UNITED STATES ARMY APRIL 1966

AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

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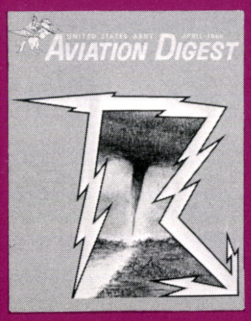

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U.S. Army Aviation Digest, Fort Rucker, Alabama.*

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LETTERS

Sir:

Inclosed is an aircraft accident report of a major accident involving a USAF UH-1F. Factory representatives, after being briefed on the details of this accident, quickly associated the circumstances of the accident with an article in your May 1965 U. S. Army Aviation Digest entitled "UH-1 Collective Bounce." The accident board finally located a copy of this Digest in the Safety Office at SAC Headquarters, and it was made available to the accident board. A number of the board members felt that if the pilot had been aware of the information in your article, the accident might not have occurred. Further, information concerning this phenomena was not adequately covered in the USAF UH-1F Flight Handbook. This technical data deficiency was determined to be the primary cause of this accident.

With the vast amount of helicopter experience in the U. S. Army, we feel that a more effective crossfeed of information would greatly benefit our accident prevention program. Your Digest serves as an excellent educational tool and is a place to start to effectively provide for this desired crossfeed of information. We have three helicopter units presently operating UH-1Fs and UH-19s, and in the near future all three units will have completed transition into the UH-1F. We request that these units, as well as our office, be put on distribution for your Aviation Digest. Addresses of units are attached. We desire that the units and our directorate receive two copies each. If this distribution creates a funding problem, please let us know and we will make provisions for reimbursement.

COL THOMAS L. MURPHY, USAF
Director of Safety
Headquarters, 2nd Air Force (SAC)
Barksdale AFB, La. 71110

• *AIR FORCE and AIR FORCE auxiliary elements submit requests for the DIGEST to Mr. F. X. Thornton, Publications Division, Department of the Air Force, Washington, D. C. Temporary distribution will be made from this office until the paperwork catches up.*—Ed.

Sir:

In the article "Army's New Sidearm," Nov. 1965 issue, Captain Webster states that a .38 cal. flare ammunition has been tested and found to be more satisfactory than tracer ammunition. I have attempted, thru my ordnance people, to locate this flare ammunition in the Navy but have been unsuccessful.

I would appreciate any information you can give me as to where this type flare may be procured. All of our pilots carry the standard .38 cal. pistol and I would like to make flare ammunition available.

I have just begun receiving your magazine and wish to compliment you on its content and format. Our helicopter people especially are anxious to read it.

LCDR W. T. BARRON
U. S. Naval Air Station
Los Alamitos, Calif 90721

• *Research of the information you requested resulted in the following sources for .38 caliber flare ammunition: Special Air Warfare Center, Eglin AFB, Fla., and CG, U. S. Army Munitions Command, Picatinny Arsenal, N.J.*—Ed.

Sir:

After walking away from graduation yesterday, I felt mighty good to have my wings on, that I was finally an Army Aviator. It was at that time that I realized the work which lies ahead for me in maintaining the keen edge the flight program has given me.

My thoughts began to recollect an article in the November edition of the Aviation Digest entitled, "A Thing Or Two From B Phase" which illustrates the type of training flights needed to maintain the keen edge required to be considered an Army Aviator, not just another pilot.

As the article put it, practice of the "bread and butter" aspects of B phase via the method of Captain Gobel, will enable us to maintain our mission-oriented proficiency.

I would say that this article is more than a reminder; it is an attitude; an attitude with which I plan to begin my career with Army Aviation, keeping in mind that I am not just a pilot flying from one field to another, but that I'm an Army Aviator.

1/LT CHARLES HOSKINSON
Arty

Sir:

While on a recent mission to Fort Bragg, N. C., we came across the January copy of the AVIATION DIGEST. Since we fly the CH-21 helicopter on our missions we found your magazine very interesting. We especially enjoyed the article "Ne'er Forget" by Major Milton P. Cherne. Many of your other articles brought home some important facts.

We would like to receive your magazine regularly but we do not have a DA Form 12-4. I am writing this letter in hopes that you will put us on your mailing list or send to us the proper application form.

Thank you in advance for your cooperation in this matter.

2/LT RICHARD C. TOBIN, USAF
4502 Spt Sqdn (Hel)
Shaw AFB, S. C. 29152

• *You're on! Pigeon on its way with info as to how to receive our pub.*—Ed

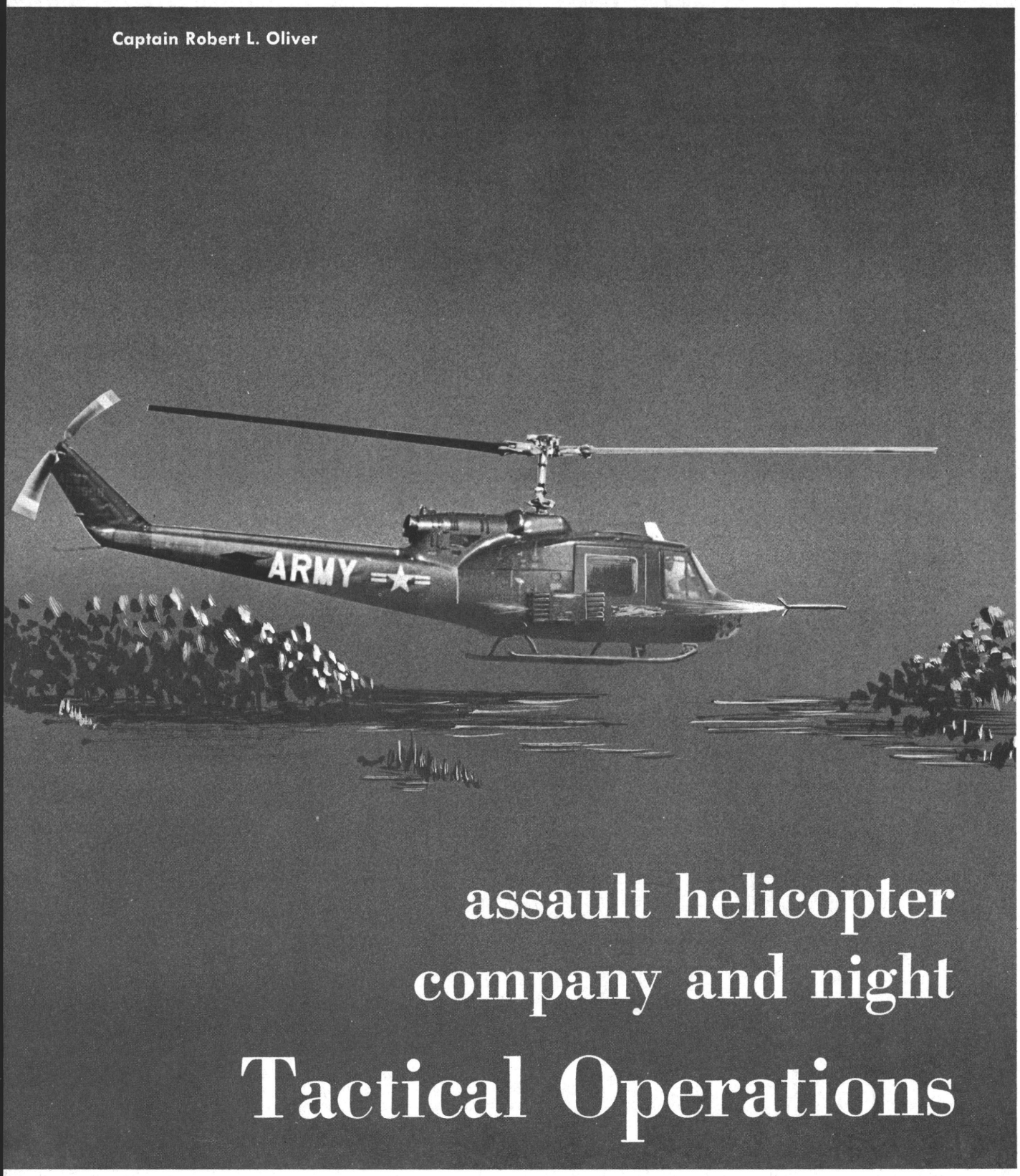
Sir:

The December 1965 issue of Aviation Digest just arrived (it takes a little while to get here) and my attention was drawn to a Crash Sense item captioned HELPING HAND on page 38. I would like to make a comment regarding the last sentence, "Unqualified personnel occupying copilot seats should be instructed not to operate any controls."

In my opinion, the individual occupying the copilot seat of an aircraft, *whatever his qualifications,* should not touch any control, switch, etc., except as directed by the pilot flying the aircraft. There are exceptions of course: A pilot in the copilot seat may be giving instruction or a checkride; a pilot and copilot may have worked together long enough to have learned to operate as a team; copilot functions may be clearly outlined

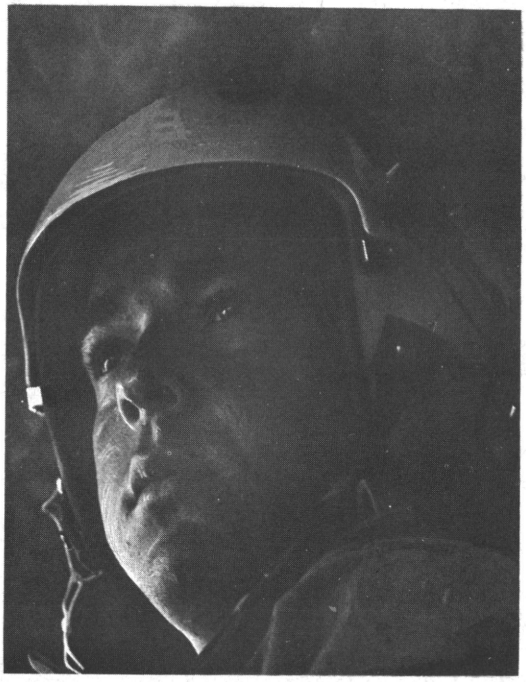
Continued on page 45

Captain Robert L. Oliver



assault helicopter company and night Tactical Operations

Ed Note: The author is primarily concerned with the type war in which the enemy has radar coverage of the higher flight levels.



THE PRIMARY MISSION of the Assault Helicopter Company is to provide assault lift to combat troops, their support weapons and equipment within the combat zone. For accomplishment of this mission, the UH-1 has been provided. This aircraft is adequate with the exception of its high vulnerability to some types of hostile fire.

