk to complete the connection. The kit also contains a supply of a new heat shrink insulation tubing that has a four to one reduction rate. To save time, weight and space, a quantity of pre-made segments are included in the kit. These pre-made segments are about 4 inches in length with splices at each end to facilitate repairs that require replacing small segments of damaged wire. The wire repair kits will be in the field in the 3d quarter of fiscal year 1987.

FUEL CELL REPAIR. This kit will contain pre-made patches and adhesives to repair fuel bladders, metal fuel tanks, "wet wing" type fuel cells and the new composite external fuel tanks. It has incorporated a new adhesive (developed by Goodyear) that needs little surface preparation and has a short cure time. In fact, the adhesive will work with the damaged area wet with fuel.

FOR THE FUTURE. The Aviation Logistics School has continued to pursue the ACM/BDR program into the future and has begun to supplement kits with advanced repair techniques as they are developed. Efforts are underway to supplement the current structures repair kit with the capability to repair composite materials. Work is continuing in developing short cure time adhesives and bonding materials along with repair techniques that will allow for rapid field repair of modern composite materials. In response to the inclusion of fiber optics in proposals for future aircraft, a fiber optics repair kit is in the early development stage. Plans are to include the optics repair techniques to the existing wire repair kit.

The final hurdle to overcome in successfully fielding the ACM/BDR system is sustainment training. Once the skills of assessment and repair use have been mastered by the soldier, there is no current method to sustain those skills at an acceptable level. Suggestions range from letting the Air Force teach continuation training in concert with their battle damage repair effort, to providing outdated aircraft from the moth ball fleet to be shot up and repaired by the field units; all are currently being evaluated. Efforts are also underway to include ACM/BDR skills in unit ARTEPs (Army Training and Evaluation Programs). *We are looking for good ideas. Please forward suggestions to: Commandant, U.S. Army Aviation Logistics School, ATTN: ATSQ-CDM (ACM/BDR), Ft. Eustis, VA 23604.*

As the air defense threat becomes more lethal and helicopters become more sophisticated we can expect that a large number of aircraft will return from missions with battle damage that will require some type of repair before the aircraft can return to combat. The intensity of future conflicts will also significantly impair the ability of maintenance organizations to provide both unit and intermediate maintenance support. ACM/BDR will provide aviation units with a means of sustaining the required operational ready rate and ensure adequate aircraft are available for the battlefield commander.



CW4 Ruffin Moore

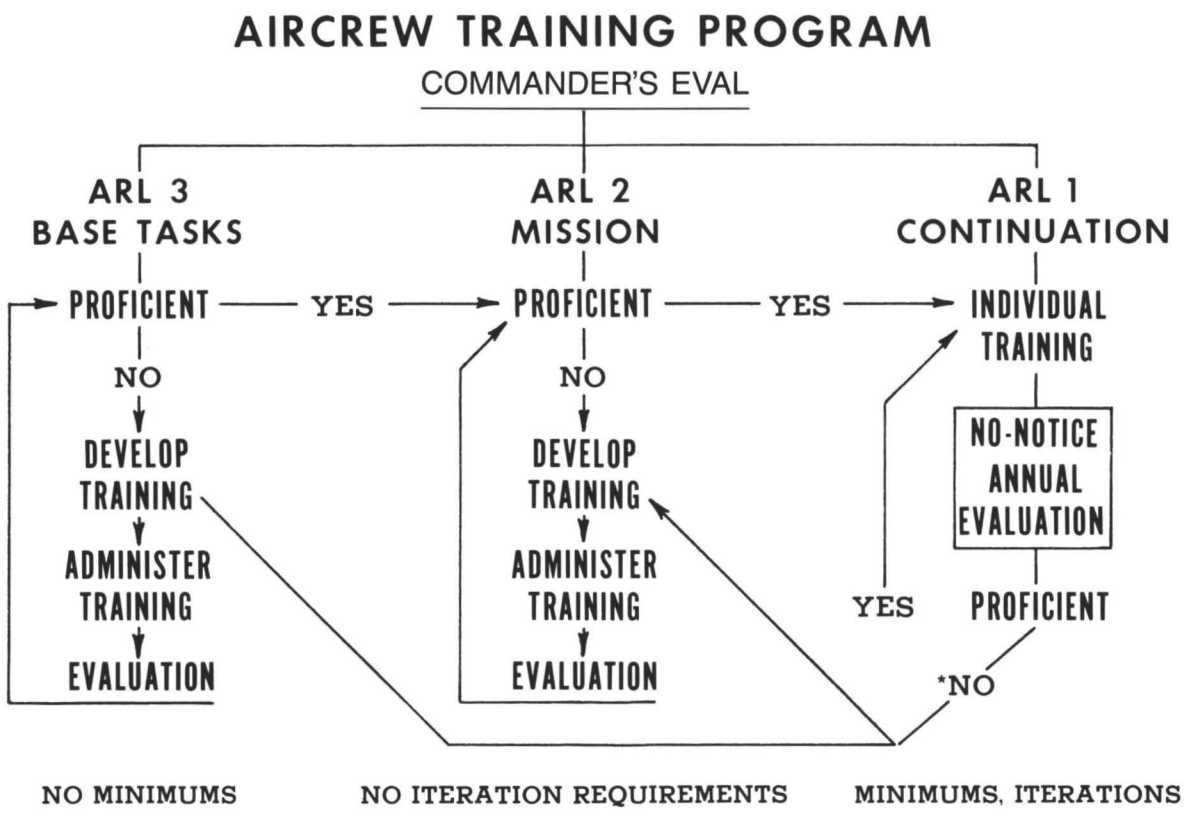
Maintenance Test Pilot and the Aircrew Training Program

DURING THE LAST few years while visiting units, the Directorate of Evaluation and Standardization (DOES), U.S. Army Aviation Logistics School, Ft. Eustis, VA, has noticed a lack of understanding of the aircrew training program (ATP) and its effect on maintenance test pilots (MTPs). The following may help clear up some questions and at the same time assist commanders in properly integrating MTPs into their standardization programs.

The ATP is a training program implemented by Department of the Army to provide standardized training objectives for all Army aviators. The ATP is a criterion-referenced program that is continually evaluated and reviewed by the Directorates of Evaluation and Standardization (DES, Ft. Rucker; DOES, Ft. Eustis) based on user input and doctrinal change.

Simply put, criterion-referenced training is the identification of the task to be done, the conditions that must exist to do the task, and the performance standards to which the task must be done.

This discussion pertains mostly to the MTPs, but with minor modification the same type of program



***IF AN AVIATOR IS REMOVED FROM ARL 1 STATUS BECAUSE OF LACK OF PROFICIENCY, HE/SHE STILL HAS THE SAME ITERATIONS, FLYING/SFTS HOUR AND AAPART REQUIREMENTS.**

can be established for aviators in any table of organization and equipment/table of distribution and allowances (TOE/TDA) position.

There are three sources of tasks for MTPs:

- The appropriate field circular (FC) (aircrew training manual (ATM)).
- Field manual (FM) 1-544 (previously FM 55-44).
- Additional tasks not listed in either the ATM or FM 1-544. The additional tasks are those making up a unit's recurring mission in which the commander feels aviators must be proficient. Since additional tasks are not published anywhere, the commander must develop the task, condition and standard for each.

From these three sources commanders can develop the most important part of the ATP, the commander's task list (CTL). A CTL is developed for each TOE/TDA position in accordance with FC 1-210. It consists of:

- Base tasks.
- Special mission tasks.
- Additional tasks.

Base tasks are tasks in which MTPs must be proficient to safely operate the aircraft. They are identified in the specific aircraft ATM, *and they are mandatory.*

Special mission tasks are those in which MTPs must stay proficient to accomplish their assigned missions within the unit. There are two sources for spe-

cial mission tasks for MTPs—the aircraft ATM and the appropriate chapter of FM 1-544. Special mission tasks from the ATM are not mandatory until the commander identifies them as such for the particular TOE/TDA position. *But, as long as an MTP remains on test flight orders, all tasks in the appropriate chapter of FM 1-544 are mandatory.*

Additional mission tasks are unique to each unit's mission. The commander will identify the additional tasks required for each position. *Once identified, these tasks become mandatory.*

The CTL for MTPs should minimally consist of all base tasks and all tasks from the appropriate chapter of FM 1-544. Selected special/additional mission tasks are added at the discretion of the commander after evaluating the MTP's mission for the unit. Consideration should be given to the day-to-day function of maintenance personnel. In addition to being aviators, the MTPs may be responsible for scheduling maintenance and aircraft, troubleshooting aircraft malfunctions, and taking care of personnel. Keeping special/additional tasks to a minimum will help MTPs maintain flying proficiency and perform their everyday jobs.

After establishing the CTL, commanders can develop a training program for MTPs to progress through aviator readiness levels (ARL) to continuation training.

In ARL 3 (refresher training) status, all aviators must demonstrate proficiency in all base tasks (see figure). During this portion of the training cycle, the aviator will fly only with an instructor pilot (IP) or instrument flight examiner (IFE). Once base task proficiency is demonstrated, the aviator progresses to ARL 2.

