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UNITED STATES ARMY JULY 1969

AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

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ABOUT THE COVER

A Chinook accomplishes a resupply mission atop Black Virgin Mountain near Tay Ninh, Republic of Vietnam, in near IFR conditions. Our thanks to CWO Clyde Scott of Ft. Carson, Colo., for the photo.

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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VIEWS FROM READERS

AVIATION WO CAREER COURSE

— Late Changes —

The first two Intermediate courses begin 7 July 1969 and 26 January 1970 and will last 22 weeks and 2 days with each having an enrollment of 100 students. The first two Advanced courses with 60 students each will last 23 weeks and 2 days and will begin 20 August 1969 and 19 January 1970.

Qualifications for the Intermediate course include three years service as a rated aviator or an aircraft repair technician (non-rated).

Because of multiple typographical errors in the USAASO Sez article on page 64 of the June issue, we are reprinting that portion of the article pertaining to the new Fixed Wing Special IFR procedures.

On Fixed Wing Special VFR: The FAA has recently revised procedures reducing restrictions, imposed in April 1968, against Fixed Wing Special VFR (FW/SVFR) flights in control zones.

A new type of operation, Fixed Wing Special IFR (FW/SIFR), is being permitted in the 33 control zones specified in FAR Part 93.113. These are preplanned operations which will be permitted in less than basic VFR conditions subject to the following:

• Operations must be conducted under the terms of a letter of agreement obtainable in conjunction with waivers to FAR 91 and are limited to certain fixed wing aircraft having a frequently recurring need to operate there in less than basic VFR conditions.

• Operations must be conducted by IFR qualified pilots in IFR equipped aircraft.

In general, these special operations will be handled the same as IFR operations except that a fixed altitude will not be applied, ground contact must be maintained and visibility must be at least 1 mile.

Restrictions against Fixed Wing Special VFR (FW/SVFR) operations to control zones *other than those specified in FAR Part 93.113* have been eliminated except that VFR (FW/SVFR) traffic may not cause delay to IFR traffic.

Sir:

Major Christensen's article "Turbines Demand Computer Planning" in the October 1968 AVIATION DIGEST is of particular interest to those of us in the Marine Corps flying UH-1s. His coverage of the T53-L-11 is most certainly broad yet specific and thorough. One area, however, which was not covered but needs some discourse involves the phenomenon of hover/taxi and takeoff at overgross weight conditions, so often true for UH-1s configured as gunships operating in high ambient temperature conditions of the Republic of Vietnam. All UH-1 pilots have experienced at one time or another the surprising fact that if they pull pitch beyond max power causing a reduction in N_2 below 6600, the ship will often become airborne. How can this be possible when the author has carefully presented his case showing the direct relationship of reduced N_2 to SHP developed?

Simply put, it boils down to increased rotor efficiency at some lower rotor rpm through blade design. 6600 N_2 with its attendant rotor rpm will not produce optimum lift efficiency as compared to some lower rpm, but it does represent the best trade-off *between* optimum hover and high speed efficiency.

A canvass of UH-1 gunship pilots for first-hand reports of RVN operations will reveal, I'm sure, the fact that a great number of initial liftoffs from prepared or cleared surfaces necessitated an intentional sustained N_2 droop until translational lift was achieved. The ability of the UH-1 to hover/taxi and take off at max power with an N_2 *LESS THAN 6600,* yet not be able to do so *at 6600* is fact not fiction! This is an area of operation which needs more analysis and dissemination. Granted, it does border the edge of the envelope and arbitrary bleed-off of N_2 can bring disastrous results.

Pilots must appreciate the narrowing safety margin when less than 6600 N_2 at max power is employed in order to become airborne. Bar tales of individual expertise fail to properly educate. I would recommend an amplification of this phenomenon—advantages and pitfalls—perhaps by MAJ Christensen whose previous article was of enlightment.

Major A. T. Common, USMC
H&HS-1, MWHG-1
Aviation Safety Officer
FPO San Francisco 96602

• The technique discussed in the letter from MAJ Common is familiar to most aviators who fly or have flown the UH-1 under heavy load conditions. Few, however, have a complete understanding of *why* it works.

The simplest explanation for the increase in thrust at reduced rotor rpm is the resultant change in drag forces acting on the rotor. A helicopter rotor in hovering flight is acted upon by two separate drag forces. The first, profile drag, is a combination of form drag and skin friction drag, and remains relatively constant as long as the rotor speed is not changed. Induced drag, as the name implies, is a result of changes in angle of attack of the blade induced by the pilot to produce thrust. Unlike profile drag, induced drag varies constantly as the angle of attack of the blade, and thus thrust, varies.

A simplified illustration of the effects of these two drag forces can be seen by observing a helicopter in operation. When the engine is started, the rotor will start to turn slowly. As power is increased, the rotor will speed up until the desired operating rpm is reached. At this point, most of the power being produced by the engine is used to overcome profile drag on the rotor blades. As the pilot increases pitch on the blades to lift the helicopter off the ground, he is creating induced drag on the rotor, and more power will be required to maintain a constant rotor speed. There will be practically no change, however, in the power used to overcome profile drag, since it is basically a function of rotor speed.

If the rotor speed is reduced, there will be a corresponding decrease in thrust, induced drag and profile drag. In measuring these changes, however, we find that the changes in thrust and induced drag are functions of the square of the rotor speed (V^2), while profile drag is a function of the cube of the

Continued on page 21

ANNUAL AWARD
Monthly Winner
CONTEST

This article advocates tactical airmobility as essential to the successful conduct of internal defense operations in the developing countries. It is shown that these countries could be subject to the threat of insurgency and should be prepared to conduct operations in difficult terrain which restricts the mobility of conventional forces. The advantages of tactical airmobility are examined and the capabilities of an airmobile force are highlighted. It is concluded that the United States should encourage the developing countries to organize airmobile forces to counter the threat of insurgency. Our assistance in equipment and advisory personnel will be required.

TACTICAL AIRMOBILITY

Colonel Robert S. Kellar

INSURGENCY constitutes one of the most immediate threats to the security of the developing countries of the world, yet few of these countries have equipped and trained their armies for counterguerrilla warfare. Instead, their military budget has been allocated for the purchase of jet aircraft, tanks and warships; and their forces have been schooled in the tactics and techniques of conventional warfare. Their desire to emulate the more modern nations of the world, coupled with their perception of their basic national interest, has led them to develop forces that are better designed to combat foreign aggression than to combat the immediate problem of insurgency.

Hopefully, prestige forces will serve as a deterrent to a conventional invasion of a country, but they will not deter insurgent activities taking place within a country. If a military establishment is not capable of efficiently eliminating an insurgent buildup, the insurgency can continue to grow until it threatens the very existence of the country. This major threat to the developing nations of the world, insofar as it is military, can be eliminated if they develop a small, elite force trained and equipped for antiguerrilla warfare. An airmobile force, utilizing the tactics and techniques developed by the 11th Air Assault Division and proven in combat by the 1st Cavalry Division (Airmobile), is an answer to the threat of insurgency in the developing areas of the world.

Modern technology has made the developing countries aware of the tremendous gap between their share of the world's economic wealth and that of the modern nations. Some of these countries have been independent for many years while others have clamored for and gained their freedom within the last decade. Nevertheless, now they are all in a hurry to close this gap and to complete the diffi-

IS THE ANSWER

Guerrilla forces take advantage of protective environments that hamper operations of conventional mechanized armies. An airmobile force is able to counter this advantage

cult transition from a backward nation to one enjoying all the benefits of a modern society. A more gradual transition, such as experienced by many nations of the west, is not acceptable to these emerging nations.

In a country undergoing radical changes, conditions can be created which may promote the formation and growth of groups that are in disagreement with the national policies of the existing government. In their hurry for rapid modernization, these dissident groups are not content to seek, or may be precluded from seeking, an orderly political solution to their grievances. They usually resort initially to acts of civil disobedience and other measures short of outright militant force to emphasize their point of view. If these tactics do not achieve the desired results, these groups may turn to the use of violence to overthrow the incumbent government.

The same modern technology which conveyed to them the realization of their substandard condition in life, also will enlighten them on the methods and procedures for organizing guerrilla movements. The guerrilla doctrines of Mao, Ho Chi Minh and Castro are well publicized in these areas of the world. Trained revolutionaries are readily available to offer material aid and assistance in organizing and initiating guerrilla wars. Thus, when a group chooses to resort to violence, the ingredients are present which may foster the growth of an organized insurgency.

The embryonic nature of a guerrilla movement requires that its growth be acomplished in an environment where it is protected from the military force at the disposal of the government. A guerrilla force seeks refuge in the most inaccessible portions of a country such as jungles, swamps and mountainous terrain. In these areas, roads and other means of communication are virtually nonexistent. The terrain is rugged and impassable except for a beast of burden or a man on foot. This is the environment where the guerrilla force establishes a base and builds its strength for future operations. It strikes out from this sanctuary only at opportune times to attack selected targets with overwhelming force.

The guerrilla force feels secure in this protective environment with the knowledge that a conventional mechanized or motorized army cannot penetrate its base area. In order to seek out and destroy the guerrilla, the conventional army is reduced to footmobility and forced

to operate under conditions which present the initiative to the guerrilla. By carefuly selecting his area of operations, the guerrilla eliminates the mobility and firepower advantages which normally are held by the conventional forces.

The successful conduct of internal defense operations depends on the ability of the government forces to seize the initiative from the guerrilla. This requires the capability to overcome the obstacles of the terrain thereby gaining mobility and firepower over the guerrilla with the ultimate purpose of placing decisive forces on the ground to defeat him. This is what an airmobile force is capable of doing.

The war in Vietnam is characterized by an extensive use of airmobility in the conduct of internal defense operations. This is not the first conflict, however, in which airmobility has been utilized to enhance the footmobility of the soldier and to overcome the advantages which the terrain affords the guerrilla.

The British pioneered the use of airmobility in internal defense operations in their battle to save Malaya from communist insurgents during the period 1948 to 1960. A force of 26 medium helicopters flew a total of 20,000 sorties transporting troops over jungles where the rate of movement on the ground was restricted to 800 to 1,000 yards per hour. This rapid movement of troops into jungle clearings in the area of operations saved as many of 10 days of unproductive marching time for use in active patrolling in the operating area. Resupply and evacuation of casualties were performed by air. Commanders found that the use of airmobility increased the utilization of their available troops by a factor of not less than four. By Vietnam standards, the use of airmobility in Malaya was rudimentary; but these operations did signify the obvious advantages which airmobility had to offer.

The French use of helicopters in the Algerian War heralded the advent of large-scale airmobile operations. The outbreak of the Algerian revolution in 1954 caught France totally unprepared to fight a guerrilla war. The units which France initially committed to Algeria were equipped and organized for conventional warfare. They were NATO-type forces and unable to cope with the tactics utilized by the Army of National Liberation (ALN). The terrain and the nature of the conflict stripped the 50,000 French troops of their normal technological superiority. The insurgent movement continued to grow. By 1956 the French strength had increased to 260,000 and by 1958 to 400,000.

The French reorganized their forces in 1956 to give them an improved reaction capability against the ALN. Jet fighters were replaced with slower ground-support planes and helicopters were added to improve the tactical mobility of the French forces. For the first time in history, extensive use was made of armed helicopters to provide necessary fire support for airmobile operations. The French realizing that paratroop units were lightly equipped and well trained for the shock action associated with airmobile operations, coupled these units with helicopter transport units to form airmobile task forces. The mission of destroying the rebel units was given to these task forces, whose total number never exceeded 50,000 men. The success of these tactics contributed immeasurably to reducing the strength of the guerrilla forces from a high of 40,000 to less than 12,000 in 1960.

There were many French innovations in the use of the helicopter during the Algerian conflict. The need for an airborne command and control group during large-scale airmobile operations resulted in the adoption of helicopter command posts. Helicopters were armed with machineguns and rockets to provide suppressive fire

The British pioneered the use of airmobility in the defeat of communist insurgents in Malaya from 1948-60 (see "Malayan Operations," DIGEST, October 1962). Below, an S-51 in a jungle LZ in Malaya

Above, the 11th Air Assault Division (T) establishes the validity of the Army's airmobile concepts in maneuvers against the 82nd Airborne Division in late 1964. The 11th was quickly deployed to Vietnam as the 1st Cavalry Division (Airmobile). It was extremely effective as in Operation Pershing (below), a search and destroy operation near An Khe

on the landing zones to permit the troop-carrying helicopters to land without excessive losses. The Vertol (CH-21) helicopters were equipped with self-sealing fuel tanks, and crews were provided flak vests and armored seats. The French adopted a regulation which required two qualified pilots on all helicopters so that if one was wounded or killed the other could bring the aircraft back. These measures, together with the tactics and techniques which the French developed for airmobile assaults, resulted in a steadily decreasing rate of helicopter and crew losses due to ground fire.

The success which the French achieved in combat helicopter operations in Algeria provided a great incentive to those in the United States Army who were developing airmobile tactics and techniques. Combat reports and a wealth of statistical data were analyzed to further the airmobile concept which was formulated in 1962 by the Army Tactical Mobility Requirement Board, headed by General Hamilton H. Howze. The recommendation of the Howze Board for the organization of an air assault division to formally test this bold, new concept of mobility was approved by the Secretary of Defense.

The first elements of the 11th Air Assault Division (T) were activated at Ft. Benning, Ga., in February 1963. Extensive field training was conducted to test and evaluate new items of equipment and to standardize unit procedures. By late summer of 1964, the full division had been organized and battalion and brigade level testing had been accomplished.

The evaluation of the division was culminated in November and December of 1964 when the division, supported by an air transport brigade, was opposed by the 82nd Airborne Division in the Carolina maneuver area. In a series of controlled exercises, the 11th Air Assault Division was placed in every known tactical environment. Reams of statistical data were compiled by hundreds of umpires, controllers and analysts. It was found that the helicopter, if properly employed, was not as vulnerable to enemy fire as many skeptics believed. Also important in the era of cost-effectiveness considerations was the fact that the initial and operating costs of the division were justified by its special capabilities not found in other divisions.

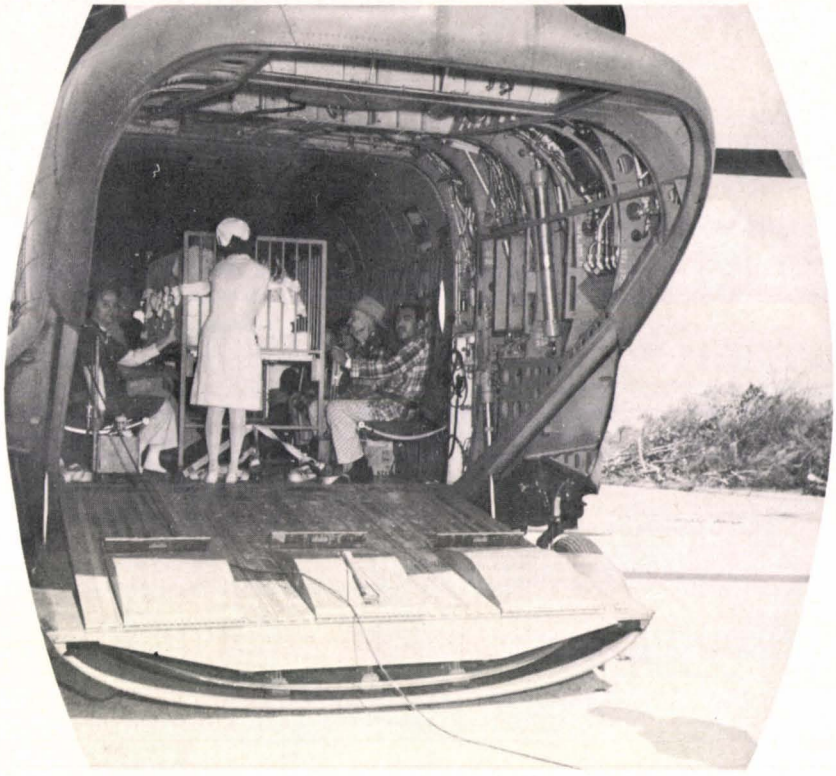
The final results of the test con-

firmed the validity of the airmobile concept as a bold means of improving tactical mobility on the battlefield and led to the recommendation that an air assault-type division be included in the permanent force structure. This recommendation was accepted by the Department of Defense and the 11th Air Assault Division was redesignated as the 1st Cavalry Division (Airmobile) on 1 July 1965.

Although airmobile operations in Vietnam were initiated in December 1961 by utilizing separate helicopter companies to transport Republic of Vietnam units, and later our own forces, the commitment of the 1st Cavalry Division was significant in that it was the first unit specifically equipped and trained for airmobile warfare. The early and rapid deployment of this unit indicated the confidence that the Army and the Department of Defense had in the capabilities of this unit to successfully fight an insurgent war. In less than 90 days after reorganization, this unit arrived in the Central Highlands of South Vietnam and established its base of operations astride Highway 19 at An Kke, midway between Pleiku and Qui Nhon. From this base, airmobile forces of the division effectively dominated an area approximately 150 miles by 150 miles.

The Pleiku Campaign of October and November 1965 provided the acid test of the airmobile concept. Regular North Vietnamese forces in division strength threatened the seizure of Pleiku and dominance of the Central Highlands. In the battle of the Ia Drang Valley, the airmobile concept was validated in combat when forces of the 1st Cavalry Division met and defeated these insurgent forces in terrain which they had believed would protect them.

A brief examination of the airmobile division's structure and capabilities is approximate to highlight the suitability of this type force to fight an insurgent war. The 434 aircraft of the division, all but six of which are helicopters, enable this unit to conduct sustained combat operations independent of surface means of communication. As helicopters are the primary means of movement weight is a most important consideration in all operations. Lightweight equipment is utilized wherever possible in lieu of the heavier type found in the infantry division. The equipment of all combat and combat support units of the division is designed to be compatible with the capabilities of the organic aircraft. Only the heavier equipment found in the division base area is dependent on nonorganic aircraft for movement. The 1,500 wheeled vehicles in the unit are approximately one-half the number authorized the infantry division. The airmobile division's weight of 10,000 tons is less than one-third the weight of an infantry division.



Airmobile forces can be used in civic actions as above where a CH-47 is used to evacuate flood victims

The airmobile division utilizes aircraft as the primary means of accomplishing the five major functional tasks of land combat: command, control and communications; intelligence; maneuver; fire support; and logistics. Helicopter command posts are structured into the units of the division to facilitate the close coordination necessary between all elements of an airmobile force. The air cavalry squadron has the capability to screen vast areas of terrain to find and fix the enemy. Organic aerial fire support is provided by the aerial rocket artillery battalion. This capability permits the initiation and conduct of operations without first establishing a "fire base." The close-in fire support which this unit provides also allows operations to be conducted

Tactical Airmobility Is The Answer

under conditions of low visibility when tactical air support cannot reach the objective area.

The division aviation group has two battalions of UH-1D lift helicopters and one battalion of CH-47 medium lift helicopters. These units provide 90 knot mobility for the maneuver battalions, the direct support artillery battalions, the combat support units and for the logistical resupply of all units forward of the division base. The close integration of these capabilities in an airmobile operation results in an overwhelming differential in maneuver and firepower over any guerrilla force.

The airmobile division is emphasized because its organization and capabilities best illustrate the type force that can provide a military answer to the threat of insurgency in developing areas of the world. The mobility of other units may be enhanced by periodic augmentation with aircraft, presently being done successfully in Vietnam. This arrangement, however, does not achieve the full potential which airmobility has to offer. This is attained only by a force which is structured, equipped and trained specifically for this type of combat.

Airmobility, as a way of life, must be built into the unit. The techniques which are necessary for the most efficient use of the helicopter can be perfected only by repetitive training. A close rapport between all elements of the team is essential to successful airmobile operations. Professionalism cannot be achieved on a part-time basis.

Developing nations generally cannot afford the cost of a division-size airmobile force, but a unit of this type can be tailored to any size consistent with the needs and resources of a particular country. Regardless of the size of the unit, it must include aerial vehicles as the primary means of accomplishing the five major functions of land combat. A platoon-size force, equipped with three armed reconnaissance helicopters and six troop-carrying helicopters, would have an airmobile capability that would spell doom to a much larger guerrilla band.

Developing countries that are contemplating the purchase of jet fighters could acquire a far greater number of helicopters for the same amount of money. There is little disagreement among those experienced in insurgency operations as to which type aircraft can best carry the fight to the guerrilla.

It takes time, however, to equip and train an airmobile force. It is too late to think about one when an insurgent movement has begun. The developing countries should have these forces now to respond immediately to the threat of even a handful of guerrillas. A convincing argument to justify the existence of airmobile units in a peacetime force structure is the many ways in which the helicopters can be utilized in civic action programs. Airmobile units can be instrumental in nation building and eliminating the basic causes of insurgency.

The United States must undertake an aggressive program of selling airmobility to the developing countries. This improved means of battlefield mobility is at least the partial military answer to the peril of insurgency which threatens their efforts to achieve peaceful evolution. We cannot assume that our extensive use of airmobility in Vietnam will suffice to convince them that they must reorganize their forces to gain improved tactical mobility.

The forces which many of these countries now possess must be restructured, re-equipped and retrained for three-dimensional land combat. The success of the 1st Cavalry Division against regular North Vietnamese forces and the Viet Cong should serve to assure these countries that airmobile forces are capable of defending against outright invasion as well as the primary threat of insurgency. Our considerations for hemispheric defense may be partially responsible for the primary orientation of the armed forces of some Latin American countries toward repelling foreign aggression rather than defeating internal subversion.

If the goal of capable airmobile forces is to be attained in the threatened areas of the world, we must actively assist in the organization and training of these units. As a result of our operations in Vietnam, we have a large number of personnel who are thoroughly indoctrinated and experienced in the airmobile concept. These are the ones who as military attaches and members of military assistance advisory groups must lead the way in the planning for and the organization of these forces. At lower levels our unit advisors will be required to assist in the training of these units. There is no substitute for the know-how which these experienced personnel possess.

Tactical airmobility has evolved from the process of transporting a few soldiers by air from point A to point B to the present day capability to conduct large-scale, sustained airmobile operations. Further advances in technology will facilitate our ability to find, fix and destroy guerrilla forces. Today, tactical airmobility presents the best solution to the problem of bringing the full spectrum of combat power to bear on an insurgent enemy. The United States is winning the war in Vietnam with airmobility. The blueprint exists with which the developing countries can build a force to guarantee their freedom.

CHINOOKS IFR

(CAV STYLE)

CW2 Carl L. Hess and CW2 George J. Combs

DURING THE Tet offensive in January 1968, combat and weather conditions forced helicopter pilots of the 1st Cavalry Division (Airmobile) to fly numerous cargo helicopter instrument missions in the northern part of I Corps area.

The IFR requirement grew out of a situation in which generally poor weather was forcing helicopters to be flown low level. They were fired at and hit almost daily. In fact, to fly a mission without taking hits was rare.

From the evening of 31 Jan 1968 to midmorning on 2 Feb 1968, the Cav's 228th Aviation Battalion had 11 CH-47A cargo helicopters shot up and three crewmembers wounded.

The aircraft were attempting to move personnel, equipment and supplies under marginal weather conditions which required low level flight into and within the division AO (area of operations). When the weather permitted, flights were made at altitudes above 2,000 to 2,500 feet. The aircraft received only occasional hits but with the rainy season in progress good weather flying days were few and far between.

On 28 and 29 Jan 1968 equipment flown into LZ Evans included an ATC section complete with personnel. This equipment was set up and became operational on 1 Feb, although it was not flight tested due to poor flying weather. The next morning extremely poor weather existed throughout the division AO. Missions involved air lifting troops of the 101st from Hue Phu-Bai to Camp Evans and refueling equipment from Hue Phu-Bai to Dagmar Bravo, 15 miles north of Hue Phu-Bai on the coast.

Three cargo helicopters, flying low level due to marginal weather, were shot up on the mission going to Dagmar Bravo. As a result, all aircraft were placed on hold, pending an improvement in the weather. As it became apparent the weather would remain poor and with the urgency of the missions prevailing, it was decided something different would have to be tried if the missions were to be completed successfully.