The problem of high vulnerability to certain enemy fire can be solved in two ways: first, provide armor to the aircraft, and second, fly undetected. Armor* is not feasible for aircraft, but undetected flight is feasible. In fact, during World War II flights were conducted at low level and in instrument conditions where possible. Low-level flight prevented detection by enemy radar, and instrument weather conditions prevented detection by enemy observers. Helicopters were not used in World War II, and because of inadequate navigational aids all weather, day or night, helicopter flight is still not feasible. But couldn't the same results be obtained by low-altitude, formation flying at night?

Some of you reading this article may have received artillery and guided missile training. Those who have will tell you that the probability of the enemy scoring a hit on a radar target is almost 100 percent. An enemy employing missiles for air defense can destroy any target on its radar screen. So low-level flying is mandatory.

At best, the UH-1 can carry only one squad of troops. To employ troops a squad at a time is generally senseless and may be costly in manpower. So formation flying is mandatory.

Formation flying at night, especially at low-level, presents several problems. However, solutions to these problems are readily available. They don't require action by design engineers; simple field expedients and aviator training are more than adequate.

One problem immediately apparent is the amount of lighting on the helicopter necessary to provide adequate reference for formation flying but no target for the enemy. At night even the light of a cigarette will offer a target. A modification kit has been installed on the Huey to direct all formation lighting upward, and a system to dim these lights is provided. In tests observers on the ground were not able to see the aircraft unless they were silhouetted. Formation lights could be seen only from above. Enemy interceptor aircraft could possibly locate the air column, but it is unlikely that an interceptor would be dispatched unless radar detects a target.

Flight at low level is dangerous even during daylight hours. At night it is particularly hazardous. Obstacles are difficult to see and an outside horizon is often lost. Further, aircraft can be flown into instrument conditions with no warning to the pilots concerned.

---

* While complete armor protection for pilot is not feasible, armor protection for the crew and vital components of the aircraft is in wide use today.—Ed.

Therefore, precise weather forecasting is necessary, and an instrument qualified aviator should pilot each aircraft.

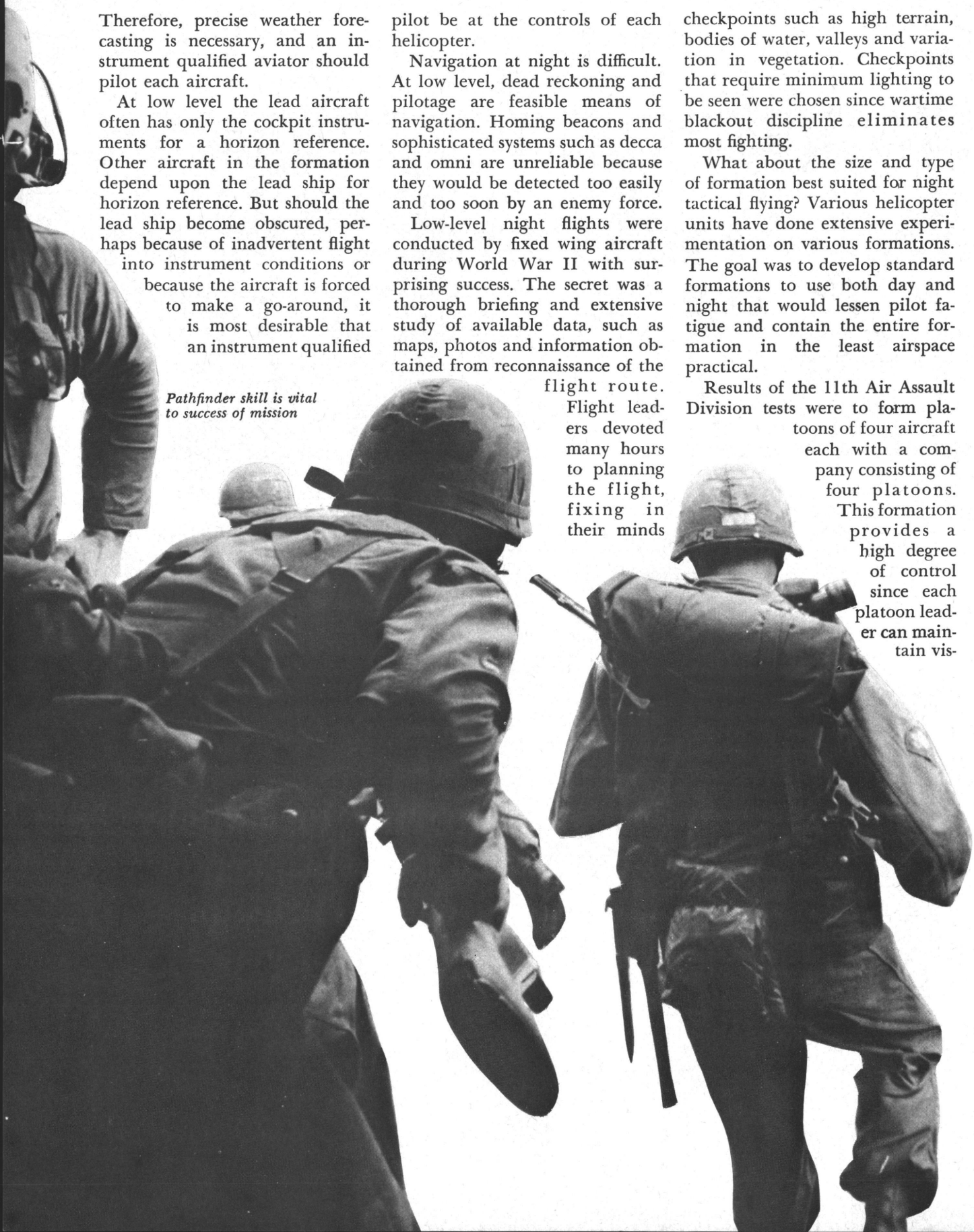
At low level the lead aircraft often has only the cockpit instruments for a horizon reference. Other aircraft in the formation depend upon the lead ship for horizon reference. But should the lead ship become obscured, perhaps because of inadvertent flight into instrument conditions or because the aircraft is forced to make a go-around, it is most desirable that an instrument qualified pilot be at the controls of each helicopter.

Navigation at night is difficult. At low level, dead reckoning and pilotage are feasible means of navigation. Homing beacons and sophisticated systems such as decca and omni are unreliable because they would be detected too easily and too soon by an enemy force.

Low-level night flights were conducted by fixed wing aircraft during World War II with surprising success. The secret was a thorough briefing and extensive study of available data, such as maps, photos and information obtained from reconnaissance of the flight route. Flight leaders devoted many hours to planning the flight, fixing in their minds checkpoints such as high terrain, bodies of water, valleys and variation in vegetation. Checkpoints that require minimum lighting to be seen were chosen since wartime blackout discipline eliminates most fighting.

What about the size and type of formation best suited for night tactical flying? Various helicopter units have done extensive experimentation on various formations. The goal was to develop standard formations to use both day and night that would lessen pilot fatigue and contain the entire formation in the least airspace practical.

Results of the 11th Air Assault Division tests were to form platoons of four aircraft each with a company consisting of four platoons. This formation provides a high degree of control since each platoon leader can maintain vis-



Pathfinder skill is vital to success of mission

ual contact with all aircraft under his control. Column type formations are undesirable because the aircraft are spaced over a vast area, depending on the number of aircraft used, and detection by enemy observers is easy. Also, control of the aircraft is difficult. The diamond formation within the platoon and the company provides the best type of en route formation. The actual landing formation is dictated by mission and terrain.

Protection for the formation can be provided by fighter aircraft. However, these aircraft should not be used if surprise is considered essential to the success of the mission, since enemy radar would detect an aircraft at higher altitudes. The UH-1 armed with rockets and machineguns provides the best en route protection. These aircraft are highly maneuverable and are capable of instantaneous reaction to suppress ground fire in the vicinity of the formation.

Security in the landing zone is provided primarily by infantry troops transported in the aircraft. Escort aircraft can help secure a landing zone; however, their fires would be employed at the perimeter of the zone rather than risk injury to friendly forces on the ground.

Deception is another method of passive defense and adds a measure of protection for the helicopters. Thorough reconnaissance, whether by map or actual flight, mentioned as a must for navigation, should also be used to select landing zones for diversionary measures. At night diversionary landings would prove most effective in confusing the enemy, for during this time the only way of locating an airborne assault helicopter unit is by sound.

When he wrote his article, Capt Oliver was operations officer for A Company, 229th Assault Hel Bn, 1st Cavalry Division (Airmobile).

Hueys armed with rockets and machineguns provide the best en route protection for helicopter formations

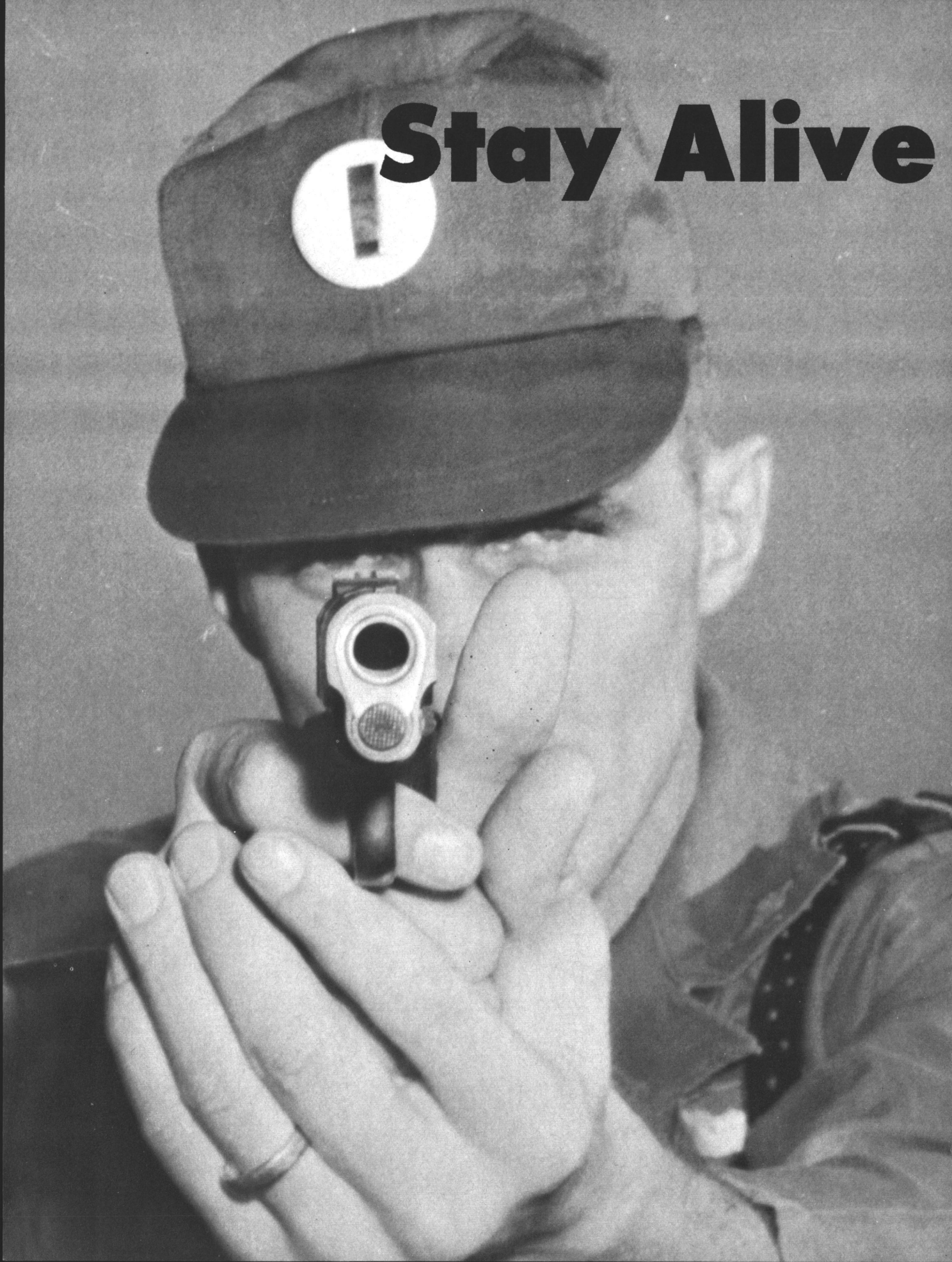
With the current modification of the external lights on the helicopter and if the mission is flown on a moonless night or in overcast weather conditions, enemy observers cannot see the air column until it is in the immediate vicinity. Diversionary landings in areas known to be free from enemy elements would possibly cause enemy forces to displace or orient their defense in a less advantageous manner. Of course, these areas must be within the vicinity of the objective.