In ARL 2 (mission training) status, MTPs separate from the other aviators. Here MTPs not only work on special/additional tasks but also begin to work with the maintenance test flight evaluator (MTFE) on test flight proficiency. Test flight training and special/additional task training can be done simultaneously. Both the MTFE and the IP must recommend ARL progression for the MTP to progress to continuation training.

One of the biggest questions that occurs during the ARL 2 training phase is, "Can MTPs be placed on maintenance test flight (MTF) orders in this training phase?" The answer is a qualified "yes." The only requirements for being placed on MTF orders are that the MTPs successfully complete an MTF evaluation and the IP and commander feel they are capable of operating the aircraft as command pilots during the MTF.

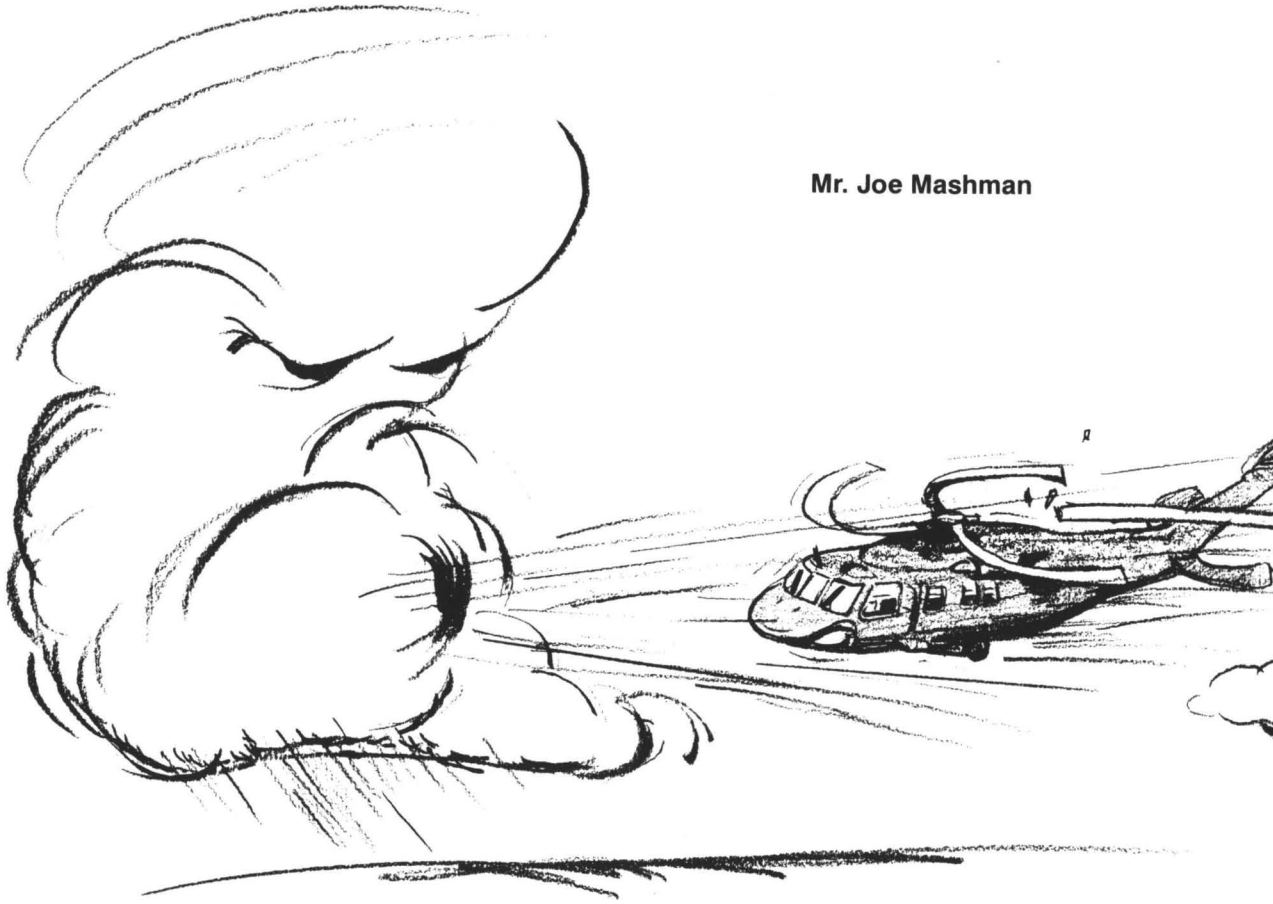
After completing the test flight and other special task training, MTPs progress to ARL 1 (continuation training) status. Before progressing to ARL 1 status, the aviator has no iteration or hour requirements. In continuation training, iteration and hour requirements are established and prorated, if required, in accordance with FC 1-210 (see figure).

Once MTPs are in continuation training, they must complete all requirements of their annual proficiency and readiness test, including an annual MTP/MTFE evaluation. They are also eligible for no notice evaluations in both pilot and MTP proficiency.

The ATPs allow commanders to design a training program for each TOE/TDA position so that each position can best be used to support the unit's mission. By tailoring the MTPs' program to concentrate on test flight duties, commanders allow MTPs to concentrate on their jobs (test flying) just as other pilots in the unit concentrate on their jobs (tactical flying). This releases the MTPs from some of the tactical missions required of others. It does not make MTPs second-class aviators—just differently task-oriented aviators.

ABOUT THE AUTHOR

CW4 Ruffin Moore is a CH-47 SIP/MTFE assigned to the Maintenance Test Flight Standardization Division of the Directorate of Evaluation and Standardization, U.S. Army Aviation Logistics School, Ft. Eustis, VA. For more information about the author please call AUTOVON 927-6166.



Mr. Joe Mashman

Helicopters and Turbulence

The *Aviation Digest* and its readers thank Mr. H. J. Leech, editor of the fine Canadian aviation safety magazine *Vortex* for permission to reprint this article by Mr. Joe Mashman who holds a very important place in the history books as a helicopter pioneer. Already an established engineering test pilot with Bell, working with airplanes like the Airacobra, Kingcobra and the jet P59 Air Comet, Mr. Mashman joined the helicopter division in 1945 and was immediately involved in the Bell Model 30 which would lead to the Model 47, and the first ever certification of a civil helicopter. He went on to become Bell's chief demonstration pilot and flew in just about every country in the world, including the Eastern Bloc. His passengers have included Harry S. Truman, Dwight D. Eisenhower and Lyndon B. Johnson.

Mr. Mashman was closely associated with the early development of the 206 and is one of the few people who can tell you what it's like to operate a C-18 Jetranger at 20,000 feet in the Himalayas—without oxygen! After a career spanning 40 years and 20,000 hours, 16,000 of them in helicopters, Joe retired from Bell in 1982 as a vice president. He is still actively involved in aviation, working out of Fort Worth, as a consultant.

You can be sure that when he writes of turbulence and wind shear he does so, not just from the textbooks, but from personal experience. Literally, his article can save your life.

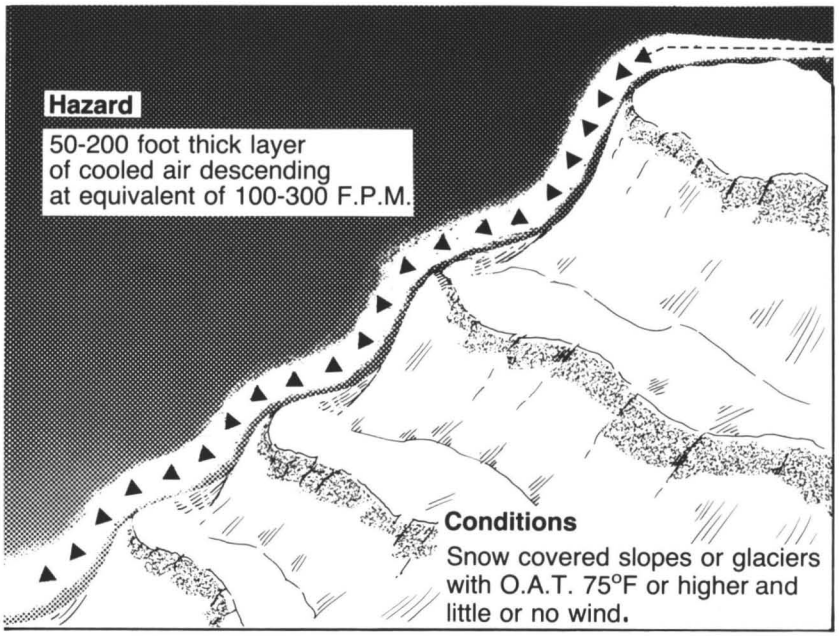


FIGURE 1

AS A RESULT of a series of widely publicized commercial air transport accidents and near accidents that have been attributed to wind shear and downburst atmospheric conditions, it is timely to examine their effect on the rapidly increasing numbers of rotary wing aircraft.

Historically, fixed wing pilots upon transitioning into helicopters have been impressed with the noticeably lesser effect of turbulence on the aircraft. While this is true, wind shear and downbursts are a different matter and in some respects can more greatly affect the helicopter than high speed fixed wing aircraft.

