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AVIATION DIGEST

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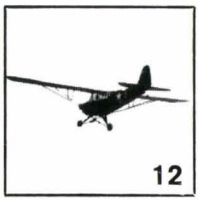

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BICENTENNIAL 1775-1975
UNITED STATES ARMY

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MG William J. Maddox Jr.

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U.S. ARMY AVIATION CENTER
BG James M. Leslie

EDITOR, U. S. ARMY AVIATION DIGEST
Richard K. Tierney

ABOUT THE COVER

There is a parallel relationship between the helicopter on the cover and nap-of-the-earth (NOE) flight tactics. Just as the artist's final strokes have not been applied—neither has the last word been written on NOE doctrine! This issue opens a four part series that will share with you the thoughts of those who have vital interests in applying airmobility to achieve combat effectiveness in a high threat environment

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, AL 36360.

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Welcome, Army ROTC Cadets

IN THE NEXT few weeks you will be engaged in an intensive effort to attain the standards required of an officer in the Army of the United States. You will be associated with some of the finest young men in America.

As a member of the Army ROTC, you are a part of a long tradition of excellence which has contributed significantly to the effectiveness of the Army and the progress of the Nation in both war and peace.

The skill and understanding which you will acquire at camp will be of benefit no matter what career you pursue. Awaiting you is an opportunity only available to few Americans. Make the most of it! Make the most of yourself!

GEN W. E. DePUY
Commanding General
U. S. Army Training and
Doctrine Comand
Fort Monroe, VA

IT IS A PLEASURE to add my welcome to General DePuy's to the many thousands of young men gathering this month and next at ROTC cadet camps at Ft. Bragg, NC; Ft. Riley, KS; Ft. Lewis, WA; Ft. Benning, GA; and Ft. Knox, KY.

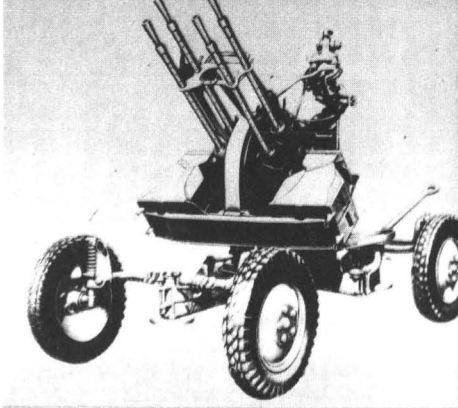
Most of you are getting your first opportunity to live and train on an Army installation and to see firsthand today's modern Army in action. One of the things you will notice is that the modern Army is placing heavy emphasis on airmobile operations.

Army aviation is not a branch, such as Infantry or Armor. Rather, it is integrated into all parts of the Army concerned with combat operations. Army aviation is cosmopolitan in nature. The combat arms all have a stake in airmobility and will be expressing their views in a series of articles the DIGEST begins this month and will be carrying in its next three issues. The theme is airmobile tactics, with emphasis on nap-of-the-earth (NOE) operations.

I urge you—and all who are associated with Army aviation—to read this series on airmobility in which ground commands will be reflecting their points of view on airmobile tactics. Special arrangements have been made so that the AVIATION DIGEST's tactics series will be available to you.

This comprehensive exchange of views on airmobile doctrine is intended to benefit all who are on active duty, striving to increase the credibility of our Army and to ensure that it is capable of meeting and destroying the very real, formidable strength of our potential enemies. Among the many cadets training this year are the future officers who —should the occasion arise—will meet the enemy challenge in combat. The tactics you use will most certainly include airmobility . . . and much of this doctrine may spring from articles you read in this tactics series.

MG WILLIAM J. MADDOX, JR.
Commanding General
U. S. Army Aviation Center
Fort Rucker, AL



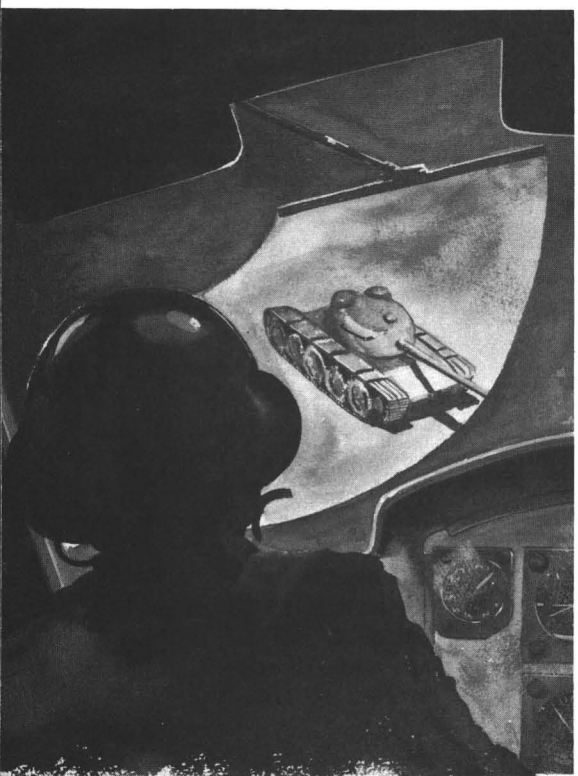
TO THE COMBAT soldier, tactics is the basic stock in trade. It is the means by which he accomplishes his mission. It is the way he survives to fight another day.

Tactics also is a "sometime thing." What works on the battlefield today may be passe tomorrow. What doesn't work today may be great tomorrow. This is because of the infinite number of battlefield variables such as strength and disposition of the enemy, his alertness and determination, our weapons and people, and the weather and terrain. Skill and luck also are important ingredients.

For the aviator, the nature of the threat has changed remarkably in the last few years. What we did during the tough days of the mid-60s in the Republic of Vietnam and on the occasion of the Tet offensive was not appropriate at Hue during the 1972 North Vietnamese offensive. Enemy air defenses toughened with heat seeking missiles and radar directed weapons. A year and a half later on the Suez Canal and Golan Heights the threat became even grimmer; therefore, tactics, which served well during most of the Vietnam war, require adjustment. Much work already has been done to revise our tactics. However, more work is required—and this must be reinforced with deadly serious training.

In order to stimulate our thinking and to spread the word on new tactics for the high air defense threat battlefield, the AVIATION DIGEST is devoting this and its next three issues to the subject of tactics. I hope that you will read these issues with the express intention to do your part in improving the capability of Army aviation to survive and fight effectively.

MAJOR GENERAL WILLIAM J. MADDOX, JR.



Bringing Army Aviation Through The 70s . . .

Into The 80s

Brigadier General James H. Merryman

AS ARMY AVIATORS, each of us has a mutual responsibility to help Army aviation meet the challenge of both the 70s and 80s. Just as we put out hearts and souls into developing, testing, perfecting and validating in combat the airmobility concept, we must now redirect our talents and skills toward developing new concepts, doctrine, tactics and equipment to support the Army's mission into the next decade. In short, we must continue to demonstrate beyond any reasonable doubt that Army aviation cannot only survive on the mid-intensity battlefield but also will be an essential ingredient in the five functions of land combat.

Before launching into the specifics, let me digress briefly to define the challenge. A recent quote from General Creighton W. Abrams, U.S. Army Chief of Staff, provides the big picture: "The major military challenge to our global interests is the Soviet Union. It is the only other truly global military power. And so we must gage our ability to maintain freedom of action in terms of the Soviet Union, and in terms of the challenges that Soviet global interests and actions pose for us." With General Abrams' thoughts in mind, we can translate Soviet strategic objectives into the threat facing the U.S. Army.

The threat, as you know by now, is mid-intensity war. You've heard the term bandied about quite a bit lately; it seems fashionable to use it.

General Merryman looks at the challenges of the 70s and 80s...Army aviation must continue to be a credible, integral member of the arms team

Let me caution you . . . it's much more deadly than it is fashionable. Picture, if you will, predominantly armor forces supported by extensive, in-depth artillery. The force thrusts forward quickly under the cover of surprise and an umbrella of a formidable antiaircraft network, pausing only long enough to consolidate ground gains, and reposition antiaircraft weapons before moving on to deep objectives in the exploitation phase.

The enemy's armor vehicles are fast and maneuverable in all types of terrain. The main armament consists of ballistic and missile systems with sophisticated night vision devices, computerized fire direction and perhaps radar guidance. Because the ground elements are vulnerable to air attack, air defense will consist of traditional radar guided antiaircraft guns, radar guided missiles, individually launched heat seekers, and small arms fire.

Antiaircraft fire will be coordinated into sectors by altitude and by distance from the forward edge of the battle area (FEBA), constituting the most deadly array of antiaircraft fire ever encountered on the battlefield by U.S. forces. Considering this scenario, it should become readily apparent that the way we employed our aviation assets in the Republic of Vietnam simply won't "cut it" on a mid-intensity battlefield. Therefore, we must shed the "Vietnam straight jacket" type of thinking and face employment of Army aviation in a tough, rugged combat environment where the enemy will be equipped with the best weapons and systems that Soviet technology can provide.

There are some very specific and demanding tasks which must be accomplished to prepare Army aviation for the mid-intensity battlefield. Unlike the Vietnam conflict, Army aviation will not set the tempo for ground force operations. Army aviation will not be employed as a "lone actor" on the battlefield. Instead, it must become a credible, integral member of the combined arms team.

In this regard it is appropriate to consider what being a credible member of the combined arms team really means. If you'll draw upon your knowledge of tactics acquired in various basic and career schools, you can readily relate to this concept. To begin with, every supporting arm has but one basic mission —to support the ground-gaining infantry and armor unit. Everything we do is oriented toward helping that infantryman and tanker to reach his objective while concurrently inflicting maximum punishment upon his adversary. It's an orchestrated, deliberate effort. Every team member must know his job to the Nth degree as well as knowing the roles of other team members. The commander still calls the shots, but he needs the expertise of each team member to advise him how each element can best be employed to maximize the unit's capabilities.

With this in mind, it's only fair to ask: What is expected of Army aviation on the mid-intensity battlefield? To be candid, I can't provide the complete answer because I believe we've only begun our development of new tactics, concepts and doctrine for our new mission. This much I do know—in addition to the missions we performed routinely in Vietnam, we will be called upon to perform antiarmor roles, and air defense suppression. We'll do these things as one facet of the maneuver scenario in support of the entire maneuver effort; and, as I alluded to earlier, it will be accomplished in the toughest combat environment we've ever encountered.

Now to specifics. Our first task is to convince maneuver element commanders at all levels that Army aviation can do all those things I discussed and more! The ground commander must be shown that Army aviation is just as essential to unit mission accomplishment as other combat support arms. This can only be done by aviators who

Brigadier General James H. Merryman, former Director of Army Aviation, commanded the 269th Combat Aviation Battalion in Vietnam. During a second tour he commanded the 17th Aviation Group. General Merryman also served as the Executive and Assistant for Air Mobility to the Assistant Secretary of the Army (R&D)

are well qualified in their respective branches of service and who are fully appreciative of the role played by each member of the combined arms team.

For commissioned officers this means that once you gain solid experience in aviation, you should seek branch related assignments. Seek command and key staff positions in your branch and become an expert in your own right. When you return to aviation you will be invaluable to us and can make even greater contributions to aviation and your Army.

For warrant officers, I encourage you to look at the big picture. Become a professional within the scope of your duties and bone up on the entire role of Army aviation as a supporting arm. Familiarize yourself with division tactics, read professional magazines and journals, and keep your ear to the ground so you can measure the pulse of the Army. Know where we're going and help us get there.

With well-rounded, knowledgeable, professional aviators, Army aviation will not only be a nice-to-have luxury but also an effective, essential tool that will enhance ground force operations. Some may feel "Mission Impossible" is unfolding before their eyes. However, I strongly disagree. We've done it before. Only through the dogged persistence of visionary aviators were commanders convinced that airmobility would succeed in Vietnam, and Army aviation rose to the challenge admirably. It's no different today. Again, some commanders are skeptical about Army aviation's role against an armor weighted threat. Again, we must rise to the challenge by demonstrating that Army aviation belongs on the mid-intensity battlefield. Once commanders realize we know the score, then, and only then, will we have the opportunity to employ our wares as an accepted, respected member of the combined arms team.

Next, we must dispel reservations among many who believe helicopters cannot survive on a mid-intensity battlefield. This is a tough nut to crack and requires 100 percent support of every aviator. Our capability to operate around the clock, on the deck, cannot be given lip service. We must do it and do it well! Indications are that we're moving in that direction. Training Circular 1-15, "Nap-of-the-Earth Flying," is the first publication to contain comprehensive guidance for unit nap-of-the-earth (NOE) training. It is the culmination of the best efforts of the Aviation Center, the Armor School, Project MASSTER (Modern Army Selected System Test, Evaluation and Review), Combat Developments Experimentation Command (CDEC) and aviation units in the field. The training circular will help commanders develop safe, realistic NOE training—the first giant step in realizing an NOE capability in Army aviation.

Other actions are on-going to support NOE. The U.S. Army Aviation Center has altered its Initial Entry Rotary Wing Training Program within the school to provide 15 flight training hours in the NOE environment. Also, a multitrack instructor pilot course will be introduced which will emphasize NOE qualification as well as instrument and synthetic flight trainer instructor qualifications. Concurrently, the Army Research Institute (ARI) is studying the behavioral aspects of NOE operations as it impacts upon aviator performance capabilities.

Night vision devices are being tested at MASSTER and CDEC to help make night NOE well within our reach. For many years, night vision equipment has remained a dream in the minds of commanders and is a tremendous technological problem for industry. Our search for effective night vision devices is centered on three approaches: low light level TV, direct view image intensifiers and thermal image equipment. Of the three, thermal image equipment shows the greatest promise as a result of recent technological breakthroughs.

MASSTER tested an image intensification device—the AN/PVS-5 night vision goggles—in 1972. Although rudimentary equipment, the test results give a clue to what the future holds. For example, helicopter crews fitted with the AN/PVS-5 were able to attain airspeeds up to 90 knots at altitudes as low as 50 feet. Nap-of-the-earth navigation was successful but required detailed *map* reconnaissance prior to each flight. The aviators were able to detect moving company-sized armor units out to ranges of 2,000 meters under clear weather and half-moon conditions.

At the end of our research and development (R&D) efforts, we hope to acquire equipment that will provide daylight imagery under the darkest night conditions, in clear or foul weather. Then we'll have the capability to detect, identify and recognize enemy personnel and vehicle targets at ranges where our weapons can be employed at maximum effective range.

Development of an NOE capability is therefore dual thrusted. First, the field must develop the best capability possible with existing equipment. Second, the field will be supported to the maximum extent possible with all the new concepts and devices that our technology can bring to bear. But, let me caution you. No amount of studies, tests and new equipment will provide an automatic NOE capability. We must confront the problem head-on. It takes gutsy aviators willing to grapple with a demanding requirement—*practice, rehearse* and *refine*. In a phrase, WE MUST DO IT!

Last, we need to consider the family of aircraft on hand to meet the challenge of the 70s and 80s.

Our new generation of tactical aircraft—the AAH (advanced attack helicopter), UTTAS (utility tactical transport aircraft system) and ASH (advanced scout helicopter)—are not due until the 80s. As you know, we cannot sit on our hands until then waiting for a total hardware solution to our problems. We must adapt our tactics and doctrine in concert with current aircraft capabilities to give us the mid-intensity capabilities we seek. Once again, this is not something new. In Vietnam, both our gun and lift helicopters had limitations in power and armament, yet we demonstrated time and time again that when the "chips were down" we could accomplish the mission and do it well.

You can anticipate some help prior to the arrival of our new family of aircraft. First, the AH-1 HueyCobra will be product improved with a mightier engine. This will provide greater agility and out of ground effect hover capability for NOE. This becomes particularly important when the bird is configured for the TOW (Tube launched, Optically tracked, Wire guided) missile.

Second, Major General Donn Starry, Commandant of the Armor School, heads up an Advanced Scout Helicopter Task Force. He will determine if the LOH (light observation helicopter) should be product improved and/or if an entirely new scout should be developed or brought off the shelf.

Third, avionics will be getting a lot of attention. The OH-58 and AH-1G helicopters are being fitted with improved visionics and avionics so that aviators will have a decent inadvertent IFR capability.

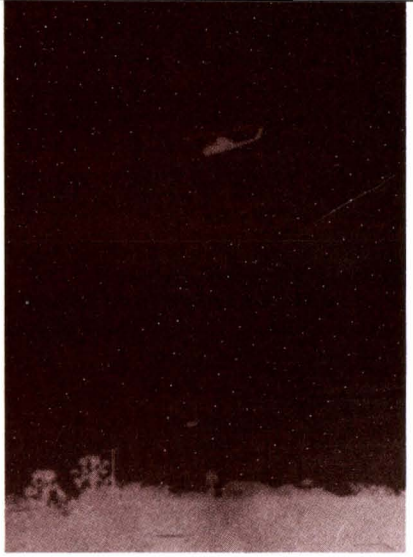
Fourth, advanced fiber materials are now under development which will provide improved rotor blades, airframe components and control elements. Their lower weight can reduce aircraft empty weight by 20 percent, providing increased endurance or disposable ordnance payload.

In Vietnam we flew at altitude... on the mid-intensity battlefield we must fly in the nap of the earth

Fifth, great strides have been made in providing increased aircraft stability through the use of hydrofluidic principles. Using these advanced techniques, fluidic detectors sense aircraft motion and transmit these sensings to hydraulic servos which activate the appropriate flight controls.

Sixth, one of the most significant developments is our Synthetic Flight Training System (SFTS) program. With this system we will conserve energy and dollars. The field will start receiving the SFTS within a year. These systems are really marvels and provide a realism that can be matched only by actual flight. One of the advantages of the system is that the operator can program realistic emergency situations that will really test your mettle, but should you crash it won't hurt a bit . . . except for your damaged ego. At this time we are not really certain how far we can go with SFTS. Their value in instrument training has already been proven and it is possible that we could use them for NOE and gunnery training prior to turning the first set of rotor blades.

At this point, I would like to comment on Soviet R&D. In the past the Soviet Union has not spent a great deal of money on development and procurement of new systems, even though it devotes a greater portion of its gross national product to defense than we do. In addition, Russian industry and technology have not been suited to wide and varied weapons development programs, although they are closing the gap in this area. When the Russians have become convinced that a particular weapons system is outdated, the first step



taken is to reevaluate the employment of the system. In other words, they see if training can be improved and tactics revised to maximize the weapons' fullest potential. Having accomplished this, the next step taken is to improve the system—not develop a replacement. For example, rather than retiring a battle tank, a new main gun will be developed. We do this frequently ourselves and we call it product improvement. The dividends are obvious: training requirements are minimized since we're dealing with a familiar system; little turbulence is generated in the logistics systems; the leadtime to acquire the product improvement is short in comparison to new procurement; and it's very cost effective.

The Soviets embark on new developments only as a last resort, and herein lies the basis for my message. Far too often I fear that some of us gripe about a given system's shortcomings and say we need a better one. I would suggest that *maybe all we need to do is learn to use the current system!*

After watching Army aviation in Vietnam I am not concerned. If Vietnam proved anything, it proved that innovative Army aviators with "can do" attitudes can surmount any obstacle. These kinds of guys, imbued with a mission accomplishment philosophy, will be able to do the kind of flying necessary to operate and survive on the mid-intensity battlefield.

ANNUAL AWARD
Monthly Winner
CONTEST

TACTICS outlook

speculations on the future

General Hamilton H. Howze, USA (Ret.)

The author discusses our past and present airmobile strength, speculating on what Army aviation should be and will be

FUTURE PROSPECTS for Army aviation are of course profoundly affected by what happens to the Army itself, so we'll tackle that matter first.

Every crystal ball, when duly interrogated about the Army, gets pretty fuzzy. At the end of any war (in every one of which the Army does a major share of the fighting) the Army loses more of its strength than anybody else, and its budget is the most drastically reduced. In this respect history always repeats itself; it is an extraordinary commentary that the active Army before the start of the Vietnam war had 17 divisions (including the 11th Air Assault) and now has only 13. There is nothing in the international political or military climate that justifies such a cut below an earlier peacetime level. It *could* be justified if the active Army were backed by really ready reserve components such as the Israelis and the Koreans have, but no one appears in the least inclined to do anything about that.

In the 50 year period in which I (man and boy) have known what was going on in the Army, that body has alternated between feast and famine—lavish support and very inadequate support—with *never* a peacetime year in which the Army was of a sufficient size and at a proper state of readiness. The Army is largely governed by what is politically expedient in the civil government and is, therefore, usually caught short by an emergency. It is true that a suitable force was ready in 1962 to intervene in Cuba, but that would have been a quick and relatively easy campaign.

Just last summer in 1973 there were repeated calls among congressmen to reduce our forces further in Europe. Antimilitarism in America and the unpopularity of the Vietnam war made these proposals politically expedient and likely to bring credit and applause to their originators. If effected, the proposals would have resulted in further major cuts in our overall strength, because divisions brought home would in all probability have been deactivated. When the Arab-Israeli war erupted in October, however, all U.S. forces were alerted. The crusading congressmen fell silent again for it was no longer good politics to suggest that military strength was unnecessary and wasteful.

The point is simply that the Army has always been painfully influenced by irresponsible and self-serving political action, and that should not be. It is long past time that the Pentagon be required to write a long-range plan—based, one might hope, on a realistic appraisal of the international state of affairs. Such a plan, after discussion and approval by the executive branch and selected committees of the legislative branch of the government, should then be blessed with legitimacy and a reasonable life expectancy even though subject, very properly, to formal annual review and revision.

A 13-division Army is very unlikely to have a sufficient quantity of airmobile troops. In 1962 I served as chairman of the Tactical Mobility Requirements Board which met at Ft. Bragg, NC. We recommended a larger Army to include five air assault (now called airmobile) divisions and three air cavalry brigades. Our rationale was that the United States was not apt to fight on the ground anywhere without allies, whether the war be a localized one in

Vietnam, Korea, the Near East or Middle East, or a general conflagration involving Europe and North America; so we were talking really of only a few airmobile formations in a framework of some 200 divisions on our side of the Iron Curtain. The logic for a strong U.S. airmobile force still holds entirely true, but the prospects for eventuation presently appear dim.

But one cannot be sure. The Army has ballooned and then collapsed so many times in the past that it is probable that it will balloon again when a new and threatening circumstance arises—which, of course, it will.