Naturally, the landing zone has to be established with lights before arrival of the aircraft. Establishing a lighted landing zone depends upon the skill of pathfinder personnel. The practical and easy approach to this problem is to airland pathfinder personnel during daylight hours. At night, secrecy is best maintained by parachuting pathfinder personnel into the vicinity of the proposed landing zone. Secrecy is further enhanced by using a minimum amount of lighting in the landing zone and by waiting until the aircraft are on their landing azimuth before turning the lights on.

Pathfinders receive formal training in night assault operations, while aviators involved receive their training informally. This training must be conducted at unit level. The unit must emerge from its training cycle as a highly proficient team, and this team must be maintained regardless of personnel attrition. In other words, an air assault unit can never complete a training cycle as such, since "new" aviators are constantly being assigned as replacements for those who are lost through normal attrition.

Night assaults are not restricted to large open areas that provide excellent fields of fire for an enemy. Some experimentation has been conducted on pinnacle operations at night. Even in mountainous terrain and confined areas, night operations are still feasible. Time separation of aircraft is necessary to avoid congestion at the landing zone. The number of aircraft that can land at one time may be as few as two, depending upon size of the area. Time separation should be maintained at a minimum to ensure that a sufficient number of troops are landed to secure the area as rapidly as possible.

To summarize, night tactical operations with helicopters in formation is feasible and should be, in my opinion, the primary method of employing helicopters in combat. Night tactical helicopter operations can be related to driving an automobile after midnight. Driving at this time of night may seem hazardous, but the traffic is light. The same should be true for night flying. The enemy is least prepared and the flight of helicopters will be past his position before he musters enough firepower to present a problem. The enemy must rest, logically during the hours of darkness.


Stay Alive

With Your .45

CWO Ernie L. Greening

IT SEEMS THAT many people in service today do not realize the capabilities of the caliber .45 automatic pistol—or their potential with it.

In the November DIGEST article "Army's New Sidearm," Lieutenants Neverready and LTBA (Lucky To Be Alive) found themselves in dangerous survival situations. Lieutenant Neverready had only one sound arm and a .45 he could not operate. This spelled disaster. Lieutenant LTBA survived, but wound up eating grub worms because he could not kill a bird at four meters with his .45. If Lieutenants Neverready and LTBA had taken the time to develop their own potentials with the .45 their stories would have read like this:

* * *

Lieutenant Neverready crawled from his burning aircraft with a useless left arm. The sudden crack of rifle fire told him the enemy was closing in. Lieutenant Neverready eased his .45 from its holster and calmly hooked the rear sight in his belt and chambered a round. Using the raised sight technique he had practiced only last week (fig. 1), he was able to keep the enemy 100 yards away. This gave him plenty of time to reload by inserting a fresh magazine of 7 rounds into the weapon. Then, releasing the slide retainer, he was back in action in less than 8 seconds—*one handed!*

Lieutenant LTBA ate his last candy bar yesterday. Three days ago he climbed out of the jungle trees that snagged his parachute after he had bailed out of the burning aircraft. Most of his survival gear went with the plane.

He is hungry but happy. He has his fully loaded .45 automatic carried comfortably in his holster. He has six other magazines in issued holders—one of birdshot, one of flare and one of tracer for signaling, two of ball for large animals or enemy, and one of buckshot.

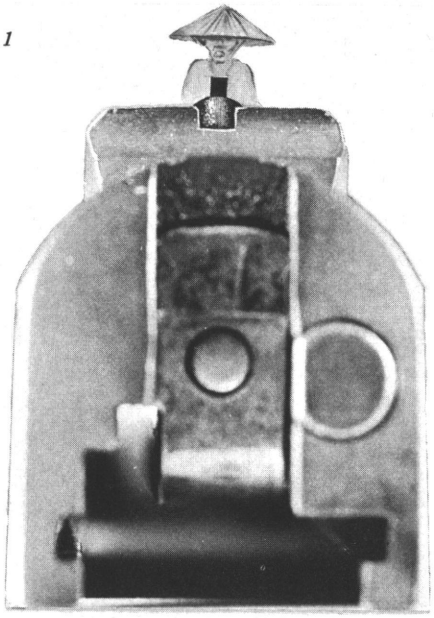
Lieutenant LTBA plans to use the powder from one round to start a fire after he shoots a grouse with birdshot. He knows he can start a fire by dumping the buckshot out, then firing into dry grass or, if available, gasoline soaked rags.

Twenty days later Lieutenant LTBA is picked up reciting "birdshot for turtles, rabbits, birds; buckshot for jacks, fox, coons; ball for larger animals; and tracers for signals. This .45 is a life-saver when you take the time to learn what it can do."

* * *

Let's take a closer look at the .45.

Figure 1



CWO Greening is rated a National Rifle Association Expert with rifle and pistol. He has fired on USAREUR pistol team, has six years duty as an MP and two as an infantryman with .45 as basic weapon.

One-handed operation of the .45 is very simple unless the user lacks imagination. The .45 can be loaded in many ways with one hand (fig. 2-5). Loading a fresh magazine is no trick either since the .45 stays open when empty. Merely eject the spent magazine with your thumb, lay the weapon in your lap, on the ground, or stick it in your belt or pocket. Using your good hand, place a full magazine in the weapon. The average man can load the .45 faster one handed than he can load the .38 revolver with two hands.

As for firing the two weapons with dirty, sweaty, greasy, or even bloody hands, the .45 will not rotate up and out of your hand. You do not have to cock the .45 each time to fire. Only a chosen few can fire a revolver double action and hit anything.

Critics of the .45 always mention jamming. I have only had this problem with wad cutter ammo, which the pilot most likely would not be using. I discussed jamming with several marksmen, military policemen, and a small arms gunsmith. If the slide is pulled all the way to the rear when loading the first round, 99 percent of firing line jams will be eliminated. It seems people don't pull the slide all the way back to give it sufficient inertia to seat the round. For every jam with the .45 an equal number of stoppages can be found with revolvers, which are plagued with rounds extending, bent firing pins and ejectors, bent locking cams which cause lead to be thrown out of the side of the pistol during firing, and dirt in the timing mechanism. Every weapon has stoppages.

Critics of the .45 also question the accuracy of automatics. But at the famed Camp Perry shooting matches, automatics are predominant and becoming more so every year. Why? Because of ease of handling and accuracy. Even policemen who use revolvers in everyday life are turning to "autos" for center fire events.

The .45 has an advantage in that its sights can be adjusted. If the shots are grouping out of target, say to left, the .45's sight can be moved with a drift pin, bringing the group to the center of the bull's-eye. This cannot be done with the issue revolver.

A pistol *is* difficult to shoot well, especially for those who are not particularly interested in it. But the advantages of a .45 automatic are many to the man who is willing to use it more than once a year for required qualifications.

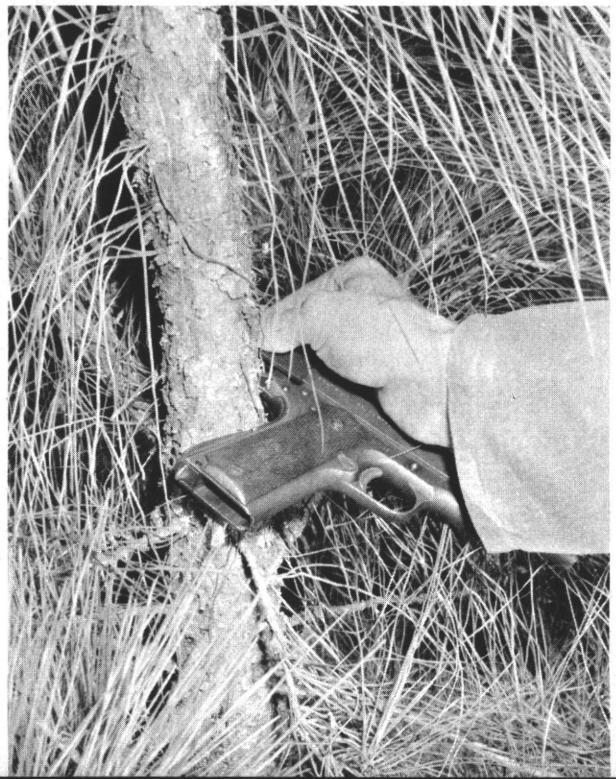
Everytime the .45 is discussed someone is bound to state, "I'm good with a rifle, but I can't hit the broadside of a barn with an automatic." Of course not! And probably he cannot fly every aircraft in the Army inventory, dance ballet, or repair a clock. Like firing the .45, these things require learning and practice.

Don't say "I can't shoot an automatic well." Say "I haven't taken the time to learn to shoot the pistol well."