Before discussing the manner in which this happens, let us examine some of the conditions that produce turbulence and the atmospheric phenomenon known as horizontal and vertical wind shear. The most common causes experienced by helicopter pilots are irregular terrain when combined with strong surface winds, gradient winds, temperature inversions or thermal convection movements that in some instances can occur close to snow-covered or glacier slopes (figure 1). All these conditions can be cause for concern. However, research shows that the most dangerous conditions can prevail in the vicinity of warm and cold fronts, thunderstorms and other rain-producing clouds some of which may not have necessarily grown to thunderstorm intensity. Frontal passages are often accompanied by wind velocity changes as well as directional changes. These shifts can occur along the entire frontal surface that separates warm and cold air and pose a particular threat to aircraft flying within 1,000 feet or less proximity to the ground, which is the most common regime of flight for helicopters.

Records show that wind shear hazards can exist for up to an hour or more after passage of a cold front. The potential for a hazardous shear increases with the magnitude of temperature difference across the front. A rule of thumb is to be on the alert if the temperature difference exceeds 15 degrees Fahrenheit (F) and its movement is 25 knots or more. In the case of a warm front, the most critical period can exist up to 6 hours prior to frontal passage. Typical warm fronts produce significant changes in wind velocity with little change in direction. Warm fronts can produce more dangerous wind shears than cold fronts. Both cold and warm fronts, even when dry with little or no associated weather, can produce violent shears.

Now let us examine the anatomy of some of these most dangerous forms of wind shear involving severe down drafts that meteorological terminology refers to as downbursts and microbursts.

Figure 2 shows the wind characteristics involved in both downbursts and microbursts. The principal difference is that downbursts affect a surface area of up to 15 miles in diameter, whereas microbursts are smaller and affect a surface area of approximately 1 to 2 miles. The hazardous elements produced by both of these phenomena become a concern to low-flying helicopter pilots when one realizes that 1,000 feet per minute (fpm) downward movement of air, and in some instances vertical velocities of 2,000 to 3,000 fpm, can be encountered within 200 feet of the terrain, thereby posing the potential for *forcing the helicopter into the ground.*

For the loaded helicopter, downward velocities approaching 1,000 fpm can be a serious threat to safety when close to the ground. Also, an accompanying wind shear of 30 knots or more could cause the air-

craft to exceed its placarded red line speed. This could impose structural strains on the airframe and rotor system. But of even greater importance is the possible effect on controllability in two areas. Exceeding Vne [velocity never to exceed] by 20 to 30 knots even for a short duration could produce severe retreating blade stall with accompanying severe pitchup and roll. On some types of helicopters, a light gross weight can result in an aft center of gravity (CG), and there could be insufficient forward cyclic to offset the severe pitchup.

To avoid flight into hazardous conditions, we must examine the most common cause of downdrafts. When a column of rain is seen falling from a cumulus cloud, it is quickly cooling the surrounding air, increasing its density. If sufficiently dense, this column of cool air can become an intense local downdraft. If the helicopter pilot cannot find a place to land and avoid this hazard but elects to fly "special VFR" (visual flight rules) through this local heavy rain downpour, he may not encounter a severe downdraft, but another hazard that a recent National Aeronautics and Space Administration study indicates could affect rotor lift and drag, thereby adding to wind shear problems. This condition results from a buildup of rain on an airfoil that could result in up to a 30 percent loss of lift and up to 20 percent increase in drag. So for you special VFR pilots, avoid flight into these visually recognizable hazardous conditions.

What can we expect if one inadvertently flies into a low level downburst or microburst condition? In addition to the controllability problems, upon entering the severe downdraft, the helicopter will sink with startling suddenness that most likely will result in one being thrown upward against the seat restraints. Unless you can outclimb the downdraft or quickly fly through it, you can expect to be forced into the ground with dire consequences.

The most severe burst conditions are produced by intense thunderstorm activity. However, dangerous conditions can be produced by cumulus and towering cumulus clouds. Devastating downdrafts can be encountered when flying through seemingly innocent rain showers emanating from these clouds. Another form of violent downdraft can be produced by the phenomenon known as virga. This condition is most commonly encountered in arid regions when rain originating from high-based clouds evaporates before reaching the ground. You can expect such occurrences when surface winds are light, with temperature above 80 degrees F and the spread between the dew point and temperature exceeds 35 degrees F.

What can we do to minimize the adverse affects of dangerous wind shears? The most important rules govern airspeed and power employment. If flying at an aft CG, fly well below red line placard speed allowing a 20- to 30-knot margin for encountering head wind shear that could result in placard exceedence. If a severe downdraft is encountered, employ maximum power and establish a best rate of climb speed. Do not allow your speed to drop any further even if you continue to experience a sink rate. If ground contact cannot be avoided, maintaining your best rate of climb speed will provide you the capability of initiating an effective flare to lessen ground impact.

In summary, a helicopter pilot has only two alternatives to counter hazardous wind shear—avoidance and excess power. Since most helicopters do not have excess power to counteract high sink rate downdrafts, the only real alternative is **AVOIDANCE!**

FIGURE 2

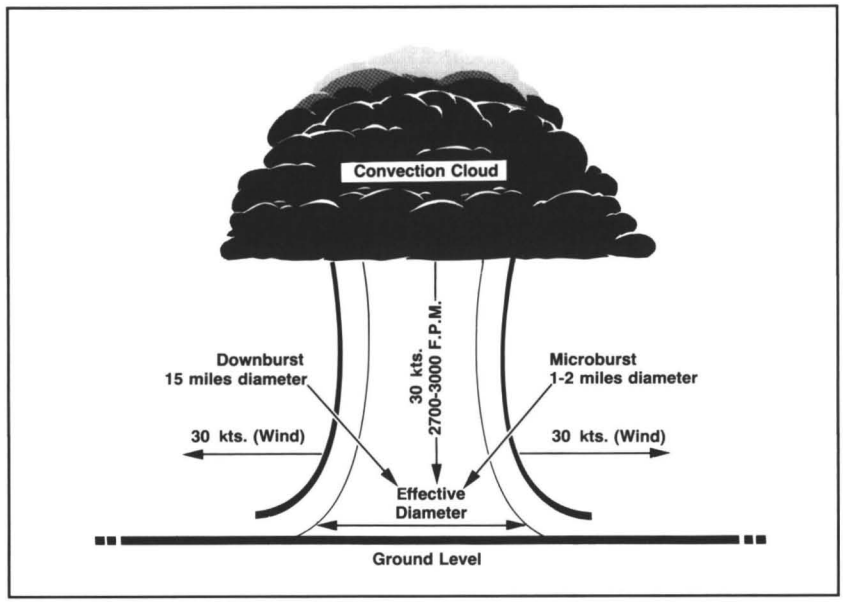
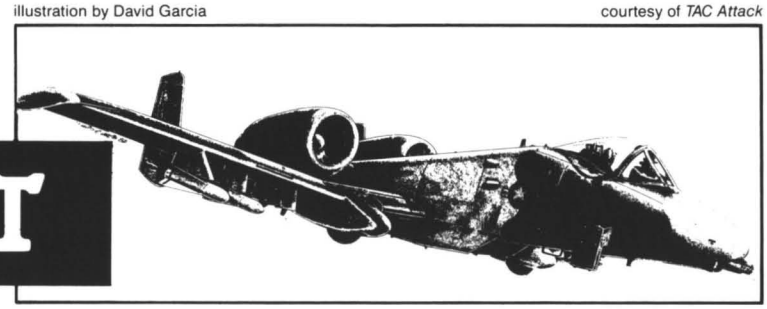


illustration by David Garcia courtesy of *TAC Attack*



A-JAAT

Lieutenant Colonel Kenneth R. McGinty
First Lieutenant Eduardo Gutierrez

THE JOINT AIR attack team (JAAT) is certainly not new to the U.S. Army's attack helicopter elements. But, with the emergence of the AH-64A Apache attack helicopter, we may just now be realizing its full potential on the battlefield.

The AH-64, with its sophisticated weapons systems and fire control, provides ground commanders with a true synergistic, lethal and efficient tank-killing team. More importantly, the Apache brings with it a totally new dimension to the old JAAT concept. Along with its cohort, the U.S. Air Force's A-10 Thunderbolt, the AH-64 ensures greater efficiency and effectiveness by achieving total integration and distribution of fires on the battlefield.

The advanced-JAAT (A-JAAT) concept reduces the possibility of multiple hits on destroyed targets. Further, it improves both fire distribution and the artillery lethality prospects for altering the enemy scheme of maneuver. A-JAAT now can respond to the spontaneous JAAT requirements of the battlefield with a greater degree of efficiency. It expands the utility of JAAT from the standard old front line's less survivable, defensive battle into the more progressive high pay-off scenarios. These could include some day/night cross-FLOT (forward line of own troops), rear battle, guard and exploitation missions.