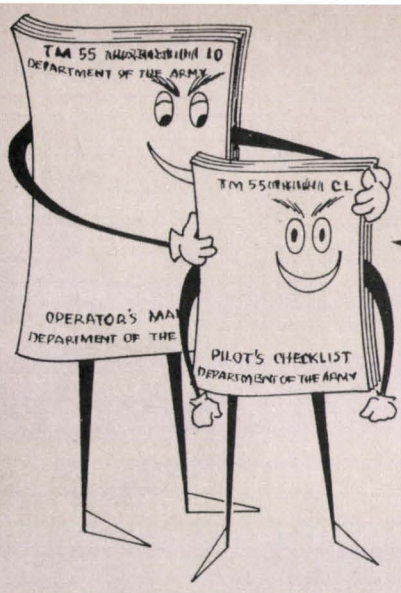
Although previous instrument flying with division organic radar assistance had not met with complete success, it was now felt it would be necessary for the division to attempt wholesale IFR flight.

In addition to the lack of an established procedure for combat IFR flying in the Jeb Stuart AO, there also was the question of whether the ATC section would be able to handle traffic in a great enough volume to satisfy the division requirements.

On contacting the ATC chief at Hue Phu-Bai, the pilots were informed there was no communication between Hue ATC and Evans ATC. The aircraft commanders felt they could resolve this problem by contacting Hue Phu-Bai for IFR clearance and requesting radar vectors to VFR-on-top. Once on top contact would be made with Evans ATC for radar vector and letdown to Camp Evans.

Around noon on 2 Feb the decision was made to launch three helicopters to Camp Evans. The three aircraft departed Hue Phu-Bai with 15 minute separation. The hand off from Hue Phu-Bai ATC to Evans ATC was effected and a letdown using ASR procedures was made since the PAR system was inoperative.

Upon landing at Evans the aircraft commanders and assistant battalion S-3 contacted the ATC section chief to coordinate and establish procedures for IFR missions in the AO. The Evans ATC chief indicated his section could control a max-



In the June issue of the AVIATION DIGEST, I introduced myself and my big brother, Danny Dash 10, and asked that any questions regarding the checklist (CL) or operators manual (dash 10) be directed to us at: Evaluation Division, Office of the Director of Instruction, ATTN: Charlie Checklist, Ft. Rucker, Ala. 36360. During the past three weeks several questions have been received. Here are a few.

I HAVE BEEN reading about the DA checklists that are being prepared on all Army aircraft but my unit hasn't received them as of this date. What is the procedure of obtaining the CLs?

Charlie's answer: The checklists are distributed through AG distribution channels. Each unit must submit its requirement to AG on DA Form 17 and 17-1, Requisition for Publications and Blank Forms. Complete the forms and you will receive the checklists.

My unit has received the new CL on the AH-1G and aviators are using it faithfully. One slight problem, though—it is in looseleaf form. Any suggestions on securing it for use?

Charlie's answer: Yes, there is a container specially made for the checklist. Its official name is Operators and Crewmembers Checklist Binder, TM 1500-1. One TM 1500-1 binder is authorized for each aircraft and may be obtained through AG distribution channels; however, users must submit requisitions in order to receive them.

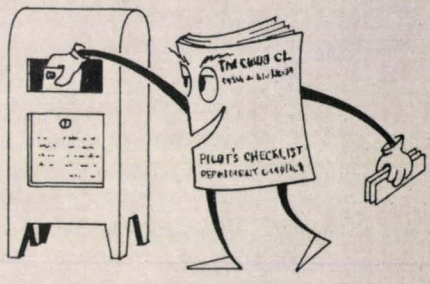
On page ii of my checklist the term "thru flight" is associated with an asterisk (*) symbol. What exactly does the term and symbol indicate?

Charlie's answer: Refer to Chapter 3 of the operators manual (dash 10) for your aircraft and you will find the following: When the aircraft is flown by the same flight crew during tactical or administrative missions requiring intermediate stops, the flight crew need not perform all the pre-flight checks required by the amplified or condensed checklists for beginning flights. Under these conditions, all of the starred (*) items in these lists are required checks to assure safe operation.

In the UH-1C engine runup procedure, as outlined in the CL, Step 6 states "FUEL BOOST PUMPS—CHECK." What is the correct procedure for checking the boost pumps?

Charlie's answer: I'll answer your question but first let me mention that the CL is a condensed form of the normal and emergency operating procedures chapters in the operators manual (dash 10). For more detailed information on specific items in the CL, refer to the appropriate chapters of the dash 10. Now, your question. Step 6. FUEL BOOST PUMPS —Pull LEFT FUEL BOOST circuit breaker, note caution light on and normal fuel pressure. Pull RIGHT FUEL BOOST circuit breaker, note caution light and fuel pressure reading of 0. After 10 seconds, LEFT FUEL BOOST circuit breaker in, note CAUTION LIGHTS out and fuel pressure returning to normal. RIGHT FUEL BOOST circuit breaker in, all caution lights out.

I have been flying the U-21 here in the Republic of Vietnam for nine months and there are some items in the new CL which appear to me to be out of sequence. I have documented my proposed changes; now what do I do with them?



Charlie's answer: You are encouraged to list your proposed changes to the CL and operators manual on DA Form 2028 (Recommended Changes to DA Publications) and forward them directly to: Commanding General, U. S. Army Aviation Systems Command, ATTN: AMSAV-M, P. O. Box 209, St. Louis, Mo. 63166. Your proposed changes will be evaluated along with other suggested improvements and, if adopted, published as a change to the checklist. These checklists are published for the pilot and you aviators are best qualified to suggest improvements, so don't hesitate to submit your recommended changes.

. . . We have been able to shift forces rapidly . . . in any part of Vietnam we choose. We have demonstrated this in some rather spectacular operations, as for example, in the Ashau Valley . . . where our choppers air-assaulted troops and their artillery over rugged mountains, in foul weather under IFR conditions—General Bruce Palmer Jr. in an address to the Association of the United States Army

The Chinook climbs slowly until it clears mountain peaks and cloud layers

imum of five IFR aircraft at one time. A procedure for lost communications was established using the Evans NDB for a figure eight approach on the 360 degree axis.

Due to limited storage, refueling in the AO was done at Hue Phu-Bai and Camp Evans on an emergency basis only. The main refueling was done at Dagmar Bravo. A route and procedure for Dagmar Bravo was agreed on, but without an approach fix there, the problem of making an approach existed.

The ATC chief indicated Dagmar Bravo could be plotted on his radar scope and aircraft could be vectored to this point and an approach made using ASR procedures. This procedure was agreed on by the aircraft commanders and within the hour aircraft were taking off from Camp Evans to test the new routes and procedures. The flights went smoothly and with minor modification the procedure was considered adequate to accomplish the mission.

CH-47As began airlifting personnel, equipment and supplies from Da Nang and Hue Phu-Bai into and within the AO under all but the most hazardous of weather conditions. The aircraft were able to climb to a safe altitude and enemy hits were greatly diminished. The route and procedure for those aircraft departing Da Nang to Camp Evans involved VFR low level flight along the coast, keeping far enough out to sea to avoid enemy fire. They refueled at Dagmar Bravo, and contacted Evans ATC for IFR clearance into Evans. Flights from Hue Phu-Bai to Evans, due to the lack of communication between ATC sections, were required to climb to VFR-on-top, then establish communications with Evans ATC for clearance and radar letdown to Evans.

Since the cloud tops were sometimes higher than the heavily-loaded helicopters could fly, the problem of hand off from Hue to Evans presented a problem. It was rectified by having the aircraft communicate with Hue Phu-Bai ATC on UHF and Evans ATC on FM in flight, thereby coordinating their own hand off.

Helicopter flights IFR were usually conducted between 2,000 and 3,000 feet, while fixed wing aircraft operated at much higher altitudes, thus maintaining adequate separation in the AO.

During the month of February pilots of the 228th flew more than 700 hours in weather, making hundreds of approaches without incident. As a result of the successful procedure to locate and approach

Dagmar Bravo, the same procedure was used to resupply remote LZs.

Missions involving external sling loads under IFR conditions, although still in the infant stage, were starting to grow. As the week passed, more and more pilots were becoming receptive to the idea of attempting IFR flights carrying external loads. More than 20 missions involving sling loads IFR were successfully completed with only three sling loads intentionally released during flight due to severe oscillation. Pilots who had previously experimented with sling loads on hooded flights, completed these actual missions successfully.

The problems overcome during this period and the experience gained were to prove very valuable to the 1st Cavalry Division during the April 1968 assault into the Ashau Valley in "Operation Delaware." Aviators holding only Tactical Instrument Tickets, when given supplemental unit instrument training, were found capable of performing IFR sling load missions, even when paired together in the aircraft, which happened on many occasions.

On the morning of 19 April 1968 "Operation Delaware" launched the initial assault into the Ashau Valley. Forecast weather for the week indicated clear to partly cloudy skies in the early morning, becoming broken to overcast during early afternoon. Rapidly building towering cumulus clouds and thunderstorms were forecast in the mountain regions throughout the afternoon and early evening, gradually dissipating during the night.

The terrain between Camp Evans and Ashau Valley starts just above sea level at Camp Evans remaining level for several miles, rising rapidly to more than 5,000 feet in the mountains adjacent to the valley, then dropping sharply to the valley floor some 3,000 feet below. The valley is long and narrow, running southeast to northwest for approximately 27 miles along the Laotian Border.

The area of operation from LZ Tiger in the northwest part of the valley to LZ Lillian in the southeast averaged slightly more than a mile in width.

By mid-morning the routes to the valley saw heavily laden cargo helicopters, some loaded internally, some with sling loads of ammunition or a 105 howitzer, slowly climbing for altitude that would clear the mountain peaks and lower cloud layers. The aircraft using radar monitored climbs to VFR conditions-on-top, would descend through holes in the cloud layer to LZs in the valley. Returning to Camp Evans the helicopters would contact Evans GCA for approaches.

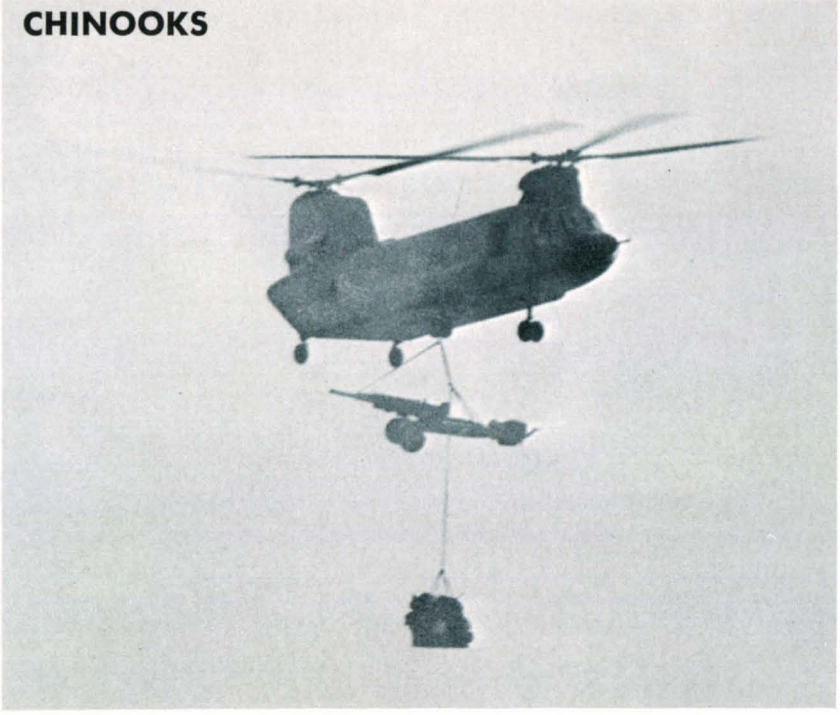
Weather continued to be a major problem each day and though plans were underway to set up a GCA section and NDB in the valley as soon as the Aloui airstrip could be taken and secured, it would be another week before this was to happen. Then it was found inadequate to satisfy division requirements, due to its location and type equipment. Throughout the Ashau Valley operation, Evans GCA was indispensable in providing radar vectors to and from the valley, traffic separation and GCA approaches to Evans.

Although handicapped with inadequate equipment and maintenance problems, the GCA section's performance was nothing short of magnificent. Its instant responsiveness was a tremendous morale factor, especially to those crews returning with wounded aboard, aircraft shot up or dangerously low on fuel.

As the weeks progressed, more than 20 aircraft were being simultaneously controlled or monitored by radar to and from the valley. Handling of inflight emergencies became routine. By 27 April "Operation Delaware" progressed southeast to secure Aloui airstrip. A nondirectional beacon and a mobile ATC unit were flown in.

The section was operational the next morning, but due to poor weather a flight check to determine its accuracy could not be conducted. Reports from the valley indicated weather had closed pre-

A radar monitored climb to VFR-on-top is made



. . . without cargo helicopter IFR flights, the success of "Operation Delaware" may have been more costly

viously existing holes in the cloud layer. Ammunition was badly needed by some of the units who were in contact.

An aircraft was launched and the crew was asked to take a look at the valley to see if they could get in. A radar monitored climb from Evans to VFR-on-top and a vector to the valley was made. On reaching the valley it was found covered with a solid overcast. The GCA at Aloui was contacted and an approach to Aloui was completed.

Within the coming weeks and until "Operation Delaware" was completed on 15 May, numerous IFR flights were made by cargo helicopters to and from the valley. It is highly conceivable to conclude that without an IFR cargo helicopter capability, the success of "Operation Delaware" could have been more costly.

In discussions prior to and during "Operation Delaware" many aviators felt cargo helicopter IFR flights in a combat environment were not only practical but in some cases highly desirable. This being true the need for better equipment, both ground and airborne, is a must.

Ground equipment should include radar with "moving target identifiers" in order to locate and track aircraft flying in areas of precipitation, locate thunderstorms and vector aircraft around them. Radar equipment should have increased quality and range to satisfy mission requirements in the AO.

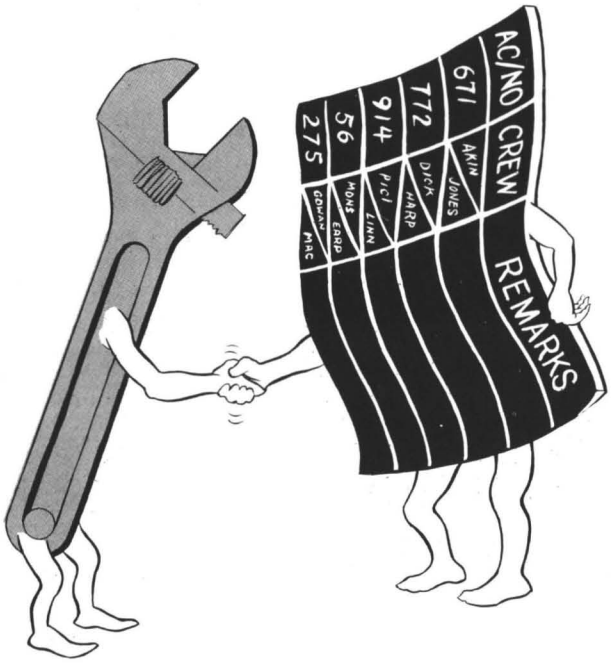
At least two nondirectional beacons of a high quality with individual power source and a back-up power source should be widely separated at division base. Generator failure, or a well-placed enemy mortar or rocket could spell trouble with only one beacon in use as is the present case.

The ATC section personnel should be better trained to operate and maintain their equipment in order to fulfill their responsibility. Aircraft should be equipped with airborne radar, a better quality transponder (the present transponder in use is a World War II hand-me-down), Doppler navigation equipment, an absolute altimeter and Tacan. This equipment is and has been available for procurement off-the-shelf for some time.

It is necessary that the aircraft be maintained in a continuous mission ready status; therefore it is highly desirable that on-board navigation equipment be self-contained when possible. In the chronological advancement of cargo helicopter combat instrument flying in the 1st Cavalry Division, a peak in efficient operation was reached during "Operation Delaware." But in June 1968 a turnover of ATC personnel resulted in an experience void requiring considerable in-country training. New, inadequately trained controllers during practice instrument flying under VFR conditions, frequently issued incorrect clearances and generally demonstrated a lack of understanding of ATC procedures.

The need for an IFR combat capability was demonstrated during the Ashau Valley campaign. As a result, an intensive instrument training program was initiated in the division at unit level in order to widen the present experience level of instrument flying and to maintain an IFR capability.

It was found highly desirable to have at least one instrument examiner and one school trained instrument IP in each helicopter company for a continuing instrument training or refresher-type program. An improved IFR capability will aiso enhance the night capability. With continued emphasis on training of aviators and ATC and electronics personnel, the optimum in experienced personnel will be available. With the added ingredient of better ground and airborne equipment, a state of total flexibility may then become an integral part of the airmobile division.



Maintenance vs Operations

. . . a plan that worked

Before the new plan, this company's maintenance personnel could only work at two speeds—wide open or stopped

Lieutenant Colonel Thomas W. Wheat

PRIOR TO A new plan to dovetail operations and maintenance efforts, the maintenance personnel of the 174th Aviation Company (AML) operated at the same two speeds as a Volkswagen on the Autobahn—wide open or stopped. Helicopter availability varied from 10 one day to 16 the next. Periodics came due three or four a day every four or five days. The operations officer would be short aircraft one day and over the next. Things were not going too smoothly.

A plan was devised to help integrate the maintenance and operations efforts and smooth out the availability peaks and valleys. The plan worked. It was a graph of hours to periodic inspection plotted against sequence number to inspection. The plan was in the form of a 8 by 10½ inch paper, plotted with 21 horizontal lines and 28 vertical lines. The horizontal lines represented 100 flying hours and were labeled on the right side from top to bottom, 100 to 0 in five-hour increments. The vertical lines represented the sequence number to periodic inspection (PE) and were labeled across the bottom, right to left, 0 to 18 followed by 0 to 8. This allowed the gunships to be kept separate from the slicks, since they fly at different average rates; while it also allowed the aircraft to be shown on the same graph as they had to be spaced into the slick periodic workload.

The 75th, 50th and 25th lines represented intermediate inspection (PMI) points and were underlined. Aircraft records were inspected to obtain the hours remaining to PE on each aircraft by tail number and arranged them in sequence. Then each aircraft was plotted where the hours remaining intersected its sequence number and the tail number was indicated by that dot. A line was drawn from the lower right corner to the highest dot representing a flyable slick. The same thing was done for the gunships. This gives an exact picture of the spacing of the ships.

If all the dots fell on the reference line, things would be perfect. The dots frequently missed. If a ship was very far removed above the line, it was assigned a heavy mission for the next day. If it was very far below the line, it was given a low-time mission.

All three platoon leaders owned their aircraft and crews. The gun platoon leader had his own graph and was solely responsible for his ships. The two slick platoon leaders assigned missions to their ships and crews. They worked together to keep their ships near the reference line. Occasionally they traded missions in order to move ships toward the line. The graph was constructed nightly after the ships were back in. When the graph showed aircraft

Maintenance vs Operations

bunching up, the company commander held a scheduling conference. The next day's graph usually indicated improvement.

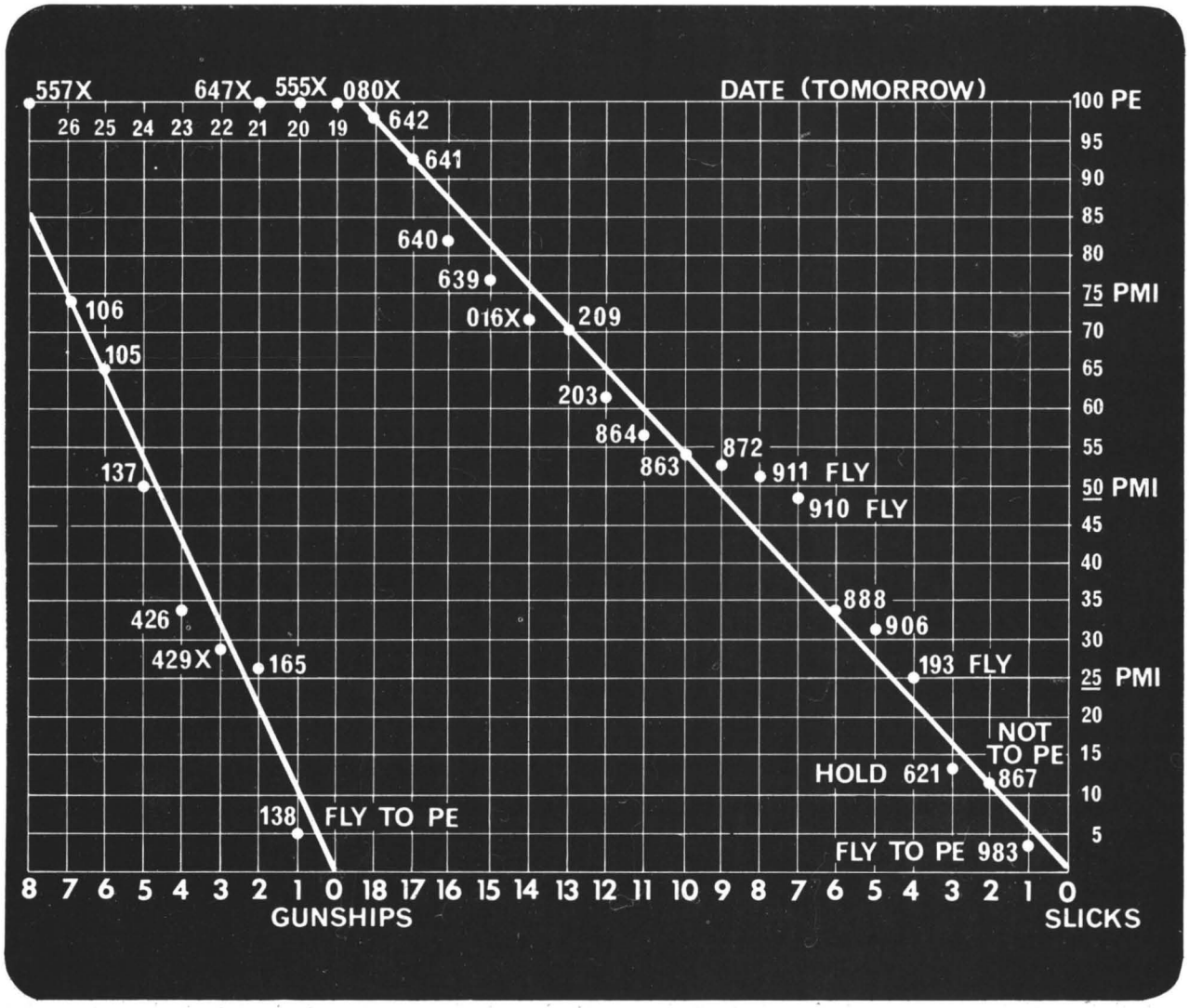
The maintenance officer became ecstatic. He could forecast maintenance requirements and work his crews efficiently. If a problem was developing, he could see it far enough ahead to do something about it. Since his clerk constructed the graph, the maintenance officer got the first look at it. He would make notes by a particular ship for the benefit of the platoon leaders. FLY, HOLD, FLY TO PE and NOT TO PE were his most often used notes.

The 75th, 50th and 25th-hour lines indicated which ships were coming into intermediate. The maintenance officer may want to pull a ship the night before in order to keep it from coming down after a short flight the next day. The ships were normally pulled three hours early if they were needed.

As a matter of routine, intermediate inspections and periodics were not overflown. As a result of this and an extremely capable maintenance officer, the company maintained high availability and high utilization. In August 3,200 flying hours were recorded. On 16 September, the company had 100 percent availability after having flown 6,300 hours the previous 60 days.

There were other programs

Helicopter Availability Chart



which contributed to this availability. Every time an aircraft was shut down, a postflight inspection was performed. Woe be to the aircraft commander who parked one for the night and had overlooked something that kept it from meeting its scheduled take-off time the next morning. There are some things that can go wrong overnight; but bearings do not get loose and rotor blades do not hit limbs. This program kept surprises from ruining the morning departure schedule. The heads, intake and exhaust were also covered.

Our ships were relatively high-time aircraft. We took our share of hits. It took a lot of effort to keep the availability high. This one simple management plan helped more than anything else. The more it was used, the more information it gave. The chart could work for anyone who flies more than approximately six aircraft.

There were usually four aircraft in for PE and they usually took four days to pull. The plan called for one in and one out every day. There was a lot of night maintenance performed too. The periodics were usually performed during daylight by the day crews. They were less likely to overlook something in daylight than at night. Later on, the platoon leader assigned an aircraft commander to each ship and it was his. This also was a tremendous boost to the overall effort. The major problem here is that one cannot fly as much, daily, as can the aircraft. It became necessary to put other people in his seat just to keep him from wearing himself out. When the aircraft commander would be out on the ramp helping the crewchief pull the intermediate at midnight, you can figure the state of morale.