Current training procedures for firing the pistol

Figure 2

Figure 3



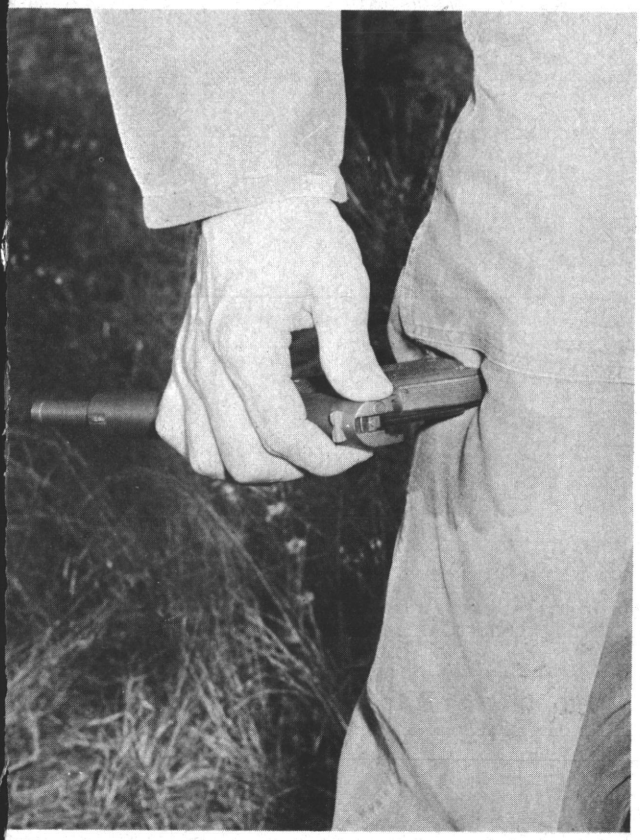


Figure 4

can be improved. Trying to tag a 6 inch bull's-eye at 25 yards with one hand extended with a heavy load is enough to ruin the morale of any would be Wyatt Earp. Try using two hands. A resting or kneeling position will greatly increase range and accuracy. The only time a pistol should be fired with one hand is for qualification or if the other hand is out of action.

When shooting a handgun assume the steadiest possible position for given situations (fig. 6-9).

At ranges over 75 yards use the raised sight picture illustrated in figure 1. To achieve this picture, raise the front of the weapon until the bottom of the front sight is aligned and centered with the top of the rear sight notch. This increases range and keeps the shots in a 3-foot circle at 100 yards. Practice this sight picture at the range. Use the prone position and rest your hands on a sandbag (or whatever is available) to practice firing at a 100 yard rifle target. When using a sandbag or other rest lay your hands—*not the weapon*—on the rest or the pistol will buck when fired. This also holds true when leaning against a tree or rock: place your hands, not the weapon, on the rest.

Take the time to do some dry firing. Shooting live ammo does not eliminate this need. Dry firing can be done in any amount of available space. A properly proportioned bull's-eye can be made to give a sight picture in a small room as well as on a range.

Figure 5

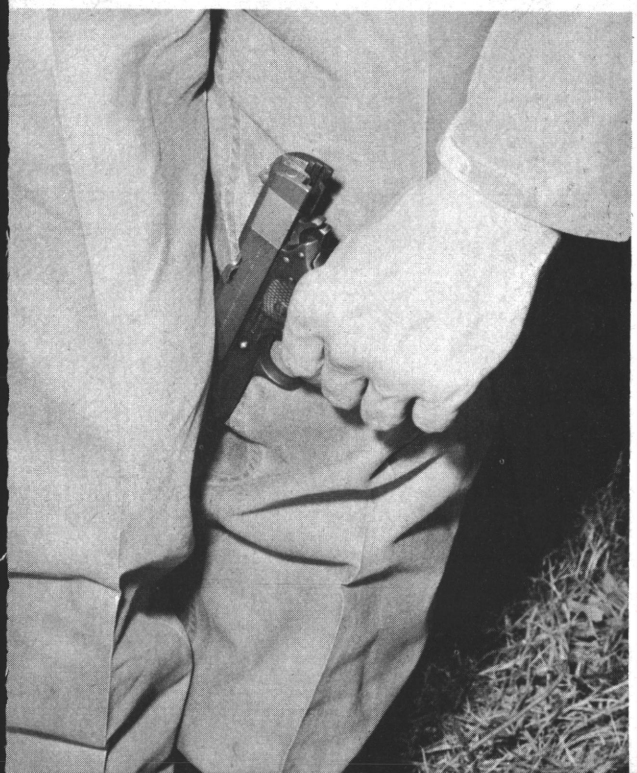


Figure 6. Prone: Both arms extended with the right hand holding the weapon while the left hand supports the right. This is the sturdiest overall position and affords the most cover in combat.

While dry firing, concentrate on the front sight and on trigger control. Any tendency to jerk or heel the weapon is picked up quickly. Some guard house lawyer types insist that dry firing will hurt your weapon. This is NOT SO. It holds true only in case of rim fire weapons. As long as it is DRY firing, no damage will be done to weapon or room. Most experts and masters dry fire their weapons several hundred times while preparing for a match.

The novice shooter believes subconsciously that good shooting comes from good weapons. This is not entirely true. A good shot can qualify as expert with any serviceable weapon in the arms room. And if he can hit a 12 inch bull's-eye at 50 yards, he can hit a man.

While shooting, concentrate on the sight not the target. Let the target be fuzzy. There is greater error with fuzzing sights than fuzzy targets.

Most aviators in a combat zone will have a shoulder weapon. His handgun is only secondary but could spell the difference between life and death, as in the case of Lieutenants Neverready and LTBA. The best sidearm? My choice is the .45 with its proved killing power. That's why the Army obtained it in the first place.

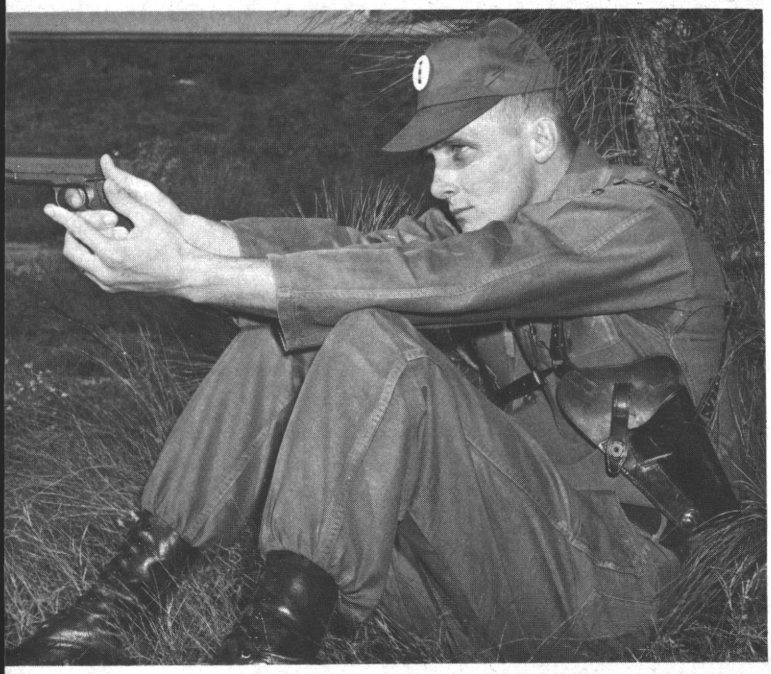


Figure 7. Sitting: Two hands hold the weapon with the arms braced on the knees and the back braced against a tree, rock, etc., if possible. This position is best in grassy or broken terrain where the prone position results in limited visibility.

Figure 8. Kneeling: Drop to one knee, brace the left elbow on the other knee. Grasp the right hand with the left. This position is used when time does not permit the prone or sitting. It should be practiced so that it can be assumed quickly.

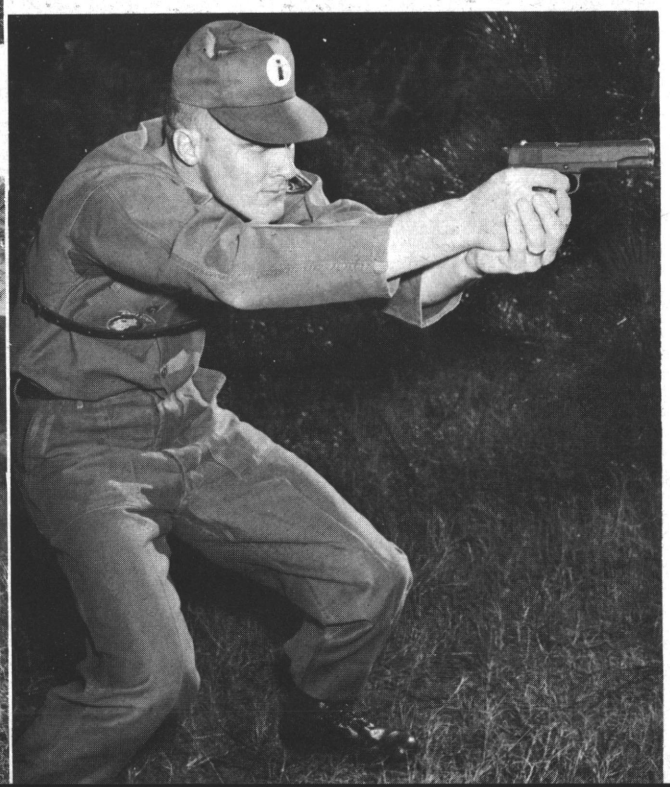


Figure 9. Offhand: Crouch with arms fully extended and the weapon held with the right hand and braced with the left. Since this is not the sturdiest of positions, it should only be used for hurried shots. The position of the hands and weapon cover the heart, chest, neck and lower face.

The fighting man's argot changes with the generations and the geography, the weapons and the war. Hearing the lingo of South Vietnam, the dogfaces, gyrenes and swabbies of World War II would hardly know Dodge City from the Boonies. A GI glossary, updated:

In the Boonies It's Numbah Ten Thou

Reprinted with permission from TIME magazine

DEP CHI rhymes with hep guy (the *ch* as in chap) means roughly that. It derives from *dep trai,* or handsome boy, which Vietnamese bar girls call all U. S. servicemen.

SAO (pronounced sow) also denotes what is sounds like: hog, jerk, liar or anything else derogatory—another bar girl contribution.

CHOI OI (as in the Yiddish expletive *oy oy!*) is an all-purpose Vietnamese phrase of uncertain origin, meaning, at best, good grief.

NUMBAH ONE (from pidgin English) means the best. NUMBAH TEN, until recently, meant the absolute worst. As the war has grown more arduous, NUMBAH TEN THOU' has come to describe a man or a circumstance 1,000 times worse than numbah ten, if possible—and far worse than MICKEY MOUSE, a versatile expression that labels an activity superfluous, unheroic, fouled up, or all three.

BOONIES, short for boondocks, is an unaffectionate term for the back country where the fighting and the living are rough. BOONIES NUMBAH TEN THOU' describes the Ia Drang Valley.