The Apache's technological enhancements, complemented with improved onboard weapon systems, have transgressed the previous JAAT boundaries. Before the Apache arrived on the scene, the primary attack helicopter was the AH-1 Cobra in one of several configurations. Its antitank weapon (TOW missile) was limited to day only line-of-sight engagements and therefore made the Cobra vulnerable to small arms fire and antiaircraft systems. The Cobra also had to rely on roads, streams or other less defined terrain features to divide kill zones and distribute fires.

Maneuvering the Cobra to subsequent battle positions was difficult and time-consuming. Also, it was difficult for the A-10s to get into the battle other than by keying off the AH-1's direction to the target area. AH-1 keying was the A-10's best prospect for initial target acquisition due to the Cobra's faster low level airspeeds and the Thunderbolt's inability to maintain a precise location during the spontaneous scenarios (all compounded by the requirements of map reading, jinking and woffer-dills to avoid threat air defense artillery systems). Coor-

dination problems, at this juncture, are compounded by all of these difficulties. The result is excessive and unnecessary radio communication among all aircraft involved with the battle. Thus the JAAT effort often is degraded to the point of confusion—culminating in little or no team coordination and ultimately turning into a two-party independent attack. But, with the AH-64's target acquisition and designation capabilities, coupled with the Air Force A-10 and Pave Penny advancements, the team can produce more effective fire power on the battlefield. Thanks to its improved optics and night vision systems the Apache can now detect, identify and destory enemy armor at more extended ranges.

During the day battle the target acquisition designation system and day TV provide the AH-64 gunner with a 126X power capability. At night the Apache's 36X power magnification forward looking infrared is used to find, identify and engage targets. With these advanced optics the Apache gunner can engage targets well outside the range of most direct fire and antiaircraft systems, thus ultimately improving the team's battlefield survivability.

Specifically, the AH-64, unlike the Cobra, is not limited to terrain features or other types of landmarks for dividing or sectioning kill zones. The Apache's onboard laser designation system provides the crew with several options in A-JAAT. It can be used to designate targets for the A-10 and almost any other "fast mover." This expands the possibilities of the JAAT by incorporating many aircraft variances.

The laser also can be used for rangefinding specific targets for employment of laser guided bombs, artillery, the 2.75 inch aerial rocket, and of course the 30 mm cannon, available in both the A-10 and AH-64. Numerous A-JAAT exercises conducted with various A-10 units have experienced great success with the laser designation capability. So far, A-10 pilots have been able to acquire AH-64 laser designations well beyond visual range from the target area via the use of the Air Force Pave Penny laser receiver/tracker.

Coupling these laser systems adds an entirely new dimension to the JAAT. It affects survivability, effectiveness and efficiency by improving the target hand-off to the A-10s. In several reduced visibility scenarios we found that we can enhance the capability of the team with "Blind Bogie Shots" for the GAU-8 and Maverick missiles. This means that the A-10 pilot need not be in visual contact in every case with the target. Often all that is required is to shoot at the spot that appears on the pilots heads-up display.

The improved Maverick can lock on armored targets well beyond the pilot's ability to see them with magnified optics. When the designating Apache or laser-augmented scout lases the point target, the A-10's Pave Penny tracker allows the pilot to home his aircraft onto the target until identification or "missile lock" and then to attack with much greater efficiency than is possible without the helicopter support. The AH-64's laser also provides for designation of its antitank missiles, a passive laser seeking missile capable of destroying all types of tank armor in use today at ranges in excess of 6 km. The stand-off ranges of both A-JAAT antiarmor missiles, coupled with laser accuracy, facilitate the precise maneuvering of the A-JAAT. This results in more time to attack the enemy in the kill zones.

New venues for deeper cross-FLOT JAAT are evolving. The Army has just begun working with F-16 units to further assess the potential of helicopter and fighter-bomber hookups. At this juncture, it appears that the interdiction mission of the Air Force could be enhanced by AH-64 crossings of the FLOT and lasing specific targets for pinpoint accuracy of laser-guided munitions. Although not fully evaluated yet, the concept appears valid and will truly extend the reaches of both Army and Air Force commanders.

The A-JAAT concept goes a long way in reducing the communication and confusion of the spontaneous JAAT. The Army currently is working with new radio procedures with the A-10s to reduce the radio traffic to only three radio calls: *thunder, spot* and *lightning*.

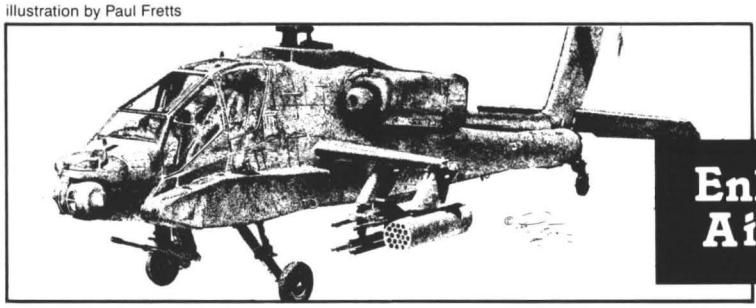
The *thunder* call means the A-10 is inbound toward the kill zone and will be bumping for a laser spot by means of the Pave Penny system. This call also cues the Apache to unmask and designate a target for the A-10.

The second call, *spot*, indicates to the Apache crew that the A-10 gunner is in fact receiving laser energy and, depending upon the mode of attack (gun or missile), has identified a target. This call also gives the Apache crew clearance to either acquire another target in preparation for a second A-10 attack or to remask.

The third call, *lightning*, signifies to the AH-64 crew that the A-10 gunner has attacked and is breaking off the kill zone or target for either a subsequent pass or termination of mission. In either case, the call clears the Apache crew to shoot into that particular kill zone if desired. At this juncture these three calls are the only radio transmissions needed among the A-10s, Apaches and the scout/forward air controllers.

Not to belabor the point, but, the laser has added another dimension that in the past has been treated as an aside during the JAAT. Artillery, with its modern munitions and extended ranges, provided a JAAT operation the extra bit of punch that is often times needed to chan-

illustration by Paul Fretts



Enhancing the Joint Air Attack Team

nelize the enemy. With advanced optics the Apache gunner can acquire, engage or segregate threat forces long before they enter the engagement area. The early effective employment of artillery fires buttons-up threat armor, deceives them, forces them to move out of march formation, destroys their radar dishes, rips off their antennas and alters their will to fight.

The Army has integrated live-fire artillery into its JAAT training scenarios. By coupling its modern munitions, the Field Artillery proves to be an important asset to the JAAT. Although artillery is not a new ingredient of the JAAT, in the past the Army did not have the ability to capitalize on its accuracy. Before the Apache, artillery effectiveness was less than today and compounded by the errors of map-reading skills at long distances. Now, the AH-64's sophisticated laser rangefinder designator and its doppler and attitude heading reference system provide precise eight-digit coordination for artillery adjustments. Also, by sectoring the target for the A-10s, the Apache crew provides positive separation from friendly artillery fires.

Thanks to the combination of these three combat assets, *advanced attack helicopters, close air support airplanes and artillery*, orchestrated with the Army's formidable ground force potential, ground commanders are provided with an extremely mobile, lethal, effective, efficient and flexible force that they can change to meet their needs or to create a battlefield in their favor—thus epitomizing the air-land battle!

ABOUT THE AUTHORS

LTC Kenneth R. McGinty commands the 3d Squadron, 6th Cavalry Regiment, 6th Cavalry Brigade (AC), Ft. Hood, TX, which is the first tactical unit to field the AH-64 Apache (formerly the 7th Squadron, 17th Cavalry). An OCS graduate, he has commanded both mechanized infantry companies and attack helicopter companies. Before assuming command of the 3-6th Cavalry, LTC McGinty served as the force integration officer for attack helicopters in the office of the Vice Chief of Staff.

1LT Eduardo Gutierrez is the attack platoon leader for A Troop, 3d Squadron, 6th Cavalry Regiment, 6th Cavalry Brigade (AC). A 1983 ROTC graduate of Corpus Christi State College, this is his first assignment.

Flight Data Recorders To Be Installed In Army Aircraft

Major John C. Mainwaring and Mr. Billy H. Adams

SINCE THE FIRST Wright Flier accident at Kitty Hawk, there has been a keen desire to understand flight profiles and system status prior to impact. The hope was that with this knowledge the cause of an accident could be determined and a permanent engineering solution or a change in pilot technique or procedures could avert a similar occurrence in the future.

The Federal Aviation Administration (FAA) recognized years ago that to develop safe and reliable public air transportation, a major effort would be needed to accurately determine the cause of any commercial airliner accident. Therefore, two important actions were taken: 1) the Department of Transportation set up the National Transportation Safety Board as an independent agency for the investigation of all transportation accidents; and 2) the FAA required installation of flight data recorders (FDRs) in the commercial airliner fleet.

This initial FDR monitored five channels of data by physically inscribing the information on a metal foil strip. However, reading this metal tape information was a difficult, labor-intensive task. Recent advances in technology and the need for additional information have led the FAA to require all new commercial airliners to be equipped with a magnetic-type tape recorder that records a minimum of 11 channels of data.