Inspections were as thorough as they were regular. The aircraft were not down for unscheduled maintenance very often. This is a benefit of regular and thorough maintenance. Occasionally a ship would not come out of inspection because of something ususual. There was one intermediate that took eight days. A vibration in the aircraft, that defied detection, was finally found in the swashplate.

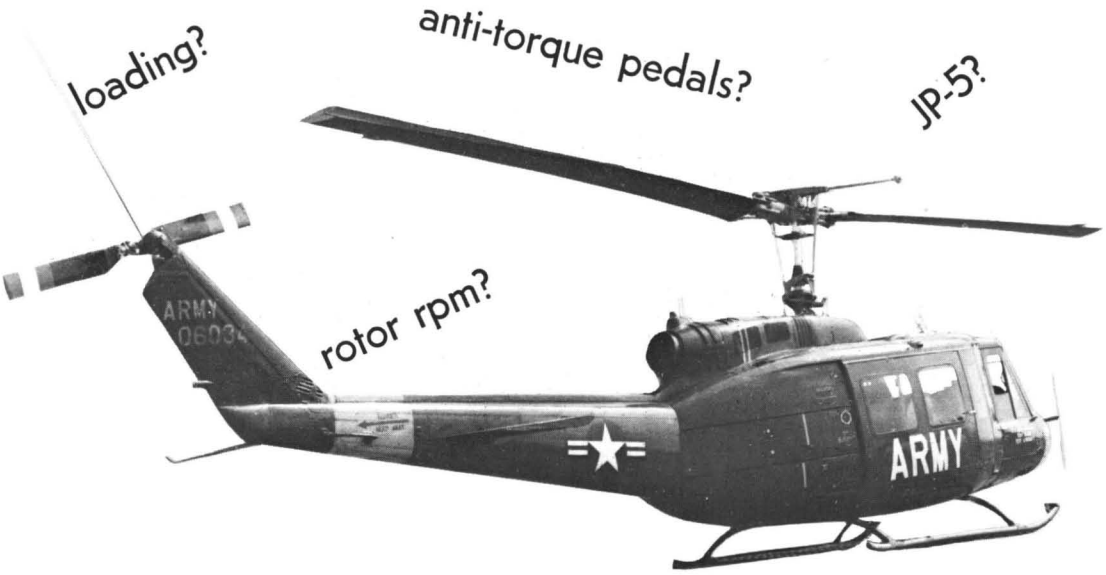
The chart shown is an actual chart adapted to show all the situations which could possibly arise. The lower right corner is where the slicks slide from service to periodic and this is where the chart pays dividends. Aircraft number 983 is only three hours out of PE. The next ship, 867, has 12 hours remaining. With a light mission tomorrow, it can be held off. By looking left to the gunship line, 138 is only five hours out. By scheduling it on the primary team, it will go into PE tomorrow too. This will mean that only two ships come down for PE tomorrow. A light schedule tomorrow is also needed for 621 which is crowding 867 a little too closely. Aircraft 193 is in for intermediate tonight and can use a heavy flight since it is displaced vertically above the reference line. The maintenance ship is 906 and is controlled exclusively by the maintenance officer. Aircraft 888 is okay but 910, just out of PMI, needs a heavy schedule to obtain proper spacing and return to the reference line. Aircraft 911, 872 and 863 were placed here to illustrate a special problem—they are all within 3½ hours of PMI. About noon tomorrow they would all come down together. However, the night crews will be busy getting these ships through PMI tonight, enabling their use all day tomorrow instead of half a day.

Woe be to the aircraft commander who parked his bird for the night and had overlooked something that kept it from meeting its scheduled takeoff time the next morning. There are some things that can go wrong overnight; but bearings do not get loose and rotor blades do not hit limbs

A second problem is indicated by the spacing between 910 and 864. Five ships are within a 10-hour block which means that spacing must be improved or five ships could come down for PE in one day. This must be avoided. There is good spacing between 864 and 203 but both are below the line. With a couple of days of light or less than heavy scheduling, they should move up to the line. Aircraft 209 is no problem. Aircraft 016 is down for unscheduled maintenance combat damage or accidental damage. Tomorrow 639 will probably by-pass 016 as 639 is only two hours from PMI—another night job for maintenance. There is no problem when ships pass each other; the scheduling is continued so that each dot moves toward the reference line. Aircraft 641 and 642 are just out of PE and should be flyable for approximately 12 days, when their next PE will be due. At the present, 080, 555 and 647 are in PE and should come out one a day for the next three days.

The gunship line shows an almost perfect situation. Aircraft 138 goes into PE tomorrow and with luck, 557 comes out; 429 is down for bullet holes and will be out in one to two days. This spacing is indicative of a good gun platoon leader in that he schedules all gunships.

There is no way to separate the maintenance effort from operations. Operations makes maintenance necessary. Maintenance makes operations possible. The solution is to more closely integrate the two.



Do You Really Know The UH-1?

Captain Charles Nolan and Captain Henry Roll

THE MAJORITY of rotary wing rated aviators in today's United States Army are well aware of the capabilities and record of the UH-1 helicopter. Introduced as an aircraft ideally suited for medical evacuation duties in the late 50s, the UH-1 is now the backbone of the Army's fleet of rotary wing aircraft. Not only did the UH-1 fulfill its original intended mission, but through the efforts and foresight of many dedicated individuals, the "Huey" began to serve as a weapons platform, a troop transport aircraft and a command and control center. The number of missions that the UH-1 performs today are almost infinite.

However, an aircraft is only as dependable as the people who maintain it and the aviators who fly it.

Since maintenance is an aspect of aviation where the aviator is largely dependent on the skills and professionalism of others, this article will not cover any maintenance problem beyond the scope of the Operators Handbook (dash 10). Of course, an aviator can preflight his aircraft and it is to his benefit to learn as much about it as he possibly can, but it is still the responsibility of another to place the proper torque on a critical bolt. This is the responsibility of supporting maintenance and a factor over which the average aviator has no control.

However the aviator has the important responsibility to know the

an aircraft is only as dependable as the people who maintain it and the aviators who fly it

capabilities and limitations of his aircraft under all conditions. Only when the aviator matches his own capabilities with those of his aircraft can he continually achieve mission effectiveness.

The following section of this article consists of a test which will allow you to evaluate your knowledge of your aircraft. Like all tests, it cannot cover everything but we believe that it does an adequate job. It is not intended that the test get into specifics for which the aviator has to search his operators manual, but if you find yourself doing just that it may indicate that your knowledge of the UH-1 is not what it should be. The majority of questions concern information which is applicable to all models. A few questions do concern a particular model, but these are considered important enough to be known by all UH-1 rated aviators.

All that is left to do now is to try your skill. If you know your aircraft, the test is extremely easy. If not, well, you be your own judge. Good luck!

Multiple Choice

(1) On UH-1 aircraft equipped with a fuel filter caution light, should its illumination occur: a) flight may be continued not to exceed 30 minutes, b) the aircraft should be landed immediately, c) the fuel bypass line will open and the aircraft may be flown until the next intermediate inspection, d) the fuel filter will continue to operate but the occurrence should be entered in the 2408-13.

(2) The UH-1 aircraft may use the following fuel(s) when equipped with the T53-L-13 engine: a) JP-4, b) JP-5, c) ordinary gasoline, d) A and B, e) A, B and C.

(3) As fuel is consumed during flight the center of gravity of the UH-1D will: a) move aft, b) move forward, c) remain unchanged since the fuel cells are located directly beneath the rotor mast, d) move upward.

(4) Rapid and abrupt movement of the cyclic controls of a UH-1 may possibly cause: a) a nervous copilot, b) extreme wear on all stabilizer bar components, c) a check valve in the hydraulic irreversible valve to become unseated resulting in control lock-up, d) a reduction in transverse flow effect.

(5) The proper emergency procedure in the event of a tail rotor malfunction in the UH-1 (inflight) would be: a) immediately execute a normal approach compensating for torque movement about the yaw axis with manual throttle control, b) execute a running landing as soon as possible, c) execute an autorotative landing as soon as possible, d) either B or C may be the correct solution depending on the type of malfunction.

(6) In the event of complete boost pump failure, the engine driven fuel pump in all UH-1s is capable of supplying engine fuel requirements: a) at pressure altitudes of less than 5,000 feet, b) at pressure altitudes of less than 4,600 feet, c) at density altitudes of less than 5,000 feet, d) at density altitudes of less than 4,600 feet.

(7) Based on the fact that the load factor on the main rotor system in level flight is equal to one G or the weight of the helicopter, a stabilized turn with 60 degrees of bank: a) will double the load factor on the main rotor system (two Gs), b) will not increase the load factor if the rate of bank is held constant, c) load factor is not a consideration in UH-1 helicopters, d) both B and C.

(8) Maximum allowable rotor rpm in autorotation for the UH-1C and D is: a) 341 rpm, b) 329 rpm, c) 339 rpm, d) 349 rpm.

(9) Retreating blade stall in the UH-1 is most likely to occur: a) at high airspeed and high rotor rpm, b) high airspeed and low rotor rpm, c) low airspeed and high rotor rpm, d) never because retreating blade stalls are virtually eliminated by the damping action of the stabilizer bar assembly.

(10) The recommended turbulence penetration airspeed in all UH-1 models is: a) 60 knots, b) 80 knots, c) 45 knots, d) 70 knots.

(11) Assuming a normal center of gravity loading, loss of the synchronized elevator on UH-1 helicopters will result: a) a tuck-under tendency of the aircraft nose at higher airspeeds, b) a tuck-under tendency of the aircraft nose at lower airspeeds, c) no change in aircraft pitch attitude, d) complete loss of control.

(12) The low rpm audio signal is considered operational within limits if it is heard at: a) 285 ± 10 rotor rpm, b) 295 ± 10 rotor

rpm, c) 310 ± 5 rotor rpm, d) 315 ± 5 rotor rpm.

(13) Maximum allowable EGT during start in the UH-1C and D models equipped with the L-11 engine is: a) 675 degrees C, b) 760 degrees C, c) 740 degrees C, d) 650 degrees C.

(14) How soon after power is applied to its circuits does the pilot's artificial horizon gyro become reliable? a) immediately, b) in three minutes, c) in two minutes, d) in five minutes.

(15) The recommended cruise airspeed for the UH-1C and D models during instrument flight is: a) 70 knots, b) 75 knots, c) 80 knots, d) 85 knots.

(16) Floor loading in the UH-1D shall not exceed: a) 250, b) 175, c) 150, d) 300 pounds per square foot maximum package size and gross weight limits.

(17) In the UH-1C, equipped with the collective accumulator, when the HYD control switch is moved from BOTH (center) position to SYS 1 on position, the no. 2 hydraulic system is disabled. In this situation, the: a) anti-torque pedals, b) armament, c) horizontal stabilizer, d) collective pitch, *hydraulic system will be rendered inoperative.*

(18) In the UH-1B, C and D models when the rpm increase/decrease switch is activated to full increase, the engine rpm should stabilize at: a) 6600 ± 50, b) 6700, c) 6700 ± 50, d) 6650 rpm.

True and False

(19) The UH-1C, D, B and H models are equipped to operate in forecast moderate icing conditions.

(20) The handling qualities of the UH-1 helicopter at speeds less than 60 knots are not considered compatible with instrument flying.

(21) The UH-1 series of aircraft requires no special loading preparation.

(22) A fuel pressure indication of 5 psi is acceptable for continuous operation in all UH-1 helicopters.

Answers

(1) a) TM 55-1520-210-10/220-10/219-10, Chapter 2

(2) e) However when an alternate fuel is used a write-up is required in the 2408-13. TM 55-1520-210-10/220-10/219-10/218-10, Chapter 2

(3) b) TM 55-1520-219-10, Chapter 7, figure 7-6

(4) c) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 4

(5) d) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 4

(6) b) TM 55-1520-210-10/218-10, Chapter 4

(7) a) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 8

(8) c) TM 55-1520-210(220)-10, Chapter 7

(9) b) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 8

(10) b) TM 55-1520-210(220)-10/219-10/218-10, Chapter 10

(11) a) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 2

(12) b) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 2; 300 ± 5 is the dash 10 answer, therefore, b) is closest and is also the range taught at USAAVNS.

(13) b) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 3. Note, however, that exceeding 650 degrees C for five seconds during a start requires a hot end inspection.

(14) c) TM 55-1520-210-10/220-10/219-10/218-10, Chapter 2

(15) c) TM 55-1520-210(220)-10, Chapter 10

(16) d) TM 55-1520-220-10, Chapter 13

(17) b) TM 55-1520-220-10, Chapter 3

(18) c) TM 55-1520-210-10/220-10, Chapter 3

(19) *False.* Equipped for only light icing conditions, TM 55-1520-210-10/220-10/219-10, Chapter 10

(21) *True.* The loading procedure consists of placing the heaviest items to be loaded as far aft as possible. Such placement locates the cargo nearer the helicopter center of gravity and allows maximum cargo load to be transported, as well as maintaining the helicopter within safe operating limits for flight. TM 55-1520-210-10/220-10/219-10/218-10, Chapter 13

(22) *True.* TM 55-1520-(all series)-10, Chapter 7

Add up your number of correct answers and refer to the following table to see how you scored.

18-22	Correct—Excellent
10-18	Correct—Good
5-10	Correct—Average
0-5	Correct—Poor

Although you might have found the test to be a little too specific, familiarity with the finer points of the UH-1 aircraft could very easily help you to avoid a dangerous situation. The UH-1 is a sophisticated and demanding machine. An "Arms and Legs Pilot" has no business in the cockpit of the Huey as the physical manipulation of the controls is only a part of the overall picture. The very nature of the UH-1 mission is such as to frequently lead the aviator to ignore the necessity for comprehensive flight planning and maintenance of a high level of technical proficiency. Instead the aviator is "tempted" to just "kick the tire and light the fire."

The dash 10 for the UH-1 is just what its title says: an "Operators Handbook," not merely a flight school study aid or a dust collector in your unit's file. Read it, study it and know it. It's the key to safety and proficiency.

VFR continued from page 1

speed (V^3). At normal operating rpm then, a slight reduction in rotor speed will result in a proportionally greater reduction in profile drag than in induced drag and thrust. Naturally, with a reduction in profile drag there will be a corresponding decrease in the power required to overcome it. This extra power can then be used to overcome induced drag and produce more thrust from the rotor.

A more graphic illustration of this phenomenon can be seen by hovering a less-than-fully-loaded UH-1 with the engine and rotor rpm set at various speeds. It will be noted that the lower the rotor rpm, the less torque and gas producer rpm will be required to sustain the hover. This does not mean, however, that we have increased the *total lift capability* of the helicopter simply by setting a lower rotor rpm with the "beep switch," as some aviators believe. To understand this apparently ambiguous statement, one must first have a basic understanding of the operation of the fuel control unit on the gas turbine engine.

The primary function of the fuel control on the T53 engine is to regulate gas producer speed. It does this by increasing or decreasing the amount of fuel delivered to the combustion chamber of the engine. It will also maintain a set speed on the power turbine, within limits, by changing the gas producer speed to meet the demands of the power turbine. If the pilot has told the fuel control to maintain 6600 rpm on the power output shaft of the engine, then changes the load on the engine by applying collective pitch, the fuel control will sense this increased load and supply more fuel to the engine.

Note, however, that we said "within limits." This also should apply to gross weight! Once the gas producer turbine has reached a certain predetermined speed (max N_1) no more fuel will be supplied, regardless of what happens to the rpm of the power output shaft. If the pilot increases the application of collective pitch, the engine and rotor rpm will decrease, because the N_1 turbine will refuse to meet the additional demand placed on it. (As noted by MAJ Christensen in his article, the reduction in engine rpm will also cause a corresponding reduction in shaft horsepower (SHP) produced by the T53-L-11 engine.) Under these conditions, the fuel control is ignoring any instructions it receives from the power turbine, and will continue to do so until N_2 speed is increased back within the governed range.

Applying what has been said to the situation posed in MAJ Common's letter, let us assume that a pilot is attempting to hover a fully (over max gross) loaded UH-1. With the engine rpm set at 6600, collective pitch is applied until max N_1 is reached, and the helicopter will not hover. Still more pitch is applied, and the engine (and rotor) rpm is reduced, let's say to 6400 rpm. Now less power is required to overcome profile drag, this extra power is used to overcome induced drag, and, despite the attendant loss in engine SHP, the helicopter lifts off the ground.

The same results would be realized if the pilot had intentionally reduced his engine rpm to 6400 with the "beep switch" prior to attempting to hover. The combination of N_1 speed, N_2 speed, induced and profile drag, and thrust would be identical to that posed in the previous situation. The only difference would be in the method used to arrive at these results.

It goes without saying that operating the UH-1, or any helicopter, below the prescribed rotor rpm entails certain risks. It is not our intent to justify this practice. Too many aviators have found, to their dismay, that the extra lift gained in this manner is not enough to get the job done. Bleeding down the rpm is poor procedure and can result in operation over max gross weight or deterioration of rpm below that necessary for sustained flight.

The above discussion has ignored many areas which could properly be applied to the subject, such as directional control problems, transition from hovering to forward flight, effects on air density from prolonged hovering, rotor momentum, etc.—The Editors

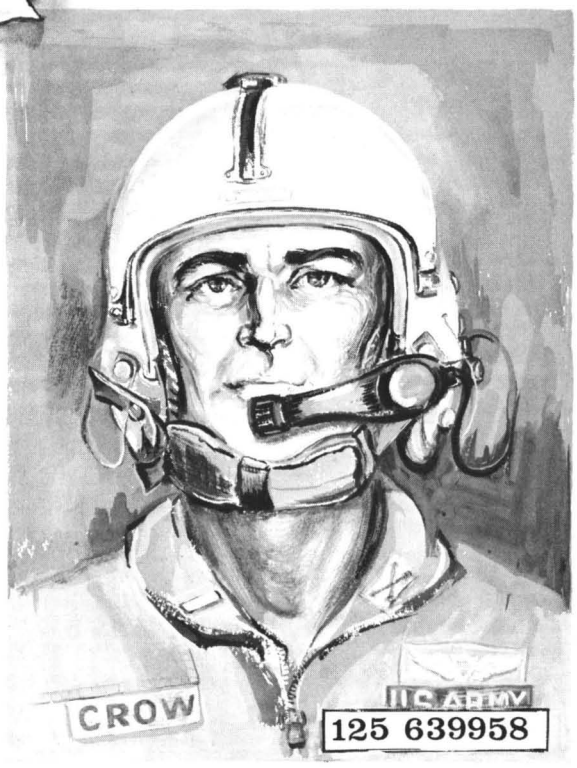
★ ★ ★

◆ *From Bell Helicopter:*

The U. S. Army Model OH-58A will carry the nickname Kiowa, officials of Textron's Bell Helicopter have been informed.

The OH-58A is the Army's version of the Bell Model 206A JetRanger. Last March it was named winner of the Army's re-opened light observation helicopter (LOH) competition and Bell was awarded a contract for 2,200 of the five-place, turbine-powered aircraft.

◆



WANTED!

INSTRUMENT EXAMINERS

Major William H. Gardner

Reward: Plenty of long hours, extra duty and additional responsibilities. Although no extra pay is offered, instrument examiners enjoy the prestige of being the best instrument qualified aviators in the Army. Other rewards include having the following honorary aliases: "Old Man's Pilot," "Bad Weather Missions Officer," "Safety Officer" and "Standardization Officer."

THE UNITED STATES Army Aviation School (USAAVNS) at Ft. Rucker, Ala., is the base from which all the standards for instrument flying for Army aviation are established. The doctrine and lessons learned at USAAVNS are carried to the field by the instrument examiners who graduate from the course at the school. Therefore, the instruction presented and training conducted in the examiner courses is world-oriented and student-centered. The objective of the examiner courses is directed toward teaching each individual examiner the skill and knowledge necessary to maintain the high standards of the Army instrument program.

To accomplish these goals, the instruction reflects not only approved procedures and doctrines but also demands of the students, the highest degree of professional competence, tact and judgment. The examiner program remains oriented to the concept that its product will, in turn, exert considerable influence upon the Army's instrument flying program.

An examiner not only awards or withdraws an aviator's instrument rating but also administers the Annual Written Examination. He must willingly accept, if not seek, additional responsibilities with regard to the establishment and maintenance of the instrument program within his unit. Finally, he must be prepared to assist the commander, upon request, in such areas as standardization, operations and safety.

The philosophy of an individual examiner then must be to present to each aviator with whom he comes in contact, the current standard policies, procedures and doctrine with regard to all aspects of instrument flying. In addition he must give a realistic presentation of the tasks required and sufficient assistance in attaining the necessary proficiency. He verifies this proficiency through examinations, both written or oral, and professionally conducted checkrides. Adherence to these principles and standards has resulted in examiners who best represent USAAVNS and the Army's instrument program.

Unfortunately, today, there are several problems throughout Army aviation with regard to examiners and consequently the Army's instrument program. One of these problems is the shortage of examiners in many areas of the world. The current number of rotary wing examiners, in particular, doesn't even come close to meeting the requirements generated by the spectacular increases in rotary wing aviators since 1966. The majority of these aviators graduated from flight school with tactical instrument ratings. This problem of a shortage of examiners is not just one of numbers available.

The majority of examiners in the system now are field grade officers with duties and responsibilities precluding them from being anything but occasional examiners. Of those military examiners remaining, many of the senior warrant officer examiners will begin attending the first or subsequent classes of the newly formed Warrant Officer Career Program commencing in mid-1969. This will further reduce the number of examiners in the field. In addition, many other experienced examiners no longer attempt to remain current due to the press of their other duties. To emphasize this point, in January 1969, 170 examiners were appointed to the Instrument Flight Qualification Board at USAAVNS. Of these, 67 were field grade officers and 71 Department of the Army civilians. Of the 32 remaining, 5 were company grade officers and 27 were warrant officers. Putting these figures another way, that of the military examiners on this board (many of whom give less than five checkrides per year), only five in 99 or 5 percent were company grade officers and 25 in 99 or roughly 25 percent were warrants and the remaining 70 percent field grade. There are other examiners at USAAVNS who were not appointed to the board because they have been unable to get "current."

The obvious question raised by the above is, "Why can't the Army qualify more examiners—particularly from among its junior officers and warrants?"

The increased promotion rate is one reason why there is a shortage of examiners among company grade officers as many become qualified examiners while they are captains only to be promoted before their training can be fully utilized.

Another reason, and more important, the course prerequisites as established were difficult to meet, again particularly in rotary wing, because of the Vietnam War which has restricted most aviators' exposure to instrument flying and the fact that almost all of the new rotary wing aviators since late 1965 were awarded tactical instrument ratings. The shortage of rotary wing examiners is far more serious than fixed wing. Part of the blame for this deficiency must rest with the unit commander. Paragraph 2a, AR 95-63 states: "An objective of the Department of the Army is to require instrument qualification of all aviators. Major overseas and zone of interior (ZI) Army commanders (NOTE: It has been proposed that the revised AR 95-63 read 'commanders authorized to award and revoke instrument ratings . . .') will establish and conduct a thorough and continuing instrument training program utilizing available literature, equipment and guides provided by the Army Aviation School or higher authority and

WANTED: Instrument Examiners

available within the command. This program will insure that ample time and facilities are made available to permit aviators to attain and maintain the degree of instrument flight proficiency required for issue and retention of an instrument rating." If this is the Army's policy, then there has been a definite lack of emphasis in many units and at many installations on flying instruments and on instrument flying.

There is an important distinction here. "Flying instruments" means the ability to fly on the gauges and "instrument flying" implies knowledge of procedures and regulations. It is quite possible to be current and proficient in one area and not the other. This lack of emphasis coupled with the special considerations generated by the war in Vietnam (e.g., lack of aircraft, limited exposure to instrument flying, etc.) and the tactical instrument background have reduced the general instrument proficiency level of rotary wing pilots in the field. Admittedly, some units have had no choice with regard to the instrument proficiency of their aviators. When your aviators fly 125 combat hours a month, fatigue, the flying hour program and common sense all combine to eliminate any kind of an instrument proficiency flying program in a unit. However, many units make no effort to have their pilots fly under the hood on ferry or related missions, when the provisions of the appropriate regulation could be met.