To quote a much maligned but nevertheless astute General Charles De Gaulle: "What reason have we for thinking that passion and self-interest, the root cause of armed conflict in men and nations, will cease to operate; that anyone will willingly surrender what he has or not try to get what he wants; in short, that human nature will ever become something other than it is?"

Unfortunately, Army aviation doesn't balloon gracefully or quickly. It is a long leadtime item if only because helicopters take a long time to build and helicopter manufacturers take a much longer time to expand production to anything like a proper wartime rate. Our small peacetime Army should, therefore, be heavily weighted in favor of airmobile units. As a guess, we could in a general mobilization expand the active Army from 13 to 40 divisions—which would take years—before we could expand our list of airmobile divisions from two to three. And we only now are establishing our first separate air cavalry brigade.

The combat effectiveness of airmobility is greatly dependent on how much of it one has. Quality certainly is important, but the demands for quality must be balanced by the demands of quantity. The cavalry of ancient Persia was famous for its battle effectiveness, but this could hardly have been true had there been only one or two regiments, no matter how ably manned and superbly mounted and equipped.

It is in this area that aviation hardware decisions the Army is now making are of lasting importance. I shall not try to second-guess the decision makers, but do offer the fervent hope that their judgments are correct. To be correct, I believe, they must not make it impractical, because of hardware cost, to create an adequate number of airmobile divisions and brigades and to provide for enough aviation support for all nonairmobile formations. Against the admittedly powerful and attractive considerations of aircraft performance and safety, at high unit cost, are the less appealing considerations of simplicity and greater numbers at much smaller unit cost.

I do not bemoan the current and (I suppose) irreversible trend toward greater and greater sophistication and complexity, but I do suggest that some heavy thought be given to the idea of providing a quantity of more simple and less expensive aircraft to supplement the gaudier ones. I suggest that we acknowledge that perhaps 90 percent of the troop transport helicopter's missions will be out of the sight and range of enemy weapons. Thus, cannot most of these missions be accomplished by cheaper aircraft? Must a behind-the-lines liaison and general utility helicopter have all the sophistication of an advanced scout? And while I'm reluctant to suggest that the armed helicopter be anything less than pretty smart and fast and quick on the draw, I do believe that there should be a smaller and somewhat simpler type to supplement the big busters.

In all this, too, I think it desirable to acknowledge that one of the great strengths of Army aviation—in fact a prime reason for its existence—lies in its integration into the line units of the Army. Large and complex items of equipment tend to filter back from the forward edge of the battle area into higher echelons of command. This will hold true for helicopters that are hard to hide and hard to maintain without special equipment. If the Army's maneuver battalions are not to lose the enormous battle advantages bestowed on them by quick, responsive, light aircraft, some of those aircraft had better be of a size and configuration enabling them to live up there with the tankers and doughboys and cavalrymen, in the mud and under the trees.

It is obvious, in this brief speculation, that I divide the future for Army aviation in two parts: what ought to be and what will be. That future *ought* to be one of imposing growth in strength and doctrine, if the well-being of the western world is to be properly safeguarded. It *will* be something less than that; how much less depends on international events—economic, diplomatic and military. If a real crisis should develop suddenly, instead of over a long period of build-up, we shall be woefully short of airmobile units. But the saying is that God takes care of children, fools and drunken men. I do not put the United States in any of those categories, but in the absence of national wisdom we must bank heavily on national luck—and the continued favor of the Almighty.

General Howze earned his Army aviator wings in 1947. As a Director of Army Aviation and the Chairman of the Tactical Mobility Requirements Board (Howze Board), he is widely recognized as the intellectual force behind current airmobility and Army aviation doctrine. He developed new tactical principles for the employment of Army aviation

11th Air Assault And The Future

LTG Seneff recalls the dedicated people who in 1963 were given the framework of a concept and developed the airmobile tactics to be employed by Army aviation during the next decade

Lieutenant General G. P. Seneff Jr.
Commander, Fifth U. S. Army

WHEN I WAS ASKED to write this article, I think it was envisioned that it would be a rather serious thing about the history of the 11th Air Assault Aviation Group, together with lessons learned and all that. I have decided that it might be more readable if I just told some "war stories" and that is precisely what I am going to do—although I would hope there still might be some lessons learned.

The years of 1963 and 1964, the period during which the 11th Air Assault Division (T) was built up, trained and tested, were years of really great adventure; in many respects even more adventuresome than our later experience in the Republic of Vietnam. It was the only period in my knowledge in which a group of dedicated people was given the framework of a new concept, and priority on resources and people, and told to go out and write a new chapter for the Army. It's almost hard to recall at this juncture that when we started in February 1963, 11 years ago, it was actually against Army regulations to fly helicopters in formation —we've come a long way, baby.

Under the leadership of Lieutenant General (then Brigadier General) Harry Kinnard (now retired), our initial leaders and a few staff officers assembled at Ft. Benning, GA, in February 1963. We had little to start with except our imaginations and the promise of things to come. There were very few UH-1 Hueys in the Army at that point in time. We were promised them as they came off the line, but we had to start with one CH-34 company. We had few people but we were promised the best, and we were given money to enable us to do unusual things and to experiment freely. From this we built up to first one assault helicopter battalion, one air cavalry troop, and one CH-47 Chinook company, and one composite OV-1 Mohawk company, and then progressively built up until we had battalions instead of companies. So, by the time we went through the 2-month test period in the Carolinas, late in 1964, we had pretty much the same aviation configuration as the Airmobile Division as we know it today (with the exception, of course, that we lost the Mohawk battalion). It was a period of progressive excitement that built up to the climax of the airmobile tests. We knew from the beginning that the secret to success was going to be a combination of training, tactics, safety, equipment, communications and people, and these are the areas in which we worked hard from the beginning. For the rest of this article I am going to simply relate experiences that we had in each of these areas.

TRAINING AND TACTICS

Nap-of-the-earth (NOE) flying had been talked about a good deal in the Army prior to 1963, but not a great deal of it had been done. Procedures had not been standardized and very few people had done any of it in formation. We knew that we were going to have to do this in formation in order to be able to get the job done and to survive, so this was one of our first large areas of endeavor. Since the Army had done no formation flying in helicopters, we went to the other

services and with some modifications to suit our purposes came up with a combination of Navy and Air Force procedures.

Our goal from the beginning was to achieve parallel structures between our airmobile infantry and our assault helicopter formations so that one aviation platoon could carry one rifle platoon; one aviation company could carry one rifle company; and an assault helicopter battalion could lift the combat elements of one infantry battalion. We never really achieved this because the Huey Delta (UH-1D) would not lift an infantry squad except on the coldest days. *Memo: We have still never achieved it, but one of these days we've got to.*

The formation we adopted was flights of four in the so-called heavy right or heavy left formation which was the most flexible and most adaptable to changing formations while airborne. It also offered the most in the form of being able to slide the heavy side from one side to the other when tight turns were necessary. We flew these platoons in columns, V's, echelons or diamonds, depending on the tactical situation. Our infantry, unfortunately, never got very good at asking for changes in formation for landing as the ground situation changed. They normally wanted to land the way they had taken off. A little flexibility of thought, however, would have enabled a company commander to ask that the landing formation be changed so as to put two of his platoons up and one back, with the supporting elements behind the rear platoon; or a perimeter organizing formation, or anything else he might desire. Unfortunately, this was the one thing our infantry never got very good at. *Memo: They still haven't!*

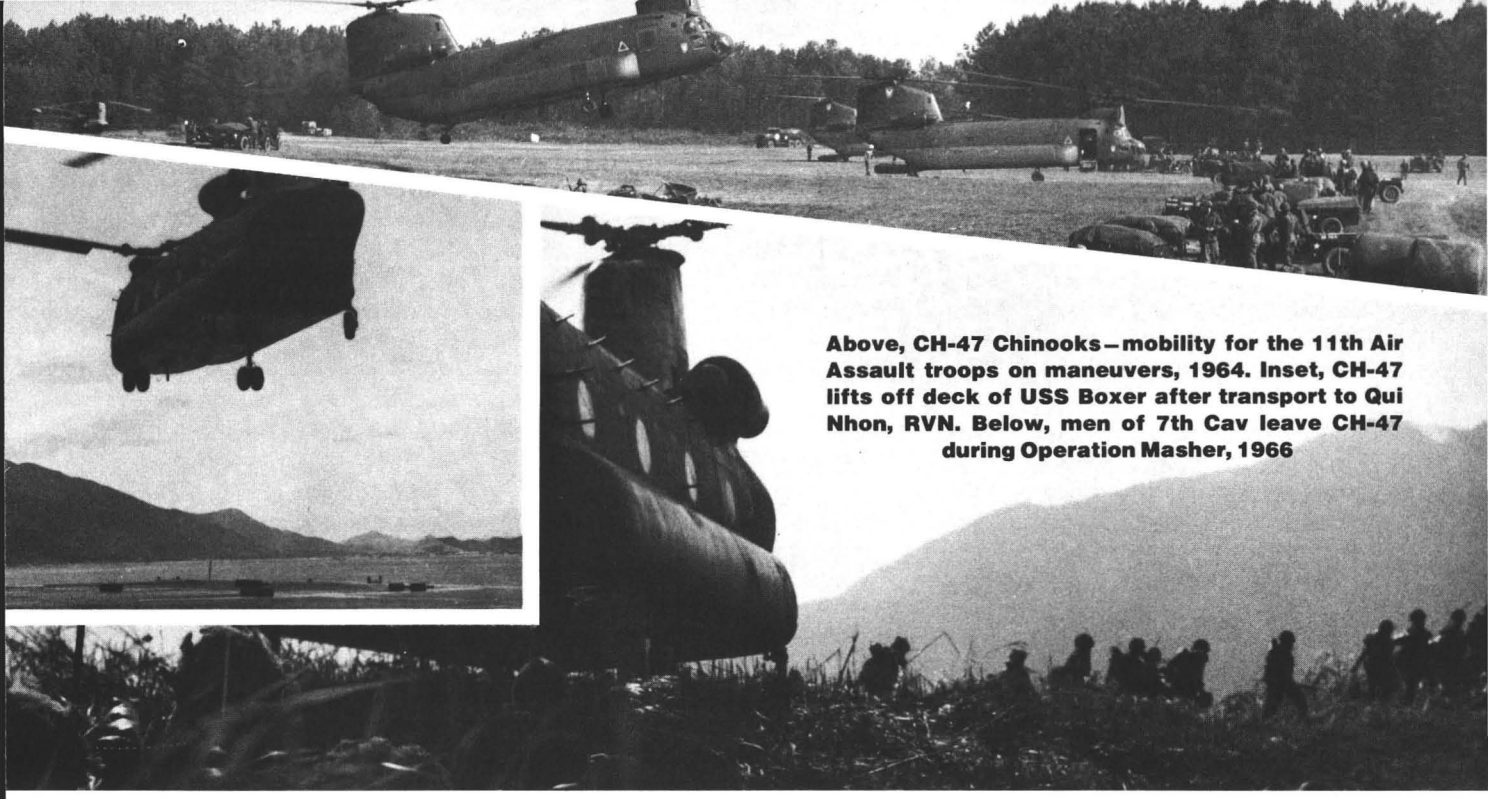
We obviously spent a great deal of time in our practice formation flying, starting out very slowly and carefully outlining every change of formation we were going to go through in a different practice period *before we did it* to cut down on the chance of midair collision. It paid off to the extent that through the entire period we had only one midair collision and this, as usual, was because a couple of guys had their heads down and locked and forgot all of the training they had been given.

We were getting ready for any type of warfare but took mid-intensity as being the most difficult case and did all of our flying with skids in trees. We were also very conscious of the enemy high performance air threat, and practiced things like "formation breaks" in which we could very quickly disperse the formation to individual aircraft which were capable of taking evasive action, and then reassembling on the leader when the danger was past. The FM (frequency modulated) radio homing capability helped in this and the new one should be better. *Memo: This one has sort of been forgotten in my recent experience, but we should get back to it.*

We probably did more night flying and training than anyone has done before or since. We did most of our flying in formation about 1,000 feet above the ground. We fiddled around with all sorts of homemade formation lights to try to furnish a better guide for relative location and distance from one ship to the other. None of these worked very well and we finally wound up masking our nav lights so that they couldn't be seen from the ground and flying on a combination of those—the lights on the instrument panels within the birds and a general outline of the birds—our people were probably the best formation flyers the Army has ever seen; they came to prefer flying at a distance that would horrify less experienced people. They normally flew at night in "parade formation" by which I mean one rotor width apart. They simply felt more comfortable that way because then they could see their lead man well enough to know precisely where they were even on the blackest nights. We never did any NOE flying at night in formation because we didn't have the equipment and didn't want to take too hazardous a course. *Memo: We did state requirements for both formation night flying lights and for night vision equipment that would enable us to fly NOE—these requirements still haven't been really met, although some rudimentary attempts have been made.*

We experimented extensively in shooting landings at night under the light of flares dropped from Mohawks. We calculated winds and offset distances as carefully as we could, but nonetheless the inevitable happened on one dark night at

Any landing you walk away from is a good one? We (Soucek, myself, our crewchief and my dog) think so! Emergency procedures paid off; LTG Seneff



Above, CH-47 Chinooks—mobility for the 11th Air Assault troops on maneuvers, 1964. Inset, CH-47 lifts off deck of USS Boxer after transport to Qui Nhon, RVN. Below, men of 7th Cav leave CH-47 during Operation Masher, 1966

(then) Camp Stewart, GA, when a cannister from a flare managed to float further than anyone thought would be possible and connected with the tail rotor of the lead in a 20-ship formation about 50 feet off the ground on final. Our training paid off—the lead pilot made a successful autorotation from which everyone walked away, and No. 2 calmly said "Pull pitch and follow me" and then he led the formation around again. It never broke. There was lots of adrenalin flowing, but what could have turned into a mass disaster was saved by cool, trained heads.

We spent many a night in landing zones (LZs) messing with homemade glide slope indicators and other allied equipment. We finally settled on one and made a special buy of small, lightweight, portable gear that suited our needs. *Memo: We don't have a good one across the board in the Army today.* We spent so much time at this that Tommy Tomlinson who was our head pathfinder, NATTY BUMPO 6, gave me a plaque which I'm looking at on my wall which appoints me "the outstanding amateur expert in pathfinder operations."

We trained extensively in low level navigation and got pretty good at it although we still had tremendous problems in hitting a small LZ on the button while flying NOE. We had a Decca chain installed for this purpose but it wasn't sufficiently accurate to really put you into a 300 meter square clearing in the woods with great precision. We sometimes used "vector" ships at a higher altitude, but of course that gave the flight away. Probably our best tactic was to have gunships lead in and literally tell the formation lead when to start to flare. The Decca never got used very much because people got to know the countryside that we were operating in too well and simply didn't use it. This same thing later happened in the Republic of Vietnam and would probably happen most places in the world if we were in the area for any length of time, but we felt we did need a good navigational system to use in places like the Middle East. *Memo: We still need it and we still haven't got it.*

The Mohawks were a special case. Twenty-four of them were armed and they got very, very good. The Navy helped with our training and under the leadership of (then) Major Bob Litle they became real hotshots. Navy types who saw them operate claimed that if we ever had a threatened shootoff with the Air Force we'd win hands down. They reached the point that they were hitting tank sized point targets with one out of four Zunis on every run.

We employed them in a variety of ways, but one of their main functions was to try to protect our formations from ground fire while en route. For this purpose they developed different methods of flying back and forth across our formations, the most popular being the old "thatch-weave." They, too, flew at very low altitude—just clearing the choppers. This led to some interesting banter from time to time, such as "You're driving me into the trees" from the choppers or "Open up your doors and we'll come through" from the Mohawks. One thing we were never able to devise was a really good way of handing off a target spotted by

someone in the chopper formation to the Mohawks. Oral identification is very difficult and we never came up with any sort of spotting identifier that would help. *Memo: We still haven't and this is going to give us trouble the first time the Air Force ever tries to cover a chopper formation.*

The 11th Air Assault lost the Mohawks. I don't think we should have. I regarded them as being fixed wing substitutes for a good armed attack helicopter, and not a *very* good one, but nonetheless we lost them in the emotions of the moment which became so severe that we were almost forbidden to use the words "attack" or "assault" in connection with anything.

We worked intensively at learning how to beat the weather. We learned that even the lousiest weather, so-called zero-zero, has soft spots and holes in it and that by adopting a willingness to sit down if necessary, flying slowly and sending out "weather scouts" we could pick our way through almost anything. The training side of this culminated in the 227th's famous —or infamous as some people look at it—flight from Camp Blanding Military Reservation, FL, back up to Ft. Benning in which they finally had to sit down in small patches all over the countryside for the night, but it paid off.

The payoff came on the opening day of Air Assault II. The weather was really lousy. There was a hurricane in the Atlantic, the airlines were all grounded, the Air Force was grounded—it was theoretically zero-zero. But in actual fact the ceilings varied from zero to 50 or 100 feet and the visibility from zero to ½ mile. Hordes of our "bad-wishers" were sitting around rubbing their hands waiting for us to fall flat on our faces. If we had that would have been the end of the battle, but our past training came through. We took off, 1 hour off schedule, with a 120-ship formation that flew 100 nautical miles to land precisely in their predesignated landing zones. *Memo: There are still a lot of people around who think that we shouldn't practice that sort of thing but I'll state categorically that if you don't train for it you'll never be able to do it safely.*

We came up with a system for trying to fly through weather when it's possible to land at the far end that was dubbed "Red Dog." It involved climbing ships to staggered altitudes up to 4,000 feet or so with fairly tight time separation and letting down in different directions on a beacon using tactical letdowns. It would have enabled us to close a battalion in a given area in about an hour. We never got a chance to practice it very much or to try it out in real weather, so we never really developed it to a successful conclusion. *Memo: We still haven't.*

Many other things were worked up during this timeframe. We developed the first "piggyback" scheme for carrying artillery and ammunition in slung loads. We experimented with carrying the M-102 howitzer with the Huey which was barely possible at Ft. Benning in the wintertime. (This is the reason the Army eventually got the -13 engine—which later saved our lives in Vietnam.) The Air Cav people under the irrepressible John Stockton, developed their techniques of moving into a bivouac area in the enemy rear in the late afternoon and then moving to another location just at dusk to mystify the enemy as to their whereabouts (they used this technique a few times in their early days in Vietnam very successfully but later gave it up). In short, we'd try anything that looked good and a lot of it worked.

SAFETY

Our approach to safety was training. One of the first things that we did, of course, was to study the Howze Board report to get as much from this data as we could. One thing that stuck out like a sore thumb was their accident record, which, as I remember it, was something like 350 accidents per 100,000 flying hours. We knew if we racked up a rate like that the whole idea was dead; we had to learn to do much, much better. I'm not criticizing the guys who flew for the Howze Board. They were hastily assembled, didn't have much time to train, and I think that under the conditions those results were predictable. We analyzed each of their accidents and came up with the general finding that most of them were caused by a lack of really long term solid training in how to go at things. So, the safety program became a very strong part of our overall training program with the determination that we would not let the "safety tail" wag the "mission accomplishment" dog. We developed and practiced very extensively our emergency procedures; the major one was the low level autorotation. We learned early by the bitter experience of losing a gunship and four good guys that you simply don't have time, when you're flying on the treetops, to fiddle around with complex emergency procedures. There is not time enough, for example, to try to figure out whether you've got a low or high side fuel control failure, or a tail rotor failure, or anything else. The only thing you have time to do is automatically and instantaneously go down on pitch, back on cyclic, into a full flare to zero out your airspeed and then nestle it down into the trees, pulling pitch as you go. We had a lot of guys walk away from piles of junk after doing this, and a few other guys who killed themselves by trying to stretch a glide, taking the time to figure out what was wrong and so on. Part of the "walkaway gang" was Leo Soucek, myself, our

Continued on page 31

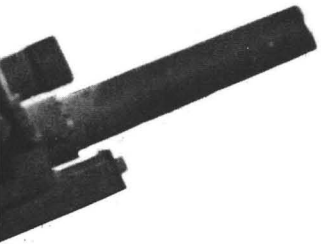
One of the significant events that led to the birth of Army aviation was the publication of the article "Wings For Santa Barbara" by Major William W. Ford in the May 1941 issue of the FIELD ARTILLERY JOURNAL. Usually when the history of Army aviation is discussed or written, this penetrating article is mentioned. It impressed Major General Robert M. Danford, the Chief of Field Artillery, who along with Major Ford was destined to play a key role in the establishment of Army aviation (see "The Army Aviation Story, Part II," July 1962 DIGEST).

The DIGEST is reprinting "Wings For Santa Barbara" to help commemorate the 32d birth date of Army aviation on the 6th of this month. We thank the FIELD ARTILLERY JOURNAL for permission to reprint this article. The FIELD ARTILLERY JOURNAL first appeared in 1910. Its publication was interrupted in 1950 and the Artillery School disseminated information through periodicals entitled ARTILLERY TRENDS and later THE FIELD ARTILLERYMAN. However, in January 1974 we were happy to see the FIELD ARTILLERY JOURNAL back in circulation.

Wings For Santa Barbara

Major William W. Ford

Major Ford is particularly well qualified to write this article, as flying has been his hobby for 7 years. During this time he has owned two planes and has accumulated over 500 hours of pilot time



IT IS PERHAPS unfortunate that most of our field artillery officers have learned their gunnery at Fort Sill!

Before the author of that statement is shot as a heretic, he wishes to explain.

He doesn't mean the School, he means the terrain.

He means that the terrain at Fort Sill, though admirably adapted to the *teaching* of gunnery, unfortunately creates in almost everybody's mind false conceptions as to the relative frequency of employment of the methods taught. In vain may the School caution its young graduate not to expect such favorable terrain at his next maneuver, or in the next war! In vain may it admonish him that observed fire or good maps will be the exception, not the rule! Not until he gets out and tries to maneuver over those vast reaches of land where there is no observation and where there are no maps does he realize just what he's up against. And then he finds that while he has a remedy in theory he has none in fact. There he is brimful of learning, but as helpless as a statute of Napoleon.

HISTORICAL

During the Third Army maneuvers in the early part of 1940 this writer was a battery commander in the light artillery of a "streamlined" division. During successive division, corps, and army exercises he participated in a number of field problems. *Not once,* during this period of four months, did he find a decent OP! *Not once* did he have a map or map substitute from which fire could have been computed! *Not once* was an actual air observer available to adjust the fire of his battalion!