The information obtained from FDRs has become an important investigative tool and, when used in conjunction with other information such as physical evidence, results of teardown analyses and eyewitness accounts, it gives a clearer understanding of the causes of an accident. Again, while never intended to be used as a *sole* source of information for accident investigation, flight recorder data helps reconstruct events leading to the mishap, thereby providing focus and direction for conducting the investigation.

All three military services (Army, Navy and Air Force) have desired at the time of an aircraft mishap that an FDR or similar device had been onboard. But, with the exception of those few aircraft that were instrumented for flight tests, military accident investigation teams have had little data on pre-accident flight profiles and systems status (information reports) to help them better understand the circumstances at the time of a mishap. While the services recognized the need to determine the cause of mishaps, it has been difficult to justify operational funds for occurrences of relative infrequency.

About 4 years ago, the military services attempted to promote a standard FDR for use in all military aircraft. The Air Force took the lead and developed a crash-survivable solid-state FDR for the F-16 aircraft that served two purposes: preservation of accident

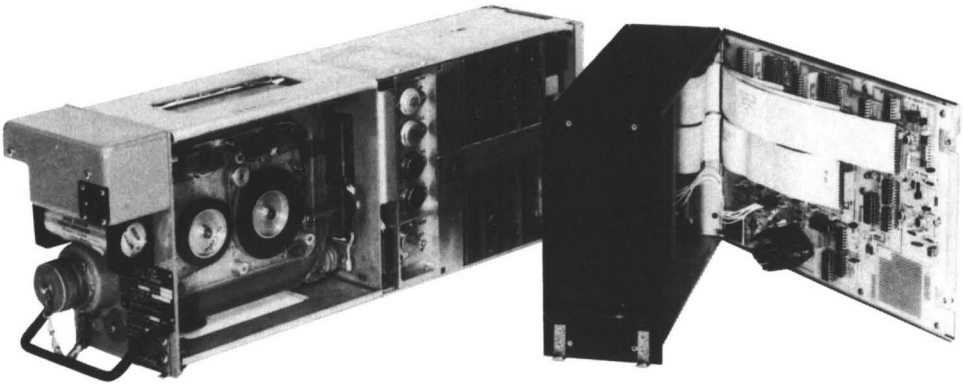


FIGURE 1: The flight data recorder and the expansion unit make up the flight recorder system for the UH-60.

data and accumulation of maintenance data. However, the F-16 recorder has not met the Army's needs for its helicopter fleet.

Since the inception of the United States Army Safety Center (USASC) and tracking of mishap data, the need for FDR information has been recognized. However, the lack of funds for FDR installation and the relatively simple design of the existing helicopter fleet led the Army to develop and rely on accident investigation techniques to determine accident causes. In the last 14 years, however, a total of 373 Class A through C aviation mishaps have occurred (17 percent of the total mishap picture) for which the cause could not be determined using these techniques. The cost of these unsolved mishaps was nearly $208 million.

The advent of much more sophisticated helicopters, with hybrid flight controls and flight control computers, has hampered the ability of investigation teams to always determine mishap causes, using the current investigation techniques. The increased violence of the accident sequence in which today's aircraft are involved is also reducing readability of physical evidence at the mishap site, a key source of technical information.

The need for FDRs has been further highlighted by several unsolved Class A UH-60 Black Hawk accidents during the past 4 years. In response to these unsolved mishaps, Army Chief of Staff General John A. Wickham Jr., in March 1986, directed immediate installation of FDRs in UH-60s flying high-risk missions. This authorized the Army to immediately procure 200 off-the-shelf standard magnetic-tape FDRs for the high-risk-mission UH-60 fleet and mandated development of a solid-state crash-survivable FDR designed specifically for helicopter operations.

The solid-state FDR will be placed in all UH-60s, all AH-64 Apaches and in other specified Army helicopter fleets as the FDRs become available.

Selection of the magnetic tape FDR (figure 1) for installation in the UH-60 fleet was made based on its immediate availability and its flexibility, allowing it to be tailored to UH-60 requirements. The magnetic-tape FDR works on the same principle as a reel-to-reel type recorder, with the exception that the magnetic tape is housed in a container that can withstand crash forces and postcrash conditions.

The magnetic-tape FDR unit records 14 analog signals and 52 discrete signals focusing on suspected problems of the UH-60. The analog signal is a continuous data stream, such as rotor rpm, while a discrete signal is simply the record of a switch or light being on or off. These signals include: aircraft attitude, flight profile, crew response/control inputs, and selected systems' status. Each channel receives an electrical signal from a particular sensor that describes an aircraft parameter. The FDR receives signals from each sensor at a specified rate and, with its built-in logic, determines the validity of the data, converts each signal to a binary code, and writes that code in 64 12-bit words per second onto magnetic tape. The magnetic-tape FDR records 25 hours of flight data and weighs about 25 pounds. This unit will be installed in the avionics rack in the aft transition section of the UH-60.

The solid-state FDR is the newest type recorder system to come into service. It acquires data in the same manner as the magnetic-tape unit, the difference being the increased data-acquisition capability and the medium used to store information. The solid-state FDR will be able to record about 40 analog signals and

FIGURE 2 (above): Flight data recorder connected to the copy recorder to download flight information.

FIGURE 3 (left): A safety specialist will operate a readout and test unit to read the flight information out of the flight data recorder and convert it into engineering units.

150 discrete signals of data. The storage medium for this FDR is nonvolatile computer chips, housed in a compartment that also is able to withstand crash forces and postcrash conditions. Due to weight restrictions, electronic storage space is limited and data compression techniques are employed to store the data. Data is sampled continuously, but stored in memory only when it exceeds the selected threshold consistent with the accuracy requirements for the specific data channel. The chief benefit of the solid-state FDR is its ability to handle increased channels of data and the presumed higher reliability of a purely electronic system over a mechanical system.

In the event of an Army helicopter mishap, the USASC will be responsible for retrieval and analysis of the FDR information. Once USASC determines a mishap aircraft is equipped with an FDR, a team from USASC will either remove the FDR or use a copy recorder to copy the information onto a tape, figure 2. The copy tape will duplicate the binary or raw data contained on the FDR tape. In either case, the FDR information will be shipped to the Army Safety Center. An IBM PC computer will be used to read the copy tape or the FDR, figure 3. A software program will read each bit of information and, through mathematical conversion, will translate the binary data into engineering units. At this point, a printout can be made showing a time history of the aircraft flight. Analysis of this information can reveal the events that preceded the mishap. The findings of the analysis will be forwarded to the investigating team to assist in the mishap investigation.

The data from the FDR has many applications, and is only limited by the number and types of parameters sampled and the capability of trained personnel and their equipment to manage and analyze the data after it has been retrieved. However, the current focus of the FDR is for accident investigation. Initially, only Class A, selected Class B, and B-E mishaps with catastrophic potential will be investigated. We anticipate that this will be expanded to all Class A-E mishaps as resources become available and are dedicated. The USASC is currently developing a data management plan to implement this concept in the future.

It should be noted that while FDRs are valuable in reconstructing flight history, they can never be a sole source for determining the causes of accidents. Information from the FDR is an important investigative tool that must be used in conjunction with other information such as physical evidence, results of teardown analyses and eyewitness statements.

The cost and long production lead times of today's modern Army helicopters require that we actively seek ways to reduce unnecessary waste of resources. Today, with the advent of flight control systems such as fly-by-wire, fly-by-light, flight control computers and the like, there are very few physical clues left to show what the aircraft was doing before the crash. It is for this reason, and the quest to determine the cause of every accident so as to reduce the loss of life and machine, that flight data recorder acquisition is so important. The UH-60A Black Hawk, for example, has experienced several catastrophic accidents and their causes are unknown. Our inability to precisely determine what is causing departure from controlled flight has been expensive in both lives and equipment. The FDR is not expected to identify the problems, but it will point investigators and engineers to the area creating the problem and indepth analysis may then lead us to the means by which the problem can be corrected.