With so many rotary wing aviators with a tactical instrument background going directly to Vietnam, it is no surprise that most return with little or no instrument proficiency. What is surprising and unfortunate is the fact that most return remembering little of what they were taught with regard to instrument flying. This is the fault of many unit commanders who do not take the time, *often available,* to keep their aviators current on the many changes and developments in instrument flying through some type of periodic ground school. This is especially important in Vietnam where the tactical situation has precluded the administration of the Annual Written Examination for the past few years.

As stated, there are just not enough rotary wing rated company grade and warrant officers in the field with anywhere near the prerequisites desired for the examiner courses. As early as spring 1968, many examiner students began arriving at the Aviation School with waivers for many of these established prerequisites:

- Possess a current instrument rating (other than tactical).
- Have held the rating for the previous two years and flown a minimum of 10 hours of actual instruments as an IP, pilot or copilot during the past two years in category; or had the rating one year provided he flew 10 hours of AI as an IP or pilot.

The instrument examiner must seek additional responsibilities in establishing and maintaining the instrument program within his unit

• Minimum of 1,000 hours with 500 in category.

• Have a certificate of proficiency signed by an instrument flight examiner who has been delegated the authority to determine qualifications of aviators for award or retention of instrument ratings.

Tests are now being conducted to determine prerequisites for the examiner programs commensurate with the abilities of aviators available and acceptable in terms of course length.

A third problem area also related to the shortage of qualified aviators (particularly junior officers and warrants) is that the examiner field apparently has lost some of its former appeal. Many of those aviators, particularly warrant officers, who meet or come close to meeting the prerequisites are reluctant or even unwilling to attend the course. There is no question that the working examiner puts in long hours above and beyond his regular duties conducting checkrides for personnel who can't get away during the week. It is also true that he gets called upon to fly the key mission—the night medevac or the AI mission that "must go," even though there may be other qualified pilots available. It is also no secret that the examiner doesn't get paid any more or promoted any faster because he is an examiner. In fact, if he is conscientious and does his job the way he has been trained, he may even occasionally step on the wrong foot. He's the safety officer, the standardization officer and the Old Man's pilot—more often than not, in addition to his regular duties. And finally, some will tell you also that the examiner has lost prestige because the course prerequisites have, of necessity, been reduced.

Now, having addressed these problem areas, it is important to discuss a few facts and to see what is being done to resolve these problems.

Fact Number One. No matter what innovations, new techniques and adjusted prerequisites may be incorporated into the examiner programs—the end result, the man who qualifies as an examiner, is still at the top of his field. There will be and has been no lowering of standards. He may not look old enough to shave or to buy a drink in some states but when he says he's an examiner, he's as professional and knowledgeable as any examiner the system has ever produced—in some ways better for he knows all the latest procedures and techniques.

Fact Number Two. A test class at USAAVNS qualified four examiners in the summer of 1968, two fixed wing and two rotary wing, from aviators with minimum instrument experience. The knowledge gained from these tests provided considerable input into two DA directed test courses conducted from January to April 1969. These latter test courses had the following as test objectives:

• To establish the most realistic course prerequisites in view of the overall situation throughout Army aviation versus course length.

• To evaluate the use of programmed instruction and synthetic flight training in the examiner course.

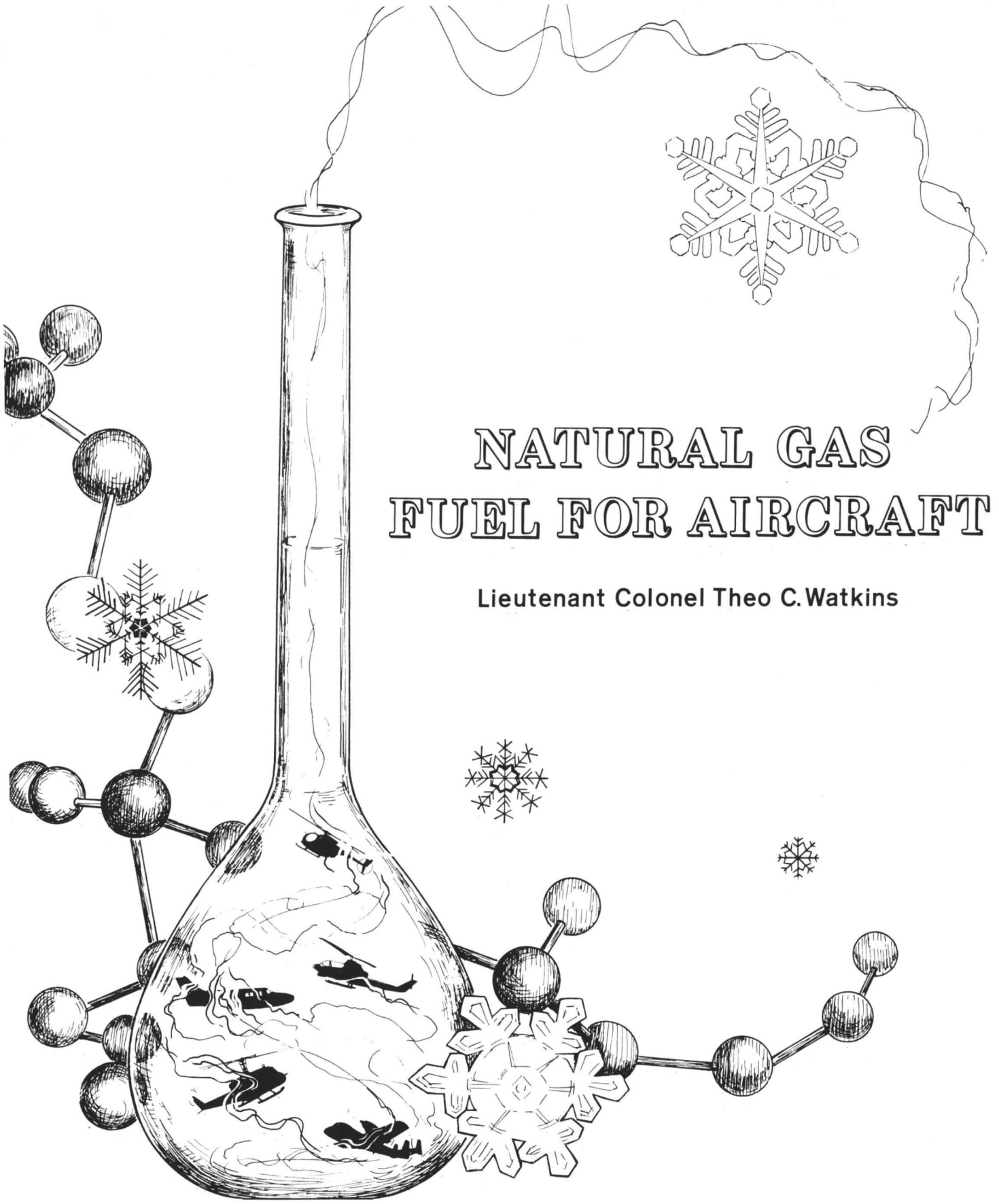
• To evaluate the feasibility of overlapping courses to permit students in the examiner phase to conduct checkrides and training for incoming students. This would provide a savings in aircraft as well as permit more classes per year.

• To evaluate extensive application of jumpseat training for the student not actually at the controls.

In addition, two other tests were initiated in February 1969 at USAAVNS to determine the requirements for qualifying substantial numbers of experienced instructors at USAAVNS as examiners with the minimum of additional resources and minimum impact on the training departments. In one test selected IPs were required to establish the necessary proficiency (primarily as a "guinea pig" for the examiner courses) during breaks in the training schedule when they were not required to fly their students. In the other test, the IPs selected established not only the necessary proficiency but also completed examiner academics during periods when they were not needed to fly students. Upon completion of these requirements, an aircraft and an examiner were allocated for the necessary examiner training.

Fact Number Three. Another area receiving considerable attention with regard to the problem of the shortage of examiners involves the establishment of procedures to identify the potential examiner during his earlier training. His records will be annotated during flight school, subsequent flight training and MOI to indicate that he has the necessary ability and integrity to become an examiner. This idea of identifying students during early training has application, of course, not only in the examiner program, but throughout the Army aviation field.

One final step to improve the examiner program can be made by all commanders worldwide—that is, to make the entire business more attractive. This involves many intangibles. It could include, however, becoming aware of the extra efforts of the examiner and making adjustments accordingly. Needed will be increased command emphasis on instrument programs in field units (which would then provide more aviators in the system with the necessary prerequisites), and finally recognizing that this man, regardless of his rank, age or experience in terms of hours and years, has achieved the pinnacle of our profession.



NATURAL GAS FUEL FOR AIRCRAFT

Lieutenant Colonel Theo C. Watkins

DOZENS of operational research studies have been concluded; countless conferences within and out of military and private industry circles have addressed the subject and millions of dollars of research and development monies have been spent on developing new aircraft engine fuels. The most promising fall-out of these efforts is the use of Methane (CH_4) as a fuel for aircraft engines.

The purpose of this article is to acquaint the reader with the Army's approach to Methane, as visualized by the U. S. Army Combat Developments Command (USACDC). USACDC is charged by Department of the Army with determining answers to the following, for 20 years into the future.

- How should the Army fight?
- How should the Army be equipped?
- How should the Army be organized?

The mission of USACDC is epitomized by our motto, "Vision to Victory," and those of us directly involved with the CDC mission, are proud of its contributions to the overall Army mission. So much for the commercial; Methane is a major component of natural gas. It also is a cryogenic substance, which means it is very cold (−260 degree F) in a liquid state.

Engine and Fuel Background—The past 15 years have seen a revolution in aircraft engines with the change over from reciprocating to gas turbine power. The Army has provided the main impetus in this accomplishment. The current generation of gas turbine engines using the JP fuel series has provided a significant weight to horsepower reduction with quantum jumps in reliability and maintainability. Further significant progress in the field requires a solution permitting higher turbine inlet temperatures, and a reduction in specific fuel consumption (SFC). Current state-of-the-art technology indicates an upper limit has been reached in both these areas using the JP fuel series.

Advantages of Methane as a Fuel—At this point let me invite the reader who may be assuming that a highly technical presentation will follow, to please continue with me since what follows is outlined in "soldiers" terms and a concerted effort has been made to stay away from engineering language. Before enumerating the advantages of Methane I should explain how it can function as an aircraft engine fuel. There are three key points:

- Methane is a cryogenic fuel stored at −260 degrees F and pumped as a liquid.
- It can be heated and vaporized while concurrently cooling engine components.
- It is injected into an engine combustion chamber as a gas.

Heat Efficiency—The efficiency of a fuel is frequently judged by the amount of heat released per pound. This is true for fuels used to heat your house or propel your car. Methane releases approximately 18 percent more heat per pound than the JP series.

Higher Turbine Engine Inlet Temperatures—As outlined earlier, Methane is a cryogenic substance. As such it can absorb heat in the neighborhood of 1,250 degrees F (525 degrees F for JP) without breaking down. This feature can be used to cool turbine blades and other components, and permit increases in inlet temperatures to approximately 4,000 degrees F (curret inlet temperatures using JP fuel peak at approximately 2,200 degrees F). The fall-out of these advantages is decreased specific fuel consumption (SFC) and greater engine performance. Figure 1 outlines this advantage in chart form.

Noise Reduction—Noise reduction on the battlefield is receiving a great deal of attention in the Army. Methane fuel requires 50 percent less air for combustion than JP. This feature produces two advantages: a reduction in engine size for a particular horsepower requirement and a significant reduction in noise due to less air entering and leaving the engine.

Reduction of Infrared Signature—The widespread acceptance of the airmobility concept with the intended movement of air vehicles all over the battlefield has caused many of us to meditate on the consequences of the enemy launching a heat seeking device up our tailpipes. It is possible to use the cooling properties of Methane in the engine exhaust sections and reduce infrared signatures to an acceptable risk category (see figure 2).

Smog Reduction—Many levels of the military, the government and industry are agonizing over the problems of smoke control from air vehicles using JP fuels. The problem is so acute it may eventually preclude aircraft operation in certain high smog regions. Methane by comparison, is a clean burning fuel. Carbon monoxide is drastically reduced because Methane contains less carbon in proportion to hydrogen. Soot and sulfur in the exhaust stream are negligible.

Safety—Those of us who drive air vehicles are acutely aware of the hazards of post-crash and refueling fires. Studies conducted by USABAAR indicate the fatality rate is very high in accidents where fire has broken out. Methane as a fuel has four safety considerations:

- Methane (in vapor form) is difficult to ignite (1,200 degrees F vs 500 degrees F for JP).
- Rupture of fuel tanks during an accident would permit Methane to vaporize and float into the air away from the crash site.
- The cryogenic properties of Methane would assist in preventing or quenching fires due to its

ESTIMATED ENGINE PERFORMANCE

(1800-2200°F)	SPECIFIC HORSEPOWER, HP/LB/SEC	BRAKE SPECIFIC FUEL CONSUMPTION AT MAX POWER
JP FUEL (CURRENT TIT)	90-100	0.64-0.69
JP FUEL (2400°F)	200	0.46
CH_4 FUEL (2400°F) (METHANE)	220	0.40
CH_4 FUEL (3000°F) (METHANE)	305	0.39

FIGURE 1.

super-cooling effect and high ignition point.

• Methane is non-toxic to fuel handling personnel.

Cost and National Considerations—Methane is plentiful and cheap. Figure 3 outlines the estimated reserves of natural gas and petroleum. It takes little reflection to deduce the fact that national objectives and foreign alliances could be influenced by these fuel reserves in the future. It should be emphasized that only 10 to 20 percent of the total petroleum reserves are suitable for use as aviation fuel.

Maintenance and Supply—The final advantage of Methane is its potential influence in the logistical field. Aircraft have always been expensive to buy and operate. This fact is particularly applicable to rotary wing aircraft, where the total cost of one flying hour for a large helicopter exceeds $300. Much of this cost is due to spare parts and maintenance requirements, with engines constituting a major portion of the requirements for spare parts. Methane, in contrast to JP fuel, is a clean burning fuel and produces very little coke and gum to block passages and create engine problems.

In the supply field, the long logistical tale associated with ship-

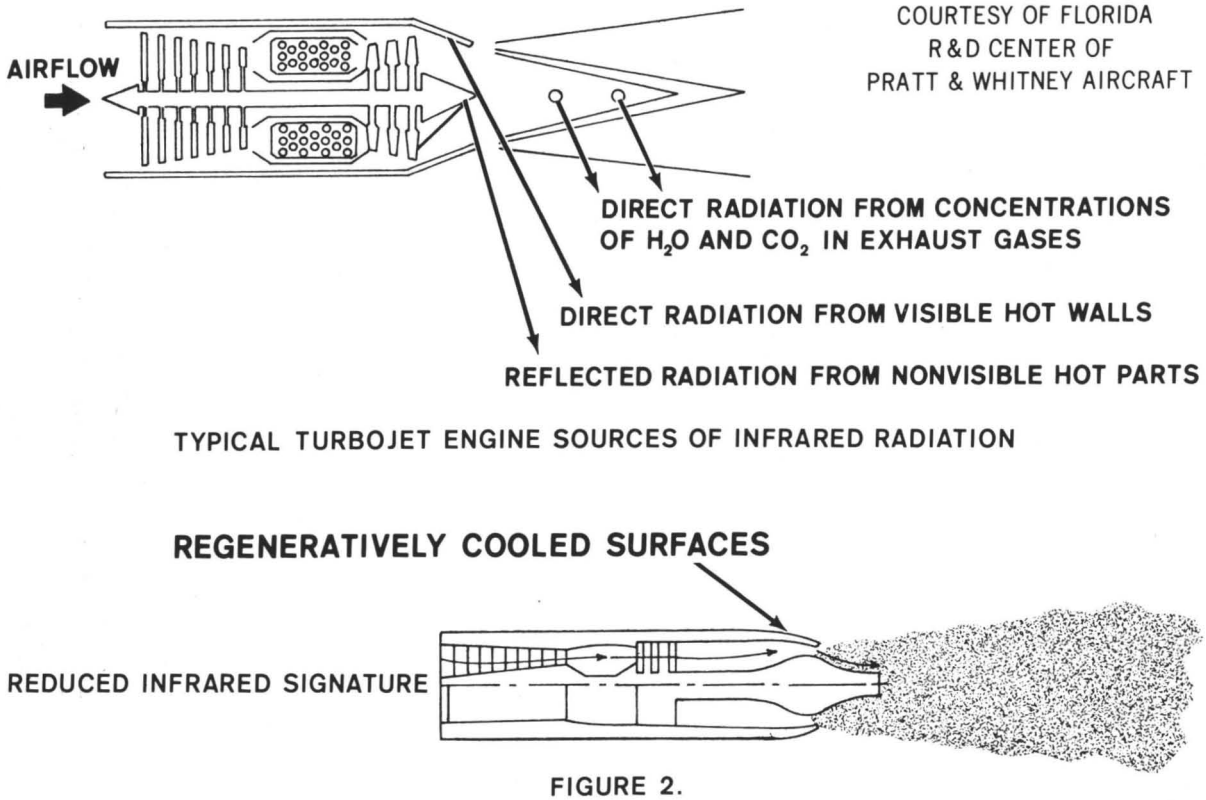


FIGURE 2.

ESTIMATED RESERVES
(BILLIONS OF STD CU FT)

	NATURAL GAS	PETROLEUM
NORTH AMERICA	1,750,000	1,580,000
WORLD	15,300,000	11,700,000

1 BARREL PETROLEUM = 5850 FT^3 NATURAL GAS (EQUAL ENERGY)

REF. U. S. GEOLOGICAL SURVEY 1964.

COURTESY OF FLORIDA R&D CENTER OF PRATT & WHITNEY AIRCRAFT

FIGURE 3.

ping and storing POL products is well known. Analysis of state-of-the-art technology by CDC indicates liquefaction plants capable of being transported are presently available. During future conflicts, these plants could be set up in areas of the world where natural gas is available, and Methane produced on the spot. This procedure could free the military services from reliance on the "bridge" of ships that normally link the combat theater to CONUS.

Disadvantages of Methane as a Fuel for Aircraft Engines—The disadvantages of Methane as a fuel for aircraft engines stem mainly from its cryogenic property. Lubrication of engine components could be a problem due to rapid cooling or even freezing of lubricants. Special tanks for aircraft and dispensing equipment would be required. Commercial equipment currently used by industry in transporting natural gas utilizes double-walled tanks with vacuum insulation. The tanks are extremely heavy. Considerable research is required in this area to produce tanks light enough for helicopter application. Finally, Methane is an escape artist. It is constantly boiling and a recapture feature is required on tanks to convert the gas back to liquid state for storage purposes.

A transition to Methane in lieu of JP fuel would have to be considered in light of an overall cost/effectiveness study which would consider the basic fuel costs as well as the cost of conversion to the ancillary equipment associated with the use of Methane. It is obvious the costs associated with new tanks and fuel handling equipment would be significant.

The USACDC Approach—In keeping with the CDC responsibility for providing Department of the Army answers on *how* the Army should fight, be equipped, and organized for at least 20 years into the future, the use of Methane gas as a fuel for Army aircraft engines is being addressed. The tool for implementing the program is an "Operational Capability Objective" (OCO). An OCO is defined in AR 705-5 as follows, "A Department of the Army approved description of an operational capability desirable of achievement in a specified time frame 10 or more years in the future." An OCO is used as the basis for research and in some cases exploratory development.

I would like to conclude with a plea. USACDC is the representative of the "user" for the Army in the field. Ideas come from many sources. Procedures for submission of ideas are outlined in the new Army Regulation 71-1. If you have an idea that will assist USACDC in providing answers to the questions outlined above, I urge you to submit it to us regardless of how wild or off-the-wall it may appear to other people. Our future is tied, for better or worse, to technology. In the last analysis, breakthroughs in technology are frequently the end product of a better idea.

Captain Howard B. Gentle

4 LITTLE WORDS

Fatal accidents often have a mysterious quality about them because we are unable to determine what happened in the cockpit

"I have the aircraft"

A CAPTAIN and a lieutenant were returning to the home field after demonstration and practice of basic upper air maneuvers. For an initial in-country checkout the lieutenant wasn't doing bad at all, his planning was good and coordination excellent. The captain planned several touch and go landings so while on downwind for their first approach, he announced over the intercom, "O.K., I'll show you one first." The approach, landing and takeoff were executed in a flawless manner. On the crosswind leg, the captain who was understandably pleased with his demonstration, said "O.K., now its your turn," but he didn't release all of his control pressures because this was the lieutenant's first approach and the captain wanted to keep it safe.

The lieutenant could feel the instructor assisting him and it made him feel like a pre-solo student again. The instructor still seemed to have control of the aircraft because by the time the lieutenant decided to use flaps they were already coming down, making it impossible for him to foul up the approach. After turning final all was well in the back seat, the captain saw the boys from his platoon by the approach end of the field. They probably wanted to see how the "new guy" was doing. He knew it would be a good landing because they were all set up and couldn't miss. A little further down final he noticed one of his men standing on the hood of his freshly painted quarter-ton vehicle. This greatly upset the captain, but only for an instant because his thoughts were interrupted by the Bird Dog's vio-

lent swerve to the left while on the after landing roll. Before anything could be said or done, the 0-1 had turned a full 720 degrees. For a moment all that could be heard was the left main wheel still spinning. The lieutenant turned to the captain and said "Sir, I thought you had it." The captain shook his head and as the wheel slowly turned its last revolution he lifted his eyes and muttered, "I *have* had it."

How about the Cobra instructor who became upset when his student failed to answer the control tower while they were hovering for departure. Finally, after several more transmissions, the instructor said "I got it." Disaster could have resulted, but as the gunship shuddered toward Mother Earth, the instructor pilot gained control. After his pulse slowed somewhat, the instructor almost unleashed verbal hell and damnation. However, he just happened to think first. It was apparent that his student thought that he, the IP, was taking control of the aircraft.

The primary cause factor involved in these incidents was the failure of the instructor to utilize the old standard change of control procedure. These pilots were fortunate for they lived to tell of their experiences. It's unknown how many fatal accidents have been caused due to this lack of standardization.

Fatal accidents many times have a mysterious quality about them because we are unable to determine what happened in the cockpit. How many times have the pilot and aircraft commander fought each other for control during an unusual situation? How many times did this result in the complete loss of effective aircraft control and disaster? We are unable to answer these questions but it is possible to completely avoid this type situation.

Now then, let's go back to school. Do you remember what your primary flight instructor taught about the change of control procedure during those first few days? This procedure is still in effect and applies to the field as well. It is basically intended to be used by both fixed and rotary wing aviators.

The following procedure for exchange of controls is published by the U.S. Army Aviation School. You may need to substitute the word stick for control wheel, depending on what type bird you fly.

PROCEDURE FOR EXCHANGE OF CONTROLS

Students will adhere to the following standard procedure on all dual flights:

- When the instructor wants to take over the controls he will call you over the interphone and say, "I have the aircraft." You acknowledge by answering him over the interphone and saying, "Roger, you have the aircraft." Then you visually check to see that he has the controls.
- When the instructor wants you to take the controls he will call you over the interphone and say, "You have it." You acknowledge by answering him over the interphone and saying, "Roger, I have the aircraft." Then you visually check to see that he has the controls.
- At any time you have the controls and your instructor does not call you on the interphone and advise you otherwise, assume you are still in charge of the aircraft and continue to fly it until he calls and tells you to get off the controls. *Never* release the controls, relax your control pressures or quit flying the aircraft until you know beyond a doubt that the instructor has taken over.
- Don't think he has it! *KNOW* he has it before you turn it loose.

A good time to return to these standard procedures is today and an excellent method of beginning is by first facing up to your instructor or aircraft commander responsibilities.

One of the most important portions of your preflight briefing is to outline the procedure for exchange of controls, but don't drop the subject there. Test your student or copilot while taxiing. Tell him, "I have the aircraft." Does he respond properly by saying, "Roger, you have the aircraft," then shaking the control wheel (or stick) and releasing the controls? When you relinquish control by saying, "You have the aircraft," does he say, "Roger, I have the aircraft," assume control and shake the wheel? Well, if his procedure is incorrect, right then is the time to make corrections and not later in perhaps a critical inflight situation.

When your student or copilot has control, allow it to remain full control; don't get into the habit of riding or applying your own control pressures. This habit destroys the man's confidence as well as his control touch, more important it tends to confuse him as to who actually has control of the aircraft.