DAI UY, the Vietnamese rank of captain, is pronounced dye wee by Americans and used to designate anyone in charge of anything.

GRUNT is a current Marine Corps term for its infantryman.

DI DAI (rhymes with tree high) is Vietnamese for "O. K., go ahead," not to be confused with DI DI (pronounced dee dee), which can mean anything from "get out of here" to "follow me."

PEE is a piastre, the Vietnamese monetary unit; FUNNY MONEY and RED DOLLARS mean scrip issued U. S. personnel in lieu of dollars.

THUD is an Air Force onomatope for the F-105 Thunderchief, many of which have been shot down.

ZAP, or WAX, also onomatope, means to clobber.

DODGE CITY is Hanoi, where a pilot has to JINK (zigzag) to keep from getting zapped from the ground.

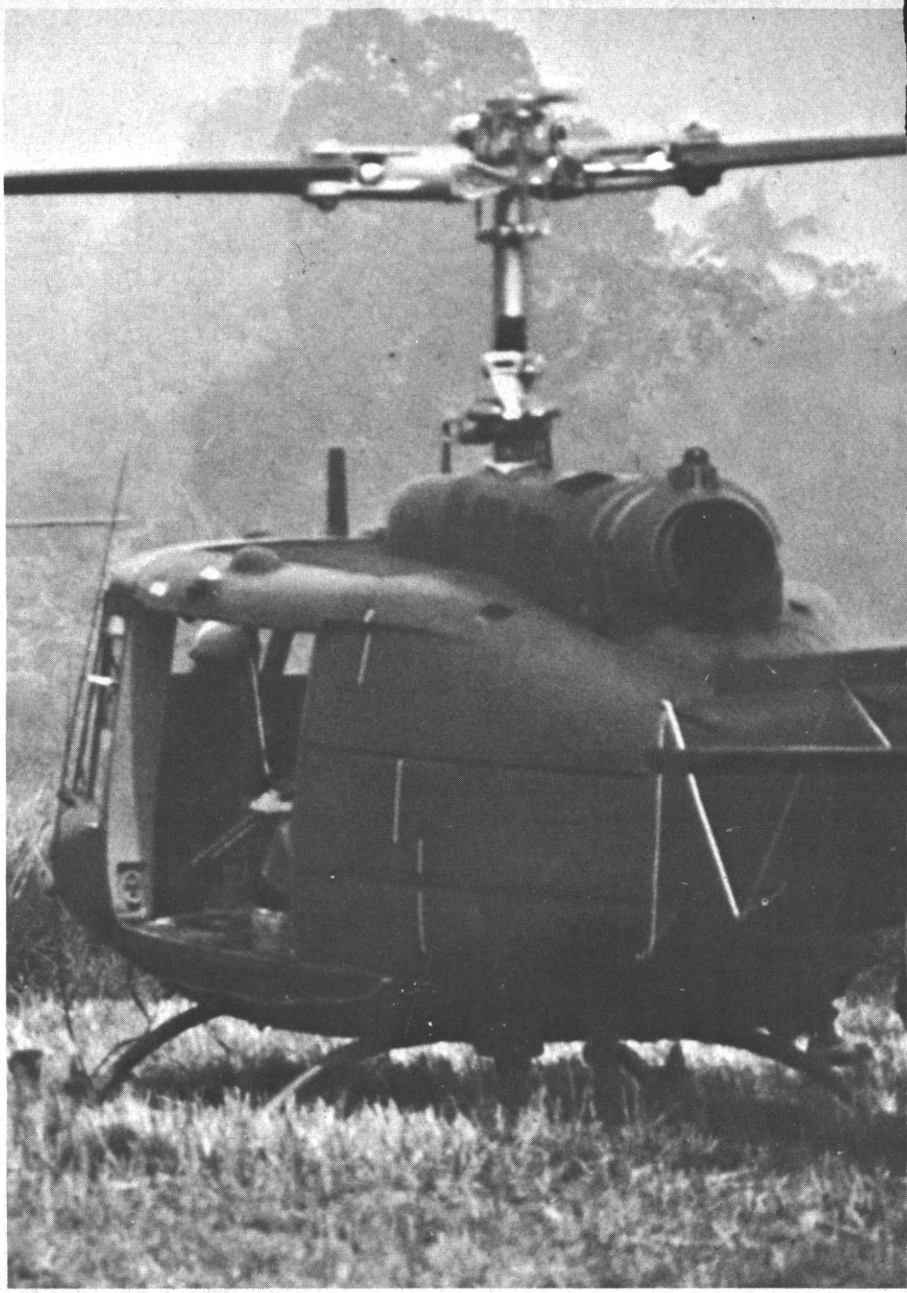
SHOOTOUT, by contrast, means flying straight down into heavy antiaircraft fire.

Single sideband communications equipment—history and development

SSB in the Army

Clyde A. Wilkes

Mr. Wilkes is a technical writer/editor in the Information/Orientation Office, Ft Huachuca, Ariz.



RVN-based Huey with familiar zigzag SSB radio installation

SOME CONTROVERSY has been generated by the relative lack of single-sideband (SSB) communications equipment within the Army, as compared with the other services and with its growing use in amateur radio circles. It is quite normal for members of any organization to be concerned with obtaining the latest and most up-to-date equipment for their unit. However, it would seem that most, if not all, of the controversy over SSB arises from a basic misunderstanding of the relationship of SSB to Army communications requirements. It is hoped that this article will set some minds at rest, on this issue at least.

Actually, the Army has been using some SSB equipment for many years, as well as actively engaging in programs to develop SSB equipment more suited to Army requirements. The relatively low rate of past procurement arises, primarily, from the nature of Army communications. Although it may seem contradictory, considering its worldwide deployment, some 94 percent of Army radio communications involves short range links, on the order of 40 kilometers or less.

Within this 40 km range, tactical radio links and nets form a dense concentration of electronic signals. This, in turn, produces

severe interference problems which require emphasis on interference reduction characteristics in the equipment used. For a variety of reasons, both technical and economic, this short range requirement is best filled by frequency modulated (FM) radio operating in the very high frequency (VHF) band (30 to 300 megacycles). VHF-FM, at these ranges, operates on a direct line-of-sight basis and does not rely on either ground or sky waves.

The longer range 6 percent of Army radio links requires an entirely different approach. When radio signals are transmitted to ranges beyond 40 km, they must be bent over the horizon. This can be done by either of two general methods: by using high frequency techniques of reflection and refraction in the upper atmosphere, or by low frequency ground waves which follow the curvature of the earth. It is in the latter approach that SSB becomes advantageous.

Let us now take a brief look at just what SSB is. The term "single sideband*" refers to a special form of amplitude modulation (AM). The more conventional AM transmitter, in very simple terms, transmits three frequencies: the carrier frequency and two sidebands, as shown in figure 1. Since either sideband contains all the information being transmitted, this system wastes power and band width.

In SSB transmission, figure 2, one of the sidebands is completely eliminated and the carrier frequency is partially suppressed or completely eliminated. This means that the transmitter power can be concentrated into the remaining sideband. The result is higher effective power and more efficient use of the frequency band. Interference reduction, which is more difficult in SSB, is not so important since this transmission range is considerably less congested.

The higher effective power of the SSB transmitter significantly increases the range of the ground wave. In tactical applications, this means much quicker initial contact when setting up on a new site, in addition to greater reliability and clarity of communications. This apparent suitability is not, however, the whole story and did not make it feasible for the Army to procure any great quantity of the SSB equipment available in the past.

Another factor enters the picture at this point. Most commercial SSB transmitters are designed to operate with a duty cycle of around 50 percent. This translated into something like the following: 2 minutes transmit for 2 minutes rest; with an absolute limit of 10 minutes of continuous operation followed by 20 minutes rest. Such limitations are, obviously, unacceptable for combat communications.

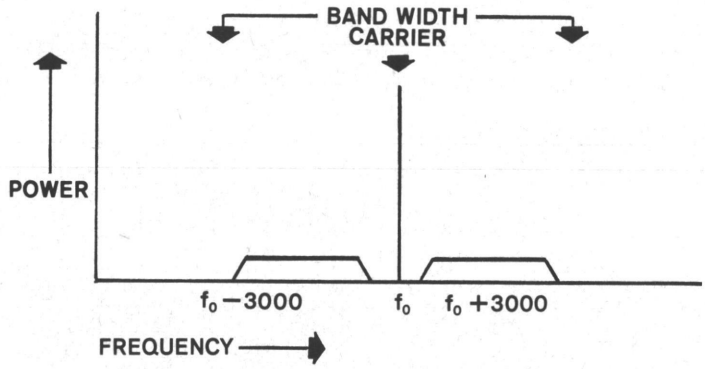
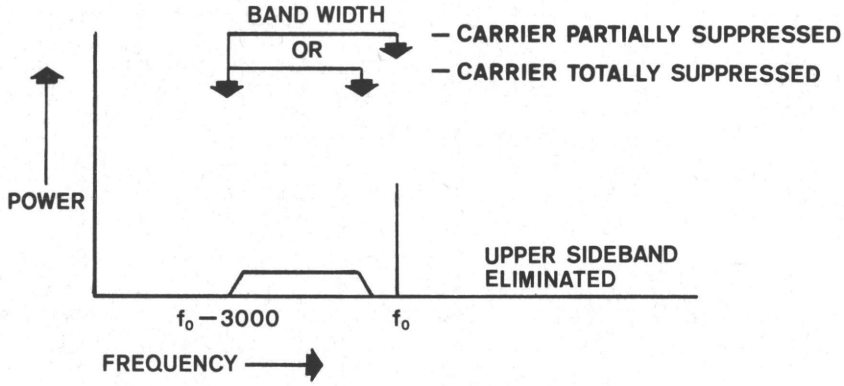
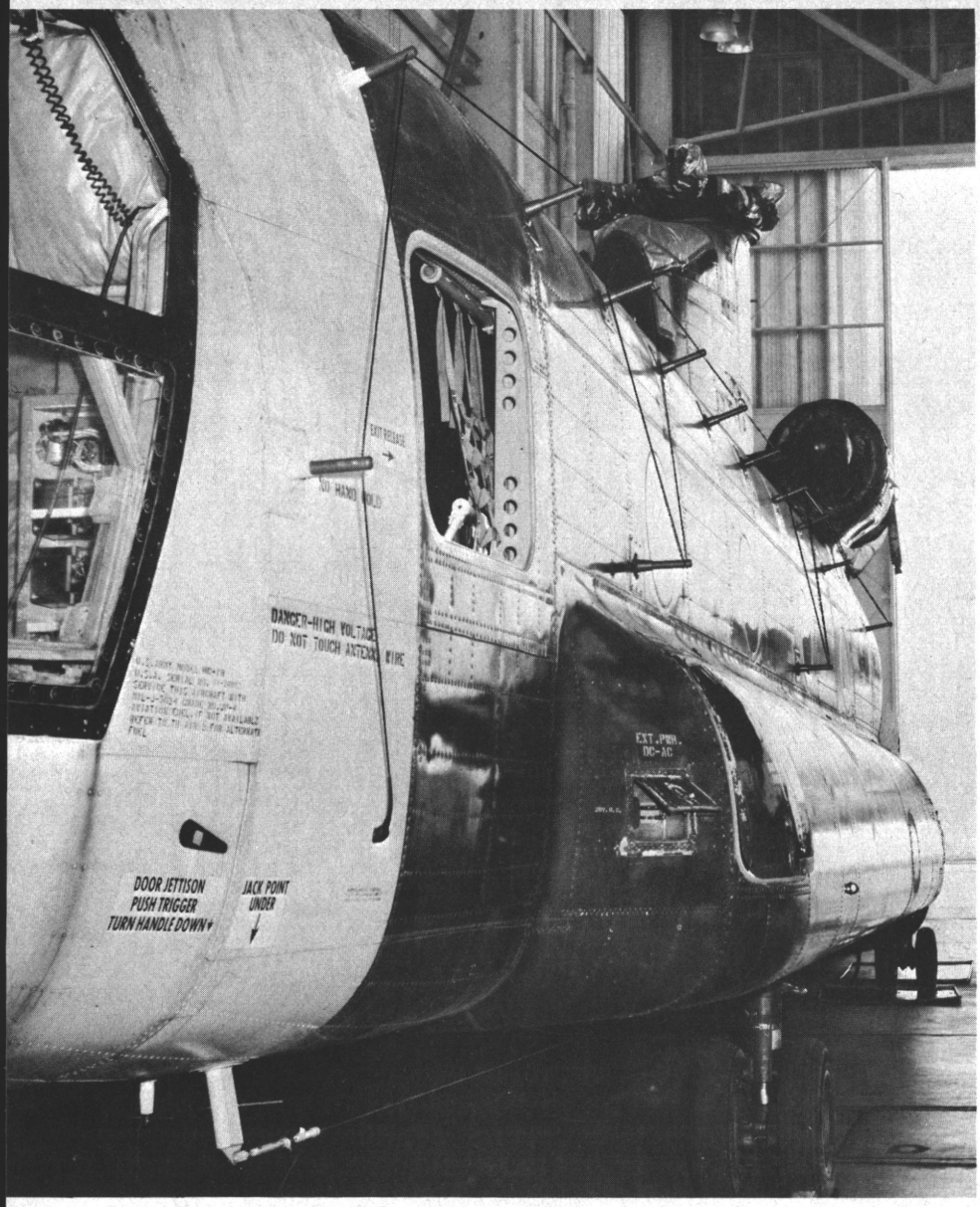