ABOUT THE AUTHORS

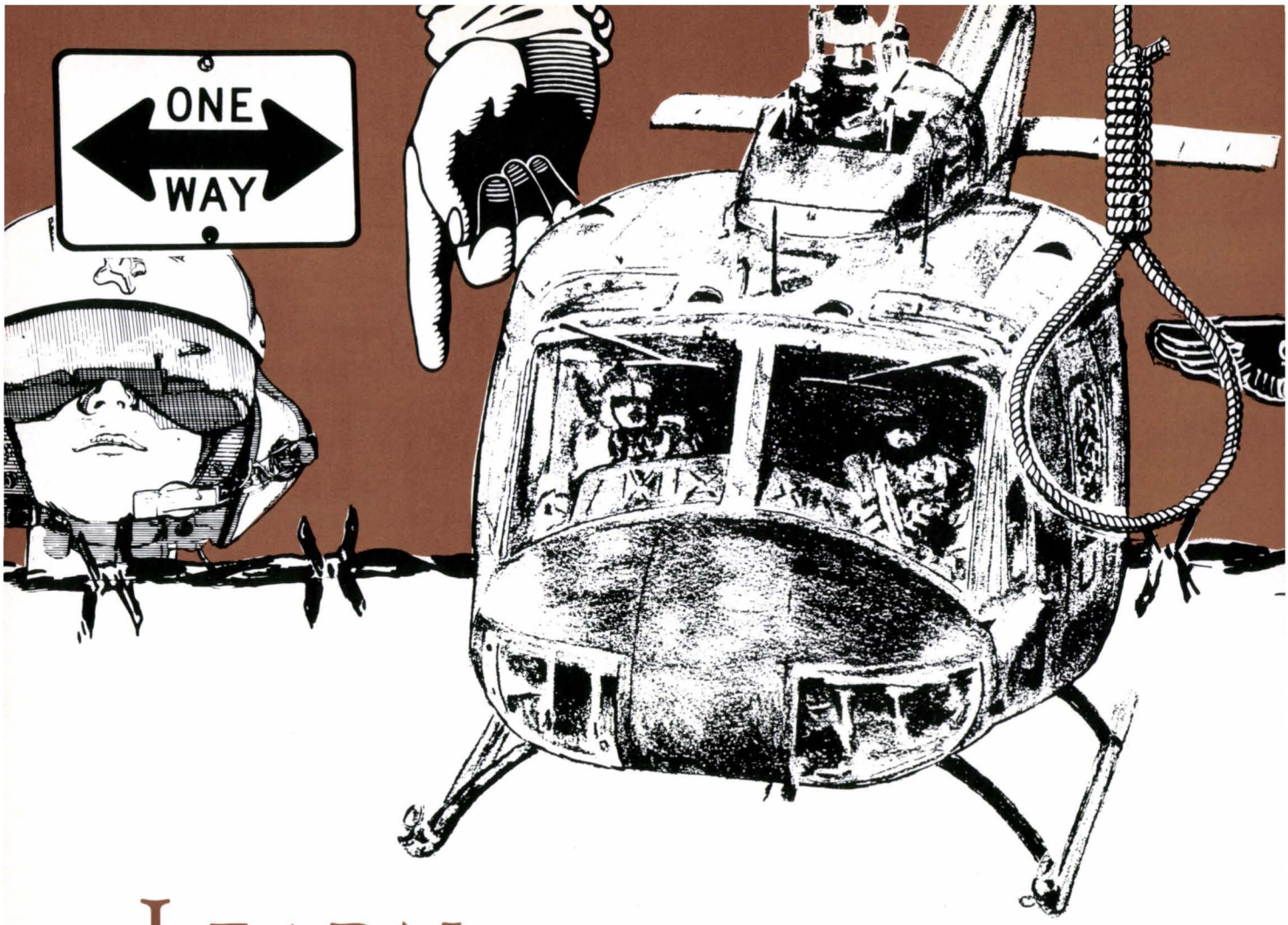
Major John C. Mainwaring graduated from the United States Military Academy at West Point in 1974 with a B.S. degree in engineering. He completed his master's degree in aeronautical engineering at the Naval Postgraduate School in 1984.

Major Mainwaring has served as an aeronautical engineer at the U.S. Army Safety Center since November 1984. His prior assignments include both armor and aviation unit experience with the 1st Cavalry Division, 8th Infantry Division and the 9th Infantry Division.

He has been awarded the Ranger Tab, Parachute Badge and Senior Aviator Wings.

Mr. Billy H. Adams graduated from Auburn University in 1962 with a B.S. degree in mechanical engineering.

Mr. Adams has served as an aerospace engineer with the Army Safety Center since 1974. Prior to this he worked as an aerospace engineer with the National Aeronautics and Space Administration, Huntsville, AL.



LEARN FROM MY MISTAKES

CW2 Charles E. Butler
Directorate of Training and Doctrine
U.S. Army Aviation Center
Fort Rucker, AL

MONTHLY WRITING AWARD

THERE I WAS, late at night—out of pitch, power and ideas. One moment warm and fuzzy flying a good ol' UH-1 Huey, the next dropping like a streamlined footlocker into the remote mountainside I knew lay below, but couldn't see. The blinding red light and the blaring audio of the low rpm system stiffened my muscles and seemed to command my body in precise responses, much to my brain's bewilderment. Those responses were made for no apparent reason; I couldn't see and things were happening much too fast as we dropped lower and lower. When I thought it was time, I pulled pitch. Thank God I was right!

GLOSSARY

rpm	revolutions per minute
NBC	nuclear, biological and chemical
TOC	tactical operations center
recon	reconnaissance
LZ	landing zone
NAVAID	navigational aid
AGL	above ground level
NDB	nondirectional beacon
ADF	automatic direction finder
yaw	turning by angular motion about the vertical axis

I can't say this is the only story I have about a close call, but it's one of the best for sharing. In this comedy of errors, tons of mistakes were made, and most before we left the ground. I'm the type that needs answers when something goes so wrong. After considerable thought there were some important lessons pulled from this ill-fated mission. In fact this experience did more to shape my future habits than any other single event in my flying career. First, let's take a blow-by-blow look at the entire story as I remember it. Then, we'll put a finger on some of the causes.

A May Morning In 1980, 1000 Hours

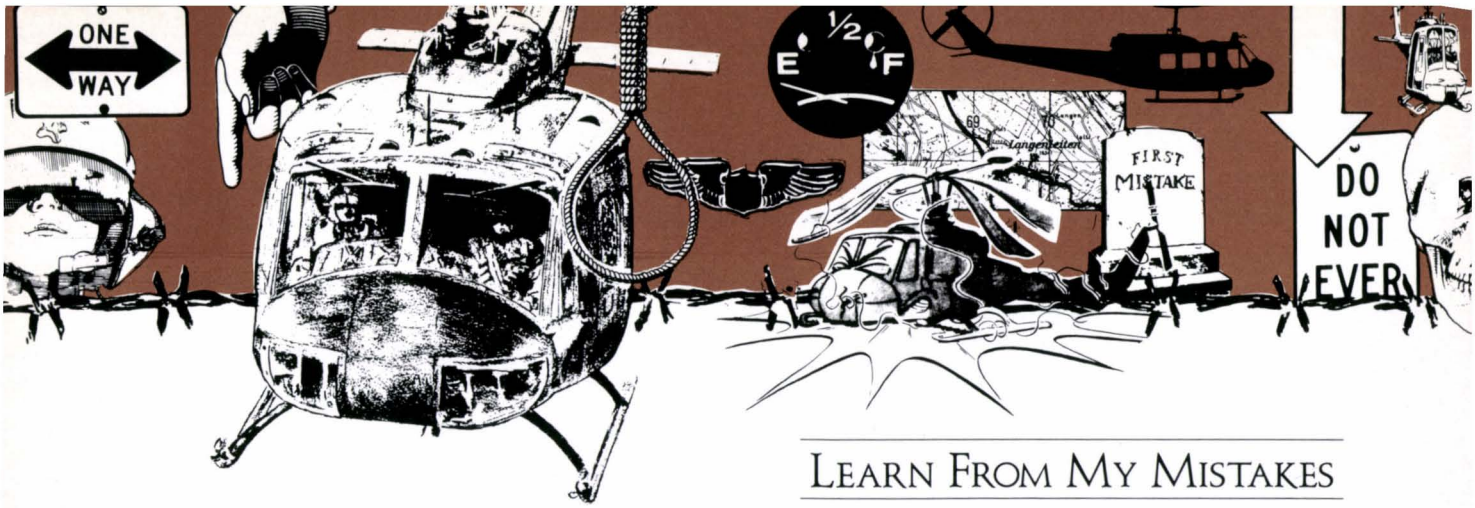
There were only two of us in the tent, myself and good ol' Howard. The others in the platoon were out on missions. This was the first big field exercise for the pair of us. Howard was fresh from flight school. Having much more experience (I'd been out of school for 5 months) I had a set of newly signed pilot in command orders as proof of my expertise. Even if the ink was still wet, it was all the proof that Howard needed of my competence. Now that I think about it, our "vast" experience was probably why we were the only ones left in the tent—or the bottom of the barrel.

It was about 1000 hours and I was waking from a long sleep after our all night movie marathon. One of the guys in the flight platoon brought his VCR and TV, which ran great from our beautiful new generator. Boy, what a life.

Ring! Ring! Ring! Oh God, the field phone!

"Please not another NBC alert," I was so tired of being gassed!

We both stood still as if it would go away as long as it didn't know we were there. I kept hoping Howard would bend to the pressure before I would, and answer the darn thing. Most likely whoever answered would be sent on one of our opera-



LEARN FROM MY MISTAKES

tion officer's famous gopher runs. Howard finally broke.

"Mr. Howard, sir."

His expression signaled doom as he listened intently. Slowly his doom changed to excitement, and I knew I should have picked up that phone. Sure as shooting he had got that one in a million shower run. What luck!

"Chuck, we got it. We got a mission!"

"All right, let's go!"

We were as happy as two punks at a weenie roast, rushing to get dressed so that we could proudly march to the operations tent and officially receive the details of this historic event.

Confident is the best way to describe the way we marched through the wet German woods that morning. It was about halfway up to the tent that I realized just how great a guy that operations officer really was. He had waited to find exactly the right mission for us young pups. It would be easy enough to ensure success yet still worth a swell of pride—what a life!