What? You say that now I've gone too far—one thing for certain you don't ride the controls. Well, maybe you don't, but many of us are guilty. A good way to check yourself while inflight is during an approach for landing. Place your hands on your lap, or near the wheel, and move your feet an inch or so off the pedals. If you have one of those uncontrollable urges to apply control pressures even while the aircraft is still high and safe, shame on you!

We all know that Army aviation is becoming more demanding and complex each day. It takes a real professional to keep pace. Don't allow the simple little things to destroy your effectiveness or place your passengers and aircraft in a dangerous situation. Take time to re-evaluate your techniques before you become another example, or worse, a statistic.

The French Allouette (above) was one of the first helicopters to be armed and used against insurgents. Both the British and U. S. armies used the H-19 (below) to move heavier payloads

Light A
and Hel
in Anti-
War

Captains Carl Liddy Jr., Rober

MANY AMERICANS feel the u
in anti-guerrilla warfare is a ne
of the war in Vietnam. In reality, th
having first been used by the German

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flying reconnaissance aircraft, especia
copter. This method can be used only

The British Auster was used to

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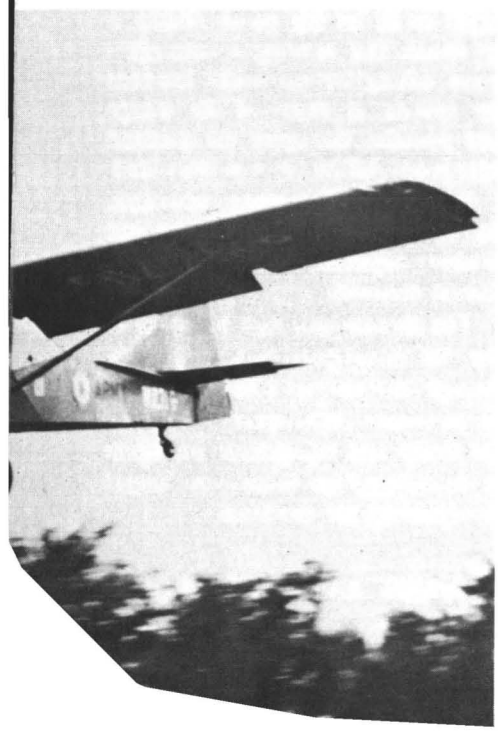
M. Bower and E. Hinderks

e of light aircraft and helicopters
v concept developed since the start
s use is more than 20 years old,
during WW II.

"Warfare Against the Bands,"
gh command, reads much like a
used by aviators going to Vietnam.
reads, "is to make use of slow-
ly the Fieseler Storch or the heli-
if the band (guerrilla) territory is

combat guerrillas in Malaya



The British used the Bristol Sycamore (above) extensively in Malaya to combat guerrilla forces. Below, French troops disembark from a Piasecki H-21 during the operations in Algeria

frequently flown over, and the bands cannot conclude from the appearance of the aircraft that an undertaking is being planned. This danger is presumably smaller with large bands which fight it out than small bands which avoid battle."

Many other countries have found themselves combating guerrillas since these first known instructions were written. It would be nearly impossible to cover every anti-guerrilla activity, but we would like to touch on a few where light air support was used.

Much has been written about the Russian partisan action and its success in fighting German units behind the front lines and in German occupied territory during the second World War. In fact, this movement was so successful that the 1944 pamphlet states that aerial surveillance by light plane "is to be used without hesitation."

The principal aircraft used in this type mission was the Fieseler Storch, a small monoplane similar to the Army's O-1. The plane's crew consisted of the pilot, an observer and a gunner who was seated facing to the rear. The gunner was needed since the Germans did not always enjoy air superiority over Russian territory.

The manual also recommended using the aircraft for what we now refer to as forward air control activities.

Although the use of "helicopters" is mentioned several times in the pamphlet, research indicates the only such aircraft available to the Germans at that time was the Flettner. Prior to the outbreak of the war, more than 1,000 of these aircraft were ordered but only a very small portion of that amount was ever assembled. There are no records to indicate any of those that were completed were actually flown over combat areas other than for anti-submarine work. Most of the helicopters delivered were used for testing.

Although the German army was not very successful in its actions against the partisans, it did recognize the importance of light reconnaissance-type aircraft in guerrilla warfare.

The British realized aircraft reconnaissance possibilities in Malaya, yet even with this advantage took several years and 70,000 troops to finally defeat an enemy of six of seven thousand guerrillas.

They soon discovered, as the Germans had, that periodic sightings of aircraft warned the enemy that an operation in that area was imminent. The guerrilla troops then either moved entirely or separated into several smaller bands.

In order to overcome this, the British scheduled aircraft so one was continually overflying these areas until sight of them was commonplace.

Pioneer light aircraft and helicopters carried out communications and resupply type missions, delivering supplies to jungle posts. They also were used to resupply patrols and to evacuate casualties.

Reconnaissance in Malaya was a primary duty of army pilots flying Auster aircraft. The Auster also was similar to the U. S. Army's O-1.

Each British pilot was assigned to a particular area with which he became thoroughly familiar. By so doing, the pilot could easily spot any changes which might indicate the presence of guerrilla forces or "terrorists" as they were then referred to.

Sound familiar?

Helicopters (Bristol Sycamores) were used for more precise reconnaissance such as spotting a base camp or a stream crossing. In Malaya, locating a stream crossing meant finding a few boats along the shore used to transport the guerrillas across.

The introduction of UH-19 helicopters in the 1950s increased the capability to move more personnel and supplies in addition to heavier slingloads. The British could then airlift small tractors for building airstrips and forward positions.

The UH-19s also enabled the British to move patrols in and out of dense jungles with relative ease, saving several days of marching through the thick undergrowth.

They also were used to spray the enemies' crops with kerosene and chemicals, resulting in a marked reduction of food supplies for the guerrillas. Its effectiveness was apparent when the crops were no longer easy to locate and were scattered about in considerably smaller fields, camouflaged as well as could be.

Psychological warfare was used including leaflets and the first helicopters mounted with loudspeakers. These choppers used tape recordings made by captured guerrillas and enemies who had recently surrendered.

Often these loudspeakers were used at night when sound carried further and the guerrillas were more likely to be on the move. There is no doubt that hearing a comrade's voice asking for surrender lowered the morale of many of the troops and possibly disrupted the planned operation before it was executed.

In addition to these activities, the helicopter was used for air and artillery adjustment and command-liaison missions.

The British also had occasion to use the helicopter in Cyprus. Although this was not a major guerrilla encounter, helicopters were used for troop and equipment transport in encircling-type maneuvers aimed at capturing the terrorists.

Because of the rugged terrain, the helicopters were used to lift troops to the high ground along ridges and hills where they would work their way down in search of the enemy. They also were used in establishing and resupplying observation posts on the high ground.

Light aircraft were used in convoy control and in countering ambush as well as reconnaissance of terrorist hideouts.

The French made their first use of helicopters during the latter stages of the Indo-China War, primarily for evacuation of wounded troops from remote areas. However, reconnaissance missions also were flown in search of Vietminh camps and supply routes. The French had some difficulty locating river crossings, as the Vietminh used a Russian WW II tactic of using plank-type crossings below the surface of the water.

French light, fixed-wing aircraft were used for convoy cover to locate possible ambushes and to call for reinforcements or air strikes. However, a great time delay was usually encountered in getting help and the enemy attack was either successful or the guerrillas had disengaged by the time help arrived. A definite need was seen for slow flying aircraft armed with machineguns or rockets to escort road convoys that could effectively engage the enemy. This weapons system is, of course, available today in the form of the armed helicopter.

A few years after the Indo-China war the French found themselves in a similar conflict in Algeria. Guerrilla-type warfare was being waged by factions in that country against the French forces.

It was during this war that large scale use of assault helicopters came into being with the task of moving combat troops into battle. Air reconnaissance also came of age and often the unit commander was able to make his own reconnaissance in the area by helicopter prior to the engagement.

Light, fixed-wing aircraft (usually the O-1) were used for all types of recon work and were also used for marking landing zones for the helicopters in assault movements. For large scale troop movements the Piasecki H-21 was the primary helicopter used. A normal troop load consisted of eight men, however more were sometimes accommodated.

As the war progressed, combined operations of infantry, armor and heliborne troops were conducted. Usually the helicopters lifted in blocking or encircling forces making several trips with troop loads. Eventually small arms anti-aircraft fire became a problem with most of the fire directed at the helicopters and light observation aircraft. This soon led to armor plating, adding armament to the aircraft and the requirement of two pilots in case one was wounded.

Although the best example of the use of helicopters and light airplanes is the present action in Vietnam, this is by no means the only one taking place today. From Colombia in the Western Hemisphere to the jungles of Southeast Asia, light aircraft and helicopters are being utilized daily to combat terrorist-type activities

The French experimented with arming helicopters to counter the ground fire. Rockets and machineguns were mounted on H-21s, but due to the weight of the system the helicopter could barely get off the ground and could carry no troops at all.

Later developments included mounting rockets on light helicopters of French manufacture, the Allouette.

One of the first, primitive means of arming helicopters in the Algerian war took place when a ground commander placed two men with automatic rifles on the stretcher pods of a helicopter. The aircraft reached a commanding altitude and the riflemen placed suppressive fire on an enemy position while the ground troops assaulted the position.

But the Algerians, too, were making innovations. The guerrillas established effective helicopter traps with machineguns cross firing on landing zones. In fact, there have been reports of Viet Cong representatives going to Algeria to receive instruction on combating helicopters.

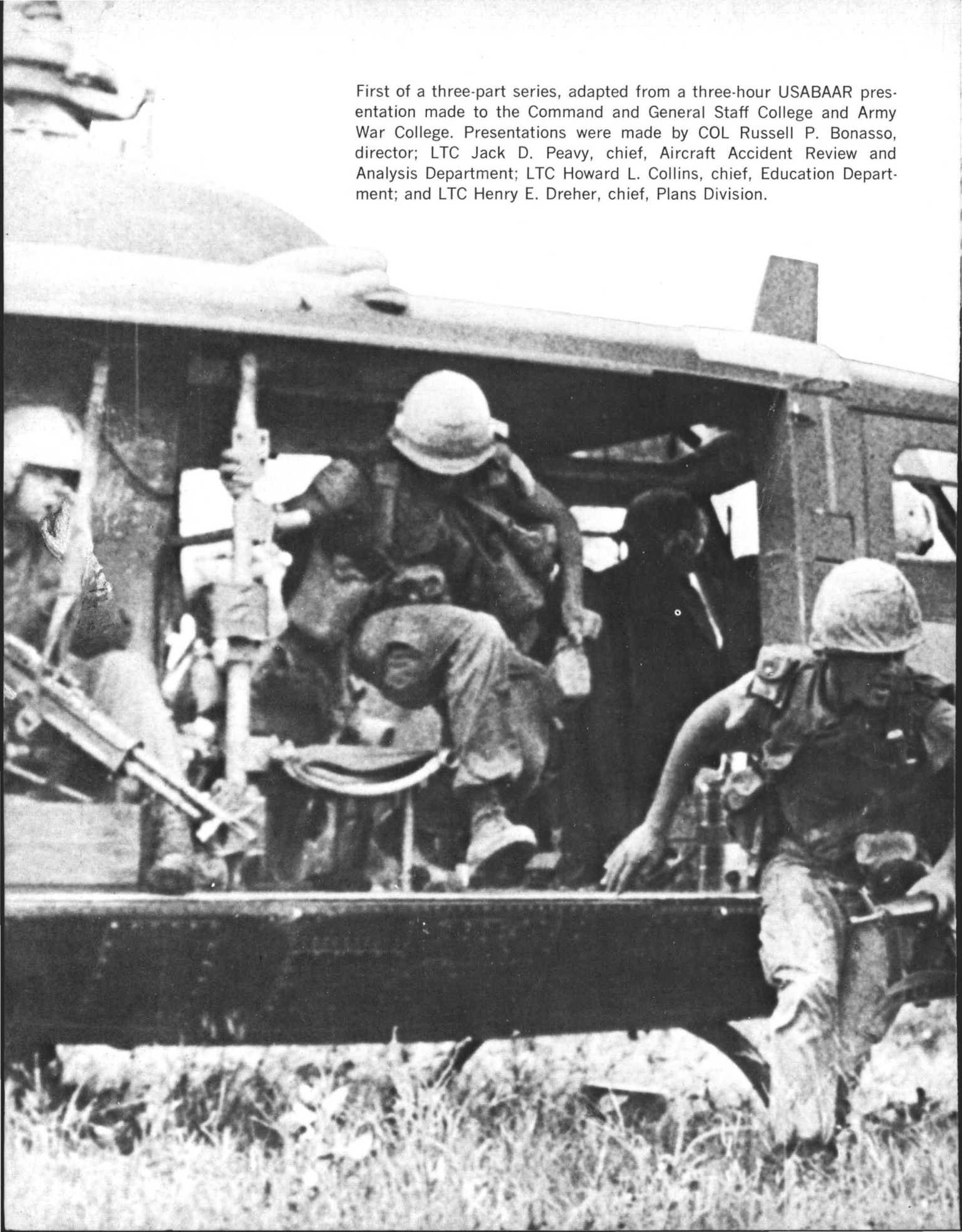
Of course the best example of the use of helicopters and light aircraft is the present action in Vietnam, but this is by no means the only one taking place today.

In the western hemisphere they are being used in Colombia to counter terrorist-type activities that, if unchecked, could develop into a major guerrilla threat to that country.

While during the past 20 years there have been other anti-guerrilla actions where aircraft have been used, these we have mentioned are significant because development of aircraft and techniques resulted. With the versatility of the helicopter improving in speed, range and load carrying capacity, the innovations of the aviation unit commander, ground commander and the pilots themselves have added to the types of missions these aircraft can perform. New tactics are being developed and exploited daily by the men using them.

Historians indicate the wars of the future will be guerrilla-type actions lacking the fixed front lines of the wars of the past. There is no doubt then that the helicopter has just begun its career of usefulness.

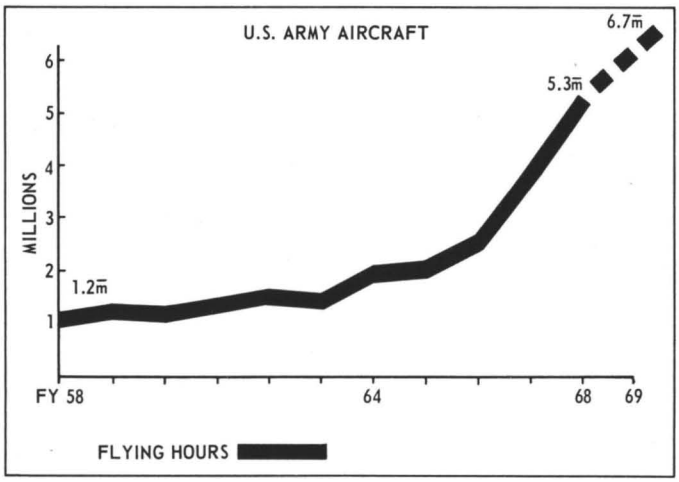
First of a three-part series, adapted from a three-hour USABAAR presentation made to the Command and General Staff College and Army War College. Presentations were made by COL Russell P. Bonasso, director; LTC Jack D. Peavy, chief, Aircraft Accident Review and Analysis Department; LTC Howard L. Collins, chief, Education Department; and LTC Henry E. Dreher, chief, Plans Division.



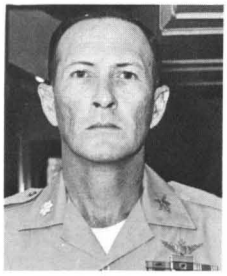
DURING THE PAST 10 years, the annual Army flying program—exposure—has increased by a factor of 5½ from 1958 to our projected FY 69 program. Despite this increased exposure, considerable progress has been made in our accident prevention effort. Accident rates have been reduced. However, no significant downward progress has been made during the past 3 years. This leveling off indicates that past preventive measures are no longer adequate. Aircraft accidents in the future are going to be much more difficult to prevent because the easy preventive measures, to a large degree, have already been implemented. If further reduction in rate is to be achieved, we must intensify our efforts and examine new methods and techniques for the prevention of accidents.

Based on last year's rate and this year's flying hour program, our projected fiscal year 69 accident cost will soar to approximately $150 million. This increase is due primarily to higher equipment cost and the more than five-fold increase in exposure. The loss in combat readiness cannot be determined. The late General Keith L. Ware said, "I consider aircraft a precious commodity in the type war being waged in Vietnam today. Commanders and aviators must grasp every opportunity and make every effort to preserve our combat resources through the prevention of accidents. The efforts expended in the

SAFETY FOR COMBAT READINESS



COL Russell P. Bonasso



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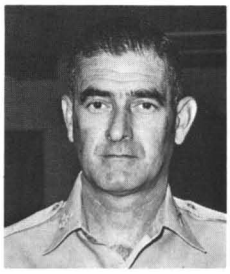
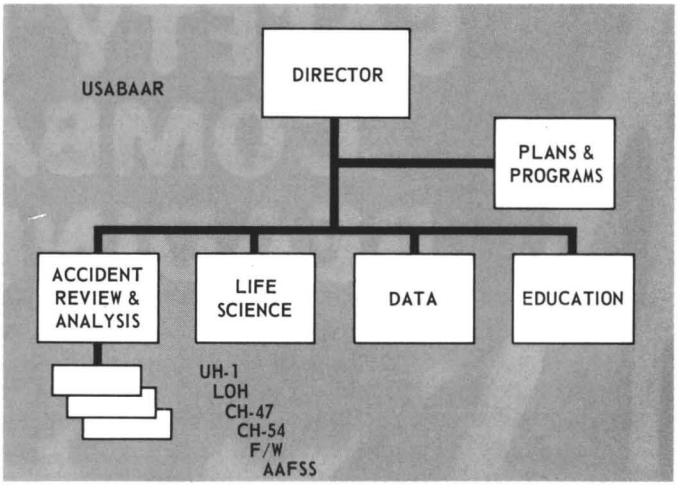


LTC Howard L. Collins

LTC Henry E. Dreher

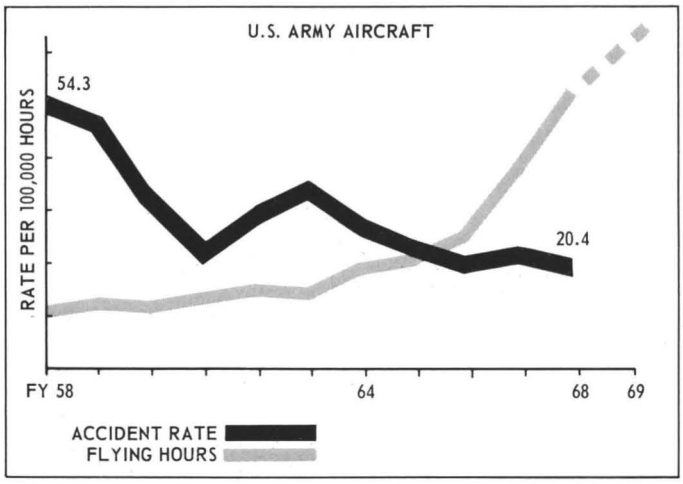


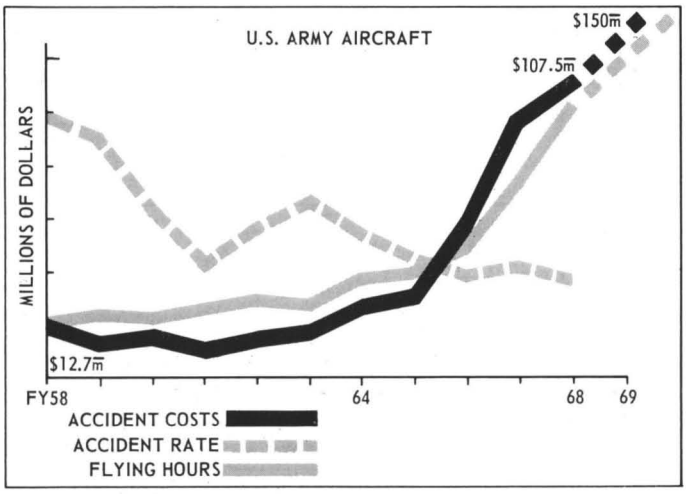
A positive aviation safety program is not self-generating. It requires command emphasis and constant supervision

implementation of a resourceful accident prevention program will provide dividends in the form of success in battle."

Recognizing our extremely limited capabilities and the urgent requirement to make continuing progress in the prevention effort, a program change request was submitted to the Department of Defense. DOD approval has provided additional personnel, modern data processing equipment with a rapid retrievable capability, and a facility for the new equipment. This action is but the initial step of a modernization program which will enable USABAAR *to close the communication gap, expand current prevention programs and research, and develop and implement new programs.*

USABAAR was about 5 years behind the times. These additional resources have enabled us to ac-





complish a much needed reorganization. The Aircraft Accident Review and Analysis Department provides a systems oriented group that will analyze aircraft accidents by aircraft type, develop timely recommendations to the field to prevent similar accidents and advise manufacturers and designers of system safety requirements for present and future aircraft. Life Science is the department that collects, analyzes and reports data concerning human factors and functioning of Army life support systems involved in aviation-associated accidents. The USABAAR Data Center will be equipped with third generation computers. Our modern data processing system will increase accuracy, flexibility and responsiveness. The Education Department will bring the aircraft accident prevention program to all echelons of the Army.

During the ensuing presentations, we are going to discuss the ways and means in which commanders and users of aviation assets can help increase combat readiness. A positive aviation safety program is not self-generating. It requires command emphasis and constant supervision. We will give you an insight into the Army aviator, his experience or inexperience; the stresses (both psychological and physiological) that play an important part in an aviation environment; and the insidious effects of fatigue which overtake aviators during combat.

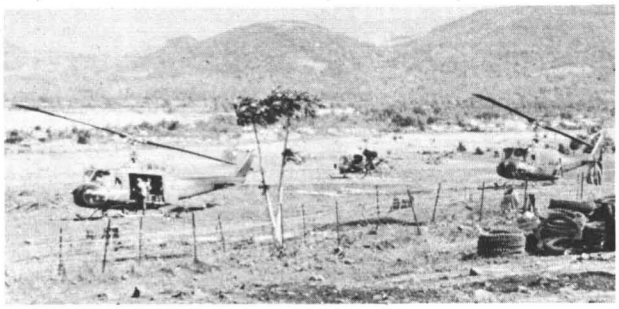
Aircraft, like tanks and artillery pieces, also have capabilities and limitations. We hope to give you a better understanding of aircraft capabilities and the limitations that are so critical.

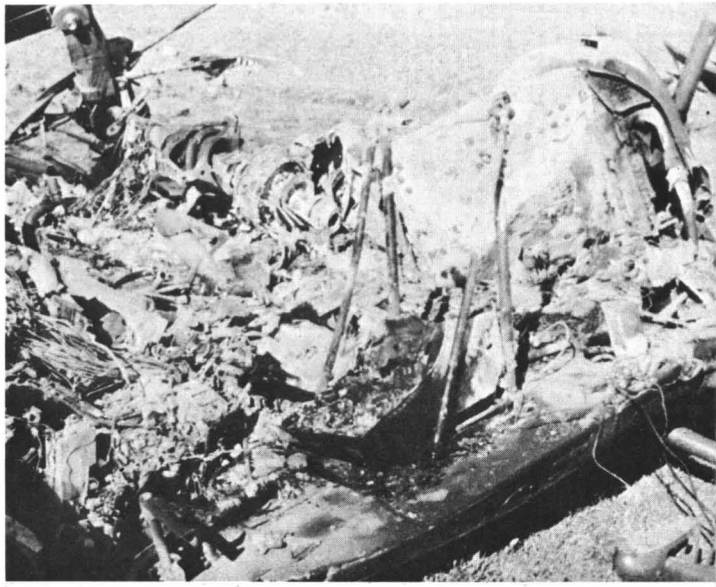
Finally, methods will be discussed to help eliminate needless aircraft accidents everywhere. It has been said many times and is worth repeating, "If you tear them up today, you won't have them tomorrow."

AIRCREW CAPABILITIES

This type of statement is sometimes heard from the ill-informed. "We can afford accidents in combat that we could not accept anywhere else."