It goes without saying that this battery was rarely capable of delivering the fire support expected of it. To be sure, forward observers with "walkie-talkies" were always on the job. Occasionally they performed a helpful service; more often *not*. The simple fact is that along the coastal plain of South Carolina, Georgia and Louisiana terrestrial observation is an exceedingly difficult business, even at short distances.

The experience of this battery was not unique. Ask anyone who was there!

THE PROBLEM

What, then, are we going to do about it?

One suggestion is to forget it, on the ground that we shall probably not fight in such abominable (artillery) country, anyway. This suggestion comes from those who still can't forget the Fort Sill terrain.

But where *will* we fight? If we should have to defend this broad land from an invader, just where would the fracas be likely to begin? In Oklahoma? Kansas? Indiana?

The coastal plain of the Atlantic and Gulf states, from New York all the way down and around to east Texas, is much the same as the country of the Third Army Maneuvers. It is low, flat, sandy, and for the most part densely wooded. It is a very depressing country from

the standpoint of one having a fondness for good OP's. If *this* is where we shall meet our invader we had better do something to enable our artillery to see.

Again, if the strategy of defense should require an overseas offensive effort on our part, on what kind of terrain should we expect to find our enemy?

This question is not rhetorical. We might of course expect to find the enemy in any sort of country whatsoever. But of this we may be sure: whatever (ground) observation there is, the enemy will have it. We would have an uphill fight on our hands. We would be blind once more.

Now all this is in no way new. It is a problem which has engaged the serious attention of our best minds at the Field Artillery School and throughout the army. The obvious need for air observation has spurred the development of an excellent procedure for firing with this aid. The trouble is that we do not have an adequate number of planes or observers for this purpose; nor are they on order; nor are the types of planes we contemplate best suited to the job. More of this later.

Much effort has likewise been spent on improving our methods of firing without the actual air observer, using air photographs instead. This development has now reached the stage where its enthusiasts believe that effective fire can be delivered using wide-angle photos and map data corrected. If their enthusiasm proves justified, a highly important addition has been made to our field artillery technique.

But surely no one will expect this or any similar method to possess the merits of observed fire. There are at least three reasons why such an expectation would prove false:

1. Even the splendid wide-angle photo presents a tough problem in the matter of vertical control. This problem can perhaps be solved fairly well if we are able to determine a number of angles of site to points in enemy territory. *But much of the time, in that type of terrain where we are most likely to fight, we cannot do this.* Ground observation will be nil.

COL William W. Ford (left) and LTC Gordon J. Wolf appear pleased with progress of the Department of Air Training at Ft. Sill, OK, in 1942. On 6 June 1942 the War Department authorized organic aviation for the Field Artillery. This was the birth of Army aviation. COL Ford was the director of the department and LTC Wolf the first executive officer

2. Even if we could fire accurately at any point on the photograph, *someone must select the targets.* Now some targets, some important targets, are determinable from geography alone. But in most cases it takes geography *and the enemy* to make targets. Who can doubt that many targets of a critical nature will develop at the decisive stage of battle, targets that were not there the day before and hence do not show on the photograph, targets which only a pair of eyes can discover in time to be of any use?

3. Observed fire ranks first in the matter of ammunition economy, transfers of fire next, map fires last. Ammunition is of the essence!

If, then, there is as yet no satisfactory substitute for observation, and if this observation is frequently unobtainable from the ground, the *what* of our decision is automatic: we must give wings to our eyes!

Requirement: The *where, when, how* and *why.*

A SOLUTION

a. *Where:* a trained *field artillery* observer, a light airplane of the "flivver" type, and a pilot, *in each battalion of light and medium field artillery.*

b. *When:* at all times. The above arrangement should be organic.

c. *How:* training the observers is a cinch; there are thousands of commercial light planes in this country, available upon requisition; if there is any shortage of military pilots, we can draw upon the tens of thousands of civil pilots holding CAA certificates of competency—they can fly these little planes quite well enough. The British hope to use artillery officers to pilot their artillery planes.

d. *Why:* because we do not have an adequate number of observers or planes now available for artillery missions, nor may we reasonably expect to get them, except through some such program as the above.

DISCUSSION

a. The battalion is becoming more and more the fire unit. It should have constantly at its disposal all the means necessary to perform its tasks. Adequate means include air observation. Furthermore, this air observation must be available to the battalion from the moment the first gun is fired. One or more airplanes "on call" at a division airdrome miles away is too few airplanes, the planes are too far away, and the observers who will man them are too unacquainted with the battalion personnel for close teamwork.

The plane for our field artillery battalion should go with that battalion at all times. The "flivver" plane, with its light wing loading and its 75 HP engine, cruises at about 80 MPH and lands at about 45 MPH. It does not require a prepared landing field, but can land in almost any cow pasture or

similar place.* Hundreds of landings and take-offs have been made on highways. Even plowed fields are practicable provided the furrows are not deep.

Aloft, this little ship is merely an elevated OP for its field artillery observer. Communication is by two-way radio having a range of five or six miles. Excellent sets of this type are already in service on civil aircraft as aids to navigation. They can be adapted to military use simply by changing their frequency to the desired military channels.

Objection will be heard that such a craft will be quite vulnerable to hostile aviation. Well, what aircraft isn't? Only the best of the fighters themselves. Does anyone think, for example, that our present service type observation ship, the O-47, would bear a charmed life in an atmosphere infested with enemy pursuit? Of what use are one or two flexible machine guns, firing to the rear, against the eight fixed forward guns of the modern fighter?

Our little flivver plane will have no armament at all; its protection will consist in:

1. General superiority of the air secured by our pursuit aviation. Let no one say we may not have this. We *may* not win the war, but we should try. We should try, likewise, to gain air superiority. No modern war has been won without it. Of course not even a definite air superiority on our part will render us immune from enemy air attack. But such superiority, or merely an equality, should make it possible for us to employ observation aviation without prohibitive losses, especially if other protective measures are adopted.

2. Observing from low altitudes *over own territory*. Low-flying airplanes, particularly if painted camouflage, are hard to see from above. If enemy fighters *cruise* at low altitudes our ground weapons should be able to make it hot for them.

3. Maneuverability. Upon the approach of hostile aircraft our pilot will put the little ship into a series of tight turns, barely off the ground; high-speed enemy fighters, much less maneuverable, will have difficulty in bringing their guns to bear.

Military pilots will at once exclaim that the average commercial light plane lacks that visibility upward and to the rear which is necessary to enable the crew to detect the approach of hostile pursuit. The answer is: (a) a few commercial designs do not have this defect; (b) a fairly simple modification will remedy this defect where it exists; (c) the ground radio station working with the plane can often furnish timely warning of the approach of hostile aircraft.

4. Short flights. a. Our plane will take off, make an adjustment, and land again in very short time; enemy craft will have to be Johnny-on-the-spot to get it.

b. Having the plane, pilot and observer constantly assigned to the battalion they serve has great and obvious advantages. Close teamwork is achieved through this permanent relationship. The plane accompanies the battalion by short hops. It is ready at the moment it is needed. Moreover, *each battalion* has this invaluable aid; no longer does the battalion commander hope in vain for the brief use of a plane said to be on some distant airdrome "on call."

c. The training of observers presents no great difficulty, but they must be trained. They cannot be produced from a hat on the field of battle. Field artillery officers, well grounded in gunnery, should be selected for this duty, especially so in view of the fact that for its protection our flying OP will probably remain for the most part over our own territory. It will not always be possible for the observer to *estimate deviations in yards;* often he will have to *conduct the fire,* using axial methods.

d. The program herein presented contains little that is new, but much that remains unexploited. It has two essential features which urge its immediate adoption:

1. It provides a more nearly adequate quantity of air observation for field artillery;

2. It does this with the maximum economy of planes and men.

Few artillerymen will dispute the desirability of having one plane per field artillery battalion. To achieve this goal, we must train observers and procure planes and pilots in large numbers. Why not train, as observers, officers whose basic military education has included the technique of artillery fire? Why not use a light commercial airplane costing $1,500 in preference to a service-type observation plane costing twenty to thirty times as much? The little plane will do the job better, it can be maintained by one mechanic instead of requiring a crew of several, and it doesn't require an accomplished military combat pilot to fly it. Since these planes and the pilots to fly them are available in far greater than the required numbers, their use would release a corresponding amount of "military" plane production for pursuit and bomber types, and a corresponding number of "military" pilots to fly these heavier types. Our present observation aviation would then be freed to perform command, reconnaissance and photographic missions, for which purposes alone we do not have sufficient planes of this kind.

Why not use the resources we have?

We need not abandon any other measures now contemplated; the cost and the difficulties are small; in so simple a way we can insure the ability of our artillery to *shoot!*

*** Recent tests indicate that the landing gear of these commercial planes breaks down after repeated landings in "cow pastures."—Editor.**

Human Factors In Nap-of-the-Earth Flying

TACTICS outlook

Provided by the Society of U. S. Army Flight Surgeons

Lieutenant Colonel Nicholas E. Barreca, M. D.

To the aircrewman: Regardless of the nature of the mission engaged by Army aviation, the limiting factors determining its ultimate accomplishment will be those of the environment, the machine systems and the men operating the controls. In the mid- to high-intensity battlefield anticipated for future military engagements, this triune complex of interrelationships will be stressed to extents and limits not previously realized on a large or continuous scale.

Certainly, the mission mode to be reckoned with is nap-of-the-earth (NOE) flying in all its ramifications. As with other military flying missions profiles, a number of human factors must be considered and analyzed if operational performance and efficiency shall be maximized.

Nap-of-the-earth flying presents many unique and significant demands upon human performance. Many of these human performance requirements will be met by man's uncanny ability to adapt to new and unusual stresses. Adaptation, however, must be accomplished with thoughtful consideration if we will develop the means to accomplish such flying missions safely and effectively. We must not wait until the time of combat engagement to resolve operational aeromedical problems associated with NOE. We must plan and provide for them now, during all stages of individual and operational unit training.

Human factors problem areas that are of especial aeromedical concern during NOE flying fall into the following major categories:

I—Perception of the external environment.

II—Protection against the external environment.

III—Flying fatigue.

IV—Crew selection, training and coordination.

In each of the above categories there are many factors and complexes that will determine successful and efficient human performance. Some require consideration for measures that may favorably modify man's capability. Others need to be accounted for so that man will avoid the inherent pitfalls with which they are associated. Part I appears below; Parts II, III and IV will be carried in subsequent months.

Part I:
Perception of the External Environment

Essential Elements for NOE: The most important determinant of accurate perception of the external environment is the visual sense. In NOE flying the "eyes have it"—be it day or night, obscured or clear, assisted or unassisted. With NOE flying there are two special requirements placed upon man's visual system . . . *terrain and obstacle clearance and visual search.* The two basic prerequisites to accomplish these are man's normal visual acuity and the aircraft cockpit's optimal design for visibility. Let's briefly examine the prerequisites before dwelling on the requirements.

Aircrewmen frequently take their visual ability for granted. When vision blurs, as it frequently does with time and age, it is easy to deny the failure (unconsciously, we dislike admitting our bodily deterioration to ourselves or others). In NOE such self-indulgence can be fatal. Any visual deterioration, however slight, must be recognized and corrected early. Thus, aircrewmen should seek the flight surgeon's help immediately with any realization of visual difficulty.

Certainly our medical standards of vision must be maintained as high as possible for NOE. Sometimes, however, even our normal vision must be assisted. NOE may require special daylight optical scanning and sighting devices and will probably require night vision goggles (see "How Night Becomes Day" and "Helicopter Low Level Night Operations," May 1973 DIGEST). These devices, while compensating for some of man's inadequacies will introduce some of their own—restricted fields of vision, the effects of vibration, parallax errors, loss of depth perception and others. Each of these must be critically analyzed and compensated for by human factors design or special training.

To use our fields of vision adequately, cockpit design must permit maximum visibility of the environmental surroundings. At present, the Army has contracted private industry to study cockpit windscreen design for all types of helicopter aircraft. Each of us has had experience with current aircraft cockpit visibility inadequacies. Under daylight conditions vision is obscured by distortion or support posts and other obstacles to vision. At night reflections help to complicate already compromised

vision. Each of these problems is amenable to solution. Finally, cockpit visibility is determined by the condition of windscreens and windows. Dirt and dust, oil and grease, pits and scratches—all combine to obscure vision. Under NOE flying operations these must be kept meticulously clear and clean to maximize visibility and minimize illusions.

Terrain and obstacle clearance has always been taken for granted by the aircrewmen. This visual ability develops slowly and imperceptably with early training and experience. Seldom does it have to be done with any accuracy until someone is asked to engage in confined area work. There are no standardized techniques for teaching clearance nor are there criteria of clearance. Most people eventually develop an ability to accomplish it safely, even tightly, by experience.

NOE flying is virtually a continuous confined area operation. How important is clearance in NOE? Read the U. S. Army Agency for Aviation Safety's *Flightfax* for 3 or 4 months. Note the number of rotor strike incidents and accidents that have been reported in association with low level, contour and NOE flight. Incidents are warnings. Accidents are unheeded warnings.

In time the location of the main rotor, tail boom and rotor develop as a perceptual "feel." How does man really accomplish it? Well, it really hasn't been studied operationally, but basic research in visual search techniques provides some insight.

Man's peripheral vision is probably the key to terrain and obstacle clearance for the aircraft under daylight conditions. Judgment of distances and relative relationships are *learned*. They can be learned by the time honored process of osmosis, known as experience, or they can be taught systematically by establishing and recognizing specific visual references early in flight training.

The basic flight student in preparation for NOE must be impressed with two principles early—to maintain a visual awareness of his peripheral surroundings and to become one with the aircraft (the aircraft being an extension of himself). In rotary wing aircraft he must be taught awareness for his rotor tip path. This path must be seen in relationship to a real environment . . . to trees, to landscape, to flora and obstacles. Initially, this can be presented somewhat simply in confidence courses associated with hovering and taxiing. Special lanes can be cut in the terrain with guide markers placed on the ground that permit an established *adequate and minimal* clearance for the rotor tip path for a given aircraft. This clearance criteria would depend upon both human and aircraft control responses and environmental conditions.

With prepared lanes an instructor pilot can take a new student and teach clearance with established criteria, first for one side of the aircraft, then the other and finally both sides simultaneously. This method would be applied and integrated in different aircraft, for different terrain characteristics, throughout all phases of individual training and into the operational unit training environment. It would be a prerequisite for the complicated and real world NOE courses now in existence or recommended in the Department of the Army training circular on NOE (TC 1-15).

To become aware of the rest of the aircraft, the student must psychologically feel the extent of the aircraft around him. Where is the tail boom and rotor—the skids or wheels? No short stops . . . raise the nose, not lower the tail! Remember the terrain just negotiated when masking and unmasking . . . those tall trees that must be cleared by the tail boom.

Simple confidence courses can be constructed to permit the inexperienced student to develop this awareness by establishing concrete references. The eye makes its judgments of distance and depth primarily by retinal image size and motion parallax and to some extent stereopsis (ability to perceive spatial relationships in three dimensions). To establish norms, reference points must be developed during controlled and safe training experiences. The instructor pilot says to the student, "As we pedal turn over this circle, you can visually appreciate a tail rotor clearance of *so many* feet in your peripheral field of vision." Thus, the student *feels* the visual closeness of the surroundings for this type of clearance. Ultimately, aircraft control for terrain and obstacle clearance must be almost totally internalized and automatic . . . subordinated to the subconscious level. So much for terrain and obstacle clearance—it permits the mission to be conducted, but mission accomplishment depends upon visual search.

Visual search is the capability of promptly and effectively identifying recognizable reference points in your field of vision. Visual search is accomplished by both the central and peripheral fields of vision, but again the peripheral field of vision plays a decisive role. In NOE, visual search is required first for navigation, then for target or objective acquisition. Recent helicopter research has shown that maneuvers performed close to the surface in proximity to obstacles requires an aviator's heads up, eyes out posture to a much greater extent than at altitude. In navigation, visual search is used in identifying pilotage references and course check points. Without acquisition and identification of check points, navigation along a course would be impossible by visual means.

Patterns of man's visual search or scanning are just now being examined experimentally. The U. S. Army Aeromedical Research Laboratory (USAARL) at Ft. Rucker, AL, is looking into the visual scanning patterns of aviators for both the performance of maneuvers and acquisition of targets. Such research may lead to more efficient techniques of visual search that can be adopted

	Meters At Which		
	Detected	Recognized	
Personnel	400	400	High
Vehicles (APC)	1,300	600	Light
Personnel	100	100	Low
Vehicles (APC)	750	275	Light

Data collected to show distance at which 50 percent of observers succeeded under search conditions.

during training phases. Interestingly enough, early studies indicate that pilots seldom have accurate subjective ideas of where they are looking during performance of a variety of maneuvers. At present, we know that points of visual fixation are highly purposeful. They are related to the content of the scene and/or the maneuver employed. They vary from observer to observer and do not cover the total field of vision.

To conduct visual search the individual must first have some concept of what he will see. To be efficient his visual expectation must encompass a given size, color, shape and relationship to its surroundings. Having this concept, which must standardize for environmental conditions as well. His peripheral field of vision begins the process of visual acquisition. It scans for forms that come close to the expectation for a given target or check point. For efficiency, his peripheral scan dwells at each prospect only briefly, accepting or rejecting it peripherally and only calling upon central vision when the form matches expectations. Then he centrally sees and identifies. The probability of seeing and identifying the target will be determined by the size of the target and the distance of the observer.

It is thought that aviation personnel can be trained to decrease the dwell time of peripheral vision and maximize speedy identification. Dwell times would have to be minimal to move at rapid airspeeds flying NOE.

In NOE flying the aircrewman must prepare in advance to *think map and see terrain.* Check points or targets must be thoroughly characterized before the mission. The aviator must have definite understanding of the effects of surrounding terrain, of light and shadows, of color (hue) and saturation, of texture and definition, and of size and form from given vantage points. A 4 hour change in time of day—a 10 degree change in direction of approach—can dramatically and significantly alter visual expectation. Thus, the aviator especially must learn to *see* in his mind all the possibilities.

An interesting experimental finding has noted that females have more superior peripheral fields of vision than males for a given age. It has been suggested, partially in jest, that this is because males look directly at females in our society, while the converse is considered bad taste, So, females learn to use peripheral vision as part of their normal adjustment pattern to social mores. Perhaps the use of peripheral vision is not determined solely by physiological factors, but rather by learning and experience.

The Daylight Environment: A recent Aeromedic article ("Effective Communication and NOE Target Recognition," April 1974 DIGEST) reflected upon target sizes that may be acquired by the unaided eye under daylight conditions. The human limit of visual perception (with recognition) of targets the size of 19.1 by 28.6 feet is 4,000 to 6,000 meters. However, this presumes 20/20 visual acuity and high contrast (black object on white background).

FM 1-80, Aerial Observer Techniques and Procedures, states that the *maximum* slant range for the recognition of personnel is 300 meters, for vehicles or large targets about 900 meters. At greater distances, when an anticipated target or check point is just detected, more detailed information about it might be desirable prior to engagement or closer approximation. Have you ever attempted to use binoculars in a vibrating helicopter or steady a high-powered telephoto lens on an object of regard? Magnification multiplies the visual decrement produced by vibration. Modern science can give us a hand, though, with gyroscopically stabilized optical sights which are under development. These too require aeromedical inputs to ensure that they will be compatible with man's visual capabilities and variability.

In addition to the visual requirements for terrain/obstacle clearance and navigation, there also is the most important and critical need to remain clear of other aircraft. This is especially important in the training environment. This must be primarily accomplished through planning of routes to provide aircraft separation throughout the mission. However, no one has 360 degrees of vision or hindsight, so the "see and be seen" or "see and avoid" concepts must be employed (see "Aeromedic—Aeromedical Factors in Midair Collisions," August 1973 DIGEST).

This again requires everyone's effort to see that existing visual deficiencies are corrected. The appropriate scanning techniques are required to minimize inherent visual shortcomings, such as the day blind spots (see "Aeromedic—O Say, Can You See," June 1971 DIGEST), and maximize detection efficiency. This requires using the head and eyes moving together and systematically. Statistically, scans that are 60 degrees to the left and the right of central visual fixation and encompassing 10 degrees up and down will permit detection of threatening aircraft. Scans beyond these sectors also must be made, but when time is limited concentrate in the most critical sectors.

Detection does require eye fixation. Broad sweeping "radar-disc" motions will simply blur important targets. If you fixate every 10 to 15 degrees you should be able to detect any contrasting or moving object in the field of vision. Since the pilot will likely be gainfully occupied simply clearing terrain and obstacles and flying the aircraft, it will probably be the navigator's burden to add "see and avoid" time to his other duties.

Aircraft systems and design can be especially important for the "see and be seen" concept. The use of conspicuous paint schemes for rotor blades and tail rotors has proven its usefulness in the training environment and should be especially important in NOE training. The recent adoption of high intensity xenon lighting to enhance day/night conspicuity is another effort to maximize collision avoidance. In the face of extensive NOE training the Army-wide installation of these devices should have high priority. Finally, there are the electronic collision avoidance devices which are both expensive and interdependent upon cooperation from other aircraft systems.

All of these efforts to "see and avoid" would be necessarily minimized in the combat/hostile environment. However, they should still be available for use over

friendly terrain or territory where aircraft densities will likely be high and flying more conventional.

The Night Environment: To minimize aircraft vulnerability, maximize surprise and ensure tactical momentum, the battle plan must include night operations at NOE altitudes. Aircrewmen most certainly must be aware of their night vision capabilities and limitations. This requirement prevails for at least two reasons (despite the advent of night vision goggles and other devices).

Unaided Vision: First of all, there will be night conditions where lunar illumination will provide conditions that may favor the use of unaided vision. Some have said that with illumination exceeding one-quarter moonlight, the unaided eye is better than that assisted by night vision goggles. This certainly would depend upon terrain differences and other factors. Night vision goggles provide approximately 20/40 resolution and a limited field of vision. Under one-quarter or greater moonlight, the human eye retains some degree of cone function and full field of vision. These advantages could exceed the disadvantages of the goggles. Some operational tests have consistently demonstrated better airborne detection of targets with the goggles under all levels of night illumination. However, the deciding factor will likely be the ability to maneuver and successfully control the aircraft to engage detected targets. Criteria will need to be established for the conditions under which the goggles will be worn versus those under which the unaided eye will be best.