Figure 1. A simplified representation of power vs frequency distribution in a voice modulated AM transmission. The power content of the sidebands, as compared with the carrier, depends on the instantaneous amplitude of the modulating signal.

Figure 2. A simplified representation of power vs frequency in an SSB transmission. Little or no power is contained in the carrier and the band width is considerably reduced.



* A detailed discussion of SSB may be found in TM 11-685.



Single sideband antennae installation on Chinook

Development projects were initiated to enable SSB transmitters to dissipate and/or withstand the extreme temperatures generated by higher duty cycle figures. To accomplish this without significant increases in size and weight required extensive research and experiment, which is now yielding dividends.

The PRC-47, a limited duty cycle SSB transceiver which can be man-carried in the field, is already in use. Projects are under way to convert to SSB on the longer range AM nets now in use. It is expected that AM systems such as the GRC-26 will be replaced by SSB systems such as the GRC-106*, which is currently undergoing tests at U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz. It should be remembered, however, that this conversion will involve a very small percentage of Army radio nets and links. SSB will remain relatively scarce in Army communications.

Some work has also been done in Army airborne applications. For instance, early tests involving the 11th Air Assault Division brought attention to the need for longer range communications between forward assault units and rearward support units. Initial response to this need was the installation of ARC-102 radio sets on some of the larger aircraft of the Air Assault units. Long term response was the scheduled replacement of the ARC-102 by the ARC-98. Currently under development, the ARC-98* is a lighter, more compact SSB radio suitable for installation in medium aircraft and assault helicopters.

The Army has no need to apologize for its evaluation and procurement of SSB equipment. In those areas where SSB is suited for Army needs, substantial progress has been made. These areas are quite limited by the very nature of the Army's mission. Any future developments of SSB, making it more advantageous for Army use, will undoubtedly be integrated into the Army's stated policy of providing its fighting men with the best equipment obtainable.

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* The GRC-106 is one of a family of SSB radios planned for the near future. According to the AMC Fact Sheet of 15 Oct 65, these will include the GRC-108, -122, and -142, with VRC-2 and VSC-3.

* A Qualitative Materiel Requirement for SSB was prepared by U.S. Army Aviation Board in February 1960 and completed by U.S. Army Combat Developments Command Aviation Agency in 1963.

A survival vest, comfortably fitting, answers this aviator's need for a take-it-with-you survival kit

Now You Can Take It With You

Captain Marion L. Davis

IT WAS almost sunset, but the pilot figured that one more approach could be completed. As he made the turn to final in the Bird Dog, his instructor pilot explained that this small strip was used only during field exercises, since it was so tight. For this reason a landing at this particular strip had not been included on the flight plan.

A good approach caused the IP to abandon his idea of a go-around on short final and to complete the landing. Daylight time was getting shorter and wind did not appear to be a factor so the IP elected to take off in the opposite direction. As the airplane became airborne a gust of wind caused a drift to the right, and when about 20 feet above the ground the Bird Dog struck a tree. It was not only impaled in the tree but immediately caught fire.

Fortunately, both pilots were able to clear the aircraft and fall to the ground without receiving any broken bones. Both received second and third degree burns on their hands and faces. The burns were very painful but did not prevent them from running a couple of miles to the nearest road. Luckily, there they were picked up by a passing motorist and taken to the hospital. This story ended with little more than embarrassment for the pilots.

* * *

Let's assume for a moment that both aviators had been seriously injured in the crash. Their position was unknown, darkness was rapidly approaching, and neither pilot had any survival equipment. No lights to signal with, no matches or knives to start a fire, no bandages or medication for cuts or burns. Their overnight stay within 20 miles of post headquarters could have been miserable, if not fatal.

In Vietnam most people recognize the need for some items of survival equipment, and such aircraft as the U-1A, OV-1, and CV-2 have survival kits for each aircraft. The question that comes to mind under these conditions is, What happens if the pilot and aircraft are separated? In the OV-1 the survival kit is in the ejection seat. In most cases it will be available but the possibility still exists for it to be lost, especially if combat conditions warrant a rapid departure from the landing area.

To the best of the author's knowledge, no Army aircraft in CONUS have more than a first aid

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kit, and these do not include such needed survival items as a knife, fire-starters, signaling devices, etc.

After many flights over the good old U. S. the author has come to realize that in a great many places in this country survival would be every bit as big a problem as in Vietnam or Alaska. The many and varied possibilities of going down in a remote area without being able to advise an FSS or ATC are unlimited. Survival could be a life or death proposition right in your own backyard.

Since survival equipment is good only if it is available when needed, there is no better place to carry it than on one's person. How can this be done and not be bulky, uncomfortable and in the pilots way? A vest is one answer, with careful consideration given to what is needed for a one or two day survival situation.

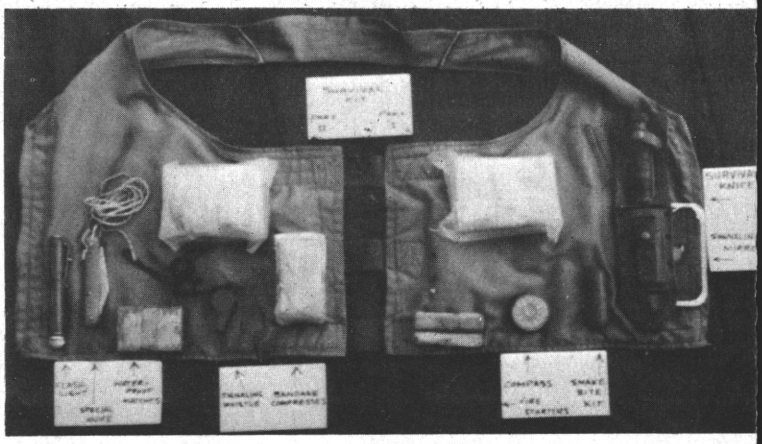
The survival vest proposed here has been worn comfortably in the O-1, U-6, U-1A, U-8, and OV-1. The backpack parachute and OV-1 torso harness both fit over the vest without discomfort. As could be expected, the vest is a little warm in extreme summer temperatures while the aircraft is on the ground, but it becomes comfortable once you are airborne.

The vest design, with all items of survival securely fastened inside it, will allow ejection from the OV-1 without fear of flying objects. This has been experienced by some Navy pilots who were carrying knives on their belts or in flight suit pockets.

Material for the vest was obtained from the local parachute facility. The outer cover is regular parachute pack material. Any type of material can be used for the inner liner and pockets for the survival items. The inside can be lined with orange parachute nylon in much the same manner as the issue flight jacket. This orange nylon can be seen for a great distance, and will enhance one's chance of being seen. Large zippers are used on the pockets and up the front. Elastic straps across the back ensure a snug fit.

The following items of survival equipment would be sufficient during a reasonable period of survival.

- The PSK-2 kits, which come in two parts and contain many items essential for survival. These kits are available in normal supply channels. (These kits are currently being replaced by the SEEK-I kits which also come in two parts.)
- A medium sized knife with sharpening stone. (I carry the standard survival knife issued by the Army and Navy.)
- A signaling mirror, which is available in the supply channel. This item is very important and has proved to be one of the most successful means of signaling passing aircraft, etc.
- Snakebite kit. Government issue kits are available in the supply system. (The kit I carry is a commercial brand which is very compact.)
- Compass. The Army compass (included in SEEK-I kit) is com-



Left: Outer cover of survival vest is regular parachute nylon.
Below left: Inside of vest can be covered with orange nylon which enhances one's chance of being spotted.
Notice large zippers for easy access and smooth appearance with survival items (shown below, right) inside pockets.

pletely satisfactory. All aviators will normally have a map, but the map will be more useful with a reliable compass. Your chance of survival may depend on moving from the crash site to a more accessible spot for pickup. In Vietnam, the jungle is so thick that navigation by the sun or stars is often impossible. A compass is a must. (My compass is small and sturdy and comes from the Navy.)