The loss of one aircraft may affect the outcome of an engagement with the enemy. Not only is the loss felt today, but because of equipment lead time, it is also felt tomorrow. A downed Huey may delay three sorties of artillery resupply because a Chinook has to make the recovery. Gunships diverted to cover the downed aircraft rob someone of fire support. The airmobile company commander may be compelled to provide a replacement aircraft that is not up to maintenance standards, but is the best available from his dwindling fleet. One unnecessary accident sets in motion a cycle by which the effects are compounded. It should be apparent then that *we can*





Two aviators with limited experience were assigned an apparently urgent resupply mission. They entered instrument conditions and the helicopter crashed and burned. It is questionable whether they should be blamed for their lack of judgment, when judgment comes only with experience

afford accidents in combat even less than anywhere else.

From management's point of view, accidents are symptomatic of substandard behavior. Unfortunately, too much of our accident prevention effort is after the fact. Accident investigations are too often finger-pointing exercises that try to place the blame at the lowest operating level. Unfortunately, that level is the pilot who, by proximity, is immediately suspect.

An understanding of the basic principles of aviation operations is necessary, if the commander is to evaluate, supervise and manage aviation resources effectively. The correction of identified problem areas will demand command action. Aviation safety is an integral and significant part of the concept of operation. It is important that operations be planned to minimize accident potential. Direct responsibility for the safety of any operation rests with the supervisor. This point is emphasized in AR 95-5.

Supervision becomes a factor when accidents result from: lack of discipline or pilot qualifications; failure to (1) provide adequate training or time to maintain flying proficiency; (2) establish adequate SOPs; (3) eliminate hazards; (4) provide adequate medical or psychiatric supervision; (5) eliminate maintenance or inspection deficiencies; (6) provide adequate crew rest.

Your role in the use of aviation assets closely parallels that which you assume in the deployment of troops, tanks or artillery. What should you consider in the employment of aircrew resources? These factors: inexperience, lack of recent experience, stress and fatigue. Accident case histories that contain these factors reveal in each case that supervision was a major factor.

One such case history involved two young aviators on their first combat tour. Their combined total flight time, since flight school, was 530 flying hours. The aircraft commander, a warrant officer, had been in-country 5 months and the pilot, a lieutenant, had been in-country less than a month. The aircraft commander had less than 15 hours of night flying time. Neither aviator had flown any actual weather time.

These aviators were assigned to an assault helicopter company and further assigned as part of a two-ship commitment to a special forces detachment. The aircraft and crews were under the direct control of the ground commander. The crew mission assignments came from the commander or the special forces group S-3. At 0230, this crew was awakened

to carry out an immediate and apparently urgent resupply mission. Due to haze and ground fog, the weather was almost zero-zero.

The warrant officer was at the controls during takeoff. A glare from the fog was reflected from the helicopter's landing and searchlights. The aircraft commander instructed the new aviator to turn them off. After the aircraft had traveled approximately 40 meters, before it reached flying speed, the aircraft commander lost his outside visual reference and stated that he was going on instruments. The flight path, probably undetected by the aircraft commander, was a flat descending right turn. Approximately 700 meters from the takeoff point, it hit the ground in a nose low attitude, ripped through some barbed wire fences, and came to rest on its right side in a mine field where it exploded and burned. There were two fatalities and two injuries.

This crew's limited experience has to be recognized. It is questionable whether they should be blamed for their lack of judgment, when judgment comes only with experience. Their training, coupled with the visual observation of the weather, should have been sufficient to cancel the mission, but they were mission oriented. In this case, the helicopter entered instrument conditions. The aircraft commander was not successful in his transition from visual to instrument flight.

This accident has strong supervisory overtones. These two helicopters, once assigned, were under the operational control of the special forces group. The special forces group, upon assigning the mission, did not take into consideration the existing weather conditions. Nor did they determine the capability of the crew to accomplish this mission.

It has been noted that, in combat, the supported ground unit will usually be assigned aircraft for direct support missions for 8 to 12 hours per day. During these hours the aircraft are under the control of the ground commander. Do not permit the blind dispatch of aircraft. Consider the urgency of each mission. In this instance the mission could have been delayed. Understand the factors influencing day-long operations and analyze each operation to minimize the exposure to error. By doing this, you will enhance mission accomplishment.

This case should have raised at least two questions in your mind. What is the quality of the aviators graduating from the Army Aviation School? What are their capabilities? One commander, in reviewing the board's findings, felt that although the experience level of the aviators could have contributed to the accident, this did not alter the fact that both officers were qualified aviators and, as such, were considered qualified to perform missions within the capability of both the aircraft and crew. He was of the opinion that successful completion of the Army flight training program presupposed a qualified Army aviator, capable of performing assigned missions and also capable of determining whether or not to undertake missions. His point is well taken, but it is an erroneous assumption.

Aviation training for the basic fixed wing or rotary wing student consists of a little more than 32 weeks. The student receives approximately 210 hours of flight training. During this short period of time, it is practically impossible to graduate a finished product that will fly, react and make decisions with the experience and judgment that require an Army career to attain. We might compare the capabilities of this crew with the 16-year-old, who after driving only 3 months with a learner's permit, has just earned his driver's license. Would you expect him to compete in the Indianapolis 500?

How are aviation resources in combat managed to solve the problems of inexperience? Consideration is given to total flight experience. However, the determining factor in most units is whether the aviator is on his first or subsequent tour. Present policy is to assign all new aviators and those on their first tour with an experienced aircraft commander.

What are the prerequisites for an aircraft commander? Total flying time is considered, but most important is the appraisal made of his judgment and flying ability. In addition to written and oral examinations on the aircraft and the proficiency checkrides, the 1st Aviation Brigade and most divisions require that the aircraft commander must have been in-country for 3 months and accrued a minimum of 300 combat flying hours.

It would be ideal if we could afford to have every new or first tour aviator teamed with a more experienced aircraft commander, with at least these qualifications.

Many units go beyond the 3 months and 300 combat hour requirements. Also, many aviators never become aircraft commanders, not so much from a lack of flying ability, but more from observations of poor judgment and lack of maturity. Likewise, many aircraft commanders lose their title for the same reason. A semblance of quality control is maintained in most units.

Does all this eliminate our problem? The answer is no. In many assault helicopter companies, mission

Pilot and copilot, with more than 10,000 hours and 30 years of flying experience between them, were scheduled for a VIP flight. Enroute to destination, they flew into a thick cloud layer and lost sight of the ground. The UH-1B crashed in the trees below the top of a hill. Desire to complete the VIP flight and impress superiors made this highly qualified crew disregard their training and experience

requirements cannot be met because of insufficient aircraft commanders. Therefore, it is possible that many crews are of this limited experience. The need for crew training does not cease when a unit enters combat. It becomes more important.

It is not always the lack of overall experience that can become an aviator's downfall. The aviator with the most flying time is not automatically the best choice for a particular mission. The supervisor must consider his *recent* experience in making his choice. The following case is a reminder of the unpleasant consequences when that basic rule is violated.

The pilot was a senior Army aviator with over 2,300 hours of flight experience. He was the deputy commander of an infantry brigade. His mission was reconnaissance, to inspect the progress of the clearing and construction of the base camp's defensive perimeter. He was also the officer in charge of this construction project. For this reason, the brigade commander requested that he fly him around the area so he could have an aerial view while being briefed on the overall progress. The brigade commander wanted to land at several points and inspect the work. He would walk from one position to another and then radio for the chopper to pick him up. The area was characterized by uneven terrain, with numerous tree stumps and roots.

The helicopter landed at one location and the brigade commander boarded. Upon liftoff, the pilot unknowingly permitted the right skid to get caught under a tree root. The helicopter moved forward, rolled to the right and crashed. One of the main rotor blades chopped through the cockpit, killing the pilot. The brigade commander was badly shaken, but escaped injury. This aviator with 2,300 hours of flying experience should not have overlooked checking the skids for obstructions prior to attempting to lift off. Furthermore, he should have readily recognized this condition when he attempted to bring the helicopter to a hover. He should also have been able to take corrective action to put the OH-13 back on the ground, instead of aggravating the situation and flipping it over.

This is a classic example of an aviator whose ground duties demanded too much of his time. He was unable to maintain proficiency during this period. The brigade commander's request to be flown by his deputy was honored, but it should not have been. Another aviator who flew the OH-13 every day should have been given this mission. Was there a supervisory factor here?

Many aviators in staff positions do not fly very often. The majority of these individuals do have a

considerable amount of flight time. Take the case of an assault helicopter company commander who had been leading combat assaults for 6 months and is then assigned to a staff position at battalion, group or division headquarters. Within 2 to 3 months, this individual will lose the keen edge of proficiency.

Aviators who fall into this category should be assigned to fly with experienced aircraft commanders or instructor pilots. They should be assigned administrative type missions (courier, liaison) and not the more demanding type missions, such as assaults and resupply. Resupply missions often start out as milk runs. But as the day progresses, they become extremely demanding of aviator proficiency. Weather, terrain and fatigue are threats to their success.

We have discussed inexperience and lack of recent experience. We would like to stress the fact that it is not so much borderline skill, but the lack of judgment that creates handicaps in cases of inexperience or lack of recent experience. Flying skill is not the only key to survival. Judgment and experience are equally important. What we are trying to develop in our aviators, from the day they start training, is respect for their own and aircraft limitations. As long as they have this respect, their skill and judgment will grow harmoniously.

Several senior officers have lost their lives in Army aircraft operated by the most experienced and mature aviators. How do we explain this? How can you go wrong when you think you have selected the best qualified pilot to fly a VIP? Is it true that rank, age and experience make a man immune to errors?

The crew of a UH-1B consisted of a master Army aviator pilot and a senior Army aviator copilot. Between them they had more than 10,000 hours and 30 years of flying experience. The copilot held special fixed wing and rotary wing instrument certificates. The pilot held special fixed wing and standard rotary wing instrument certificates.

The mission called for VIP transportation. This flight was unusual in that both points were a considerable distance from the unit airfield. The crew would be required to fly 1 hour and 20 minutes, plus an enroute refueling stop before it picked up the VIP, who was to be flown a short leg of 30 minutes. The flight was planned to follow a multilane highway. Low ceilings, fog and reduced visibility were forecast.

The unit commander scheduled himself as pilot. He arrived at the airfield at 0600 hours, received a weather briefing which confirmed the forecast of the night before and cancelled the flight plan. Fifteen minutes later, he rescheduled the flight, took off and flew VFR to an intermediate airfield. He called for an instrument approach because of low visibility in haze, smoke and fog. He completed the approach and landed to refuel and check the weather. It hadn't changed. Portions of his route were forecast to be zero-zero in the hills ahead. He could go around it by staying in a valley, but this would take longer and he would be late for the pickup.

He took off and followed the divided highway. The clearance between the clouds and ground closed, visibility dropped and he made a 180-degree turn. He then thought he saw a brighter area and turned back to his original heading. He flew into a thick cloud layer, lost sight of the ground and started to climb. Second later, the aircraft crashed into trees 50 feet below the top of a hill. The copilot, still attached to his seat, was thrown violently from the helicopter as it struck the trees, before it reached the ground. He sustained serious injuries, but survived. The unit commander was killed.

All of this experience, the enroute weather forecast and their own firsthand observation of the zero-zero weather ahead were pushed aside by the desire to get through and complete the VIP flight—to save the VIP the inconvenience of a sedan ride! The cause of this accident was the attempt to maintain visual flight under instrument conditions.

What made this highly qualified crew disregard their training and experience? An *unreasonable* desire to impress superiors distorted the unit commander's judgment to the point that he overextended himself.

There were other contributing factors. Two were low level flight under marginal weather conditions into mountainous terrain with which the aviators were not familiar and the unrealistic sense of urgency to complete the mission. These two factors, *especially mission urgency,* contribute to many accidents and fatalities in combat.

Many aviators, including recent flight school graduates, feel that Vietnam is a big testing ground. They want to prove their ability or make a name for themselves. To these individuals, nothing is impossible. They fully realize the dangers and limitations involved but completely disregard them. We are not talking about tactical emergencies or missions involving units in enemy contact. There is nothing wrong with trying to complete a mission in poor weather, as long as the pilot can exercise his option to abort the mission and return to his unit without feeling disgrace or failure.

There is a definite need to establish weather minimums for conducting administrative, combat essen-

Battalion commander requested a 1-hour extension to fly two resupply missions after the crew had already flown more than 10 hours. The tail rotor struck a tree at the second drop site and the helicopter crashed. Fatigue was a contributing factor

tial and tactical emergency missions, to include the appropriate approving authority. Once established, it should be a matter of policy that these directives should be adhered to by both aviation and ground units in planning and conducting operations.

From experience, we know that more accidents occur on single ship missions than during multiship operations, such as assaults. During a combat assault, the inexperienced crew has only to fly the aircraft and follow the leader. They have their platoon or company commander leading the flight and making the decisions. During single ship missions, the crew must make all the decisions. Their judgment is taxed to the utmost.

We can all profit from a statement made by BG Edwin L. Powell Jr., former Director of Army Aviation, in a recent aviation periodical: "All missions are important, but we must be alert to the combat syndrome—the blind acceptance of every mission as being combat essential."

What then are your mission parameters? Following are two examples of situations where commanders became victims of this syndrome.

A unit insisted that it had a lifesaving medical evacuation mission. It was at night and the weather was extremely poor. The Chinook assigned the mission made it to the landing zone. Two men, one with a broken arm and the other with a machete wound, were the evacuees. On its return, the aircraft crashed into a hill, killing all on board. The *urgency of this mission* is questionable. The evacuees could have survived until daylight.

In the other case, an extensively damaged aircraft of questionable recovery value in a secure landing zone at a large fire base was to be removed. A maintenance helicopter with a rigging crew was dispatched. Rain was encountered and low ceilings obscured the landing zone. The helicopter climbed on top of the cloud layer and was never seen or heard from again. Parts of the aircraft were found. A wreckage distribution over a 500-foot area indicated that it came apart in the air. This recovery operation could have been delayed. Could the damaged aircraft have been that important?

What can commanders do to prevent aviators from exceeding their own or aircraft limits in an effort to please? Insist on the exercise of good judgment in the assignment of missions. If missions can be delayed 30 to 60 minutes, advise the crew. Give that crew some time to discuss missions and do their planning on the ground, instead of in the air at 80 to 100 knots.

In the realm of human endeavors, especially aviation, fatigue is probably the least understood and most abused accident cause factor. There is no simple, all-encompassing scientific definition of fatigue. You can't measure or eliminate fatigue. We make our commanders aware of the effects of fatigue on

aircraft operations, but we tell them in the same breath that no mission will be refused because of fatigue. Of course not. Such an option would create preposterous situations. Does this mean that a commander can ignore the whole subject of fatigue? Definitely not. Although he may be unable to deal with the problem on an individual basis, he has to consider the overall workload, both in flying and maintenance hours, and insure equitable distribution.

Two young warrant officers were on their initial combat tour. The aircraft commander had flown approximately 650 combat hours and his pilot had flown just a little more than 60 hours of combat time. Their mission was command and control for an infantry battalion that had been in heavy enemy contact.

The battalion commander and his S-3 had been on board all day. The crew had already flown more than 10 hours and were approaching the time to be released from the mission. The battalion commander then requested a 1-hour extension to fly two resupply missions. The supported unit and resupply sites were more than 30 minutes flying time from the aviators' home base.

The command group was dropped off at the battalion CP and the aircraft was refueled and loaded with 300 pounds of C rations, plus two kick-out men who would be required at the second resupply site because it was unsuitable for landing.

The UH-1H proceeded to the first LZ, dropped off approximately 50 pounds of cargo, then flew to the second site, 1000 meters away. The approach was too fast at the second LZ and the helicopter was brought to a hover about 20 feet past the intended kick-out spot. As the aircraft commander attempted to back to the left rear, the tail rotor struck a tree. The helicopter turned to the right and descended as power was applied to get it out of the trees. It continued to turn, control was lost and it crashed to the ground. There were three fatalities, two serious injuries and one minor injury. The investigation board determined pilot error to be the cause of this accident. The error was that the aircraft commander allowed the tail rotor to strike the tree which caused the loss of antitorque control. As a contributing factor, the board cited pilot fatigue because the crew had flown almost continuously for 10½ hours.

This was an example of a battalion commander who had flown all day with the crew. He should have realized that the crew were at least as tired as he must have felt. However, despite his apparent awareness of being tired, he obtained an extension for the aircraft. Admittedly, the supply missions were of an urgent nature, but not urgent enough to equal the price paid. The effects of fatigue are insidious. They distort judgment and slow reaction time.

> Accident investigations are too often finger-pointing exercises that try to place the blame at the lowest operating level. Unfortunately, that level is the pilot . . .

It can be reasonably assumed that an aircraft commander who was not as tired would not have misjudged his approach by such a margin. Consider the crewchief and gunner who had been on board all day. Had they been rested and alert, they could have made the pilots aware of the trees to the rear and sides of the aircraft. This is a prime example of accidents in which units requesting aircraft support unknowingly demand more of their aircraft crews than the crews are capable of providing. The commander must be knowledgeable and remain aware of these limitations.

Accumulation of excessive amounts of flying time by a few pilots, while other pilots stay well below the established guideline of 140 hours per aviator in any 30-day period, indicates a lack of supervision. Simple mathematics equate 140 hours per month to be 4½ hours a day, with a 5-hour buffer. Most aviators fly in excess of these daily hours. Due to operational commitments, aviators often fly more than 8 hours a day for periods of 3 to 4 days. This results in scheduling problems for platoon comman-

ders and operations officers, especially if the unit is sparsely endowed with aircraft commanders.

There is no excuse for any commander to encourage or condone the use of total monthly flying time as a competitive item between different units. A quantitive victory may flatter the ego of the commander involved, temporarily. Eventually, he will wear his unit out—pilots, maintenance personnel and aircraft.

Almost without exception, the 140-hour guideline is adhered to in Vietnam. But, due to varying geographical locations and missions, total flight time in units will differ. Within particular commands, there are always units favored because of reputation and demonstrated results. There have been instances of ground units requesting aviators and assault companies by name. Many units will request that a particular aviation unit support them over an extended period of time, to lend continuity, especially during the initial assault phase, in the early days of an operation. On a limited basis, this is good because it develops esprit de corps. Over prolonged periods, however, it will drive any unit right into the ground.

We realize that it is very easy to discuss the management of aircrew resources and to suggest what to do to prevent losses through needless accidents in a pleasant atmosphere. On the other hand, when you are in the hot, humid and rainy jungles of Vietnam, it is another matter. The perspective changes. Whenever a mission is assigned, the resources available will be used to accomplish the mission. Unless certain factors are kept in their proper perspective, the mission will not always be successful.

For the most part, you will have young inexperienced aviators to support you. They will, however, improve with additional training and guidance, which their parent unit will provide in the time available. You will find experienced aviators spread thin. Use their experience and knowledge to the utmost. But don't expect experienced aviators in staff positions to be able to accomplish flying missions better than those who fly every day. We acknowledge the risks involved and know that only well thought out decisions establish mission parameters. Supported commanders can help by programming mission requirements so that aviation units can insure judicial aviator employment.

A noted psychologist said, "Other than acts of God, any accident, no matter how minor, is a failure of the organization." Let's not use aircraft accidents to identify voids in organization. The alternative is to make an analysis of your command to identify those voids before they become accidents.

Note: Other portions of these presentations, entitled "Aircraft Capabilities" and "Controllability of Noncombat Accidents," will appear in the August and September issues of the ARMY AVIATION DIGEST.

Ted Kontos

A BETTER WAY

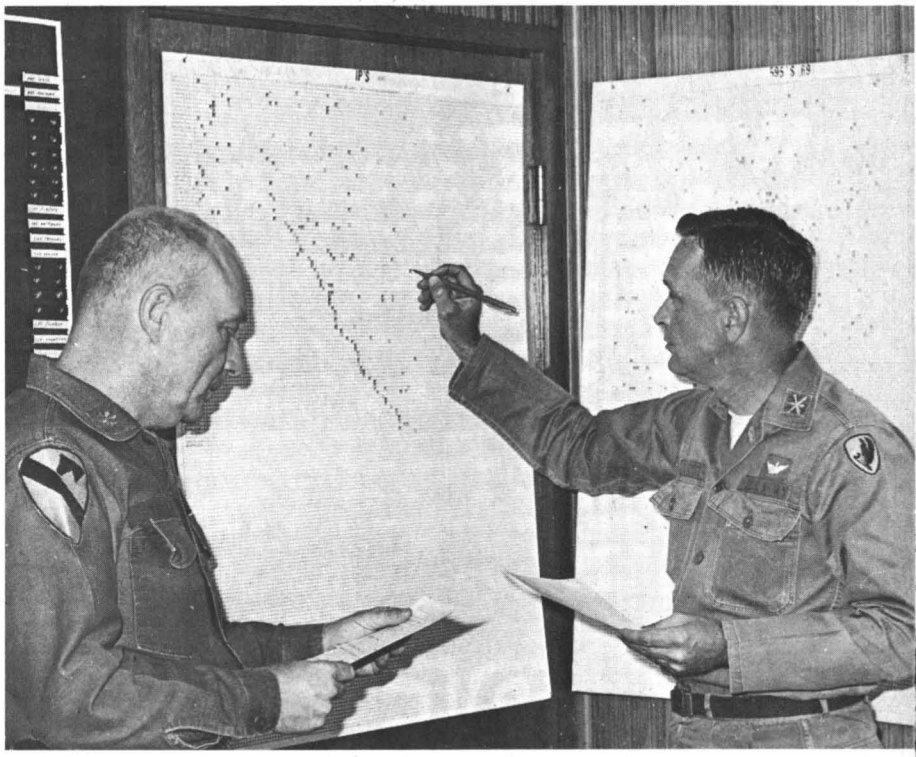
WHILE THE NUMBER of external loads accidentally dropped from Army helicopters has steadily risen, accidental drops from aircraft of the Tactical Training Division, Department of Tactics, Fort Rucker, have been reduced by more than 65 percent. This represents only one area in which improvements have been made by this division. Others include a reduction in number of mishaps from all causes; a reduction of aircraft downtime for maintenance; an increase in aircraft availability; improved quality assurance; fewer in-flight emergencies and improvement in the quality of instruction provided by IPs. Reduced costs and improved safety have resulted from these improvements, all made since January of this year.

These improvements were made without the use of computers, any type of sophisticated equipment, or the need for additional personnel. They came about as the result of a simple records keeping system developed jointly by LTC James N. Hembree, division chief, and MAJ C. C. Thorne, aviation safety officer.

The implements used are simple—three wall charts, a set of colored pencils, code sheets, and two small filing boxes. The program's success lies in the type of information coded to the charts and in the manner of coding which permit problems to be readily detected and identified for corrective action—before mishaps occur.

595 Chart

The records keeping system begins with the 595 chart which is large enough to accommodate information on each aircraft in the division for a period



Every discrepancy posted on the 595 is also posted on the IP chart. Used together, the charts point out unique problems requiring special study

Division Chief LTC James N. Hembree color codes discrepancy on chart while MAJ C. C. Thorne, aviation safety officer and chief drafter of simplified records keeping system, checks writeup

of several months. Across the top, numbers are inserted to denote the dates during which discrepancies occurred. Vertically, along the left border, aircraft serial numbers are shown. As indicated by the chart title, 595 (preliminary mishap) forms serve as the source of information. As these forms are reviewed, discrepancies are entered on the chart in the appropriate aircraft and date blocks. This information is inserted in accordance with an established color and numerical coding system. For example, red denotes engine. The numeral 1 under the red engine code indicates a suspected compressor stall; 2, a hot start; 3, loss of engine tachometer; 4, fuel pump warning light; etc.

A glance at the chart not only reveals discrepancy trends for all aircraft, but readily shows the recurrence of any discrepancy for any individual aircraft. Obviously, the more frequently a particular discrepancy appears for one aircraft, the greater the probability of a problem existing in that system.

If, for example, one aircraft was written up for high egt on the 1st, 4th, and 10th of the month, we could reasonably expect to find an underlying mechanical cause, even though routine checks after each writeup failed to show any such cause. In one instance, recurrence of high egt's led to a more thorough inspection which disclosed enough engine damage to require replacement. In another similar instance, T-canes were found to be the cause and replaced.

A repetition of high oil consumption for one aircraft was found to be caused by defective seals. Fuzz found repeatedly on a tail rotor gearbox chip detector plug induced maintenance personnel to take a special oil sample for analysis. The laboratory report showed that the gears were in the process of failing and the gearbox was replaced. Three other tail rotor gearboxes were replaced for similar reasons.

In another instance, a failing transmission was discovered and replaced after the 595 chart indicated a possible transmission problem. Undetected, any of these malfunctions or pending failures could have resulted in serious in-flight emergencies.