A second reason for the aircrewman's knowledge of his night vision capabilities and limitations is evident in that he must continue his mission even in the event of goggle failure or damage. Even in the face of sophisticated electronics and assisted sensory perception, the night vision seeing techniques are important. The ultimate cockpit system is man. When the electronic and photic systems fail, he must be prepared as the final backup system. The "Owl Team" aviators provide ample evidence that specially selected and trained individuals can perform NOE night flying with the unassisted eye. Some were even somewhat reluctant to use night vision goggles (see "NOE at Night," March 1974 DIGEST).

Man must acquire knowledge of methods of achieving, preserving and protecting dark adaptation and maximizing visual search and acquisition skills by use of specialized viewing techniques and patterns. These were recently discussed in an Aeromedic article entitled "Night Train," in the March 1974 DIGEST.

Many other problems exist for the unaided and dark adapted eye during a night mission. To preserve maximum dark adaptation and avoid troublesome windscreen reflections, instrument and cockpit light must be capable of dimming to very low levels. In certain instances this requires insertion of neutral density filters over the instrument panel warning lights.

In the minimally illuminated cockpit, the position and design of controls and function switches must carefully be considered and aviators must be intimately familiar with their location. This requires the re-institution of such old-fashioned techniques as the blindfold cockpit drill.

Maps are another problem in the minimally lighted, dark adapted cockpit. Conventional maps have proven less than desirable because information about contours and prominent terrain features is not well visualized. Recently, an experimental black background map (prepared by color reversal of conventional maps) has proven adaptable to the night NOE cockpit. In red illumination, roads that are depicted as red on these maps show up exceptionally well against a black background whereas in the conventional map, against a predominantly white background, they lose their definition. Nevertheless, color discrimination as an aid is still lost in red illumination, but with the new maps at least colored details are identifiable.

The relief portrayal of the new maps is improved and hazards and NAVAIDS are especially highlighted. Perhaps continued research will permit electronic projection of maps on a display with multiple views and/or magnification to highlight specifically requested data. This would reduce the necessary fumbling with maps and separate important elements within the map detail with a flick of the switch. However, electronics such as these would require high levels of reliability and man and maps would still be the backup system.

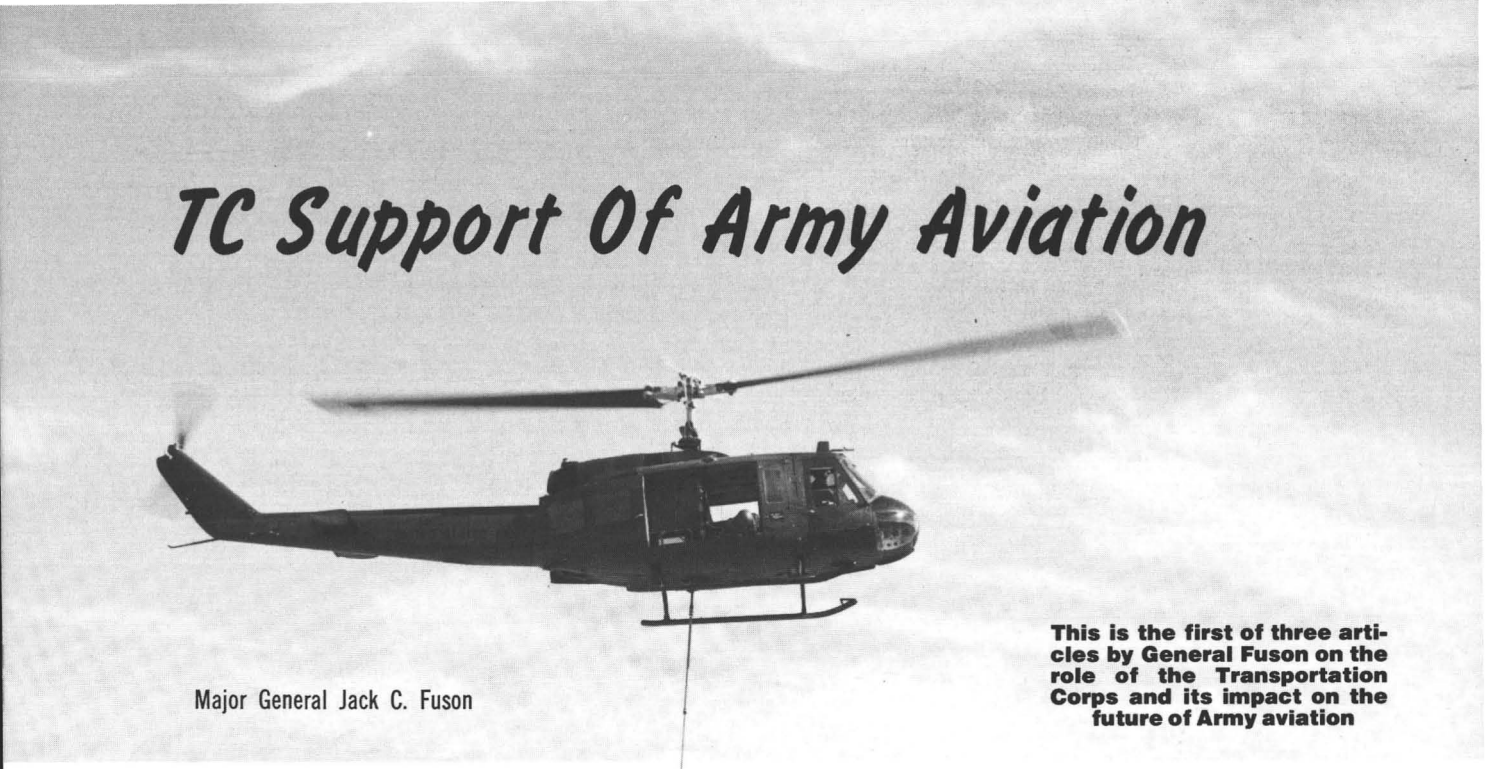
Goggle Assisted Vision: The development of night vision goggles (AN/PVS-5) is a great step forward in night mission capability, but they also spawn new and challenging aeromedical problems. The original goggles were developed for ground units by the U. S. Army Night Vision Laboratory at Ft. Belvoir, VA. Their adaptation for aviation use was accomplished by minor modification.

The first problem was related to focusing of the goggles. Each tube required separate adjustment. USA-ARL resolved this with a lever to gang the tubes, permitting simultaneous adjustments with one hand. Built-in optics provide a wide range of correction from +2.00 diopters (farsightedness) to −6.00 diopters (nearsightedness). This is more than adequate for the types of visual refractive error expected among flying populations. Astigmatism cannot be completely corrected with the current provision, however, this problem is amenable to solution. To date, few wearers have had specific difficulty with this perhaps because the devices provide only the equivalent of 20/40 resolution. Thus, fine detail is blurred but essential visual information is transmitted.

To permit map reading in the cockpit, a recent recommendation has been made to fit an executive type bifocal lens in the lower 20 percent of each lense with the focal length at 21½ inches. This focal length is felt to be a reasonable compromise that will permit focus on maps, instrument panel, pedestal and overhead consoles with a minimum of head and torso movement. However, it does reduce the overall field of view which already is limited to 40 degrees binocularly (a previous bifocal took up 33 percent of the field and had a less desirable focal length).

Continued on page 29

TC Support Of Army Aviation



Major General Jack C. Fuson

This is the first of three articles by General Fuson on the role of the Transportation Corps and its impact on the future of Army aviation

RECALLING A RECENT cigarette commercial depicting the outdoor type man reminds me of our current position within the Army today and in particular the Transportation Corps support of Army aviation. The outdoor type was shown standing on a vantage point observing the vast outdoors and as the scene faded . . . he turned to look in the opposite direction—to the future. From our "vantage point" we too must recall our recent experiences in Southeast Asia . . . but our emphasis must be on the future of Army aviation.

Through a series of three articles (the other two will appear in future AVIATION DIGESTS), I will discuss current developments within the U.S. Army Transportation School, Ft. Eustis, VA, that will impact on the future of Army Aviation. This month's article will cover the transportation aspects of combat service support of Army aviation and will include the significant materiel developmens within the combat and training development activity of the Transportation School. The second article will emphasize the concepts and study area as it relates to maintenance and supply of Army aviation. The third article will be oriented to the individual—his training as an aircraft repairman as well as our efforts in the organization and military occupational specialty (MOS) areas of interest.

The Deputy Commandant for Combat and Training Developments at the Transportation School is deeply involved in many diversified areas of transportation support of Army aviation. This is particularly true since the STEADFAST reorganization with proponency for the major responsibility for aircraft maintenance being reassigned to the Transportation School, to include doctrine, materiel, and tables of organization and equipment (TOE) development for aircraft maintenance units. Today's aircraft maintenance units not only provide maintenance and supply support but also are responsible for the important mission of aircraft recovery. In Southeast Asia transportation aircraft maintenance units recovered downed aircraft having an estimated acquisition value of 3 billion dollars. This amount of money saved is many times over and above the cost of operating these units. Aircraft recovery using today's CH-54 or CH-47 is fast, effective and efficient regardless of the monetary value aspect and ensures a high availability of task equipment in support of combat and combat support activities.

I would now like to elaborate on

Major General Fuson is Commandant, U. S. Army Transportation School, Ft. Eustis, VA

some of the materiel development actions within the Transportation School that will impact on the future of Army aviation.

There are many important developments taking place in the area of new materiel. Probably the most dynamic is the development of a heavy lift helicopter (HLH). The HLH will be an integral part of the transportation system of the 1980s, providing logistical and tactical support to combat and combat support forces. The HLH is being designed to operate 24 hours a day in a field environment moving containerized and palletized cargo as well as tactical equipment throughout the entire theater of operations. The concept formulation phase of the HLH program is drawing to a close as the cost and operational effectiveness analysis (COEA) nears completion. The COEA will determine under what circumstances the HLH can best provide the most effective logistics support to the troops in the field and what force trade-offs can be made when the HLH is available.

It is anticipated that the HLH will be used in place of a significant number of vehicles and other items of transportation equipment to provide improved logistics service to the customer. The COEA is examining the logistics role of the HLH in logistics over the shore operations (LOTS), clearance of air and water terminals, and retail delivery of cargo. The tactical support missions will be oriented toward the movement of vehicles and weapons, emplacement and removal of barriers, and onsite delivery of tactical bridging materials. The COEA will provide the primary user justification for the HLH when the decision is made to go into production with the aircraft. In the meantime a hardware program is under contract to the Boeing-Vertol Company that will result in a prototype aircraft being flown and evaluated in late 1975.

Two exercises conducted at Ft. Story, VA, in 1970 and 1972—OSDOC I and OSDOC II (Offshore Discharge of Containerships)—revealed that helicopters could be used to discharge non-self-sustaining containerships in a LOTS environment. It also revealed shortcomings in support equipment that required development. As a result two items of equipment are now being developed to correct these problems. They are a container lift adapter for helicopters and a shipboard container lifting device. The container lift adapter will be suspended from a cargo helicopter to provide the necessary interface between the helicopter and a cargo container. It will feature alinement guides and semiautomatic twist locks so that a container can be acquired or released by a helicopter more quickly and without the need for ground support personnel. Because of the predominance of container movement missions for the HLH, it is anticipated that a container adapter

Above, two 10,000 pound slingloads are being lifted in British nets. Left, a container lift adapter is suspended beneath a CH-54 Flying Crane

will be an integral part of the HLH cargo handling system. Meanwhile, a prototype adapter for the CH-47 and CH-54 aircraft has been developed under contract to the Boeing-Vertol Company and is being evaluated by the 355th Aviation Company (HH) at Ft. Eustis.

The second item of equipment—a shipboard container lifting device—is still in the initial stages of development. Required characteristics and design approaches are being examined for this device, but essentially it will act as an elevator to lift containers from the cells of non-self-sustaining containerships to the main deck. This will facilitate removal of the containers from the ships by any discharge system, but particularly by helicopters. There will be no need for the helicopter to hover over the cells to extract the containers. The container will be available for lift-off at deck level, making the entire discharge operation more efficient, safer and less expensive.

Other new developments in aviation materiel are closer to field use. In fact, some are already in use with other services.

In December 1973 two Navy personnel spent a week at the Yuma Proving Grounds, Yuma, AZ, to assist the Army in testing the Navy's sling equipment for the movement of palletized cargo. The equipment is used by the Navy for aerial replenishment of the fleet at sea. These tests indicate the slings are superior to current slings in that they provide increased safety and efficiency.

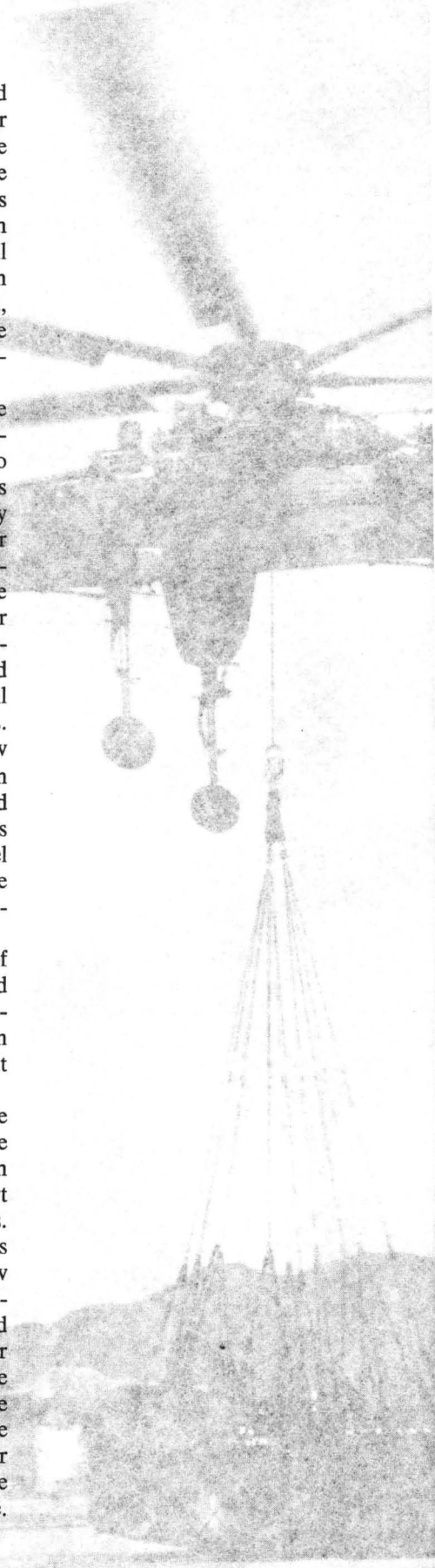
Additional tests have been made on the U.S. Army Aviation Systems Command's British external cargo nets and the British 10,000-pound capacity sling. During these tests diversified loads were clustered for multiple delivery. Six 3,000-pound loads were lifted by a CH-54 helicopter to demonstrate that one cargo helicopter could provide support to as many as six locations with one lift. The tests also revealed the need to develop the particular equipment to allow the man on the ground to release that part of the load that has been marked for his location. Work has already begun to solve this problem. The load will be released in 2 seconds rather than a considerable longer period, thereby reducing costly hover time and employing fewer ground personnel.

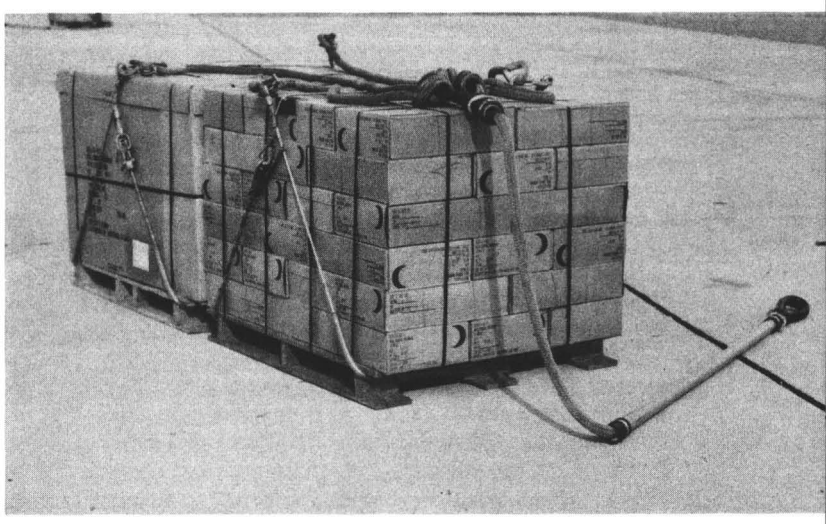
Another area where we have devoted considerable effort to improve existing helicopter cargo handling equipment is the sling sets to rig and lift heavy equipment by helicopter. The requirement for improved slings for heavy lift operation has been approved and the Eustis Directorate, U.S. Army Air Mobility Research and Development Laboratory, has contracted for the fabrication of slings that will lift from 6,000 to 60,000 pounds.

The initial test on these new slings is anticipated this year. When they are tested, type classified and issued to the field, external loads can be rigged by unit personnel more easily and faster to prepare the equipment for helicopter movements.

An entirely different type of aviation materiel being developed is aircraft ground support equipment (GSE). The Transportation School is leading the development effort.

Since the establishment of the U.S. Air Force as a separate service in 1947, we have relied heavily on the Air Force for GSE to support aviation maintenance operations. The Air Force equipment was initially satisfactory—but with new operational techniques, the introduction of airmobile concepts and the increased sophistication of our own aircraft, we must break the chain in equipment designs that tie us to the hangar and airfield type operation. To the Army helicopter pilot an airfield is almost anywhere he can get rotor blade clearance.





Above, two Navy pallet lifters are prepared for a single 2,400 pound lift. Left, two 10,000 pound loads are slung in British nets

We no longer think in terms of the fixed airfields as a necessity but as a luxury. How does this affect GSE?

The design of GSE must provide a capability to operate and survive in any location chosen by the field commanders. It must be airmobile as well as have mobility on the ground to allow for movement of the equipment to the location of the aircraft.

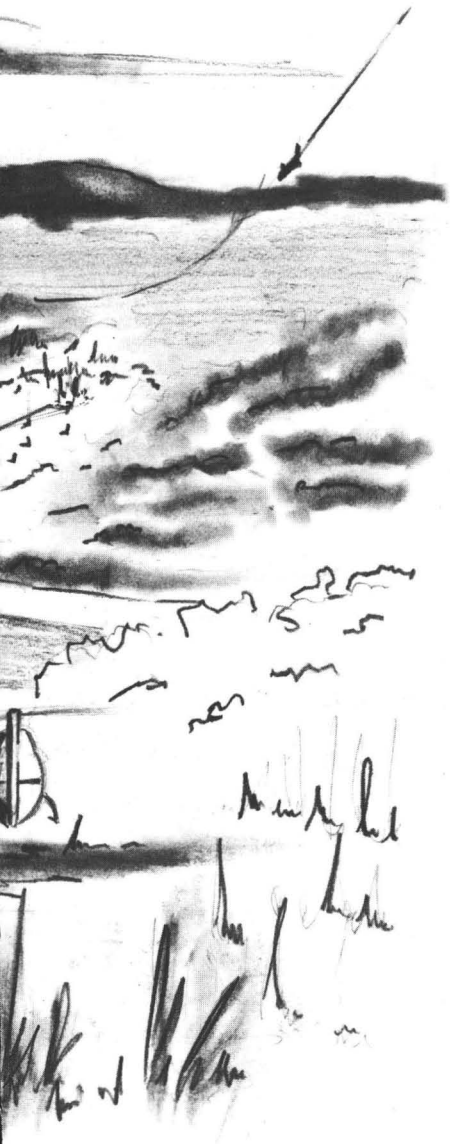
There is a new family of equipment under development and/or test to meet the needs of the men who must maintain the high standards of maintenance and availability miles from the nearest fixed base. The new items include a cleaning and deicing system, self-propelled maintenance crane, a maintenance trailer, automatic diagnostic and inspection equipment, and improved tool sets.

Continued effort will be made to provide support equipment to the man in the field which he can use effectively, day in and day out, to perform his primary mission: to keep safe, flyable aircraft available in support of combat operations.

THIS NONAVIATOR went unscathed after his speech on the advanced scout helicopter (ASH) at the 1973 Army Aviation Association of America (AAAA) convention, so he will be a little bolder and address the attack helicopter, its tactical employment including nap-of-the-earth (NOE) movement and the training challenges that come with it.

Attack helicopter development and employment have been evolutionary. In the short and dynamic history of this new weapons system, tactics have been driven by experience evolving from the 11th Air Assault Division testing and by the demands of the Vietnam conflict. The airmobility concept in low-intensity warfare has been proven and the attack helicopter played a vital role in that validation. Thus, our doctrine on the use of the attack helicopter is based on the concept that the attack helicopter unit is just another combat unit available to the commander.

We are now about to deploy our first antiarmor attack helicopter,



Major General Starry is Commandant of the U. S. Army Armor School, Ft. Knox, KY

TACTICS outlook

Aviation—Part Of The Armor Family

Major General Donn A. Starry

General Starry discusses the joining of Armor and Army aviation in the mid-intensity tactical environment

the AH-1Q; and we are developing a second generation attack helicopter, the advanced attack helicopter, which will be specifically designed for other than a low-intensity environment and which will incorporate features deemed necessary as a result of all previous combat experience. These weapons systems with multiple firepower options offer new vistas for employment within the combined arms team of which they will be an integral part.

Armor is proud to be in the forefront of developing doctrine for the employment of attack helicopter units. Having proponency

for both the attack and scout helicopters, as well as for air cavalry and attack helicopter units, has drawn the Armor community closer to Army aviation. In fact, we have learned that the integration of aviation units into the combined arms team required no significant revision in the proven principles of Armor and Cavalry doctrine.

Let me cover some truisms for employing the attack helicopter company (AHC), the newest combat unit added to the Armor family. First, the AHC is a combat maneuver unit fully integrated into the scheme of maneuver. In light of its unique characteristics of mobility and firepower, the AHC should be considered a maneuver element along with the tank and mechanized infantry company.

A second must for employing the AHC is direct command. Regardless of how you define command and control, you had better control your major maneuver elements on the FM command net, and the AHC is one of those elements.