• Matches and fire-starters. Waterproof matches not only improve your signaling capability but also can keep you warm and allow you to cook your food. Fire-starter kits are available in the supply system.

• Bandage compresses. Bandages will allow for immediate care of cuts and burns. In addition, the compresses can be used for a tourniquet. Packages of bandage compresses are available in the supply system.

• Flashlight. A small reliable flashlight is useful for signaling as well as just being handy. (The small flashlight I carry has a red and white lens and is available in the supply system.)

• Additional items, such as the Mohawk knife with riser cutter, could be very useful. A whistle is useful for attracting attention if one is injured and can't move.

In Vietnam I carried additional water purification tablets, the individual flare kit, and two extra clips of .45 ammo, as well as the international blood chit.

Survival equipment is much like a life insurance policy—you hope you will never need it, but when you do it will be a wonderful thing to have around. Since the problem of survival will be yours and yours alone, whether it is in the jungle of Vietnam or the swamps of Georgia, every man should make it his own personal responsibility to be prepared to survive.

ARMY HELICOPTERS

in the Republic of Vietnam have flown more than 1,100,000 sorties since 1 January 1962, transporting more than 1,600,000 troops and passengers and 84 million pounds of cargo.

While meeting the heavy demands in Vietnam, Army helicopters have maintained an availablility rate higher than the Army's worldwide average. In the Republic of Vietnam the UH-1, the mainstay helicopter, averages more than 50 flying hours per month for each helicopter.

Experience in Vietnam also indicates that the helicopter is hard to knock out of action and recovers quickly from hit damage. Based upon over a million sorties in the last four years, the loss rate due to ground fire is one helicopter in every 18,000 sorties. The hit ratio is 1 in every 450 sorties, while the down ratio is 1 in every 8,000 sorties. The combat loss rate is one helicopter in about 13,000 sorties although there is difficulty in differentiating between combat and noncombat sorties since helicopters receive hits on both type missions. Because of the helicopter's ability to land almost anywhere even when disabled, more than half of those which are downed are recovered, repaired and returned to service. In more than 48 months of operation, 62 Army helicopters have been lost due to ground fire.

The helicopter has proved to be an extremely versatile vehicle capable of a wide range of missions with survivability well above earlier expectations. Combat missions performed include transport of troops into defended areas, transportation and rapid displacement of artillery units and armed helicopter escort. The escort helicopter, which evolved in Vietnam, has contributed to the low loss rate by providing protection for troop carrying helicopters en route to the objective and during the landing phase. Other tasks performed by helicopters include aeromedical evacuation from the battle areas, reconnaissance and surveillance. Resupply of isolated units and besieged villages by helicopter is routinely accomplished without the hazards of surface transportation. Helicopters have given combat units in Vietnam a degree of mobility and responsiveness not possible with other means.

Chinooks on deck of USS Boxer in Qui Nhon harbor. Blades were installed and Chinooks flown to 1st Cav Div area.

Problems of getting 1st Cav Div (Airmobile)

Over the Beach

Major Theo C. Watkins

THE MISSION: Go to Qui Nhon; organize and coordinate the off-loading of the 1st Cavalry Division (Airmobile). The sequence of events to follow is a matter of record. The operation is now consigned with pride into the history of the United States Army.

The Caribou groaned under the weight of personnel, rice, tape recorders, mail, and live pigs. But under the steady throttle hand of the lieutenant, who added a couple of extra inches of manifold pressure for retirement purposes, the lights of Saigon's Tan Son Nhut airfield soon disappeared. As we swung out over the South China Sea, "Old Charley" added a touch of welcome with a burst of tracer ammunition.

After a short stopover into the very short 1,400 foot strip at Camh Rahn Bay (at full gross plus), the trip on to Qui Nhon was uneventful.

A recon of the harbor at Qui Nhon revealed some interesting facts:

There was one landing ship tank (LST) beach, but all the LST were committed elsewhere.

The beach had a gradual slope

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which would accommodate lighterage but sandbars were approximately 200 meters offshore which would pose problems.

There were no piers.

The VC held high ground approximately 2 kilometers east of the harbor; their strength was unknown.

The main limiting factor was the early arrival of the northeast monsoon which had the sea pitching to an approximate 3 meter swell.

Assets to accomplish the 1st Cav Div off-loading, initially consisted of a newly arrived Transportation Terminal Battalion and a Quartermaster Group. Machine assets consisted of Landing Craft Utility (LCU), Landing Craft Mechanized (LCM), Barge Amphibious Resupply Cargo (BARC), Lighter Amphibious Resupply Cargo (LARC), and one light and one medium Transportation Truck Company.

A site for the 1st Cav Div (Airmobile) was selected on Route 19, towards Pleiku. A crack brigade from the 101st Airborne opened the road. In conjunction with the ARVN (Army Republic Vietnam) forces they provided convoy security for pre-positioning supplies in the selected site.

"Old Charley" played his favorite game of mining the roads, bridges, and sniping at individuals and vehicles. By the time a reaction force moved into the area, "Charley" had buried his weapon and reassumed the role of a peaceful peasant scratching his rice paddy with a pointed stick.

At the same time, the advance party from the 1st Cav Div started to improve the selected area. This consisted of back-breaking manual labor to clear the jungle growth. Officers and enlisted men worked 16 hours a day in this phase of the operation. Living conditions were austere.

A few days before D-day (arrival of main body, 1st Cav Div), the weather suddenly improved. The sea calmed and the ships started arriving. A civilian contractor restarted a 24-hour operation stopped by the weather to complete a marshalling area alongside the Qui Nhon airfield for the 1st Cav aircraft.

The actual off-loading operation had everything coming across the beach. The beach area became a beehive. LCU and LCM discharged personnel and cargo directly on the beach. Rough terrain forklifts loaded cargo on trucks. Convoys moved forward with increasing momentum in spite of increased VC action.

On the second day the Chinooks and Flying Cranes began passenger lifts to the divisional area. It was work, work, work. However, there were lighter moments, such as a troop load who marched off an LCU with flags flying and a bugler playing to be met by General Westmoreland and Ambassador Lodge.

In spite of limitations, previous troop off-loading records established during World War II and Korea were relegated a lower status in the history books. During a 7 hour period, over 2,100 troops came across the beach. On the third day the monsoon came back in earnest. Concurrently, the 101st Airborne located a sizeable force of VC. Helicopters of the 1st Cav Div were used in the operation. Casualty reports started coming in: the 1st Cav Div had cut its teeth in Vietnam.

This operation was one that will be studied by future service school students. In spite of many variables, the constant shortage of transportation resources, VC action, and other classified problem areas, the mission was accomplished. The aviation portion of the operation should inflate the chests of all who wear wings.

First Chinook to land in Republic of Vietnam

To South America for Maps

Major Hughey L. Weston

AN ASSIGNMENT to Colombia, South America, as an Army Aviator sounds exciting, doesn't it? But what are Army Aviators doing in South America, since Uncle Sam isn't in the habit of sending pilots on goodwill tours? Uncle Sam is financing this tour, but to earn it Army Aviators in Colombia are flying in support of one of the largest mapmaking projects ever undertaken.

Our area of operations extends over some of the most impressive and most difficult terrain in the world. Our pilots spend about 12 days of each month in the field in a job that ranges from nursing an Otter, Beaver or Bird Dog up to 15,500 feet over the mountains to taking an OH-23F helicopter into an isolated jungle pad surrounded by trees 100 feet high.

Bogota, capital city of Colombia and home base for the Colombia Project of the Inter-American Geodetic Survey (IAGS), sits at an altitude of 8,400 feet in a mountain basin. It is surrounded by the eastern range of the great Andean mountain

This 8,000 lb Bilby tower in the jungle south of the Guaviare River was carried in by helicopter in 17 trips. A crew of 10 erected the tower. Triangulation teams using lights from such towers observe angles at night.

chain that runs south-southwest from the Guajira peninsula alongside Lake Maracaibo to the border between Colombia and Ecuador. There it joins the western range to form one range extending on to the southern tip of South America. To cross this mountain range to the east, aircraft must climb to 12,500 feet on a clear day. If the day is cloudy as it normally is, 15,500 feet minimum is necessary for safe terrain clearance.

Fifty-five miles to the southeast of Bogota lies Villavicencio, gateway to the Llanos Orientales, the great plains region of Colombia devoted almost exclusively to cattle raising. Approximately 66,000 square miles of llanos, extending from the mountains east to Venezuela and the Orinoco River, are bordered on the north by the Arauca River, the frontier with Venezuela, and on the south by the Guaviare River.

At the Guaviare, terrain changes abruptly into dense jungle that continues south to the Amazon River and beyond. In the rainy season from May through December, deep wide rivers flow toward the northeast and north of one of these rivers, the Meta, the ground is covered with water, forming giant lakes. The average elevation here is 400 feet, but south of the Meta the ground rises to about 800 feet and flooding is not quite so extensive.

When the dry season begins in January, ranchers burn the crab grass to allow it to sprout again to furnish a more tender forage for their cattle. This burning is so extensive that during the months of January and February visibility is reduced frequently to one mile up to an altitude of 10,000 feet. Smoke spills over the mountains into the Bogota basin and so drastically reduces visibility that the Colombian Civil Air Authorities restrict flying to multiengine aircraft only. To a person standing on a hill at night, the horizon appears as a solid line of fire.

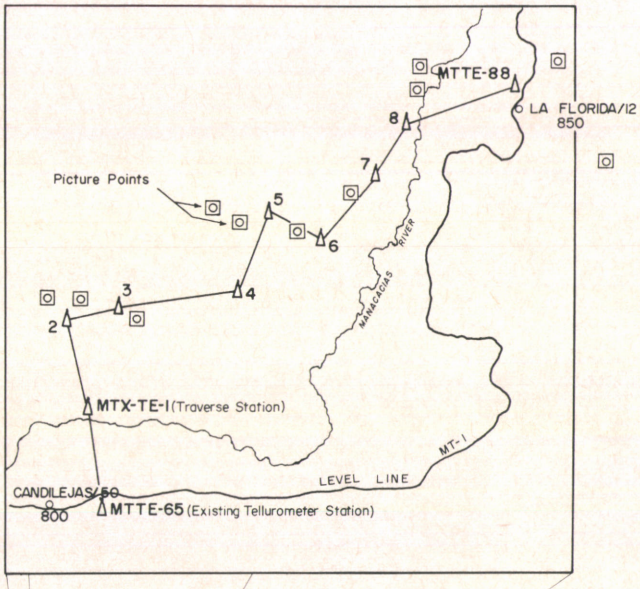
This vast plains area is traversed by only a few dirt roads. These afford travel during the dry season but become treacherous during the rainy season. Roads generally follow the high ground and cross low areas only when no other way is available. Low areas are traps to the motorist who travels these during rainy season in a vehicle not equipped with a winch.