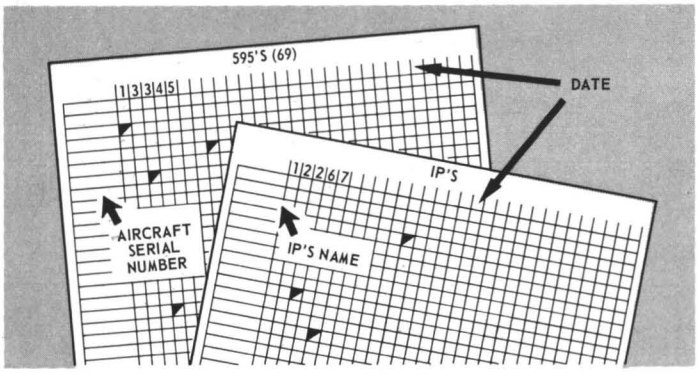
When discrepancies have been entered on the chart, the 595 forms are filed for future reference.

IP Chart

Despite its importance, the 595 chart does not

LTC Hembree refers to aircraft condition report file . . .

while MAJ Thorne uses 595 file to relate recent aircraft discrepancy to similar previous ones



tell the whole story. The IP chart is designed to augment it by serving as a cross-check. Almost identical to the 595, the names of IPs are listed in place of aircraft serial numbers. Every discrepancy posted on the 595 is also posted on the IP chart, and the same coding system is used.

Referring to a previous example, we noted that one aircraft had been written up for high egt's on three separate occasions. As stated, this would tend to indicate a mechanical problem. However, if in checking the IP chart, we were to find that the same IP had been using this aircraft during the time the discrepancies were logged, the possibility of improper procedures would demand consideration. A flight evaluation of the IP to determine if he is properly instructing and monitoring his students would be in order.

In reality, only a small percentage of problems have been found caused by deviation from approved procedures. However, such instances have occurred. They have been spotted by means of the chart system, identified through evaluation rides and corrected.

Use of 595 and IP charts in combination can sometimes provide a third benefit by pointing out that a problem may be a unique one, requiring special study. This was demonstrated in the area of inadvertently dropped slingloads. The majority were traced to mechanical, electrical or maintenance causes. Of the remaining, a few were traced to improper procedures. But there still remained some which could not be attributed to maintenance or pilot causes. To effect a cure, a change in materiel or design may be needed. At any rate, the existence of a special problem and the need for further study were established.

ACR Chart

Finally, there are those problem areas concerning the quality of service by maintenance and other ground support activities. Deficiencies in these areas can create hazards, cause mission delays and increase costs. Most such problem areas can be pointed out by use of the ACR chart. This chart supplements the previous two and is identical to the 595. The same color code is used with three additional items (dirty aircraft, servicing, and aircraft configuration) included. No numerical code is employed. Discrepancies are posted from Aircraft Condition Reports, which are then filed. The reappearance of the same color opposite an aircraft serial number sends the safety officer scurrying to the file to locate the discrepancies and see if they are identical. Again, trends are established and deficient areas identified for corrective action.

Prior to the implementation of the ACR chart, IPs and their students, who were undergoing training for operations with slingloads, would often report to their assigned aircraft only to find that no hooks were provided. Other instructors and students might be assigned empty aircraft when their training schedule called for loaded aircraft. Such problems and delays are a rarity since implementation of the ACR chart.

Simply stated, the primary purpose of this records keeping system is to establish before-the-fact trends rather than after-the-fact mishaps, *and to do this for the individual unit and for the type of aircraft and equipment being used by that unit in that unit's particular type of operations.*

In the Tactical Training Division's operations which presently involve 165 aircraft and 218 IPs and include four major areas of training, this system has proven a valuable aid. Though not a panacea for all ills that can befall an aviation unit, the benefits which can be derived from such a system are evident. The Lowe Field Branch of the Aircraft Quality Assurance Division has indicated that it plans to adopt a similar system, particularly in the area concerning Aircraft Condition Reports.

A BETTER WAY

There will always be a better way, as proven by the Tactical Training Division.

Color and numerical codes used by the Tactical Training Division in conjunction with the chart records keeping system are:

595 AND IP CHARTS

A. Engine—Red
   1. Suspected compressor stall
   2. Hot start
   3. Lost engine tachometer
   4. Fuel pump warning light
   5. Engine failure
   6. Cylinder head temperature dropped
   7. Fluctuation, engine oil temperature
   8. Engine oil leak
   9. Fluctuation, engine rpm
   10. Fluctuation, engine oil pressure
   11. Engine chip detector light
   12. Lost N_2 tachometer
   13. Lost rpm momentarily
   14. Engine overspeed
   15. Fuel boost pump failure
   16. Rough running engine
   17. Engine frozen
   18. Engine fire
   19. Engine inlet filter warning light
   20. Partial engine failure
   21. High egt

B. Transmission—Green
   1. Lost transmission oil pressure
   2. Fluctuation, transmission oil pressure
   3. Noise in transmission
   4. High transmission oil pressure
   5. Transmission chip detector light
   6. Transmission overtorque
   7. Transmission oil temperature
   8. Transmission oil temperature light

C. Electrical system—Blue
   1. Fire warning light
   2. Electrical fire
   3. Dropped slingload
   4. Chip detector light—engine or transmission
   5. Master caution came on during flight
   6. Bare wire causing sparks
   7. Fuel filter warning light came on in flight
   8. Battery fire
   9. Electrical failure

D. Tail rotor—Yellow
   1. High frequency
   2. Tail rotor failure
   3. Tail rotor chip detector light
   4. Tail rotor binding
   5. Tail rotor strike
   6. Cut in tail rotor
   7. Tail rotor drive shaft door opened during flight

E. Hydraulic—Black
   1. Failure
   2. Hydraulic leak
   3. Noise in system

F. Controls—Brown
   1. Knocking in cyclic
   2. Cyclic feedback
   3. Cyclic binding
   4. Collective binding

G. Hard landing—Pink
   1. Hard landing
   2. Suspected hard landing

H. Main rotor—Orange
   1. Rotor overspeed
   2. Loss of rotor rpm
   3. 1:1 vibration

I. Miscellaneous—Purple
   1. Vibrations in aircraft
   2. Dropped rocket tubes
   3. Aircraft experienced loud cracking noise and veered to right
   4. Flat tire—main gear
   5. Window blew out
   6. Ground looped
   7. Low side governor failure
   8. Smoke in cockpit
   9. Tree strike
   10. Hit wing tip on landing
   11. Tail wheel spring broke
   12. Wire strike
   13. Smell of fuel in cockpit
   14. Tiedown strap on main rotor during start
   15. Whining sound from engine compartment
   16. Antenna came loose in flight
   17. Loud noise in rear of aircraft
   18. Low fuel condition
   19. Suspect fuel leak

ACR CHART

Engine—Red
Transmission—Green, Dark
Electrical—Blue
Avionics—Brown
Main Rotor—Orange
Tail Rotor—Yellow
Hydraulics—Black
Dirty—Pink
Service—Gold
Configuration—Green, Light
Flight Controls—Purple

PEARL's

personal equipment and rescue/survival lowdown

Adapted from two articles entitled "Seek to Know Your SEEK" and "Stretching Your SEEK Kit" in the May 1969 issue of APPROACH. The Army personal survival kit contains many of the items found in the Navy SEEK-2. Items which do not apply to the Army kit have been deleted. LCDR Turaids, author of the first article, wrote "Medical Aspects of Survival in Southeast Asia," also from APPROACH, which appeared in the October 1968 issue of the AVIATION DIGEST and "Gourmet Dining in Southeast Asia," AVIATION DIGEST, February 1969.

ARE YOU FAMILIAR with the contents of your SEEK-2 kit? Knowledge of the functions and uses of the medical items contained may someday save your life. As with any survival material, such information is best acquired *before* you find yourself in a life-threatening situation.

Here are the intended uses of these items.

Alertness tablets (Dexedrine-dextroamphetamine sulfate) [stay awake tablets, item 48, Army kit]: This drug is an energizer useful in combating fatigue and preventing sleep. It stimulates the brain and thus increases mental alertness, restores optimism, gives a feeling of energy and well-being and causes a striking improvement in performance when the latter has been reduced by fatigue. Use only in an escape and evasion situation where you have to remain alert and keep going. They may be used for up to 48 hours, but the fatigue prevented will eventually catch up with you, causing a tremendous slump with drowsiness, lethargy, depression and weakness.

Antiseptic ointment (Bacitracin and Neomycin) [item 44, Army kit]: Very effective against a wide range of bacteria. Used for prevention or eradication of infection in minor cuts, wounds, abrasions, burns, boils, insect bites or skin rashes. Apply lightly two or three times daily. Not recommended for use in the eye as a serious adverse reaction may result.

Anti-diarrhea tablets [item 47, Army kit]: Inhibit excessive motility (irritability) of the stomach and intestines and are useful in the treatment of diarrhea from various causes such as infections or food poisoning, but will not relieve pain. Take two tablets three or four times daily.

Eye ointment (Bacitracin ophthalmic ointment) [item 43, Army kit]: Used successfully in the treatment of many external eye infections—conjunctivitis (pink eye), trachoma, inflammation of lids and styes. Most conditions respond favorably to two to three applications daily. May also be used anywhere on the skin.

Insect repellent, sun and bug ointment, leech repellent [item 39, Army kit]: Insects constitute the greatest hazard in jungle survival. Many are disease carriers; also, insect and leech bites frequently result in severe secondary infections. Apply to all exposed parts of the body. Use the mosquito head net and nylon mittens in Packet 2 [item 19, Army kit] of your SEEK kit, especially at dawn and dusk.

Anti-malaria tablets (chloroquine-primaquine) [item 45, Army kit]: Since there is no effective shot which may be given to protect from malaria, these tablets may be the most valuable drug you have. Make every effort to save them. Take one tablet each week to prevent malaria. Do not chew the tablets as they will stain teeth.

There was a young flyer named Britt,
Who forgot his survival kit.
Downed in the jungle, he ran for his life,
With no food, no signals, no knife.
No news from Britt, not a bit!

AUGUST

SUN	MON	TUES	WED	THU	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Michele Carey, MGM

PLEASE CUT ALONG LINE AND DISPLAY IN PROMINENT PLACE

Salt tablets [item 49, Army kit]: A necessary item for persons not acclimated to a hot climate. Take at least two tablets daily; more may be required with the presence of diarrhea or excessive perspiration. Crushed salt tablets may be used to sprinkle over food to make it more palatable, gargled in hot water for sore throats or applied to leeches to facilitate removal.

Soap [item 37, Army kit]: Use sparingly and do not waste it. In tropical climates, moisture, heat and less-than-ideal hygiene combine to encourage infection in the most minor of wounds. Hence, it is most important to clean and dress even the smallest scratch, cut or insect bite.

STRETCHING YOUR SEEK KIT

PR1 Stanley G. Crowley
FAETULant Mobile Survival Training Group

Most of us are vaguely familiar with all the items in our two-part SEEK-2 kit. In commands where the policy is not to open the kit until in an actual survival situation (to prevent damage, pilferage or loss), training programs can take the place of first-hand knowledge. The January 1968 APPROACH centerspread provided an excellent reference on the kit.

There's one important component of the kit, however, which you won't find in any list and it's a real kit-stretcher. Call it what you like—it's a combination of good old American ingenuity and large doses of imagination. Let's take a look at some imaginative unorthodox uses of the SEEK-2 kit items. You, yourself, can probably come up with some we haven't included.

First of all, there's a wealth of water and survival food containers in the kit's packaging. The large green plastic carrying bags which hold the two parts of the kit make excellent canteens, especially for the land survivor since the bags have belt loops incorporated. Some commands require that the kits remain packaged in the clear polyethylene wrappers as received from supply. These, also, despite the pressure relief holes near the top, can be used as water storage bags. You can seal off the pressure holes from the inside with the bandaids in your kit.

Breaking into the components of the kit, let's consider the little bar of Dial, intended for use to combat infection. You can coat your hands with soap prior to skinning game if you have cause to suspect the presence of tularemia or rabbit fever in the animal. Remember, however, that the troops in the black pajamas have been known to home in on cosmetic odors, so exercise caution using the Dial.

Take a second look at such items as the sun and bug ointment, the bacitracin ophthalmic ointment and the bacitracin anti-infection ointment. All these have a vaseline base and can serve as lubricants, rust preventives, fire-building aids and a base for retaining facial camouflage. Smeared on the body of an attached tick, these lubricants will cut off its air supply and cause it to back out. You can lubricate your weapons with these items but remember, don't do this in cold-weather areas.

There are two squeeze bottles of insect repellent [one tube in Army kit]—the old standard stuff and a leech repellent. The old standard has been referred to as instant feather stick and it does make an excellent fire starter. As you probably know, tobacco also makes a good leech repellent. The contents of one cigarette in a bloused trouser leg will help repel boarders in swampy, leech-infested areas.

Now for a couple of miscellaneous items . . . salt tablets and bandaids. The sea survivor has no need for the salt tablet and the land survivor can use it for flavoring his meals, thereby receiving his needed salt and improving the taste of his food. A wet salt tablet touched to the head of a leech will cause it to fall away. The bandaids in your kit can be used as adhesive tape as well as patching material. They also, of course, make excellent buffers to prevent foot blisters.

The matches provided in the SEEK-2 kit [item 9, Army kit] are a last resort device for starting a fire. The synthetic flint stick should be used first as it will last much longer and is good for thousands of starts. Tinder in the form of absorbent cotton and wax-impregnated paper is provided in the kit [item 10, Army kit]. Spreading and fluffing the cotton to set up a good air-material ratio will cause it to take a spark and burst into flame readily. The starters work equally well on any dry, fine combustible material. All starters operate best when struck with a serrated edge. The kit provides a combination blade-hacksaw on one side and regular cutting edge on the other [items 5 and 6, Army kit]. The serrated hacksaw edge is great for sparking. Using your Mk-79 pencil flare gun [item 8, Army kit] as a handle, the hacksaw blade is also excellent for slicing into bamboo as opposed to using the standard Navy survival knife.

The most versatile and comprehensive item in the kit is that which is listed as a waterproof receptacle [item 30, Army kit]. For the purpose of discussion, we'll refer to it as "the device." First off, it is a sterile water receptacle; by placing it in a sock or an improvised sack you can eliminate its instability.

The device can also be used to keep anything dry. It is made of natural rubber and will stretch and give

PEARL'S

If you have a question about personal equipment or rescue and survival gear, write to

Pearl

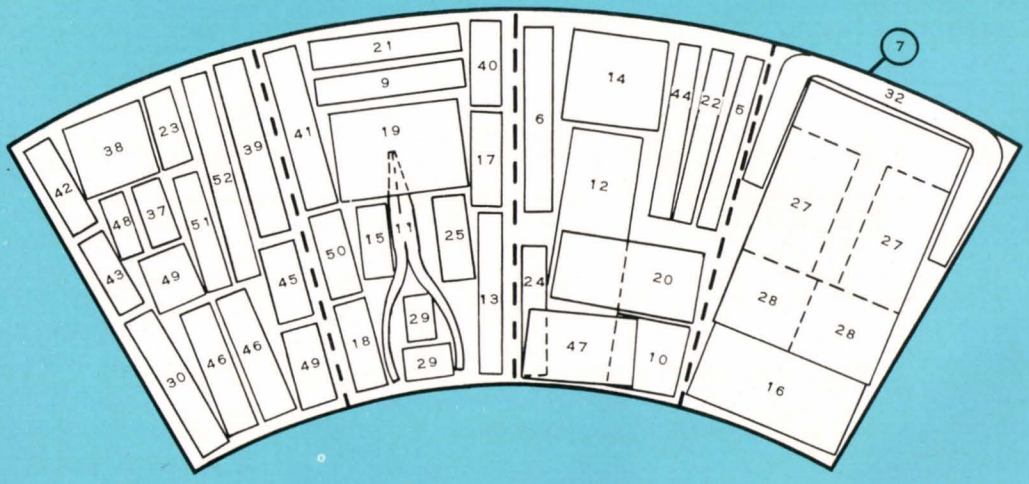
U. S. Army Board for Aviation Accident Research

Fort Rucker, Ala. 36360

to phenomenal proportions. Articles you might want to protect are your wristwatch, compass, weapons, maps, tinder material or anything else that might be subject to the effects of the elements.

The device makes a good food container and also a refuse container. In a raft at sea it can be used to hold garbage, vomitus or anything which could serve as shark lure when dumped over the side indiscriminately. The device can also be used to cover a bandage or wound that would be better off kept dry. With the reinforced ring and the end cut off, it can be used as a drain for a deep wound that needs suturing.

When fishing in ponds, blow the device into a balloon. With a good length of line tied into the dorsal of your first catch, you then place the fish back into the water in the hope that it will return to its shipmates and you'll have a surface indicator to tell where they are. You can also stretch the device out full length, tie it to the ends of a forked stick for



LOCATION OF ITEMS IN ARMY PERSONAL SURVIVAL KIT SIMILAR TO NAVY SEEK-2 KIT

5. Blade assembly, knife
6. Blade assembly, hacksaw
8. Flare projector and four flares (in pockets on lower container assembly, not shown)
9. Waterproof matches and synthetic flint
10. Firestarter sheets and tinder
19. Mosquito head net and mittens (compressed)
20. Compressed sponge
30. Waterproof receptacles
37. Antiseptic soap
39. Sun and bug repellent
43. Eye ointment
44. Antibiotic ointment
45. Anti-malaria tablets
47. Anti-diarrhea tablets
48. Stay-awake tablets
49. Salt tablets

a slingshot or wrap it around your lower leg to blouse your trousers for protection against insects and other crawling creatures. The device can, if necssary, serve as an emergency flotation aid.

When traveling in snow country, fill the device with snow and add a water purification tablet. Just before starting your trek, hang it inside your clothing in the chest area. Your body heat will melt the snow and provide you with a drink at the breaks.

There are usually only two devices packed in the kits. It is recommended that you carry at least six.

One item that is no longer packaged in the personal survival kits is toilet tissue and leaves are not the answer. This is where that small sponge or chamois cloth [item 20, Army kit] comes in mighty handy. Both can be washed clean and used over and over again.

When you use your candle, get something under it to catch the drippings—they can always be reformed into a new candle. For concentrated heat, place the candle in a small hole about the diameter of your fist and at least as deep as the candle. Leave side vents for a draft feed and use your aluminum foil as a custom-fitted container over the hole.

And here's a tip, though it doesn't come under the category of imagination, about using the wire saw. Keep it stretched tightly between two points, don't wrap it around the material you intend to cut. Keeping it straight will save you time and labor and should prevent the possibility of the saw breaking.

The insect headnet and mittens have a number of uses. Incidentally, when the headnet is used as intended, it needs something like wire or a thin sapling as a support to keep it away from your face. Without support it's like non-skid on a flight deck—it gives the bug a toehold while he zaps you. The net can be used when gathering insects for food and can also be used to drown them. It's great for gathering honey and works well as a seine for shiners and minnows. The net gloves and headpiece in combination serve also as an aid to good camouflage. You can even secure foliage to the net surface.

These few suggestions by no means encompass the fullest extent of usage of items in your SEEK-2 kit. The limits of your equipment are restricted only by the limits of your imagination. Put it to work!

FIRST AID TRAINING NEEDED FOR SURVIVAL

O-1 observer: ". . . The pilot saw something on the ground and told me to get two smoke grenades ready to mark whatever it was. He did not tell me what he had seen. We were in a right turn with about 30 to 40 degrees of bank when he told me to get the grenades. I reached across with my right hand and took a grenade from the rack on the left side of the cockpit. I was holding it in my right hand and had my left hand on the pin ready to pull it. As I looked up, we were level and out of the turn. Our altitude appeared to be about 50 feet above the trees and we flew into the trees at about a 45-degree angle. The aircraft came to rest upright with both wings off, the engine partially buried in the ground and the fuselage broken just behind my seat. The area was covered with tall trees and bamboo and was almost completely obscured from view from above.

"I got out through the rear window. I had some minor bruises, a sprained ankle, and it felt as though I might have some cracked ribs.

"The pilot had his safety belt, shoulder harness, and helmet on. He was slumped forward and blood was flowing from behind his ears and near his forehead. I checked his pulse and found that he was dead.

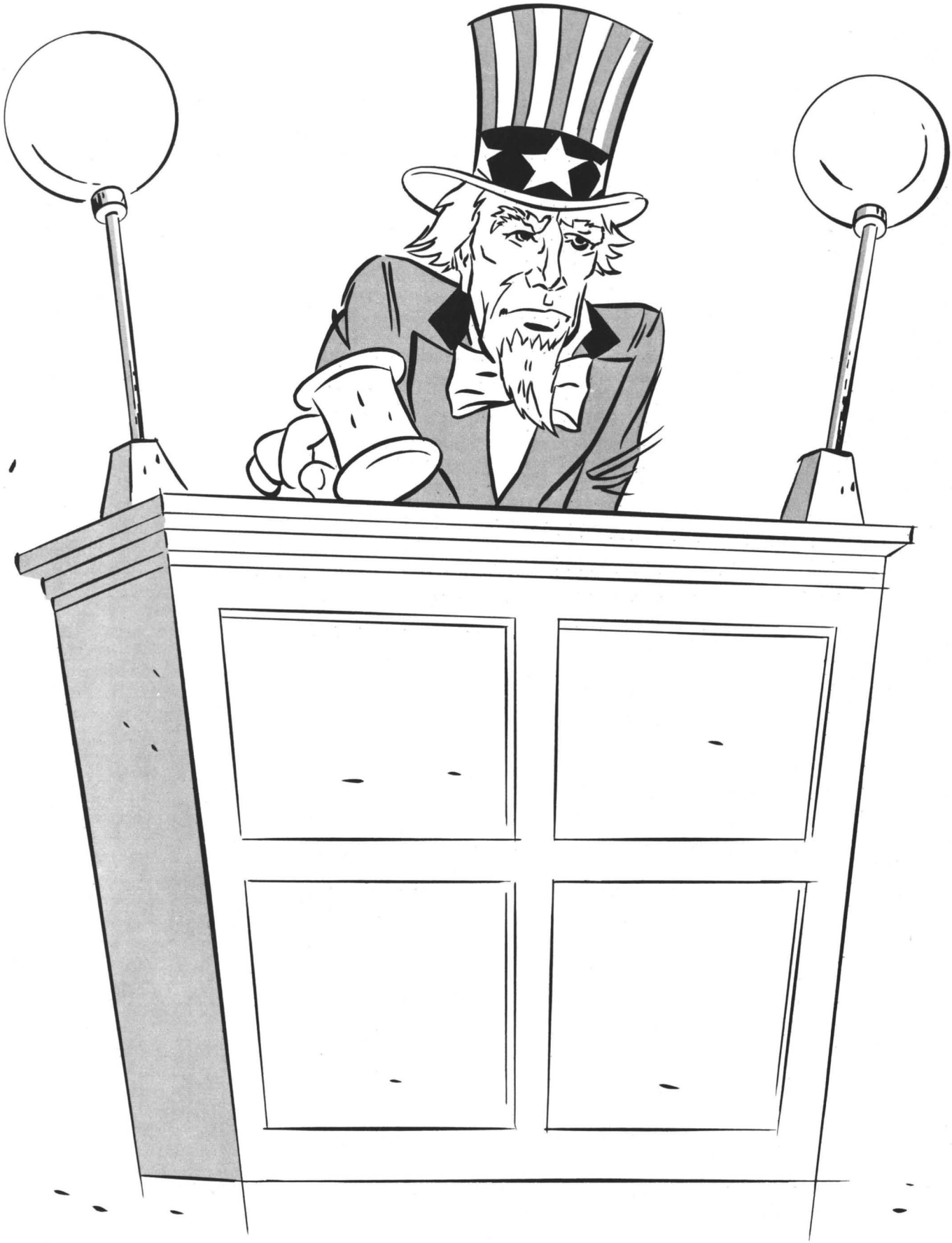
". . . I walked to a clear area where I was picked up by a helicopter."

Flight surgeon: "Autopsy findings suggested that the pilot was not killed on impact, nor did he die from bleeding or cerebral hemorrhage. It might possibly be that the pilot had an airway obstruction when he became unconscious and died of suffocation. . . . I believe that target fixation was a contributing factor and that the pilot realized too late that he was close to the trees."