Thirdly, the attack helicopter unit is not an entity unto itself. As with all other systems and units on the battlefield, there are certain things it does extremely well, but it has its limitations. It is fast, free of terrain obstacles and hard-hitting with multiple ordnance. It also is unarmored, has limited combat endurance, and must be serviced frequently and regularly.

Finally, the attack helicopter unit must fight and live in the ground environment. It is a terrestrial combat vehicle. The vehicles of the AHC will compete with the traditional ground combat vehicles for cover and concealment. This means that the attack helicopter moves on the nap-of-the-earth. It uses the same folds in the ground to hide in. And it advances in a rush, expends its ammo and leaves in a rush. That is NOE movement.

Thus, our definition of NOE is "3 feet skid height and under the wires." Or, to put it another way, "the helicopter must move at speeds that permit maximum maneuverability to avoid trees and at altitudes that require the helicopter to climb to avoid hedgerows." Hopefully, these definitions provide some insight into just how low and slow we mean when we say NOE. The sooner we accept the fact that NOE movement is essential to mission accomplishment and to survival, the sooner we can move ahead with training our aviators to destroy the enemy using NOE flight techniques.

The demand for NOE movement in combat impacts on aviation safety, and safety is inextricably linked to training. There are inherent dangers associated with this type of flight. There is little margin for error and NOE flight is fatiguing to say the least. Yet, we cannot wait until our aviators are on the battlefield to have them learn this skill. The questions that arise are: Are we, as commanders, willing to accept the blade strikes that are inevitable during NOE training? Are we willing to accept a less than perfect accident-free record without ruining an aviator's career? These are serious questions for the individual and for the Army. I am not advocating wholesale revision of aviation safety procedures, but I am suggesting that a distinction between normal helicopter flight and NOE movement during training must be made. We must prepare our rated officers and warrant officers for combat without asking them to risk their careers over flight safety rules.

As Major General Adna Chaffee, U.S. Armored Forces, stated, "It is often said, and it may be true in the abstract, that the principles of war do not change. It is, nevertheless, absolutely true that methods do change and are constantly changing." As a strong advocate of NOE flight techniques, I suggest to you that our methods are not changing in this area fast enough to meet readiness requirements.

Before elaborating on the tactics and techniques of the AHC, let me attempt to clarify a commonly asked question: What is the difference between the air cavalry troop and the attack helicopter company?

The basic difference is in roles and missions. Whereas the air cavalry troop is organized primarily for reconnaissance and security missions, the AHC locates, disrupts and destroys enemy armored, mechanized and other forces by aerial mounted combat using fire and maneuver. The air cavalry troop (ACT) is employed more

often on the flanks or forward of the main body to detect and locate the enemy. The ACT operates in the environment of the "unknown."

The AHC operates more often in a "known" environment, is integrated into the scheme of maneuver and performs missions similar to those of other maneuver units. To save fuel and blade time, the more heavily armed and loaded AHC is normally not committed until a suitable target is located.

Keeping in mind the truisms discussed earlier, it is easy to see how the AHC is readily task-organized for combat by the division and brigade commanders. The entire company can be placed under the operational control (OPCON) of a brigade, or one or more platoons may be further placed OPCON to a task force. The platoon is the smallest attack helicopter unit normally used to conduct combat operations independently of its parent unit. If a sustained attack is expected the company should be kept intact to ensure continuous attack helicopter firepower at the point of decision.

The company may be task-organized and cross-reinforced with other combat maneuver units such as tank platoons or mechanized infantry platoons. *Have you ever given thought to a team consisting of a tank platoon, mechanized platoon and an attack helicopter platoon? Have you considered that the company/team may be commanded by the attack helicopter company commander?* The latter could occur during a counterattack in the delay or in the defense.

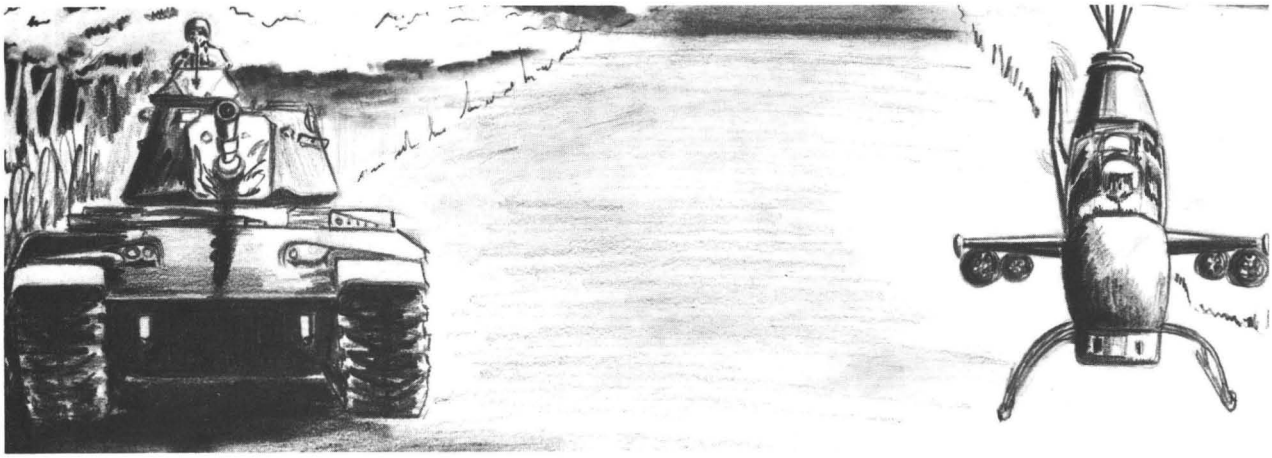
It is recognized there are limitations to cross-reinforcement. We all realize that attack helicopter units do not hold ground, but when properly reinforced to form a combined arms team they can be asked to do so.

The additional flexibility and firepower obtained through blending tanks, infantry and attack helicopters into a combined arms team aids the commander in focusing combat power on his objective as well as improving the survivability of each element. The firepower of one element has a tendency to remove or divert enemy threats to the other, thus enhancing the survivability of all. This third-dimensional force provides the commander with greater combat power and more options with which to carry out his combat mission.

The nature of attack helicopter operations is such that the company normally employs offensive tactics in the accomplishment of its mission. The company is organized and equipped to be used in the attack, ambush or counterattack role.

Offensive operations entail three basic tasks: to locate the enemy; to maneuver against the enemy to gain tactical advantage; and, at a decisive time and place, to attack and destroy the enemy. The actions of the AHC are integrated during all phases of these tasks with those of the ground maneuver forces.

The attack helicopter platoon can be used to illustrate the techniques of employment just discussed. The platoon is usually



employed as a unit. The aerial scout is used primarily to identify targets for the attack helicopter (AH) and to assist the AH in its movements around the battlefield. This technique adds to the survivability of the attack bird since it is not required to reveal itself before it actually commences the engagement. It also adds to the fuel available for time on station.

To provide the necessary command and control during the attack, the platoon commander uses control measures similar to those for ground units. These measures will include establishing holding areas, attack routes, assault positions and firing positions. Control measures are established after coordination with the maneuver commander.

The scout section is responsible for reconnaissance, target acquisition, identification, security and coordination. The section moves ahead of the attack helicopters to establish liaison with ground units, reconnoiter attack routes, holding areas and attack positions.

Targets may be located through reconnaissance or in reports from frontline elements. Once a target is acquired, the scouts then assist the platoon commander in coordinating the movement of the attack helicopters into the holding areas, assault positions and firing positions previously selected.

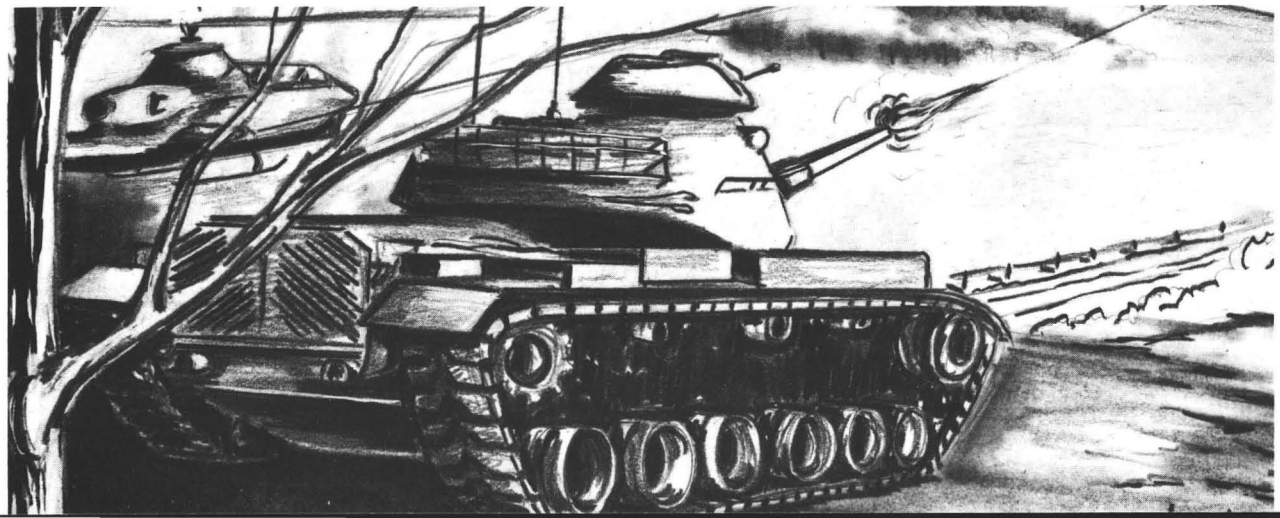
Fire support for attack helicopter engagements is planned just as it is for any maneuver force. This includes the direct fires of ground maneuver elements as well as those of artillery, mortar and tactical air.

The attack helicopter section leader may conduct the attack using the entire AH section or using one team (pair) at a time. Continuous pressure on the enemy can be maintained by using one team in firing positions while the other team rearms and refuels. If continuous pressure cannot be maintained, other company assets may have to be committed to avoid loss of contact.

Attack helicopters must habitually use their weapons at maximum effective range to increase survivability. By moving NOE and firing from standoff distances, they seek to avoid sophisticated enemy air defense weapons and to achieve maximum surprise.

We consider our doctrine for employing scouts and attack helicopters viable. Several years of field testing with MASSTER (Modern Army Selected System Test, Evaluation and Review), the 1st Cavalry Division, Combat Developments Experimentation Command and European units validated these tactics and techniques. Test results also have produced new challenges which we now are addressing at the "Home of Armor and Cavalry." Every possible question has not yet been asked, nor have all those asked been answered. *We look to readers of* AVIATION DIGEST *to help us identify new questions and to answer persisting ones.*

We at the U.S. Army Armor School, Ft. Knox, KY, invite your comments, questions or challenges so that we can improve our doctrine, teach it to our leaders and, when called upon, be ready to apply it in combat.



Continued from page 19

The 40 degree limited field of vision does not seemingly interfere with most aircraft maneuvering and navigation. As aircraft speed increases, effective field of vision normally narrows. However, the peripheral field of vision does assist in visual orientation. Thus, its loss might produce some performance decrement not yet identified.

During recent operational testing some aviators found that the hovering maneuver was most difficult and potentially hazardous with the goggles. This was particularly true with sideward hovering. It was felt that the restricted field of view and concomitant inability to detect actual movement was critical. This problem certainly requires additional investigation and is primarily of concern under low levels of illumination.

Several questions have arisen regarding the detrimental effects of the goggles on man. No serious or prolonged effects have been noted. The only emissions encountered by the eye are from the visible spectrum. Due to the nature of the light intensification, the overall hue of the field of vision is green. After use, some aviators have reported "Brown Eye or Vision." Testing has demonstrated no persistent effect on color vision and this effect is merely a short duration color afferimage due to prolonged exposure to light of a single color.

Some aviators have complained of headache and discomfort after prolonged wear of the goggles. This is presumed to be due to poor fit and/or hard spots or fatigue from the added 1.9 pounds of weight suspended from the helmet. Conceivably, some of this discomfort might be due to unresolved visual refractive error (i.e., astigmatism). A small number of aviators have experienced nausea. This may be due to the sensory discrepency or incongruity between what is seen and felt, restricted visual field causing excessive head movements or superimposed anxiety. Each of these problems can be ultimately resolved as the extent becomes known and improvements in the goggles become available.

With use of the goggles extreme dimming of instrument and working lights is essential. A recent development permits uniform, well controlled red flood lighting at minimal levels for this application. There also is a requirement for limiting distracting reflections of the instrument panel and surrounding surfaces by the use of low reflectance black paint.

The night vision goggles do have an automatic brightness control which protects the aviator against flash overloads from minigun flashes, rocket pairs and parachute flares. In this respect they are superior to unaided dark adapted vision which may become flash blinded. Recent operational reports, however, do indicate serious dazzling when aviators encounter flares to their front. Those behind or beside their field of vision are not disturbing.

The prevailing illumination provided by the goggles does interfere with the normal process of dark adaptation. With sudden failure of the goggles the aviator doffing them would find his level of night vision equivalent to that achieved after about 10 minutes of dark adaptation (partial dark adaptation). Recovery to the 30 minute level (almost full) takes from 1 to 3 minutes. In a critical flight environment (night NOE) the aviator would find himself temporarily compromised.

Although the goggles produce a fused binocular field of vision, the degree of binocular fusion produced is limited. Reduction of visual field tends to limit and disrupt fusion of images with amplitude (stereopsis) as does reduction in resolution. With the goggles in place, present Army tests of depth perception (actually stereopsis) reveal loss of stereopsis. It is likely that depth and distance judgments with the goggles will be made primarily with monocular cues.

The ultimate question with use of the night vision goggles regards performance. How do the goggles fare in permitting mission accomplishment? LTC George Moses ("Helicopter Low Level Night Operations," May 1973 DIGEST) states, "NOE flight at night without some sort of aid for the pilot does not appear designed to increase life expectancy."

In a survey of some 40 pilots who used the goggles, a good deal of variability was found between men. They reported a range of airspeeds from 30 to 130 knots with most between 50 to 100 knots. The speeds were accomplished at a range of altitudes from 3 to 150 feet above ground level (AGL) depending on overall illumination (the averages were 38 feet AGL at 90 knots).

Contrast this with the reports of "Owl Team" aviators using unaided, dark adapted vision for more than 1,800 accident-free hours. They flew at speeds of 30 to 40 knots at altitudes dependent upon terrain (in one instance given as 250 feet AGL or 50 feet above any obstacle). In flat terrain single ship missions could be conducted at 25 to 75 feet AGL dependent on illumination versus 25 to 120 feet AGL in mountainous terrain. In contrast, multiship missions required 40 to 100 feet AGL altitude over flat terrain versus 50 to 175 feet AGL over mountainous terrain dependent on illumination. A good deal of individual and group variability is apparent but an early tendency would be to favor flight with the goggles, especially if such flight is to be undertaken by most aviators. It must be remembered that the "Owl Team" members were probably unique aviators, both institutionally and self-selected for their ability, confidence and perhaps daring.

Exactly what can be seen with the goggles? Well, first of all the new experimental black background maps are well visualized despite the prevailing green. Conventional maps, however, are poorly visualized. Detection and recognition of outside targets depend on light level. The figure reveals the results of early engineering reports. For interpretation of the data, detection is indication of the presence of a target of potential military interest in a reasonable time, but without recognition of the object. Recognition is discrimination between targets (objects) as to class, e.g., tank, truck, man.

Generally, it is said that personnel can be recognized at 400 meters and vehicles at 1,300 meters. The goggles are supposed to be an effective visual aid for viewing

manmade objects out to 3,000 meters. Based on subjective reports of surveyed aviators using the goggles, men were recognized over ranges from 100 to 500 meters, and vehicles 800 to 1,500 meters. Again, variability is apparent but, more importantly, there is a marked discrepency with the previously presented guidelines of FM 1-80 which is very difficult to resolve with logic. How can night vision goggle assisted vision with 20/40 resolution permit recognition ranges that are greater than daylight unaided visual acuity of 20/20? It is apparent that comparison studies must be undertaken at defined NOE altitudes and measured illumination levels to determine current guidelines that resolve these seeming discrepencies.

The Elusive Environment: For a moment, let's consider the cockpit workloads of NOE crews. The pilot must concentrate on clearing obstacles and maintaining proper heading and airspeed, so he must be free to look outside the cockpit at all times. This is necessary to accomplish flight generally following the contours of the earth as close to the surface as vegetation or obstacles will permit. The pilot must be able to handle the aircraft with ease and finesse and use only smooth and coordinated control movements during all maneuvers.

On the other hand, the navigator/observer must monitor the engine, transmission and other instruments in addition to navigating. He must remain oriented at all times and inform the pilot of the heading to be flown and flying time to the next check point. He must navigate precisely and know the location of the aircraft within 100 meters at all times and be able to give an 8 digit grid coordinate for the position. When time permits it he describes the next check point so the pilot can assist in identifying the check point. Also, while navigating the aviator must demonstrate his ability to fly a segment of the NOE route and perform all normal functions of pilot in command while restricted by the M-24 CBR (chemical, biological and radiological) protective mask. While the time duration for wearing the mask is optional, it should be of sufficient length to prove challenging to the pilot. In addition, the pilot and navigator may fly for extended periods using night vision goggles and perhaps even oxygen masks.

Envision the navigator looking down at his map, then up through the windscreen, turning his head and scanning for references while the pilot weaves between trees at variable speeds from zero to redline and makes pedal and cyclic turns at slow and unperceived rates to roll rates capable of producing significant angular accelerations. Consider the potential for producing both visual and vestibular illusions—fascination from concentrating on a goggle limited field of view at night, to leans from unperceived motion, to mild coriolis illusion (see Aeromedic articles entitled "Which Way Is Up," April 1972 DIGEST; "Vestibular Illusions and How To Whip Them," May 1972 DIGEST; and "Visual Illusions," June 1972 DIGEST). Such illusions can lead to mild degrees of motion sickness with stomach awareness, belching and clammy perspiration. These head movements in the cockpit must be controlled, slow, subtle and primarily limited to segments of straight and level flight to avoid disorientation.

Spatial disorientation is especially likely under limited visibility conditions, i.e., night, limited visibility from haze or fog, or just plain weather. Use of night vision goggles with restriction of peripheral fields of vision, particularly in gunship type missions, might lower the threshold for production of vestibular illusion.

During night flights with unaided vision, dark adaptation makes aviators especially sensitive to light. Upon encountering flares, searchlights or ordnance and weapon flashes, the crew may be momentarily blinded. Similarly with goggle failure, the crew will face difficulty in returning to the darkened flight path, requiring recovery by instruments. Thus, instrument proficiency will be an extremely important backup or emergency skill.

Unfortunately, present instrument systems are not specifically designed for rotary wing aircraft. There is currently not a good instrument for displaying lateral drift of the helicopter and there is a lack of displays optimized for low level flight in general. In addition, the lack of standardization of instrument panels further confuses the aviator in a tight situation. Aviators must be acutely aware of these limitations so that they can anticipate and adapt to these conditions.

The Challenge

So much for the perception of the external environment. There is no doubt this aspect of NOE flying has the most immediate importance. Where are the potential problems and possible solutions? What areas need the most immediate attention?

- First, there is the question of ***flight training*** . . . the need to teach the aviator to see and feel the peripheral surroundings and know the extension of his aircraft. This must be accomplished early and throughout flight qualification and unit level training and specifically for different aircraft. There is evidence that this visual and psychological sense is trainable, the problem is to find the most meaningful and efficient means.
- More vivid visual aids for ***navigation training*** may under variable conditions be required to develop aviator skills. Perhaps this will require more concentration on aerial observer techniques and procedures both in the classroom, possibly in simulators, and in flight.
- The crewmen's expectation of their ***visual capabilities*** both day and night must be more accurately determined. Discrepancies in existing literature and experience must be resolved by continued testing to establish expected norms for assisted and unassisted vision.
- Criteria must be established to determine the ***conditions of night flying*** under which the unassisted eye is best as opposed to the eye assisted by night vision goggles.
- The significance of ***peripheral vision***, particularly under night visual conditions, must be investigated. Early evidence indicates that it is desirable for orientation and total aircraft control. The extent to which aviator performance will be compromised by goggle restriction of peripheral fields will determine the need to develop devices with greater visual scope.

11th Air Assault And The Future

Continued from page 11

crewchief and my dog Kismet (he hasn't willingly gotten into a chopper since—he's the smart member of the family). It actually was against Army regulations at that time to shoot touchdown autorotations. We asked for a waiver, never got it, but trained our people in it assiduously anyway on the basis that if you are going to ask people to fly that way, you've got to equip them with the means of saving their lives and the lives of others—even if the training does break up a few birds. The power recovery in practice is a mistake. There is simply no way with a gas turbine engine and its response timelag that you can make a power recovery without completely changing the profile and the whole feeling of the autorotation. *Memo: This subject has raised its head again and there are organizations in the Army that prohibit practice touchdowns because they're afraid of the safety statistics.* We simply have to have the guts to pay the price for protecting our people.

We established a confidence course that flew people under wires, down a twisting riverbed (where they'd have a place to sit down if something went wrong) and included various maneuvers such as popups (which are safe if people are taught to do them properly), autorotations and so on. Its value was possibly partially cosmetic to show visiting dignitaries how we trained, but it had a useful purpose in enabling all of our guys to go out with a good standardization IP and have their procedures checked periodically.

We were in the Army's normal dilemma of flying underpowered birds and this cost us dearly. As was later true in Vietnam about 20 percent of our accidents came from people trying to take off, particularly in confined areas, with too heavy a load. So we worked diligently at trying to develop methods to prevent this. Elton Smith, on loan from Bell Helicopter Company, developed the first "hover power check" for us and this helped a lot, but of course not as much as the full 6 point system that was later developed in Vietnam.