"Golly, are you excited?" Howard asked as I untangled myself from the ever-present concertina wire that surrounded the TOC.

"No, it's all right, I do this all the time," I assured my copilot.

We flung open the tent flap, and strode in with an air of ownership. There under the dim light was "Big Mike," one of the older, more experienced pilots from the other platoon. Sipping on a cup of mud black coffee, Mike explained why we had been summoned. He needed one more crew for the night operations he had been conducting, and we were the last two warm bodies in town.

The mission sounded simple at the time. We were to pick up a German recon team and drop them behind enemy lines on the other side of a slightly mountainous area, in a river valley, at night, with no lights; then, find a remote pick-up zone for the extraction of another team, return for gas and start the second half of the night's mission, two more teams.

"That's it? I thought it was going to be hard."

That statement got a stern look from Mike. Each part of the mission depended on the timely completion of the other. Starting at midnight gave us just about enough time to do our thing and allow our ground troops to establish themselves before dawn. There would be no time for dumb mistakes or wasted time, Mike had been doing a good job all week and didn't want us to mess up the record. Somehow when I thought of making a mistake, a vivid mental picture of me staked to an ant pile would come to mind. Still no big gig, we could handle this one.

The next many hours were spent squeezing every drop of planning knowledge our pointed little heads contained. At about 2000 hours, it lay before us—THE PLAN (THE as in ONLY). As we surveyed the fruits of our labor, my thoughts turned to that swell of pride I had experienced as a child after coloring my first picture. I remember it as a masterpiece, but what does a 4-year-old know about art? At least, the plan was done and it was ours—not that anyone in their right mind would have wanted it.

2400 Hours At The Initial Pickup Point

So far, so good. We had successfully flown the first 15 kilometers (following chalk #1) and were loading our brave German passengers. Minutes later the two Hueys were lumbering into the dark sky ahead. Being the critic that I am, I immediately noted the inaccuracies of the

weatherman. Always the optimist, he had given us 500-foot ceilings and no less than 1 mile visibility. It looked worse to me. No big gig; we had a plan.

After some 10 minutes had passed, Big Mike's voice came over the radio saying goodbye, and his aircraft leaned into a turn. This was it, our security blanket had just made a hard left, and we were on our own. The pressure was on as we continued with our master plan. The concentration and teamwork was immense as we marked, then verified, every lump, bump and ground light with a position on our map. The plan was proving flawless, thus far, and only one key checkpoint lay between us and our first LZ. In a matter of minutes we would know for sure.

There it was in front of us, the final checkpoint into the LZ.

"Start the clock, turn left to 085, and slow to 70 knots," I said.

Howard's execution was perfect. Had we been talking ourselves into being lost? In 1 minute, and 30 seconds, we would know for sure. My body seemed as tight as the skin on a snare drum.

"Thirty more seconds Howard, slow down."

My eyes were darting from left to right looking for a small open field. "It's so dark down there, can you see it?" The silence was deafening.

"There it is. I got it Chuck," came over the intercom.

As I exhaled, 1,000 cubic feet of air must have come out in relief. We had made it, man-whata-plan! All we had to do now was land and cool it over to the next pickup point.

0040 Hours Short Final (First LZ)

"That's it Howard, make it slow. The before landing check is complete."

The ground was slowly coming into view now. The German troops, having been alerted to their impending dropoff, were getting ready for a cold week in the woods.

Then it happened, a destroyer of great plans, the glint made only by glass and moonlight flashed from the LZ perimeter. "AMBUSH!" We all came to the same decision together. "Go around—takeoff—it's an ambush," came out of my mouth just as my copilot was pulling in power to make the climb out of the little hover hole.

In the back the German commander was jumping up and down seconding my motion for not landing. Now was the time to cough up some ideas to salvage this mess. I couldn't believe how inconsiderate the bad guys had been. I surely didn't need this kind of problem on my first big night mission.

I gave Howard instructions to hold over an open area well away from the enemy position and then started talking to the German commander. We needed another LZ, and we needed it fast. Part two of this mission wouldn't wait for us and fuel was wasting. Our friend in the back quickly selected an LZ, and I rushed a new plan for finding it. But, it would put us far off our intended (planned) route to the next pickup point. Oh well, we had to try. With the new LZ found and our troops on the ground, I looked at the clock again, "20 minutes late, we can't follow our planned course." I drew a straight line from our new position to a point just short of our next PZ. In this effort to make up our time, some great checkpoints had to be left out. So much for our dynamite plan. For now it was just wasted paper.

Minutes that seemed like hours passed and there it was, our new checkpoint. "That's the town, Howard. Pass to the north and look for a huge river. We need to turn right when it takes a sharp turn to the south."

At the bend in the river Howard executed my instructions to the tee. Only 6 minutes and we would (should) see an elongated open field with a blue strobe signal from our troops on the ground, if they waited. We were now 35 minutes late and they were to wait only 30.

Everything seemed to be matching up on the map, at least as well as I could tell without the map recon we had repeated for our original plan.

"There's a long field coming up in front, Chuck, is that it?"

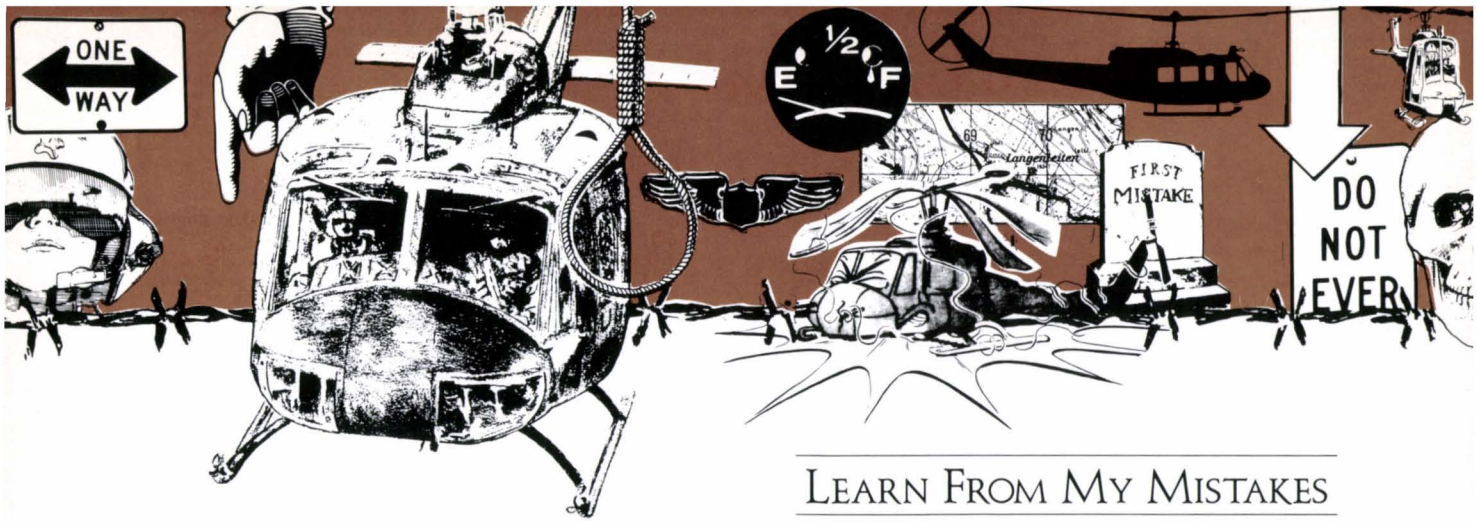
"Should be, everyone look for the blue strobe." No strobe! Damn! What to do now?

"Turn around, go back to the river. Let's make sure this is it." We couldn't make our Danish friends walk just because we messed up in navigation, so we just had to be sure it wasn't our fault. One more time Howard followed my instructions and it lead us to the same long open field, again with no blue strobe. Circling the area in hopes of a signal, an interesting idea crossed my mind—check the fuel you idiot! Damn it—420 pounds, and me not really sure of my position after all this searching.

"Howard, it's time to go back for some gas, turn 030 degrees and tell me if you cross a big river."

0130 Hours

"Here's the score, Howard. If we are where I hope we are, it will take us roughly 30 minutes to get to the Ansbach airfield for some gas. Then we can continue the mission. In the meantime we have to get every inch out of this helicopter that we can on 400 pounds, just in



Learn From My Mistakes

case I'm wrong. I want you to get 105 knots (max range airspeed) and that 030 heading. It should get us into the ballpark. I'll dig out some maps and try to get a NAVAID or good checkpoint for a direct run into Ansbach."

Now, in the mountains south of our destination we both noted that the weather was quickly going from bad to worse. In my mind I knew that the second part of the night's mission would not be flown, and for now I would be happy if we could just get back to Ansbach. This was certainly no place to land for any reason. No ground lights meant no people. There was nothing but trees and rocks below and I knew it, even though we couldn't see them. If I was correct we were about 300 feet agl, skirting the base of the overcast and occasionally able to see 1 mile. Behind us lay the river valley, totally socked in now, with our troops on the other side. Oh well, they would still be there tomorrow.

0150 Hours

"If I'm right I should pick up the NDB any time. Keep your eyes open, maintain 030 degrees, and don't run into anything, Howard?"