Analysis: ". . . the pilot had descended to an altitude of 50 feet after making a left turn and was starting a smoke marking run on a target that he had just seen. The turn was against the side of a rugged mountain slope, with little maneuver area available. . . . The pilot may have allowed himself to be distracted by overly concentrating on his target. As he was flying downslope, he must not have seen the particularly large tree extending 25 to 30 feet above the rest of the other trees to his right front. . . ."

Reviewing official: "This accident supports an accident trend stemming from flights close to the ground. Renewed emphasis should be placed on reconnaissance techniques. . . . Aviators should conduct visual reconnaissance at an absolute altitude of 1,200 feet, descending to lower altitude only if absolutely necessary for the accomplishment of the mission."

Closeout letter: "The observer's statement that the pilot had blood flowing from behind his ears and near his forehead, the aviation medical officer's statement, and the autopsy report indicated the pilot was alive after the crash and that his injuries need not have proven fatal if first aid treatment had been promptly rendered. Recommend periodical review of first aid treatment for all aircrewmembers."



continuing...

THE CASE FOR SUPERVISION

ACCIDENT NUMBER ONE

A UH-1H, WITH A crew of four and six passengers aboard, was the last of three helicopters taking off from a pickup zone (PZ). The wind was 60 degrees at 15 to 16 knots, visibility 6 miles and temperature 33 degrees C. The pilot lifted off on a heading of 20 degrees, cleared a 50 to 75-foot barrier and rpm was lost. The aircraft commander took control, turned left, and traveled 1,000 meters, never regaining rpm or gaining altitude. The main rotor struck a tree, breaking a blade and the helicopter spun 760 degrees right. The tail boom struck trees and separated. The fuselage hit the ground inverted. The AC and two passengers were killed. The pilot, crewchief, and three passengers sustained major injuries. The gunner and one passenger escaped with minor injuries.

Flight leader: ". . . My element of three had been in and out of the PZ three times prior to the accident. Upon clearing the barriers at the departure end, we encountered a crosswind from the right. Visibility was unlimited with negative cloud cover. . . . At liftoff, I experienced a 200-rpm loss. Numbers 2 and 3 were taking off single ship to avoid rotorwash. The first transmission I heard was from the pilot of No. 2, who experienced an rpm loss and decided to land and drop the troops. The next transmission was from the C&C aircraft, stating that a helicopter had gone down and that it looked very serious and would require a medevac with a winch. I immediately notified our operations of the situation."

Number 2 AC: ". . . I was in the PZ approximately 1 minute, loading six troops with their equipment and one machinegun. . . . As I lifted out, pulling about 45 pounds of torque, my rpm bled off to around 6000 at approximately 30 feet. I put the collective down to regain rpm. This put me in the trees on the northwest side of the PZ. . . . I did not regain enough rpm to continue, so I put the aircraft on the ground in an opening, unloaded the troops, and had them form a perimeter while we checked for damage. I then flew the empty aircraft back to base camp."

Number 3 crewchief: "The second aircraft took off and started to lose rpm and settle. The pilot turned slightly to the left and landed in a small area, after striking some trees. We took off and, as we departed the area, we were losing rpm. More power was applied to clear some trees and the rpm continued to drop. The AC took control and started a left turn to clear some large trees. The aircraft was shaking badly. In the turn, a main rotor blade struck a tree about 5 feet from the fuselage. The aircraft then rolled over and crashed into the trees."

Analysis: ". . . Weather reports and statements by the pilots in the area all indicated light turbulence at treetop level. At the time the third aircraft started to lift off, the C&C aircraft radioed that the No. 2 aircraft was down and the attention of the AC and pilot was diverted. The pilot was at the controls for takeoff and the rpm was bleeding off as the aircraft cleared the barriers. The rpm audio warning came on and the AC took control, but rpm could not be regained. . . .

"During the interviews, it was brought out that

hover checks were not made regularly. The flight commander should have insured that all pilots were performing hover checks prior to takeoff. This was especially true since the three aircraft had just been refueled. The fact that the first two aircraft lost rpm during takeoff indicated that the load of six passengers plus crew was too much for existing conditions. Aircraft loading was changed to five troops after the accident. The C&C pilots and mission commander brought out the fact that a better PZ was located about 1,000 meters southwest of the PZ in use. As this extraction was not an emergency, the mission commander should have been involved in the planning of the extraction and selection of the PZ. He should have given final approval for the selection of the PZ. . . .

"It was noted by the boardmembers, during their flight over the PZ and crash site, that there were two or three suitable areas for forced landings. These areas were along the flight path of the aircraft and the board concluded that any one of them could have been used to land. As the crew had already departed the PZ three times along the same flight path, the AC should have been familiar with these available areas and landed in one of them when rpm was lost."

Flight surgeon: ". . . The gunner was not using a seat belt or other restraint. His sleeves were rolled up above the elbows and he was not wearing gloves. Fortunately, because of his location in the aircraft, he sustained only minor injuries.

"The passengers were not using seat belts. This is not uncommon in this type mission. One passenger sustained fatal head injuries and another died of chest and abdominal injuries. Seat belts may have saved these passengers. However, this cannot be stated with assurance since the aircraft structure was not examined. In all probability, seat belts would have decreased the degree of trauma in the three nonfatal injuries."

Cause factors: "1. Failure to make a hover check prior to takeoff. This is also considered a supervisory factor, as most pilots interviewed indicated that they did not make hover checks.

"2. Failure to land in one of the available areas along the flight path after loss of rpm.

"3. Insufficient planning prior to the extraction led to the selection of a PZ which was not the most favorable in the area."

Recommendations: "1. That this accident be highly publicized at all levels of aviation command. . . .

"2. That pilots be reminded of constant changes of aircraft capability due to changes in fuel load, density altitude, wind conditions and temperature. A hover check should be made each time the aircraft is picked up.

"3. That pilots never hesitate to make precautionary landings if they are experiencing difficulty.

"4. Closer coordination between ground force commanders, liaison officers and mission commanders in selection of PZs and LZs."

ACCIDENT NUMBER TWO

UH-1H AC: "During runup, I asked for departure instructions and hazards. I was informed about mortar and artillery firing to the northeast and northwest. I asked for a check fire for departure and was told that if I departed to the north, I would be

clear of the fire. . . . I picked the aircraft up and made a hover check. I had only two passengers so the aircraft was relatively light. I started my takeoff.

"I hit a wire prior to reaching translational. It was approximately 25 feet in the air and was not marked. It was all but invisible against the dark background of a mountain. I believe I saw the wire just prior to making contact or at the same instant the wire struck the struts, just above the skids. I pulled full aft cyclic and added power to try and stop. However, the main rotor blade apparently made contact, for I felt violent vibrations and the aircraft made one or two 360-degree turns to the right. I had a small amount of control and was able to maintain a skids-level attitude throughout the spin. I tried to hold the aircraft straight with left pedal, but could not. Prior to ground impact, I pulled full collective to cushion the landing and kicked full left pedal, trying to stop the spin.

"I don't know what effect kicking the pedal had, but the aircraft hit level on the skids and stopped turning immediately. The blades stopped turning almost instantly as they struck the higher terrain on the left."

Pilot of another UH-1: "At about 1100 hours, I took off from the VIP pad and almost hit some commo wire strung approximately 20 feet above the ground and 50 feet north of the pad. It was in the takeoff path of aircraft departing to the north, the usual direction of takeoff.

"I called control and told them the wire was a safety hazard and to have it taken down or marked, preferably taken down. The controller said he would take care of it.

"At about 1400 hours, I landed on the pad. The wire was still there and still unmarked. I again told the controller to get it down or mark it because it was very hard to see. He said he had already told the personnel in charge and they said they would take care of it. He said he would tell them again and see that it was taken care of.

"About 30 minutes later, I made another approach to the pad and the wire was still there and unmarked. As I touched down, a UH-1H took off, hit the wire and crashed."

Indorsement: "The cause of this accident was gross supervisory error on the part of the individual responsible for the helipad and its operation. The first error was allowing the wire to be placed in the takeoff zone of the helipad. The second was that the wire was not marked or removed after several reminders. The third error was that pilots were not warned about this known hazard."

ACCIDENT NUMBER THREE

Two UH-1Cs in trail formation and one flare aircraft were on a night reconnaissance mission. A group of flares was dropped and the UH-1Cs made two sweeps over the area before the flares began to go out. The AC of the No. 2 UH-1C then requested additional flares, thinking he had seen something near a bridge in the area. At this point, he broke formation and flew an independent and opposite flight path. The two UH-1Cs collided and crashed. There were no survivors.

Flight surgeon: "From talking to members of the platoon, it became apparent that the AC of the No. 2 aircraft had a tendency to be more a leader than a follower. A breech in air discipline while he was flying trail apparently was the main factor contributing to this accident. . . .

"Another important contributing factor was lighting and visibility. By the nature of these missions, there is no fixed procedure for aircraft lighting. On this mission, the lead aircraft reportedly had no lights on and the trail aircraft had the rotating beacon on. The sky was illuminated continuously by parachute flares dropped from 3,500 feet. Prior to a request for more flares, all the flares had burned out and there was a period of complete darkness. Because it takes a minimum of 30 seconds to regain minimal night vision and several minutes to develop adequate darkness adaptation, it can be concluded that the aviators were handicapped by minimal visual acuity preceding the crash."

Flare helicopter pilot: ". . . I had completed the regularly scheduled flare drop when the AC of the trail aircraft asked us to illuminate the bridge area. We began lighting the area when we heard the trail AC say, 'Turn left,' and the lead AC said, 'I'm turning left.' This was followed by a scream. . . .

"After these transmissions, we were circling for another drop when we saw the burning on the ground and thought the flare chutes had failed to open. We then saw ammunition exploding and realized what had happened.

"We made a low pass. Because of the explosions we were unable to make a check for survivors. We stayed in the area illuminating the crash scene until rescue helicopters arrived. . . ."

Questions asked UH-1C pilot from unit: "What is normally required of a trail aircraft?"

"The main job is to cover the team leader and never lose sight of him."

"In covering the team leader, do you ever adopt a different orbit pattern?"

"Normally, you would not."

"Do you know of an occasion where a member of the platoon diverted from the normal procedure of staying with his team leader?"

"Yes sir, I know of one incident involving the people that were in the accident. The same AC flying trail left his position and broke formation."

Cause factors: "1. Failure to maintain formation and allowing the aircraft to become separated due to lack of air discipline.

"2. Inadequate training prior to becoming operational.

"3. Inadequate lighting on one or possibly both helicopters.

"4. Lack of a written SOP."

Probable or suspected factors: "1. Extreme darkness, no moon.

"2. Night blindness immediately after the flares went out."

Recommendations: "1. Thoroughly train all pilots in the duties they are expected to perform on any flight to develop discipline and professional competence.

"2. Commanders should establish SOPs in writing and closely monitor all phases of training. . . ."

ACCIDENT NUMBER FOUR

A UH-1D pilot was carrying members of an accident investigation board to a crash site. He did not have a copilot and one of the passengers sat in the left seat. After arriving at the first destination, three of the boardmembers were offloaded so that six soldiers could be carried to the crash site to secure the area. When the helicopter arrived at the crash site, an O-1 pilot dropped two smoke grenades, and the UH-1 pilot attempted an approach from the northwest with a quartering tailwind. The approach was terminated too high and the pilot elected to go around.

Because of the load, combined with a density altitude in excess of 5,400 feet, the helicopter could not be hovered out of ground effect. It started to settle and the pilot applied collective, causing the rotor rpm to decay. He applied more pitch which further aggravated the situation and resulted in loss of directional control. The helicopter settled in the trees and crashed. The engine could not be shut down and the helicopter caught fire and burned. Seven occupants sustained major injuries and two had minor injuries.

Gunner: ". . . The first unusual thing I noticed was when we were coming out of the revetment. I normally keep my seat belt unfastened when we back out so I can clear the tail rotor. The way the pilot handled the aircraft, I put my seat belt on. He had trouble controlling it.

"We flew directly to the first destination point and landed on the PSP next to an O-1. The three passengers got off and six soldiers got on board. We followed the O-1 out of the LZ. The O-1 pilot circled the slope of a mountain over very dense vegetation and put smoke in . . . .

"We made about two passes over it, and our pilot said he didn't think we could make it. The O-1 pilot then put more smoke in and said that the best place to land would be to the left, below the last smoke. We made about two more passes and the final ap-

proach was more or less flat into the side of the hill.

"The pilot told us to tell the men that we were going to hover and they would have to jump. At this time, we were about 15 or 20 feet above the trees. I unsnapped my seat belt so I could lean out and clear the tail rotor. I heard the passenger in the copilot seat say, 'Well, if we get these guys in here, I don't know how we'll get them out.'

"It seemed like the pilot tried to hold it at a hover. I don't know if he turned to the left or lost control. We started back downslope, but couldn't get enough altitude and the skids were already in the trees. I braced myself because I knew we were going in. There was a bad impact and I was dazed for a few seconds. I was afraid the ship was going to burn. The pilot and the passenger in the copilot's seat were both unconscious. I started trying to get the pilot out. His legs were broken. By this time, the crewchief came around and he helped me get the pilot out. He had tried to shut the engine down, but couldn't. We took the pilot and passenger out and got them as far from the wreckage as possible. We then went back and got one of the soldiers who was unconscious. . . ."

"The way the pilot handled the aircraft, I put my seat belt on. He had trouble controlling it"

Crewchief: "We had 1,400 pounds of fuel on board. The pilot walked around the aircraft and I think the only oil level he checked was the transmission oil. He came on top of the aircraft and I had the particle separator and barrier filters out and he asked me what they were out for. I explained about the FOD inspection. He looked in and said, 'Okay, put it back together.' He just looked at the head and wiggled the stabilizer bar rods.

"He cranked up and the way he came out of the revetment scared me because he went all different ways and the wind was not blowing much.

"We circled the destination point about four or five times and then started getting real low. On the third approach, we got so low I thought he was going to land. The transmission whine was down and the pilot was trying to lift the collective, but it was already all the way up. I braced myself the best I could and I remember hitting my head on the post."

Cause factors: 1. Flight was assigned and cleared without a copilot, in violation of command regulations.

2. Pilot did not have a 90-day proficiency check as prescribed by command regulations.

3. Pilot was not current in the UH-1D.

4. Failure to consult the dash 10 manual to determine maximum gross weight allowable for the proposed flight envelope.

continuing . . . THE CASE FOR SUPERVISION

FROM THE WEEKLY SUMMARY for 8-14 July 1963: During the past 5 years, 85 Army aviators have been embarrassed by fuel exhaustion. Forty-two made successful forced landings. The other 43 clobbered their aircraft in major accidents. Some were hurt badly and some lost their lives. Based on these cases, your chances of getting your aircraft to the ground in one piece after running out of fuel are one in two. Are these odds good enough for you?

These odds haven't changed much. Of 14 recent cases of fuel exhaustion, six resulted in major accidents, four resulted in incident damage, and the remaining four were successful forced landings. Here are the details:

Major accidents

An OH-13E pilot and his passenger were searching a river for two drowning victims when the engine stopped and they crashed into a heavily wooded swamp area. Both sustained major injuries and the helicopter was destroyed. Ten ounces of unusable fuel remained in the tank. The helicopter had flown 4 hours and 10 minutes, with less than 27 gallons of fuel added. Based on its past fuel consumption, it could only have flown 4 hours and 12 minutes total time with the available fuel.

An OH-6A pilot knew that he was low on fuel, but he continued his reconnaissance mission and landed near some troops to check his map coordinates. At this time, he reported 40 pounds of fuel aboard, took off, and headed for a refueling point 15 minutes away. Enroute at low level the engine flamed out and the helicopter crashed in an open field. The pilot sustained major injuries and the helicopter was destroyed.

A UH-1H was returning to the airfield from a troop extraction mission. The 20-minute fuel warning light was on and the fuel gauge indicated 150 pounds. The fuel pressure fluctuated and the left fuel pump warning light came on. The aircraft commander started a turn toward an open field, the fuel pressure dropped to zero and the engine stopped. The helicopter landed hard and the main rotor blades struck the ground. It rolled on its right side, causing extensive damage.

An OH-6A pilot was scheduled for a reconnaissance mission in a helicopter that had just been released from field maintenance. During a preflight, it was discovered that the engine had been serviced with the wrong type of oil. The crewchief drained the oil and reserviced the engine with the correct type oil. After a 30-minute delay, the helicopter was ready and the runup was normal, with the fuel quantity gauge showing approximately 200 pounds of fuel. The mission was proceeded without incident and with no caution or warning lights to indicate a low fuel state. The pilot's first indication was a power

loss and activation of the engine-out warning system. At this time, the helicopter was at approximately 15 feet and 30 knots over a dense hedgerow. To avoid crashing into the hedgerow, the pilot attempted to zero his airspeed and make a hovering autorotation. Because of the flare, the helicopter entered a rice paddy tail low and the tail rotor hit the water in the paddy, shearing the 90-degree gearbox. The main rotor severed the tail boom and the helicopter settled in 3 feet of water.

This accident was caused by fuel exhaustion and contributing factors were an inaccurate fuel gauge and fuel-low warning system. An analysis of the report stated: "The fact that the pilot cannot visually determine a fuel quantity of less than full does not relieve him of the responsibility for assuring there is enough fuel aboard to complete a mission. If necessary, he must top off, defuel to the desired quantity and relate this to the fuel gauge indication."

An OH-23F pilot was returning from a medevac mission when the low level fuel warning light came on approximately 10 minutes out from his destination airfield. He decided to continue the flight to the airfield and was over the end of the runway at approximately 200 to 250 feet when the engine stopped. He autorotated, hit the grassy area adjacent to the runway with excessive speed and the helicopter bounced and skidded more than 200 feet, severing the tail boom. There was also major damage to the main and tail rotor blades and the tail rotor gearbox.

An OH-13E pilot was on a training flight. He had flown for approximately 1½ hours and was returning to the refueling area. As he turned on final, the engine stopped and he entered autorotation. Seeing powerlines ahead, he turned left toward an open field to miss the wires. The helicopter rolled on its right side at touchdown, causing major damage to all components. This accident was caused by fuel exhaustion due to an inadequate preflight.

Incidents

An OH-13E pilot exhausted his fuel, autorotated, and landed hard, damaging the cross tubes and tail rotor blades.

An OH-23D pilot ran out of fuel at a hover in a parking area and autorotated to a hard surface, damaging the rear center brace and skid gear.

A UH-1H pilot exhausted his fuel, autorotated and landed with incident damage to the synchronized elevator.

An AH-1G engine stopped at 2,500 feet. The helicopter was autorotated into a small clearing and the main rotor flexed and struck the No. 5 tail rotor drive shaft, damaging the shaft. Caused by a nose low attitude with less than 10 percent fuel. The fuel boost pump sucked air from the aft fuel cell, causing the engine to stop.

Forced landings

An OH-23D pilot became disoriented during a cross-country flight. After he found his location, he flew toward his destination, exhausted his fuel, autorotated and landed with no damage.

A TH-55A engine stopped on the downwind leg of a traffic pattern. The helicopter was autorotated and landed with no damage.

An OH-23D engine stopped because of fuel exhaustion during climbout. The helicopter was autorotated and landed with no damage.

A UH-1H ran out of fuel while returning from a medevac mission. It was autorotated and landed with no damage.

From the narrative of Army training film 46-3455, *Lessons Learned From Aircraft Accidents—Fuel Exhaustion* (available through your Army film library): "If we were to go through all of the fuel exhaustion reports in USABAAR files, we'd find two cause factors repeated over and over. There should be no question in your mind as to what they are.

"Inadequate fuel monitoring is tops on the list. Fortunately, there's a technique that can make you so fuel conscious that you'll never be embarrassed or injured by running your tanks dry: *Fly as though you had no fuel gauge.* If you will cultivate this technique, you'll never be listed in the fuel exhaustion file.

"You can even make a game of it. Every time your aircraft is refueled, see how close your calculation comes to the actual number of gallons or pounds required to fill the tanks.

"The second most frequent cause factor is hard to believe. It is continuing to fly with a low fuel level. Why do otherwise intelligent men do this? It must be infallible faith in their ability to win, or the it-can't-happen-to-me complex.

"When you're tempted to take a chance, remember that it's always easier to make an emergency landing with power on and a clear mind than with a dead engine and panic. Remember that 43 out of 85 fuel exhaustion cases resulted in major accidents. This means that for every aviator who used his fuel to the last drop, then landed successfully, there was one who failed. All of the resultant waste of money and life was unnecessary. Profit from the examples you've seen here."

USAASO Sez

The U. S. Army Aeronautical Service Office discusses

Discrepancies in weather minima

GCA operator proficiency

Changes to report requirements

On DOD FLIP Terminal—Instrument Approach Procedure Chart Weather Minima: Rumor has it that some aviators and flight students have noticed certain discrepancies among the minima portrayals for TERPs (TM 11-2557-26) procedures. They are right. If you look closely, you will see that in some cases the straight-in minima are based on height above airport (HAA) for both precision and non-precision procedures; others are based on height above touchdown (HAT); still others use HAT for precision and HAA for non-precision procedures. We have not yet seen the fourth possibility.

Several semi-agreements among the U. S. operating and charting agencies account for this thorough non-standardization. The differences originate from interagency-committee tentative agreements on modifications to both the TERPs and the U. S. charting standards. But these agreements have been only partially followed up by agency actions and amendments to standards.

This undesirable situation has been recognized by all agencies and corrections are presently in the form of hard copy draft revisions to the TERPs manual. Agreement on these revisions (TERPs—Second Edition) will be followed by supplementary changes to charting specifications and agencies' directives—with luck—by fall.

On GCA Controller Proficiency: To help GCA operators maintain a sharp edge on their proficiency, and you on yours, why not give GCA a call on the way in from your next flight? Our controllers are highly trained specialists, but do you realize that most of their skill is attained not at school, but through long hours of practice? Constant usage of their facilities keeps GCA operators proficient, helps their morale, spotlights equipment deficiencies and builds a strong foundation for a sound controller-aviator relationship. Get to know the capabilities of your unit's GCA facility and use it. When you are caught up in the soup while the birds are walking, it is comforting to know that the man in GCA who has the calm, cool voice, can place you right on the runway numerals—if you follow his instructions. So—why not keep GCA on its toes by practicing along with them? To add a bit of variety now and then, you might even declare gyros out, simulated emergencies such as low fuel, etc. Try it—see what happens! If GCA is really sharp, help them stay that way. If they aren't, help them shape up by giving them the necessary practice.

On Reporting Air Traffic Activity: The new AR 95-24 (dated 18 February 1969) has finally come off the press. It reduces the report requirement to one per year, makes monthly records optional, has changed some definitions on what constitutes an operation and the report form itself has been modified. It is hoped that these changes will help to ease the workload of operations personnel. USAASO will make automatic distribution of the DA Form 1968-1 in November to all commanders required to submit reports.

Annual Writing Awards

July
Captain John H. Hastings

August
Major Bobby A. Ramsey

First Prize $250
Major Robert E. Poston

September
Lieutenant Colonel Charles W. Sills

October
Major Donald I. Bernstein

November
Major Francis X. Delvey

December
Major Robert E. Poston

Second Prize $150
CW2 Robert R. Vaughan Jr.

January
CW3 John E. Kennebec

February
Major Alvin W. Cartwright

March
Captain Richard L. Greene

April
Captain Walter L. Duckworth Jr.

Third Prize $100
Captain Walter L. Duckworth Jr.

May
Captain Richard C. Keehn

June
CW2 Robert R. Vaughan Jr.

YOUR NAME COULD be among those listed in the winner's circle if you submit an article for the AVIATION DIGEST's ninth annual writing contest beginning this month. Each month the author of the article selected as the best of that issue receives an engraved plaque and a cash award of $25. From these monthly winners, the three best articles of the year are selected for prizes of $250, $150, and $100 respectively. Winners of the monthly awards as well as the top three prize winners for 1968-1969 are listed above.

To be eligible an article must be original and concern Army aviation or related subjects. Dual authored articles are not eligible for the contest, but this rule does not prevent their selection for publication.

Winning articles are selected by judges who review the manuscripts in original, unedited forms without bylines. Selection is based on accuracy, completeness, originality, readability, soundness, substance and overall merit.

Authors should include pictures, diagrams or charts available or necessary to illustrate manuscripts. Your articles should be submitted to: Editor, U. S. Army AVIATION DIGEST, Ft. Rucker, Ala. 36360.

SAFETY FOR COMBAT READINESS, first of a three-part series, begins on page 36