Much of our safety work, of course, had to do with equipment. The Army didn't know enough about handling jet fuel in those days and we had the difficulties that one might expect with contaminated fuel. These led to the development of pills to put in fuel samples to determine whether there was an undue amount of water and subsequently to our adoption of the best "go/no-go" fuel filters that I have ever seen. *Memo: These have disappeared from the system for some reason.*

Our safety work was also tied to our growing knowledge of the new beast that we were working with—the gas turbine engine. Consternation ran rampant one hot August afternoon when birds of the 227th hovering around their sandy heliport began to lose power with horrifying backfires coming from both ends of their engines. We learned very quickly that the sand at Ft. Benning was among the most abrasive in the world and that as some of our older birds began to get a little over 600 hours of exposure to this, the compressor sections were sufficiently ground down to become inefficient and give us compressor stalls. We quickly initiated action to develop procedures governing minimum N_1 rpm and rates of application of power that tended to keep this from happening and we began work on a crash basis with Bell and Lycoming to come up with the first air filters. The latter took a little time to develop, of course, but ultimately pulled us out of it.

We had a particularly horrifying engine problem develop in the Carolinas during our big test. Six birds went down from complete engine failure in 2 days, killing about four people. There was obviously a new trend and we went crazy for 48 hours trying to figure out what it was. We inspected the fuel, brought in experts from Lycoming, tried to analyze every accident and attempted in every way possible to figure out what had changed. We finally decided that what *had* changed was the weather.

Airmobile tactics evolved by the 11th were used here at Firebase Birmingham, RVN; UH-1s provide the mobility

The first frost had occurred and the long grass in which we had been landing in many places had turned to long, silky, fine hay that flew up around the birds in clouds during many of our landings. We still didn't have filters on our Bravo models (UH-1Bs) and these were the ones that were going.

We pulled in a mobile test stand and spent one fine Sunday afternoon throwing grass into the open end of a T-53 engine on the test stand. We had no results other than gradual loss of power as the inlet became completely clogged.

Then the Lycoming people came up with a thorough analysis. A uniformly clogged inlet resulted in a gradual loss of power, but when you had a situation in which about one-quarter of the inlet was clogged there was a harmonic excitation of the fifth compressor wheel which caused it literally to explode. When cleaning the inlet from outside a Huey without taking the cowling off, one-quarter of the inlet screen was almost impossible to reach so our crewchiefs were doing an irregular job of cleaning them out. Hurriedly we started taking the cowlings off for cleaning purposes and had no more trouble. We also, of course, during this timeframe learned a lot about washing engines, using walnut shells and so on. We became expert at things like knowing when, in terms of airframe life, to start looking for cracks around the tail boom mounting bolts and developed many other minor checks as we grew with our aircraft.

We had people get hung up on rappelling ropes and learned our way around that. We learned to tape over the ground handling gear mounting lugs on the skids in parachute operations one night when one of our intrepid pathfinders had part of his gear get hung up on one of the lugs and couldn't get disentangled. This guy was thinking all the way, fortunately, because he hauled himself back up on the skid and realized that the next thing that would happen would be that the crewchief would start pulling in the static lines, thereby deploying his chute (wow!). He wrapped the static line around his arm so that the chief couldn't pull it in. The chief thought it was tangled in the skid so he shut the door, leaving the static line hanging out. A sister ship in the formation saw our brave hanging on the skid, silhouetted against the moon and spread the word. The helicopter with the pathfinder shot an approach to a field, came to a hover and our hero got himself disentangled. He then insisted on getting back into the bird and being flown back out to jump in to join the rest of his team. Like I said, we had great people!

EQUIPMENT

We've already talked about equipment to some extent, but of course our problems went far beyond that. The CH-47 Chinook was, for many reasons, a particular problem. It had many design deficiencies in its early days. Modifications were coming through hand over fist and parts were very difficult to obtain. The CH-47s were grounded many times and when they weren't we had a rough time keeping enough of them up to get our people trained to do the job. This led to a series of monthly meetings which sometimes resembled battles with Major General Charlie Rich, the Commanding General of Ft. Benning, presiding and Ben Silver, the Chinook battalion commander, on one side of the room and the leadership of Vertol on the other. Through this means we gradually solved the problems, and the Chinook became the fine helicopter it is today.

We had a great time with maintenance equipment, knowing that it all had to be airmobile. To this end we participated in the design of airmobile shelters which could haul our equipment and afford a place to work. Unfortunately, we made the mistake (over the reluctant bodies of those of us at Ft. Benning, incidentally) of going for centralized maintenance, that is, very light maintenance at company and battalion level and having all of our heavy stuff in the maintenance battalion at division level. This was ultimately reversed in Vietnam but it sure took a long time. *Memo: Part of the wrench-bending community is still persistently trying to chivvy us back in this direction; we should resist it.*

We did a lot of work with camouflage. We finally got our workhorses painted drab OD instead of gussying them up like Cadillacs—even though it was a *very* uphill battle and we experimented with nets, covers, old parachutes, you name it. We tried anything we could get and still came up with

Above, an OV-1 with SLAR pod under belly. Left, UH-1s airlift 25th Infantry Division soldiers near Cu Chi, Vietnam, 1966

the lesson that we keep relearning —a camouflaged helicopter looks like a camouflaged helicopter. *Memo: MASSTER is making some headway in this but we still have a long way to go.* We experimented with ways of pushing birds under the trees and Bell came up with some electrically powered "crazy wheels" to replace the normal ground handling wheels. They weren't good enough, but they were a start. *Memo: We still haven't licked this one.* To a lot of people's consternation this capability was not required in the design of either the UTTAS (utility tactical transport aircraft system) or the AAH (advanced attack helicopter).

One feat of note was outside of the strictly aviation business. Tom Nicholson, our signal battalion commander, built a signal battalion that had its equipment completely mounted in jeeps and jeep trailers. We also helped develop airmobile engineer equipment and many other things of this sort.

We developed the re-arming and refueling equipment that we used in Vietnam. It was rudimentary but worked. MASSTER is fortunately working very hard to make both of these areas more satisfactory at the present time.

COMMUNICATIONS

We worked very hard at getting good communications, of course, because we envisioned we would have to work over long distances. We developed some very good relay equipment. The best we had was a CV-2 Caribou equipped with enough gear to provide relays for 8 separate nets. They were very vital to us and in the final analysis one of the main things that really enabled us to communicate well.

We had the first command and control consoles, the first of which we made ourselves, although the Signal Corps came out with better ones later on.

We learned early that in any operation involving liftships, gunships,

UH-1 arrives to pick up 101st Airborne troops for reinsertion a mile away, Mai Loc, Vietnam, 1969

Chinooks and the rest, that it was absolutely essential that we have every aircraft in the area on one common UHF frequency. At times we even asked Air Force aircraft in the area to come up on the same frequency. There is simply no other way of keeping everyone posted on what's happening in controlling that particular chunk of airspace.

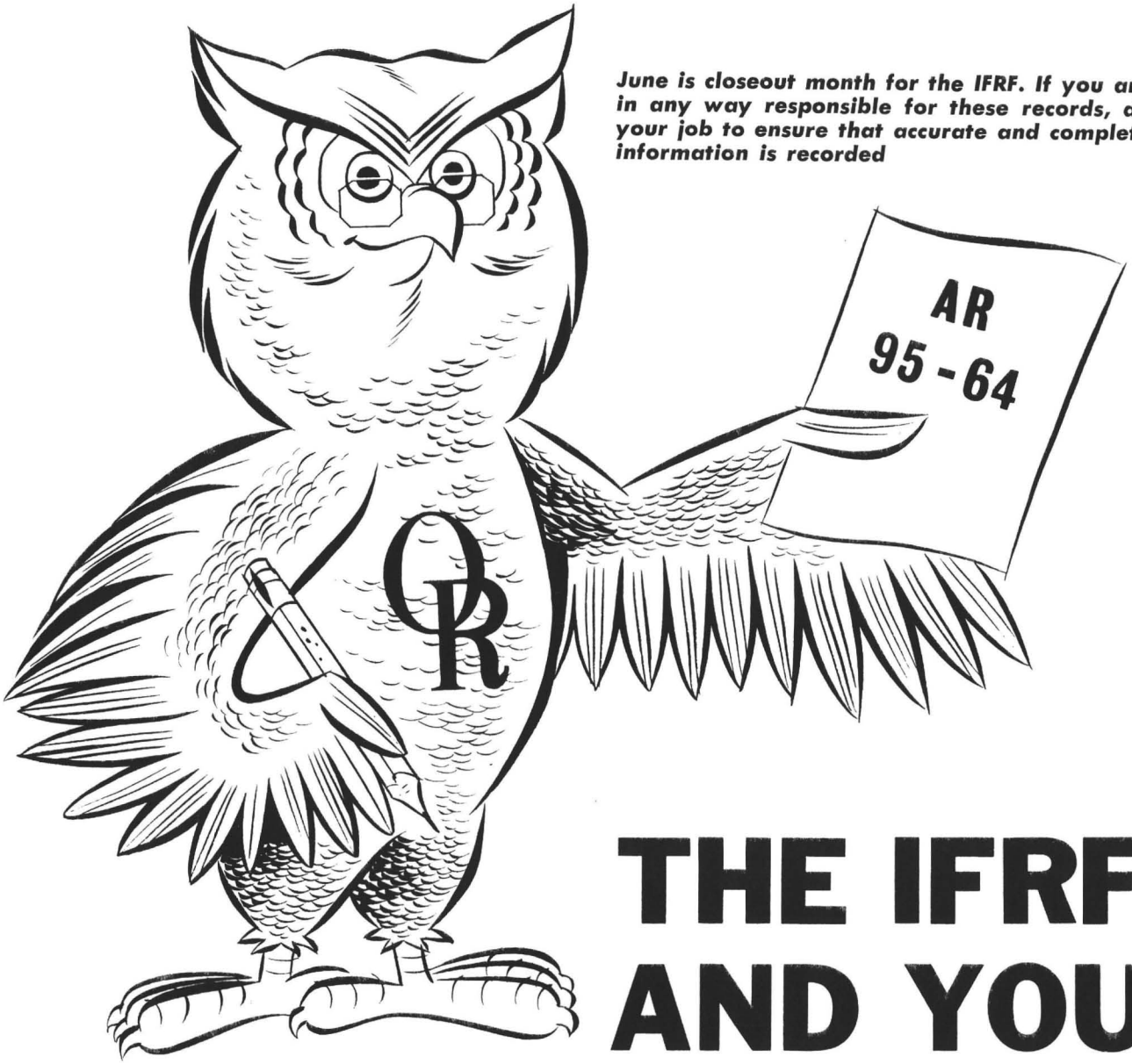
We worked hard on radio procedures to shorten them, simplify them and keep the air uncluttered so that we could get the job done. We got good at telegraphic methods of saying things and saving words. The 227th had a policy wherein every time anyone was caught saying an unnecessary word on the air, he had to put one dime per excess word in the battalion party fund. One day at Ft. Stewart we were laying on a big show for the Chairman of the Joint Chiefs of Staff, General Earle Wheeler, and Colonel John Stockton was to brief him on the operation over the intercom system in a following aircraft. Only one problem occurred—the wiring on my ship from which he was narrating had been changed from the normal and he forgot to switch to intercom; so he got about 20 minutes of Bull Whip's rich, rolling, descriptive prose completely blocking our command net. When we finally got to him and shut him up, an unknown voice came up on the air saying, "Colonel, that will be $384.60 for the party fund."

PEOPLE

As I looked at the guys we had in the 11th, I really thought that OPO (Office of Personnel Operations) had knocked itself out and given us the pick of the aviators in the Army. There was nothing they wouldn't do; nothing they wouldn't try; they were enthusiastic, dedicated, superb human beings. I learned later in Vietnam where I was exposed to a much larger sample that I was wrong about the selection process because damn near all aviators had those characteristics. Nonetheless, it was dedication, enthusiasm and innovation that made the 11th Air Assault work. It was the same thing that made Vietnam work from the aviation point of view, and they're the same things that will make anything else work in the future if we but continue to get the kind of people in this business that we have in the past. We have to work very hard on getting them and then training them properly.

It was an exciting time, the 11th brought things a long way. Vietnam brought them a lot further. We *have* come a long way, baby . . . but we still have a long way to go.

LTG Seneff, West Point 1941, organized and commanded the 11th Aviation Group until completion of the airmobility tests in 1965. His assignments include that of Director of Army Aviation; CDR, 1st Avn Bde; CG, 3rd Inf Div; Director of Operations, USSTRICOM; DCG, MASSTER; and CG, III Corps and Ft. Hood. At present LTG Seneff is CDR, Fifth U. S. Army at Ft. Sam Houston, TX



June is closeout month for the IFRF. If you are in any way responsible for these records, do your job to ensure that accurate and complete information is recorded

THE IFRF AND YOU

HOW IMPORTANT are records? Ask Hank Aaron about his record-breaking homerun, number 715. Ask any athlete how he feels about having his name in the record book. To a singer, a gold record means money in the bank, fame and bargaining power for future engagements. An accountant earns his bread and butter from still another type of records. Some types of records are important to all of us.

Army aviators depend a great deal on accurate records. One record which is very important is the DA Form 759, Individual Flight Record File (IFRF).

The 759 is your record of accrued flight time as an Army aviator. It follows you through the military service just as your 201 file does. It provides confirmation data for flight pay and annual minimum purposes. It is a ready reference showing fixed wing, rotary wing, single engine, multiengine, instructor pilot, first pilot, copilot and student time. It shows aircraft type and model series in which you have qualifications. All of this is important, even if you decide to leave the Army. You will need the information in your IFRF if you intend to join a National Guard or

Sergeant First Class Howard W. Brewer
Directorate for Plans, Operations and Education
USAAAVS

Reserve unit as a pilot. Many civilian organizations require this record before you are hired to fly their aircraft.

COMMANDER

AR 95-64 establishes responsibilities and procedures for preparation, maintenance and distribution of DA Form 759. Commanders of Army activities with personnel assigned or attached for flying duty are responsible for maintenance and inspection of individual flight records. Obviously the commander will not personally maintain these records. He will delegate this function to the operations officer, who will give the job to the operations NCO. We finally get to the level where entries are actually made on the 759—the operations clerk. All of these people should have a thorough understanding and accurate interpretation of AR 95-64.

Many record forms have a "remarks" column which is seldom used, but this is not so with the 759. Check the AR and you will find several very important entries that must be made in block 24 (remarks). Factors which affect flying status, qualifications and proficiency which are not specifically provided for elsewhere on the form must be entered in block 24, e.g., if an aviator is involved in an aircraft accident, the pertinent information must be entered. AR 385-40 states that the accident investigation board member assigned to recorder duties will be personally responsible for the entry.

Commanders may obtain necessary information for updating the IFRF by writing to the appropriate records holding office listed in table 2-1 of AR 95-64.

OPERATIONS NCO/CLERK

If you are an operations NCO or clerk it's your responsibility to properly maintain these records. It is not a simple task but it should not be a difficult one either if you have a thorough understanding of AR 95-64.

OPERATIONS OFFICER

You are responsible for keeping administrative tabs on all flight records in your unit. It is true that your operations NCO and clerks are responsible for the actual entries made on the 759, but if they don't get the information they can't enter it. Accuracy and completeness is your job, including the correct spelling of the pilot's name and proper listing of his social security account number (SSAN). Many aviators are carried on various excusal programs currently in existence. You should control these records and see that appropriate entries are made.

Distribution of the 759 is also part of your job. Make sure the record copies are mailed to Commander, USAAAVS, Fort Rucker, AL 36360, on an annual basis, and that each pilot receives his personal copy. It appears that the regulations are a little vague on deceased or permanently grounded aviators so send all original copies (No. 1 copy) to USAAAVS as a part of the permanent files. There will be times when these records will be needed for future reference.

AVIATOR

Your IFRF is more important to you than anyone else and accuracy should be your concern. Here are some of the things you should do each time you receive an updated copy of your IFRF.

- Check the spelling of your name and make sure your SSAN is correct.
- Make sure all entries are made in the appropriate blocks, including the remarks block. Read AR 95-64 and check with your operations officer or NCO for clarification of the parts you don't understand.
- Report any errors to your operations officer or NCO for correction.

With this everchanging Army of today, suppose you are assigned to a post in a nonflying capacity. What should you do with your flight records then? Take them to the airfield for retention. This way, your records can be properly updated each year or as often as need be. By following this procedure, you can ensure that your record copy is mailed to USAAAVS and that the pertinent data is forwarded to AG for input into TAGO file and branch file. *Don't attempt to keep your records at home.* On the other hand, make sure your individual copy of the 759s is given to you for permanent retention. When transferring to another unit, be sure your old unit forwards the originals to your new unit with your other records.

It is common for USAAAVS to receive requests to reconstitute individual flight records in part or in their entirety. Many of these requests cannot be filled simply because the records were never sent to USAAAVS as required by regulations.

June is closeout month for the IFRF. If you are in any way responsible for these records, do your job to ensure that accurate and complete information is recorded and properly distributed.

Arnold R. Lambert
Directorate for Plans, Operations and Education
USAAAVS

"I Understand You Like to Follow Regulations..."

This is a classical example of the great influence commanders have on their aviators. This senior unit commander encouraged pilots to violate regulations, yet was unwilling to accept responsibility for the consequences

THE MINUTE YOU enter the military service you are introduced to regulations telling you things you must not do and things you must do, with other regulations telling you how these things must be done. When you enter flight school, safety regulations are the ones you most often hear reiterated, and you constantly are reminded of these throughout your career.

The AVIATION DIGEST and many other publications remind you month after month to follow the regulations. They warn of the hazards of flying in marginal weather, unauthorized low-level flying, flying while fatigued and under physical or mental strain, etc., etc.

All regulations have a purpose and, regardless of what some people may think, they were not made to be bent or broken. It is the responsibility of supervision to see that regulations are followed.

With all that's been written about regulations and safety, why do aviators continue to violate regulations and commit unsafe acts that make accidents inevitable? Some of the reasons were found in a recent accident report.

The pilot involved had many personal problems and should not have been flying. His commander was not only aware of these problems, but was the cause of some of them. Yet he continued to let the pilot fly.

The accident. The pilot was in TDY (temporary duty) status in support of field artillery testing at a training area. After filing a flight plan by telephone and relaying his plan to flight operations, he prepared for departure. One passenger was seated in the left (copilot) seat of the OH-58 and the other passenger was seated in the right rear seat.

The pilot took off on an easterly heading and climbed to approximately 1,000 feet until crossing a highway. He turned to a heading of approximately 120 degrees and began to decrease altitude. The flight was then continued at 50 to 100 feet above ground level (AGL) or "contour flying."

The pilot entered a valley and continued his contour flight at treetop level. He looked down at his radio and began a descent from treetop level into the valley at less than 100 feet AGL. He saw some

powerlines on his right and started an immediate climb. When he saw a flash of powerlines on his left he pulled full aft cyclic to climb over the wires. Airspeed was estimated to be about 100 to 110 knots when the cyclic climb was initiated.

The main rotor blade struck the first 32-strand cable and cut it in four places. The attitude of the helicopter was extremely nose-high and the skids missed the second cable but the tail boom hit the cable and broke off about 2 feet from the vertical fin. The helicopter started to spin and struck two 6-inch-diameter trees just prior to impact with the ground.

One passenger received major injuries and the pilot and other passenger received minor injuries. There was no fire.

Pilot's statement. When I first arrived, I flew at this altitude with my commander and his pilot. We were flying low to try to locate the commander's POV (privately owned vehicle) that his wife was riding in. Flight following called and asked if 684 would squawk ident. We did not squawk but a radio call from 684 said squawking ident. Then after flight following called, my commander said, "Let's climb on out before someone gets the tail number and turns us in."

On another occasion, I had the weekend courier mission to fly because the aircraft normally used for courier missions were not available. I flew on Friday evening to be at the pickup point for morning missions. I called for weather at 1600 hours and the weather people said I could leave at 1230 hours VFR. So I called and talked with a field grade officer to tell him if he wanted to go by aircraft, weather people said we could go at 1230. He told me to try a weather check at 1230 to see if we could make it and if we could I was to come back to pick him up to go at 1600. I said, "Sir, that's kind of silly to check now." He said that I didn't understand and that I was to try anyway. I said, "Sir, the weather is good now, but it's not going to be VFR at 1500." He then ordered me to make a weather check at 1500. I said I couldn't because they couldn't clear me if weather was below minimums. He again said I didn't understand. He said he knew they got their weather from pireps and pilots didn't like to fly on weekends and they just said the weather was bad. He told me to try at 1500. I finally said I would.

At 1500, weather told me hills at 2,000 feet or above were obscured. So I didn't make a weather check because I couldn't get clearance. At 1600, I called weather again and was given the same information and the clearance officer asked if I would fly into the clouds. I said no, so he cleared me to fly up the valley and I was surprised at getting the clearance.

We left and en route the weather was so bad I wanted to set down in a field. The field grade officer, a rated aviator, said no, we would go south, then north if we had to to get through. So we tried south and no go. Then we tried west and were able to get through by flying at 40 knots below the treetops. We had to go down the river below the hilltops to make it through. It was far below VFR minimums and I should not have gone through. Visibility at times was less than one-eighth mile.

Command emphasis of this type encouraged me to do this kind of flying. I've never had a second thought about flying low since it keeps me alert and awake. AR 95-1 states we need 20 hours per tactical training, which includes nap-of-the-earth flying which is much lower than I was flying when this accident happened.

I've asked for time off to take care of financial problems—to be reimbursed for dependent travel. I'm going through a divorce which will not be final for 4 more months. My wife has been causing trouble and I don't even get time off to take care of that. I've been given directives to do things but I can't get time off to do them.

Statement from another pilot in the unit. I do feel undue pressure to perform missions at all costs has been placed on unit pilots because of command influence. For example, I had a flight to pick up a passenger. The passenger had no ID tags, so I refused to fly him. He left and came back later with another person's ID tags. Again I refused to fly him. The weather was flyable and the flight plan was valid, but regulations state that you must have your personal ID tags to ride in Army aircraft. A field grade officer requested that I fly the mission anyway. I said I couldn't and he released me. When I got to the section, I found that the field grade officer had instructed the section leader to talk to me about mission accomplishment. If the man had his ID tags, I would have flown the mission with no problem.

The next morning in formation, during inspection by the unit commander, I was told to report to him in his office because he said I needed a haircut. It was later admitted that I did not need a haircut. However, when I reported to his office, the first sentence he spoke was, "I understand you like to follow regulations." Then I listened while he explained to me that regulations could be bent.

There was a period when members of the section were on standby from 0430 to 2000 daily. During this time it was not uncommon for the pilots to grab a nap on the couch in the pilot's lounge. We normally exceed our monthly flying hour program and time off from work is not easy to get.