"Sure, Chuck, no problem."

I bent over the ADF radio, hoping to Bell that I could tune Ansbach NDB and we would be close to the proper heading. The last 400 pounds of fuel in a Huey goes fast when it's dark. My concentration was focused on the search for a few simple Morse code letters as I carefully dialed the radio back and forth over the Ansbach frequency. Only static, but this was no time to give up hope. More concentration was in order. After minutes of being off the map it was becoming clear that the only good way to find Ansbach was by this radio beacon or luck. My total concentration was in listening for a few dots and dashes. For now, there was no Howard, no helicopter, only me and that radio. ***BEEEEP! BEEEEP! BEEEEP!***

"God Chuck, this suckers going to quit!"

I looked up to confirm what my copilot had just screamed over the intercom. Sure enough, we were going down and going down now. Squinting, in an effort to see the engine gauges with the bright red low rpm light glaring in my eyes, I could barely see the needles but sensed their movements. It took only seconds to add up the score: *We had a YAW + low rpm light and audio + engine gauges moving down + dropping + "This sucker's going to quit!"* ***ENGINE FAILURE!***

"I have the controls. Howard, get the transponder up!"

For some unknown reason I started a right-hand turn and struggled slightly to get 70 knots for my autorotation. Looking over at my copilot I noticed a silly grin, a somewhat lost look, and the transponder in normal. "Howard, get that transponder up—*emergency!*"

I knew what was below and with all the stories I had heard of landing in the trees I was sure that we probably wouldn't be able to make any radio calls after impact.

"Chuck, are you sure?"

"Never mind the damn transponder, just get the lights on!"

My right arm started a slow rearward movement causing the aircraft to decelerate—still not able to see our landing site.

"The lights, Howard, damn-it, the lights!"

The searchlight flashed on as I began to pull the collective to soften the blow. What luck we were about 15 feet from the surface of the only open field for miles and seemed to have power again. Not trusting this untrustworthy engine I landed

quickly before it gave up for good.

"What in heck is wrong with you? When I say '*transponder*' and '*lights*,' I mean right now!"

I couldn't believe it. Howard still had that silly look on his face as if to communicate that he had no earthly idea what was going on.

"Chuck, what are we doing here, and why did we do what we just did?"

"Howard, we just had an engine trying to quit on us. It went off and for some reason we got it back! You're the one that told me this sucker was going to quit!"

"Oh no, Chuck. I said this sucker is really *quick*, not going to *quit*! I was beeping it down to save gas, and it just shot down to the stops. That's when you took over and started that autorotation. I thought you saw our troops and were swooping down to pick them up. I just couldn't understand why you wanted the transponder and lights."

We had successfully completed what is best described as an autorotation with your eyes closed—and lived.

This was no time to argue, who knows how far to go. I took the searchlight and swung it from left to right for a quick recon. Talk about luck. There in front, by no more than 50 meters was the biggest set of wires I had seen in a long time. I thanked God, turned, and took off.

Well, we made Ansbach without further incident. It was a very tense and silent trip. I just couldn't talk to my copilot. Upon arrival at Ansbach, we received orders from our boss canceling the rest of the mission due to weather.

It was time to go home. "Thank God!"

For months I cringed when my name was called for a mission. The effects of our romp through the air were slow to wear off.

LESSONS LEARNED

Even the untrained eye can spot some of the errors that almost led two young aviators into permanent retirement. But, just for grins, let's look at the ones I categorize as most important to *not* repeat.

LESSON NUMBER ONE: There are no simple missions. Each and every one is deadly serious. One mistake of the right kind and you are a statistic. The biggest mistake I made was to think that it wouldn't happen to me.

CREW MIX: I thought this meant putting a warrant and a captain in an aircraft. Guess I was wrong. As the mission difficulty increases, the necessity for someone on that aircraft knowing what's happening increases. Once the mission has launched, it's too late to consider crew mix, and believe me it'll come back to roost.

EGO: What can I say. A pilot's ego is what makes him or her what they are—up to a point. The thing to remember is: dead pilots have no egos. I learned to ask for help when planning unfamiliar missions, and have tried to make it easy for new folks to approach me for ideas.

MISSION/CREW MATCH: Aviation is a deadly business. Forgetting that the sky plays for keeps is a mistake when deciding when and who to send on a mission. A factor I incorporated into my evaluation of peacetime missions is: *there is no reason in peacetime to take undue risks with peoples lives while training.* If you are concerned about the ability of a crew to safely complete a mission, the time to say so is before takeoff.

PRIOR PLANNING: How many times have you heard, "always plan an alternate"? That means in training too. Had we planned for all the reasonable events that could arise, we would have had alternates planned, saving time and fuel. Simply put, had we applied all the lessons in TC 1-201, "Tactical Flight," I probably wouldn't be writing this. Rule of thumb: *never, but never, have only one way out of any situation.*

COCKPIT PHRASEOLOGY: A few simple words almost cost lives. We all want to sound cool in the cockpit, but believe me, it's much better to sound professional. Cool is one thing, but dead cold is another.

CREWCHIEFS: They don't deserve to be put through all the dumb mistakes they quietly sit through. During our whole affair, my crewchief never said a word. Remember the other people on the aircraft when you make your bold and brave decisions to be bad dudes or dudettes. Starting with my next mission brief I included an invitation to the entire crew to sing out whenever they were concerned with the flying. At that point I would either explain it to their comfort and satisfaction or would discontinue it. It's amazing how much those crewchiefs know and can help when given the chance.

Well, enough is enough. There are more mistakes we could bring up, but the biggies are in print. I bet you're wondering why anyone in their right mind would willingly tell on themselves after such a screwed-up mission. It's easy for me; if there is anything more important than my ego, it's you. I'll also ask you to share your experiences with the rest of us. Just send them in to *Aviation Digest*. [P.O. Box 699, Ft. Rucker, AL 36362-5044.]

I want to leave you with one last thought: *Learning from someone else's mistakes is a whole lot safer than making your own.*

ATC ACTION LINE

FLIP Update

Mr. Forrest H. Helfenberger
U.S. Army Aeronautical Services Office
Cameron Station, Alexandria, VA

HOW MANY TIMES have you been caught on an annual checkride looking for something in FLIP (flight information publication) that isn't there? It had either been relocated/deleted/erroneously omitted or had never been there in the first place. In an attempt to keep you informed as much as possible as to what's happening, we plan on publishing a FLIP update column about every 6 months. Mini updates will be published in the flight information bulletin (FIB) and later consolidated for the ATC Action Line articles. The format will consist of:

• RECENT FLIP—Changes that have occurred and been published within the last 6 months.

• NEAR FUTURE FLIP—Changes that have been approved but are on administrative hold and normally will be published in about 6 months; but, confirmed dates will be included when known.

• FUTURE FLIP—Will contain approved changes that require longer periods of time to implement, normally between 1 and 2 years.

RECENT FLIP:

• High Altitude Planning Charts, United States—Published August 1986. It is a good chart for planning long-range flights. The contrasting colors have been selected for future Hi and Lo En Route Charts.

• DD Form 175—Separate instructions to assist Army aviators in filling out the flight plan have been published in the FIB TB AVN 1-2012, 2 September 1986.

• VFR Arrival Departure Routes, Korea—A new product published in July 1986, to assist aviators in Korea. It contains appropriate routes, checkpoints and procedures necessary for safe operations in and around high-density and prohibited areas. Plans are underway to incorporate all helipads/heliports information pertinent to Korea.

NEAR FUTURE FLIP:

• Content Arrangement of IAP (instrument approach procedures) Books—A reformatting of the legend, general information, table of contents, etc., will occur. The order in which things will be published is too extensive for this article; but, refer to the FIB for a complete listing.

• Supplement Indexing and Cross Referencing—The U.S. IFR En Route Supplement will have an index published between Section A and B. This index will provide a cross reference for city names that are not the same as the airport names.

FUTURE FLIP:

• Hi and Lo En Route Charts—Will contain new colors, less clutter, latitude/longitude at key intersections, etc.

• Standardization of FLIP and NOTAM Abbreviations—Plan to standardize as many as possible among the International Civil Aviation Organization, the Federal Aviation Administration and the Department of Defense. There always will be a requirement for some differences.

• Radar Only IAP Charts—At locations where there are no other instrument approaches, individual charts will be published in the volumes along with the nondirectional beacons/very high frequency omnidirectional ranges, etc., for other locations.

• Revision dates for IAPs, standard instrument departures and standard terminal arrival routes. When changes are made, the dates will be published along the border of the chart. This will alert pilots to recent changes.

• ENAME En Route Chart Lo 5 and 6—Will be printed head to foot. This will facilitate cockpit use. More charts are being looked at for possible change.

Many other recommended changes are being considered. Please refer to the FIB to keep abreast and continue to send us your suggested improvements. The majority of what we change is based on *your input*. Remember, FLIP IS YOUR PRODUCT!

Readers are encouraged to address matters concerning air traffic control to:
Director, Aeronautical Services Office, Cameron Station, Alexandria, VA 22304-5050.