I UNDERSTAND

Findings. Supervision was the most important single factor in this accident. The pilot was chronically fatigued because he had flown 65 hours in the preceding 30 days in addition to other duties. He had many personal problems and was not given adequate time to resolve them nor were these problems recognized as having a harmful effect on the pilot's flying ability. The mission of the unit was considered more important than the physical and mental health and well-being of the personnel.

The pilot had only 2½ hours sleep the night before the mission. Local SOP did not provide for adequate rest before or between missions.

The passengers had their sleeves rolled up and shirts untucked, which could have caused serious burns had a fire occurred. Passenger briefings did not require passengers to roll down sleeves and/or tuck in shirts.

Pilot error was also present. The pilot was flying low level because he and the passengers enjoyed this type of flight. High airspeed, low altitude and inattention of pilot caused the aircraft to strike high-tension powerlines, resulting in loss of control and subsequent crash.

The pilot did not wear a survival vest but stored it in the radio compartment. The vest irritated his neck.

Recommendations. The accident investigation board recommended that:

- Greater command emphasis be placed on adherence to low-level flying restrictions.
- Greater emphasis on information program be established to remind pilots of dangers associated with low-level flying.
- Commanders at all levels become more aware of the amount of time being spent by their personnel in mission performance and weigh the importance of the mission against the possible hazards of personnel fatigue.
- Commanders at all levels become more aware of the physical and mental health of personnel in their command and the effect of personal problems on the well-being of their men.
- Command emphasis be placed on proper use of survival equipment to ensure its maximum effectiveness.

Flight surgeon. This case represents a classical example of an accident looking for a place to happen. All of the adverse human factors which contribute to human error accidents were present in the pilot.

The cause of the accident is obvious. The individual was flying unauthorized low level and encountered wires which resulted in a human factor accident. What is most important from a prevention standpoint, which was not even commented upon by the accident board, is why the pilot placed himself in the position where an accident was inevitable.

Reviewing the record one sees many very obvious human factors which contributed to the accident. Certainly the pilot exhibited inattention, channelized attention, distraction, preoccupation with personal problems and fatigue factors, all of which indicate some degree of underlying anxiety in flying.

The pilot had multiple social, financial and legal problems, all of which contributed to chronic anxiety and compromised his effectiveness as an aviator. His lifestyle indicated a self-induced, neurotic fatigue and his own statements support this diagnosis. His constant preoccupation with the weather prevented him from properly resting the night before the flight and his preoccupation with radio procedures in the aircraft prevented him from properly dividing his attention.

After reviewing the record I feel at the time of the accident and probably currently, the pilot, because of multiple personal factors, was incapacitated psychologically to the extent to render him ineffective as a safe and competent aviator.

I feel the board should have addressed these factors from a preventative standpoint and commented upon same in the report.

Should the pilot be administratively found unqualified for continued duty as an Army aviator by a Flying Evaluation Board (FEB) for his low-level flying activity, then that is well and good, for his lack of good judgment should not be excused on medical grounds. However, if he is cleared to return to flying by the FEB, I would not be satisfied until he is fully cleared medically by a flight surgeon before he is returned to duty.

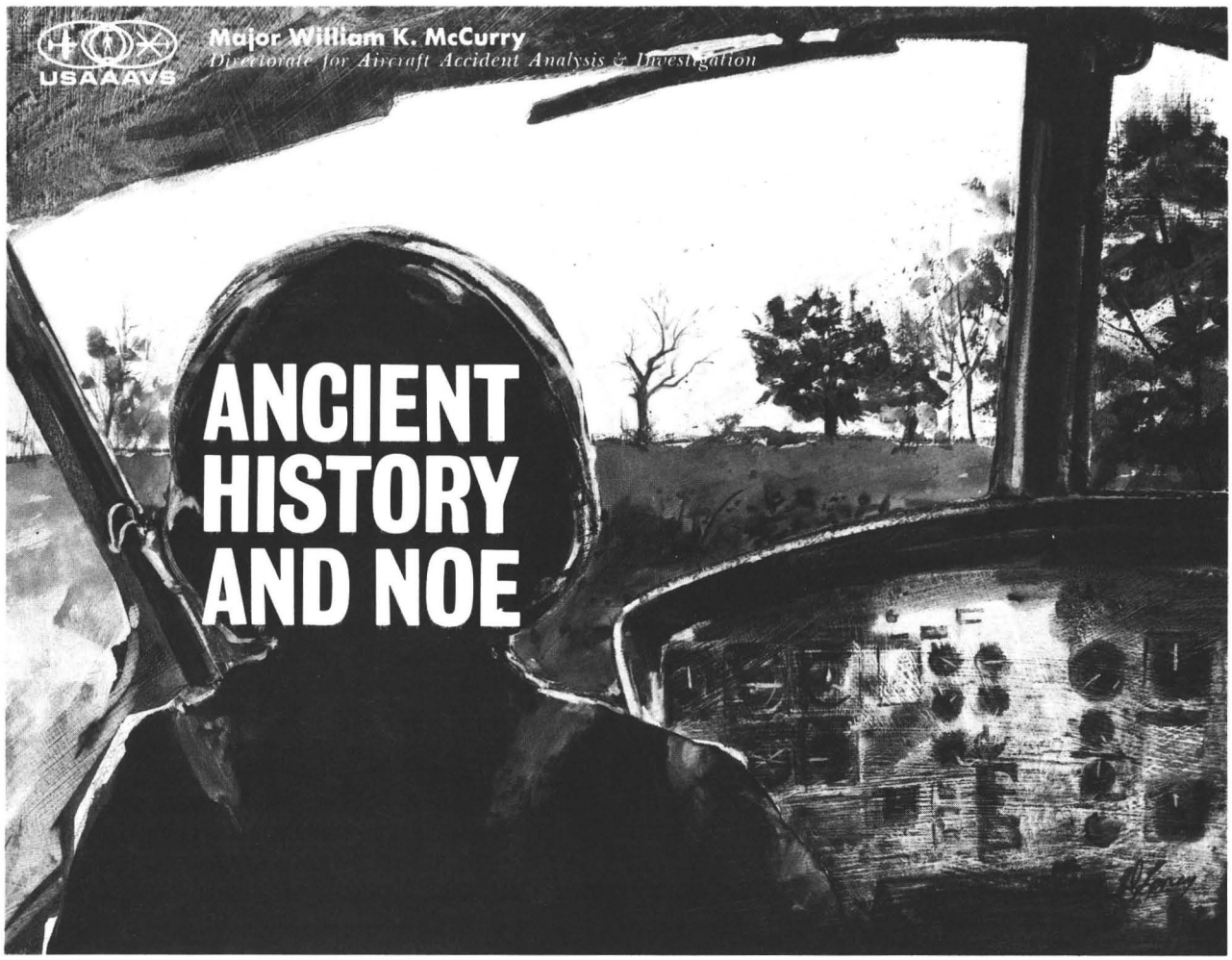
• • •

The same unit commander who had his pilot flying low-level looking for his wife in his POV, and who explained to the unit safety officer that regulations could be bent, visited the hospital immediately after the accident. He arrived before the pilot had received medical attention and proceeded to give him a verbal reprimand.

It is agreed that the pilot's lack of good judgment should not be excused on medical grounds. But this is a case where the commander required pilots to violate regulations and make unsafe flights. The commander's attitude toward following regulations was a bad influence on all unit pilots. This, plus his lack of consideration for the mental health and well-being of his personnel, created an atmosphere with a missing element—the element of safety. This made the accident inevitable.

USAAAVS
Major William K. McCurry
Directorate for Aircraft Accident Analysis & Investigation

ANCIENT HISTORY AND NOE



CAVALRY—THE WORD alone brings to mind long straight lines of horse-mounted men in blue coats, with sabers drawn, charging a terrified enemy. *Air* cavalry has added a new dimension to a glorious past, the fearless aviator darting here and there among the trees, ferreting out the illusive enemy. However, the modern-day air cavalryman has numerous problems to overcome that were unthought of in the golden days of yesteryear.

With the same pride and determination of his predecessors, the pilot of the LOH sped over the treetops deep in the jungle on a visual reconnaissance mission. He was relatively new at his job and felt he had to prove himself as being just as capable as the "old heads." He just had to find the enemy.

As he popped up over a small knoll, he spotted something off to his right. Trying to get a better look, he slowed his airspeed and made a sharp right turn. That was his mistake. As the tail boom swung to the left, it ground into a tree, ripping off the tail rotor blades and gearbox. The pilot lost control of the aircraft. His airspeed extremely low, he thought his only chance was to control crashland rather than attempt to gain altitude. So he rolled off the throttle, momentarily stopping the severe spin. The aircraft started spinning again as rotor rpm was lost. After three quick turns around the aircraft's vertical axis, the pilot lowered the nose and the aircraft crashed on its right side.

The aftermath of this *unsuccessful* low-level visual reconnaissance was three major injuries and one bashed and battered (destroyed) LOH. If there were enemies in the bunker, the noise of the crashing LOH must have scared them away, because a later search didn't uncover any "unfriendlies."

ANCIENT HISTORY AND NOE

Wait a minute. "Unfriendlies?" This is 1974. Vietnam is ancient history. The big deal today is "mid-to-high intensity" and "nap-of-the-earth" (NOE). Everyone is saying we must forget some of the past and think of new ways and means to improve our combat efficiency. Unfortunately, the same old problems keep coming up in the field of aviation accident prevention. NOE may be a new term, but Army aviators have been flying close to the ground for a long time and today's problems are going to be familiar to many "old timers."

To prevent the complete reinvention of the wheel, let's take a quick look at our past accident history and see if we can relate some of the old lessons learned to the present. What can be said about the accident just described?

Probably the most important fact is that the aviator was observing, trying to seek out the enemy while attempting to fly the aircraft low level. He had an observer on board, but failed to use him. Evidently his desire to excel obliterated his good flying sense and judgment. USAAAVS accident data shows that during a 16-month period 332 accidents and incidents in Vietnam were attributed to this type of operation. Over one-third of these resulted from trees growing too high and getting in the way of aircraft. The old axiom, "When you fly in close proximity to the trees, they are likely to reach up and smite you," is true.

The intent here is not to pick on air cavalry units, but rather to point out that their accident experience in Vietnam could very well forecast our future accident experience if acceptable solutions are not found to the problems associated with flight close to the ground.

Consider the following accident briefs:

- Aircraft was on low-level visual reconnaissance when it struck a tree and crashed.
- Right skid struck 40-foot-high powerline and aircraft pitched up abruptly, crashed and burned.
- While in climbing turn from behind ridgeline, aircraft struck high-tension wires, resulting in loss of antitorque control. Pilot attempted to recover and entered autorotation from level attitude. Aircraft descended through trees and crashed in bottom of ravine.

We could take the easy way out and scream pilot error. In fact, a recent USAAAVS study indicated that pilot error was a factor or contributing factor in about 70 percent of our accidents over a 15-year period. However, let's first take a look at the total system—ENVIRONMENT-MACHINE-MAN (including the commander).

Environment. When we look at the total picture and integrate the man and machine into the NOE environment, several things become apparent. The NOE environment, while not new, will now be the rule rather than the exception. This is also the one part of the system we can't change.

The environment will present imposing challenges. The "world" will look different at NOE altitudes and aviators' dependence on terrain features for navigation will be increased. The map interpretation skills of the infantryman must be used.

The aviator will have to be aware of the problems of blowing dust (and snow) on a continual basis instead of only on landing or takeoff because of the increased hovering and sneak and peak maneuvers necessary to avoid detection. In addition, due to limited forward visibility, the possibility of a catastrophic midair collision will be ever-present.

Probably the greatest hazard, other than trees, the aviator at NOE altitudes will face is wires. The Canadians have an ideal technique to deal with the wire problem. Their pilots are taught from the first day in flight school to verbally "call out" any wires they see—no matter how far away. This technique, which is followed throughout their aviation careers, continually reminds aviators of the ever-present danger of wires. This procedure is highly recommended; however, it is meant only to ensure that everyone in the aircraft is alerted.

In addition to wire hazards, crewmembers must also cope with birds and trees. Birds may be encountered anywhere at any time (both day and night). The hazards of trees are well known. Almost all of our NOE incidents have been blade strikes with trees!

The 7th Squadron, 1st Cavalry, Fort Knox, is developing techniques that should prove extremely valuable in teaching aviators how big aircraft really are, consequently reducing blade strike mishaps. Their experiments may not provide all of the answers to the problems associated with NOE training, but they are a definite step in the right direction. At least it will beat a demonstration with a pine tree!

Their "preliminary training course" is designed to

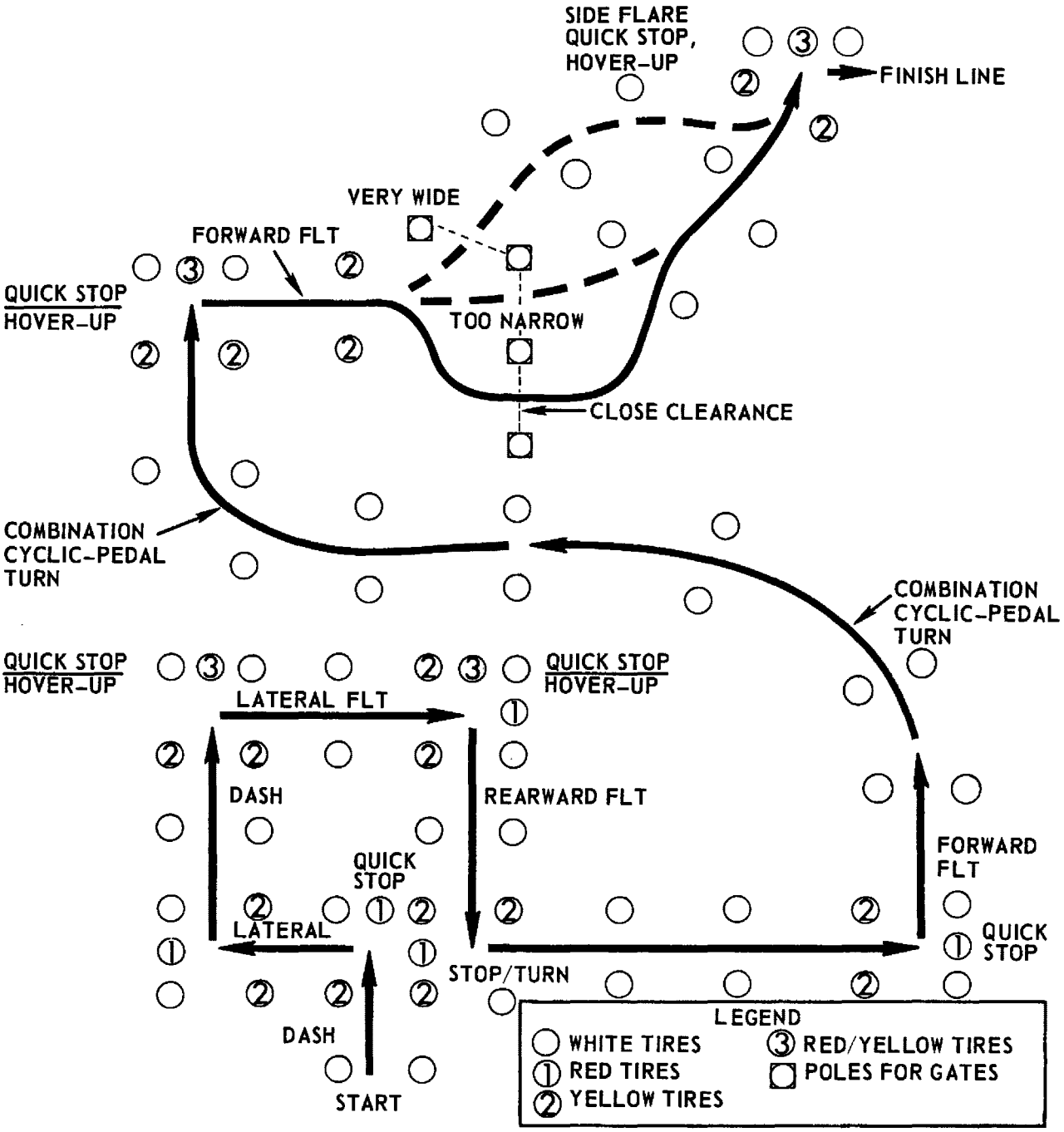

SIDE FLARE
QUICK STOP,
HOVER-UP
FINISH LINE
VERY WIDE
FORWARD FLT
QUICK STOP
HOVER-UP
TOO NARROW
CLOSE CLEARANCE
COMBINATION
CYCLIC-PEDAL
TURN
COMBINATION
CYCLIC-PEDAL
TURN
QUICK STOP
HOVER-UP
QUICK STOP
HOVER-UP
LATERAL FLT
DASH
REARWARD FLT
QUICK
STOP
FORWARD
FLT
LATERAL
QUICK
STOP
STOP/TURN
DASH
START
LEGEND
WHITE TIRES
RED TIRES
YELLOW TIRES
RED/YELLOW TIRES
POLES FOR GATES

FIGURE 1

provide training in the flight maneuvers required in NOE flight without subjecting the pilot to the obstacles found in the actual NOE environment. Minor modifications may be necessary to the layout of the course (figure 1) dependent upon the actual terrain selected. However, the terrain must be free of natural and manmade obstacles. Regardless of modifications made to the course layout, the maneuvers shown should be accomplished.

Painted tires are used to outline the course and to provide certain control measures. Additional safeguards are provided by a control tower positioned so the entire course can be continually observed. Tight control is ensured by permitting only one aircraft on the course at a time. Tires are color coded as follows:

- White tires—outline the route (boundaries of the course).
- Yellow tires—caution, approaching quick stop or gate system.
- Red and yellow tires—quick stop followed by a hover-up (high hover OGE).

A gate system (figure 2) is incorporated in the course to teach the technique of flying between obstacles (principally trees). Four telephone poles or trees that are suitably positioned provide anchor points for three suspension lines that are used to suspend doubled strips of 1-inch masking tape. Each of the poles/trees used to hold the masking tape suspension lines must be located a minimum of 80 feet apart to provide ample clearance. Each pole must be high enough to prevent the suspension lines for the masking tape from becoming a hazard while hovering through any of the three gates.

A minimum of 8 feet is needed from the top of the rotor system to the suspension lines when the aircraft is sitting on the ground. This allows the aircraft to hover through the gate at a 3-foot hover with an additional 5-foot clearance as a safety factor.

The actual gates are formed by hanging two masking tape strips per gate down from the suspension wires and anchoring them to the ground. Distances between the two masking tape strips per gate are as follows:

- Very wide. One gate has the two masking tape strips placed far enough apart that very little challenge is involved in flying between them.
- Too narrow. One gate has the two masking tape strips closer together than the diameter of the main rotor blades. If an attempt to negotiate the gate is made the tape strips will be cut.
- Close clearance. One gate has the two masking tape strips close enough together to present a real challenge in flying through. If this gate is properly negotiated the tape should not be cut.

An alternate method for suspending the masking tape to form the appropriate size gate is also being investigated. The masking tape is suspended from removable bamboo poles mounted into short pieces of pipe placed in the ground at an angle to give desired rotor blade clearance (figure 3).

These are only a couple of the ideas being looked at to solve the problem of blade strikes. They are presented here only to show that solutions are being sought, and not to encourage aviation units to construct their own gate systems. USAAAVS will continue to work with all interested agencies and to monitor all experiments in this area with the goal of

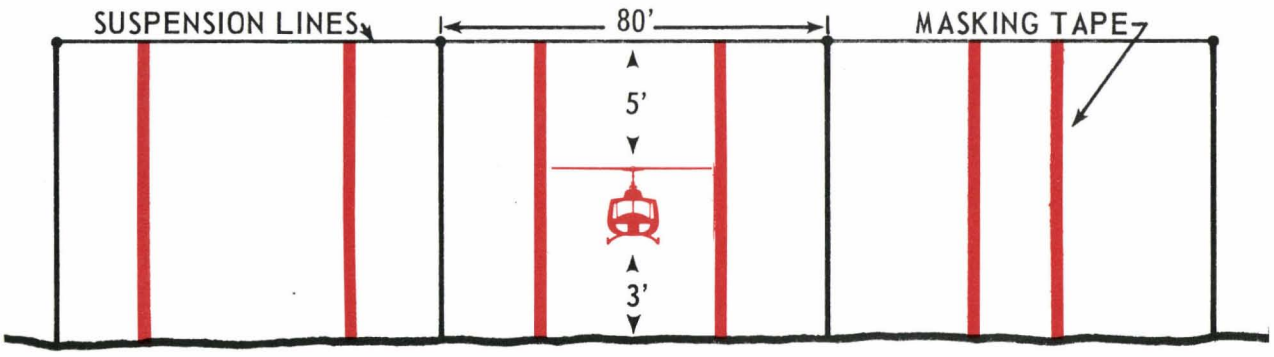


FIGURE 2

developing an approved training aid device which can be issued to the field.

Machine. The next component of the system—the machine—can be changed, as we have readily done in the past. This "changeable" characteristic makes the machine adaptable to the NOE environment if the capabilities are understood. Particular attention must be paid to ensuring an out-of-ground-effect hover capability. The tactical situation under which NOE flight will be performed will dictate this out-of-ground-effect capability in order to employ sneak and peak techniques. Consequently, the load-carrying capability of the aircraft will have to be well understood by the pilot. No amount of technical improvements to the aircraft can completely eliminate a "weight limitation" problem.

NOE obviously will require operating within different altitude and airspeed parameters that were normally experienced in the past. This requirement may uncover certain problems not encountered in operating in the "normal" flight envelope. For example, emergency procedures in the NOE flight environment may have to be investigated by flight testing or other means, such as computer simulation. Specific techniques may have to be developed for NOE flight.

These areas deal with general aircraft capability and must be solved even if only minimal use were to be made of NOE flight techniques. With the advanced state-of-the-art in many areas of aviation, the major decisions being made involve the capabilities we want the aviator to have.

Aviation resources will be employed throughout a continuum ranging from day VMC to night IMC. The added capability to operate within this range does justify the cost in terms of mission accomplishment. However, a determination must be made as to what systems man really needs to operate in the desired environment. What cues must the pilot receive from these systems to adequately respond?

Man. The last component in the system—man—is the most important element in successful mission accomplishment and yet is the most difficult to deal with. He is being forced to change in order to fit into the total system. As a result, the present-day aviator is not prepared or capable of immediately operating with a great deal of efficiency at NOE altitudes. The major reason for this lack of efficiency is readily recognized as pilot overloading because of the difficulty of navigating at NOE altitudes. As mishap statistics prove, this overloading results in obstacle strikes. This situation hints of a pilot error accident waiting to happen.

A major effect of overloading—fatigue—has been recognized. But because of the difficulty in measuring fatigue, it has not been adequately investigated. The field is wide open for the investigation of the effects of stress on aircrew performance. A complete degradation of performance can only be averted by recognizing and controlling the physical, emotional and self-imposed stresses that produce fatigue. Everyone will agree that flight at NOE is much more demanding than flight at altitude. Consequently, the effects of fatigue must be investigated.

The proper and necessary integration of the man

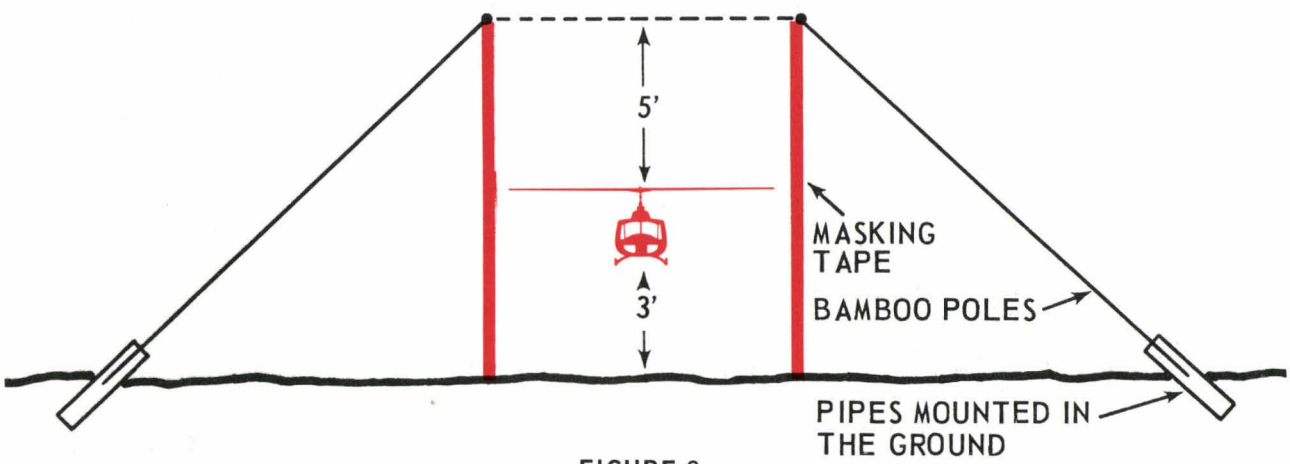


FIGURE 3

and machine systems to ensure performance equal to the demands of the environment is essential to the aviation accident prevention program. In the past, some of our aviation equipment was procured without considering the problems man would have in adapting to the system. Fortunately, this trend is now being reversed and the human factors people are being consulted about future requirements. Numerous interesting presentations were made at a recent conference at Fort Rucker on aircrew performance in Army aviation, sponsored by the Office of the Chief of Research and Development. The importance of adapting the system to man was recognized by BG James H. Merryman, Director of Army Aviation, when he said, "The aircrew's capabilities and limitations in themselves are critical factors in determining the design and development of operational equipment."

This idea was further amplified by Dr. A. Louis Medin, assistant director, Environmental and Life Sciences, Office of the Director of Defense Research and Engineering, who recognized that helicopters will have to perform missions flying NOE at night as well as in the daytime. Mission accomplishment will ultimately depend on how well pilot factors have been included in Army aviation developments. The major problem involves navigation at these extremely low altitudes. Consequently, navigational subsystems to remove the burden of navigation from the pilot's shoulders are needed. This means detailed and extensive research oriented toward the pilot's ability to use this equipment. The requirement to operate at night means that vision-aiding devices must be tailored to the tolerances of human visual parameters.

An area highlighted for further study deals with individual pilot differences in their capabilities to adapt to the NOE environment, both day and night. Research by the U.S. Army Aeromedical Research Laboratories indicates that a pilot with excellent day vision may have extremely poor night vision or the opposite may be true. This fact appears to be substantiated by the Owl Team interview, AVIATION DIGEST, March 1974.

Further investigation in this area may lead to the conclusion that we need to change our training philosophy and develop specialized units for specific tasks.

A great deal of human factors research will have to go into solving the major problems associated with day and night NOE navigation. The OCRD/ARI proposed research efforts (table 1) represent a significant and much-needed step toward providing the pilot with usable equipment and, at the same time, minimizing pilot overloading. Such overloading, by system inadequacies, pilot inadequacies or both, was the key factor in the USAAAVS pilot error study referenced earlier.

There is no doubt that NOE flight is not only practical, but also an essential technique necessary for survival on a mid-to-high intensity battlefield. We must also recognize that hazards do exist. However, these hazards must be overcome. NOE flight must be accomplished without unacceptable losses due to accidents.

Another major approach to solving these problems can be made immediately, without waiting for additional aircraft technical improvements and human factors research. This area is command supervision. Commanders at all levels, by exercising firm, positive supervision, can significantly contribute to the accident prevention program. The great influence unit commanders have on their aviators cannot be overlooked. The following episode actually took place in Vietnam.

A safety officer from another unit saw an LOH making a low, fast approach into a congested Army airfield. Without terminating his approach, the pilot made a fast cyclic turn into a maintenance area. Skid height above the ground was estimated to be 5 feet, the angle of bank in the turn appeared to be in excess of 20 degrees and airspeed was approximately 20 knots. At one point, the main rotor blades appeared to be within 3 feet of the ground.

The unit commander attempted to justify the pilot's actions by saying that people did this sort of thing every day and that maneuvering in such a manner was the pilot's normal everyday job in the area of operations. The commander also mentioned that the individual was an instructor pilot and knew how to handle the aircraft.

Evasive maneuvers will have to be performed during NOE missions. However, taking unnecessary risks by "cowboying" aircraft within the confines of a secure airfield is inexcusable. If unit commanders fail to take positive action to correct the performance of these aviators, they can look forward to a rising accident rate, with the accompanying loss of lives and aircraft. Failure to demand that aircraft be operated in the safest possible manner under the existing con-

ditions borders on criminal negligence, not purely from the safety standpoint, but also from an economic standpoint. We must conserve our aviation resources so they will be available for a combat role. Had this episode ended in a major accident, would we just have had one more "pilot error" accident?

A commander must be allowed to use his ingenuity and imagination in his NOE training programs. We need aggressive leaders for any future combat, but the commander can't stop at just developing "tigers" who will "storm the gates of hell." He must develop a "professional tiger" who will accomplish the mission with the least amount of risk and return to fight another day. A commander who does not instill this philosophy in all of his people is certainly negligent in his supervision.

Much has been written about how to fly NOE and the reasons for it. We have long lists of safety steps which don't mean a thing if the aviation commander doesn't have a strong personal safety philosophy.

Even though NOE flight is *new, different,* and to some *exciting* (others may find it *frightening*), when compared to the old "accepted" procedures, some degree of "conservatism" is in order. A commander who conveys the idea that nap-of-the-earth is not dangerous but is, instead, downright fun, may be asking for trouble. He may unknowingly be creating "unprofessional" aviators within his unit. "Unprofessional" aviators at NOE altitudes stand a good chance of becoming just more "pilot error" statistics.

Some people may disagree and say that this viewpoint is just "the tail of safety wagging the dog of aviation" (no disrespect to my chosen profession intended). Is this really true? No! *Not if we ensure the same degree of mission accomplishment* and do it safely with less risk of losing the aviator and the aircraft.

Is it possible that a few of those "pilot error" mishaps which were identified in 70 percent of our accidents over the past 15 years could have been attributed to command supervision?

Guidance for the establishment of NOE training programs has been published in TC 1-15, Nap-of-the-Earth Flight Training. It is now up to the commander to consider the man-machine-environment system and to accomplish this most difficult training mission with the maximum amount of realism, while conserving our resources of men and aircraft.

By giving the aviator better equipment which has been integrated into the system, the impact of the environment is lessened. This step, combined with command supervision in developing a more professional aviator, will ensure successful mission accomplishment.

TABLE 1

OCRD/ARI PRELIMINARY PROPOSED 5-YEAR RESEARCH PROGRAM IN AIRCREW PERFORMANCE IN ARMY AVIATION +

RESEARCH AND TECHNOLOGY IN SUPPORT OF ARMY AVIATION TRAINING

- Develop NOE course content and evaluation techniques
- Define performance objectives for use of training simulators
- Adapt programmed instruction to NOE training

NOE NAVIGATION AND CONTROL TECHNIQUES AND AIDS

- Assess representative pilot capabilities in NOE navigation
- Generate human factors requirements for advanced navigation aids
- Apply human factors requirements to design of aids for aircrew*
- Develop special NOE maps*

AIRCREW WORKLOAD STRESS

- Determine effects of environmental stressors on NOE performance*
- Enhance aircrew performance by reducing stress and fatigue*
- Determine the correlates and predictors of task overload*
- Derive work/rest cycles from stress research*

WORK METHODS, PROCEDURES, AND AIRCREW ENVIRONMENT

- Enhance man/machine integration in helicopter cockpits
- Identify behavioral capabilities and limits of NOE pilots
- Improve aircrew coordination procedures
- Develop standardized communication procedures
- Apply human factors engineering findings to crew station design*
- Develop integrated cockpit lighting system*
- Integrate cockpit display systems*

NOE NIGHT OPERATIONS

- Conduct NOE night operations test-bed research
- Determine human factors requirements for obstacle avoidance techniques/devices
- Evaluate NOE night operations devices*
- Evaluate representative aircrew proficiency in NOE night operations*

PERFORMANCE ASSESSMENT METHODOLOGY

- Develop NOE operational evaluation techniques and measurements

AIRCREW SELECTION FOR NOE OPERATIONS

- Update NOE aviator selection and classification methods

AIRCREW PROFICIENCY AND SAFETY

- Perform task analyses of NOE operations
- Apply NOE evaluation techniques during NOE combat exercises*
- Evaluate control augmentation techniques for Army aviation combat teams*
- Analyze crew station configuration as causal factors in aircraft accidents*
- Develop and apply pilot error prediction techniques*
- Develop helicopter accident reduction program*
- Identify operational requirements for aircrew body armor in NOE operations*

TEST-BEDS/SIMULATORS FOR ARMY AVIATION RESEARCH

- Develop test-bed for conducting NOE night operations research
- Apply test-bed results to development of flight simulators

+Subject to program review and budgetary approval
**Potentially for research by supporting agencies*

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, USAAAVS, Ft. Rucker, AL 36360

From TAC ATTACK

NOMEX AND REFUELING

Captain John Byers, USAF TAC/DOXBL

YOU'VE PROBABLY noticed that Nomex, from time to time, will build up a pretty good static charge. Although there are several antistatic compounds available commercially (made for use in a washer or dryer), these don't always prevent static buildup and subsequent discharge. This static discharge is usually only a minor annoyance and might affect your relationship with wife/girlfriend, children, pets and possibly your navigator. Around fuel, however, it could blow you to hell-and-gone. In fact, a recent message from AFISC advised that some POL operators have refused to service aircraft when crewmembers were wearing Nomex flight suits. The straight word on this operation is as follows: "Flight crews wearing Nomex may participate in aircraft fueling operations without violating the requirements in AFM 127-101 and paragraph 5-70, TO 00-25-172, 15 June 1973, provided the following precautionary measures are accomplished: Prior to connecting a single point nozzle or before beginning over-the-wing fueling, crewmembers will assure that they are at the same potential as the airframe. This is achieved by skin contact with the aircraft or by inserting the ground cable jack on the nozzle with bare hands. Revision to TO 00-35-172 is underway with anticipated issue date of January 1974. Appropriate information will be incorporated."

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Mr. John V. E. Hansen, director, Clothing and Personal Life Support Equipment Laboratory, and Mr. Frank J. Rizzo, chief, Textile Research and Engineering Division, U.S. Army Natick Laboratories, had these comments to add to those of CPT Byers:

Any clothing—synthetic (like Nomex) or other (cotton, wool)—can develop a static charge under the right conditions. It turns out that natural fibers tend to carry more moisture, and this gives them increased conductivity. As a result, any part of the clothing that builds up a concentration of charges in one area won't hold it for long; the charges will migrate and "bleed off," thereby reducing the effect and the problem. Synthetics are less apt to hold moisture, and this is one of their characteristics that makes them less conductive (you could also say they are almost insulators). On such materials, you can build up a localized charge that won't "bleed off" readily.

By now, you wouldn't be normal if you didn't ask "What builds up a charge?" The answer is simple. The easiest way is to have two surfaces rub together and separate—just as when your arm swings and rubs against your body.

Incidentally, since moisture is a factor in this discussion, you can appreciate the fact that static electricity becomes more of a problem as the air gets drier. On dry days (low relative humidities), regardless of what kind of clothing you wear, static can be a problem. For example, cotton at a relative humidity below 30 percent is just as "static" prone as some synthetics at twice that humidity.

Now to the flight line. Let's assume that you're wearing synthetics such as Nomex, or even polyester, or a polyester/cotton blend such as the recently approved dura-press fatigues. Your clothes may well have accumulated a charge, and some of this may have been transferred to your body. In addition, just by walking around, you can develop a charge in your body. Touching the ground cable jack on the fuel nozzle with your bare hand will, in effect, ground you, and any charge you may have will be harmlessly discharged. Your clothes may still have a charge, but two things are now alleviating the situation. First, the charges on your clothing won't flow or migrate too rapidly, so they cannot quickly "recharge" you. Secondly, if you're still contacting the nozzle or the cable with any part of your bare hand, you'll be continuously discharging any charge you may pick up.

Now let's consider the worst case—a cold dry day. Your chance of having a charge on your clothing is better than on soggy, warm days. But once you touch the nozzle or the ground cable jack with your gloves, the charge on the area of contact of your gloves will be removed. If the gloves are conductive, any charge on your body will be reduced, or if the gloves are a good insulator, the charge on your body won't go anywhere.

The long and short of it is that the normal grounding procedures established as part of flight line procedure will prevent any problems, particularly if the body is grounded to them. But they are rules that were made to be followed. Disregarding them could get you some static in more ways than one, and some serious consequences besides.

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The U.S. Army Agency for Aviation Safety recommends that individuals involved in servicing operations wear protective clothing and equipment, including gloves, to provide optimum protection. Information and guidance in the judicious selection, use and maintenance of safety clothing and equipment can be found in Department of the Army Pamphlet 385-3. Common Table of Allowances (CTA) 50-900 is the authorization document for the above-mentioned protective equipment.

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

New ATC Procedures: Two new air traffic control procedures that will become effective 1 July 1974 should prove useful to flight instructors, examiners and students:

a. Pilots may request to remain in "closed traffic" for successive operations. Definition for closed traffic: Successive landing/takeoff/low approach operations without exiting or re-entering the traffic pattern.

b. A "cleared for the option" procedure will permit an instructor pilot/flight examiner/pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go or full stop landing. This procedure can be beneficial in a training situation in which the student pilot/examiner does not know what maneuver will be accomplished.

The pilot should make his request for "option approach" passing the final approach fix inbound on an instrument approach or entering downwind for a VFR traffic pattern.

On approval, this procedure enables an instructor/examiner to obtain the reaction of a trainee/examinee under changing conditions and to select the appropriate option.

This procedure will be used only at those locations with an operational control tower and will be subject to ATC approval/disapproval. Definition for option approach: An approach conducted and requested by a pilot which will result in a touch-and-go, missed approach, low approach, stop-and-go, and/or full stop landing.

It Won't Be Published! The Consolidated Study Reference listed in DA Pamphlet 12-71P (May 1974 test period) will not be published. It is suggested that individuals study the 71P correspondence course available through the U. S. Army Aviation Center in preparing for the May 1975 testing period.

TACTICS outlook

The response to the DIGEST's tactics series has been especially generous. In fact, more fine articles than can be carried in the four tactics series issues have been received. Those that are not printed by September will be carried in subsequent issues devoted to other themes (see May 1974 DIGEST, page 19). The logo at left will be used on all articles submitted for the tactics series to identify them and tie them together. Our apologies to those whose articles will not make the basic four-issue series. But, your articles will be carried in issues subsequent to September with the logo at left. When updating may be necessary, the DIGEST will coordinate with the respective authors. Many thanks to all for your splendid responses. Indeed, it is gratifying to know that so many have such an intense interest in Army airmobile tactics.—Editor

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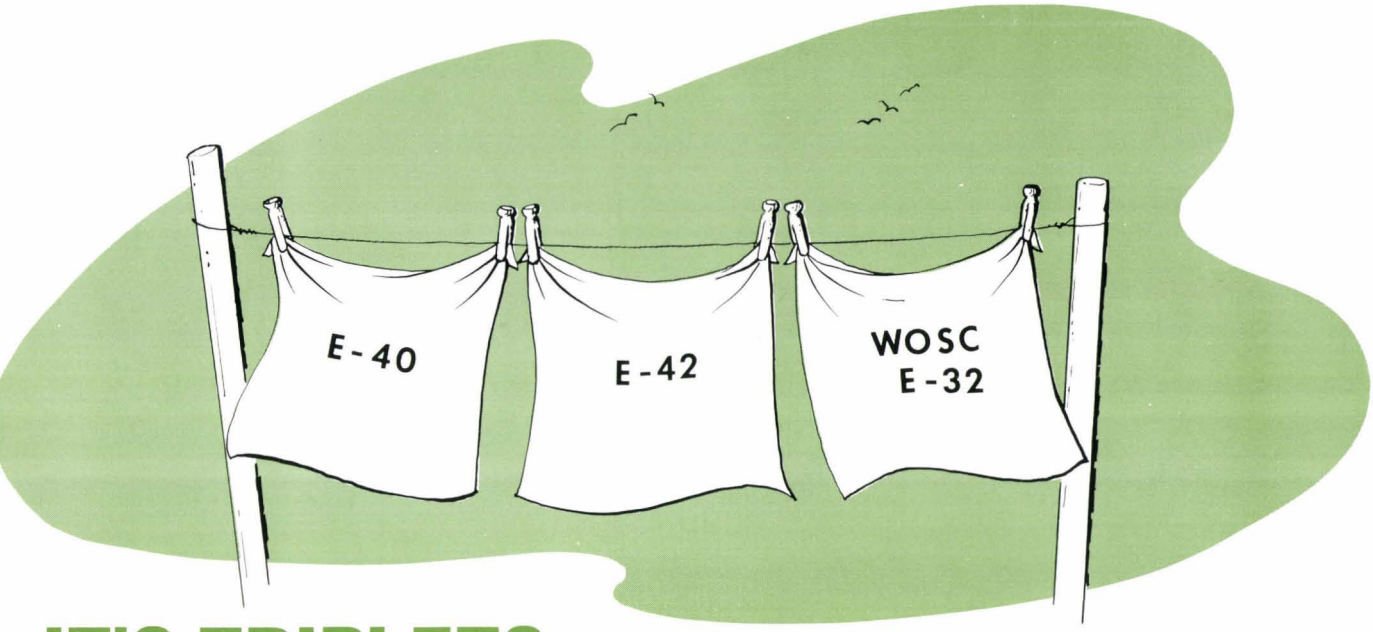

IT'S TRIPLETS

The Department of Army-Wide Training Support at the United States Army Aviation Center, Ft. Rucker, AL, is pleased to announce three new professional development correspondence courses. Two are for noncommissioned officers and one for warrant officers

Air Traffic Control NCO Basic Course

consisting of 51 subcourses with a total of 300 credit hours. This course provides training for E-5, E-6 and E-7 personnel.

Air Traffic NCO Advanced Course

consisting of 49 subcourses with a total of 312 credit hours. This advanced course is directed toward E-8 and E-9 personnel.

The two new NCO courses are in the Noncommissioned Officer Educational System (NCOES) and provide the noncommissioned officer with a working knowledge of those duties required to perform as noncommissioned officers in the air traffic control field. Prerequisite for enrollment calls for a prospective student to be a member of the active Army or a Reserve Component and qualified in the following MOSs: 71P, 93D, 93H, 93J and 93K.

To Enroll Submit DA Form 145 or For Further Information Write

COMMANDING GENERAL
U. S. ARMY AVIATION CENTER
P. O. BOX J
FORT RUCKER, AL 36360

Warrant Officer Senior Course

consisting of 40 subcourses for 437 credit hours. This course is equivalent to the officer's Command and General Staff College for all Army warrant officers regardless of their branch of service. It offers senior warrant officers a working knowledge of their careers in various duty assignments. Also, the knowledge of these subjects provides the senior warrant officer the background needed to move into technical staff positions. To enter this course, the warrant officer must be a CW4, CW3 or CW2(P) and a member of the active Army or Reserve Component with at least 6 years warrant officer service. Graduates of a warrant officer professional development course conducted by their branch may waiver the service criteria.

The following message signed by LTG Herron N. Maples, The Inspector General and Auditor General, Department of the Army, was sent to commanders worldwide on 17 May

take a minute for aviation safety

EFFECTIVE 20 MAY 1974, the responsibility for establishment and execution of the Army aviation safety (accident prevention) program will be transferred to The Inspector General. This responsibility will continue to be carried out by the Commander, United States Army Agency for Aviation Safety.

AS THE NEWEST MEMBER of the worldwide Army aircraft accident prevention team, I welcome the attendant challenge of this responsibility. I join you in being proud of your efforts in reducing the Army's aircraft accident rate to an alltime low in the first half of FY 1974 and the significant inroads made in reducing the number of lives lost, injuries and materiel losses.

LTG H. N. MAPLES

FOR UNITS TO MEET THEIR READINESS REQUIREMENTS, safety must be foremost in all our programs and particularly in aviation. The most important resource of the Army—the individual soldier—must be protected. To accomplish this objective, the current downward trend of the Army's aircraft accident rate must be maintained. I'm keenly interested in sustaining the momentum in that direction. Therefore, I urge all Army aviation unit commanders to give their full support to the Chief of Staff's **"Take a Minute for Aviation Safety"** program during the month of June. Your unqualified support will ensure the success of this campaign.

USAAAVS