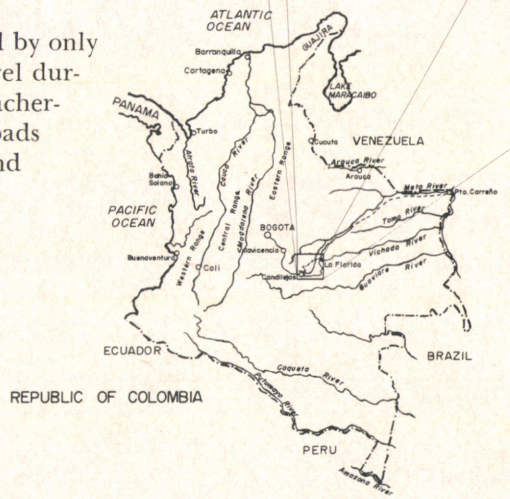
Along one of these roads about 140 miles southeast of Bogota lies a ranch called Candilejas, built a few decades ago by a Swedish gentleman who came to Colombia to make his fortune.

The nearest town of any size is Villavicencio 85 miles to the northwest at the base of the mountains, an 8-hour trip by jeep or 50-minute flight by Otter. A 4-hour flight to the east brings one to a town on the Orinoco River. Seventy-five miles east of Candilejas the ranches stop and the only humans you see are those living in the widely scattered Indian villages.

Late in July 1963, the Aviation Section of the IAGS Colombia Project moved to Candilejas with three OH-23F helicopters, an Otter and an O-1A to support the mapping activities of the Colombian

Map showing traverse from Candilejas to La Florida (map not to scale)





Crewchief makes tail rotor adjustments at maintenance facility, Guaymaral Airport, north of Bogota

Jungle helipad. Beaver flies cover for OH-23, SOP when operating with only one helicopter.

Instituto Geografico "Agustin Codazzi" in its endeavor to furnish accurate maps of Colombia.

These U. S. Army aircraft and personnel worked in this capacity under the terms of an agreement between the United States and the government of Colombia signed in 1946. (Sixteen Central and South American countries have similar mapping agreements with the U. S.) The reasons behind this agreement in a nutshell are: economic development of the host country by increasing the capability of their mapping organization and a supply of accurate maps for the host country and the United States.

To implement this awesome job, the Inter-American Geodetic Survey was established in April 1946 with headquarters at Fort Clayton, Panama Canal Zone. From here this organization controls the activities of the projects spread from Guatemala to Chile, an area of over 8 million square miles. The director of IAGS has the responsibility for the U. S. Army personnel, Department of the Army civilians, vehicles, equipment and supplies that are so widely separated from his Canal Zone headquarters. However he has direct radio contact with all projects and makes trips to projects at regular intervals.

Candilejas was picked as base camp because of its central location to a required triangulation arc. It was also selected to meet supplementary mapping control requirements that began at the Macarena and worked east 50 miles beyond Candilejas.

On 14 August 1963 we began supplemental mapping control work on 11 picture points scattered along a line 30 miles north of Candilejas to the northeast for 8 miles. A picture point is an identifiable image on an aerial photograph for which horizontal and/or vertical coordinates can be established. These positions and elevations are used by the photogrammetrist in his adjustment of blocks of aerial photographs, a very necessary step in the production of accurate topographic maps.

During the next 10 days, using helicopters to move personnel, instruments, gasoline and supplies for the construction of monuments and signals, and using the Otter to move drums of gasoline to an airstrip at the northeast end of the area, we completed tying in the 11 picture points. We brought our control from a tellurometer traverse that runs along the road through Candilejas for 75 miles to the east and then turns north along the same road

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for 65 miles to a ranch called La Florida, the point to which we closed in our traverse.

To bring control to the picture points, we established and monumented 8 auxiliary stations on a meandering traverse that ran for 100 miles (see map). We measured the river gradient at three points along the Manacacias River that flows east and north, roughly paralleling the tellurometer traverse 8 to 12 miles away.

Instruments used in this work were the Wild T-2 theodolite for measuring horizontal and vertical angles and the tellurometer, an electronic distance measuring device. Differences in elevations were determined with altimeters to allow conversion of the slope distance obtained by the tellurometers to horizontal distance. Wet and dry bulb temperatures were taken to allow corrections of the altimeters for meteorological conditions.

You might have guessed from the description of the llanos that facilities for aircraft operations were lacking. Many of the ranches had short grass strips that were generally overgrown with weeds and extremely soft during the rainy season. The only lighted paved strip east of the mountains was at the Colombian Air Force Base near Villavicencio.

Bulk fuel was available at Villavicencio and Cucuta and, on request, the major oil company would truck drum gas into these two locations. We moved it farther east by truck if there was a road and by aircraft if there were no roads. During one operation, we sent gas to a jungle helipad by canoe. Our 1,200 gallon gas tanker made the trip from Candilejas to Villavicencio and back in 2 days.

We carried the important spare parts from our basic load to the field camps but field maintenance support was a bit more complicated. Communications were maintained with Bogota and Panama through our high frequency radios. This allowed us to request EDP parts or field maintenance support when needed. Parts or personnel were sent from Panama by commercial air or flown in by aircraft of the 937th Engineer Company (Aviation) (IAGS) or the TC field maintenance unit. Response from these two units was timely, allowing down-time to be kept to a minimum.

Most of our work in support of the Colombian mapping activities was concentrated in the area around Candilejas until April 1964. Then we moved to Bahia Solano on the west coast for the preliminary sea level canal study through the jungle and swamps along the Atrato-Truando Rivers. Upon completion of this study, we moved back to the Candilejas area until December 1964. We are now plying our trade near Arauca on the Colombia-Venezuela border.

In years to come I am sure that old Army Aviators and retired IAGS engineers will recall Candilejas with pleasure, the fine hunting and fishing, the beautiful nights and the not too oppressively hot days when lines of towering thunderstorms rolled across the plains, reminding them that Mother Nature can sometimes be fickle. Occasionally they just might comment that there also was a helluva lot of work accomplished there.

Project engineer uses theodolite along the Guaviare River. Handkerchief is some protection against insects.

Colombian cartographer operates tellurometer in the field

All available transportation is used to get to picture points

WARNING

Tornado Season Ahead

HANG ON TO your hats, boys, tornadoes are on their way.

Records for the past 40 years show that more tornadoes occur in May than in any other month. The average number for May is 42 but sometimes there are many more. For instance, 120 were recorded in May 1953 and 232 in 1955. The average number of tornadoes goes down to about four in December and January. The national average is 240 a year with over half of them occurring in April, May, and June.

Tornadoes occur in many parts of the world but are more frequent in the central part of the United States. The center of activity begins in the southeast in February. It gradually moves northwest and by May is in Oklahoma, Kansas, and Iowa. In October the number of tornadoes starts to decrease and in February the whole process starts over again.

Tornadoes can occur at any hour of the day but most often happen after the warmest part of the day. Twenty-five percent of all tornadoes are reported between 1600 and 1800 hours.

They nearly always develop in the warm sector of a low pressure area between a cold and warm front. Tornadoes are the most violent of storms with winds in the vortex up to 300 mph.

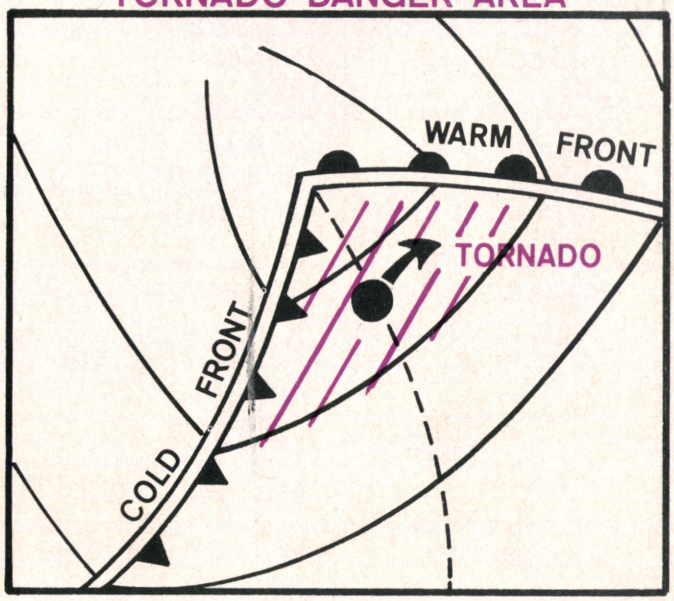
The vortex is about 1,000 feet in diameter at the top and extends downward from cumulo-nimbus clouds. They usually move east to northeast at about 25 to 45 mph.

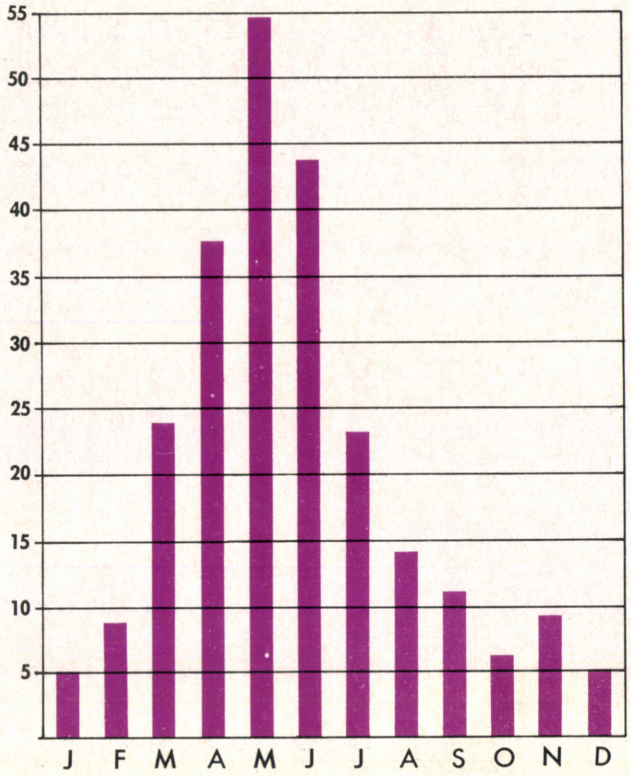
Avoid flying into tornado areas. Usually heavy thunderstorms and numerous other clouds are present and the probability of seeing a tornado while flying is exceedingly small. Remember, there have been some recorded cases of aircraft flying into tornadoes but almost no cases of them flying out.

Airfield operations officers should review their severe weather plans now and bring them up to date. These checks may ensure that your aircraft weather the storm.

Make sure everyone concerned is familiar with the plans and is aware of the importance of dis-

TORNADO DANGER AREA





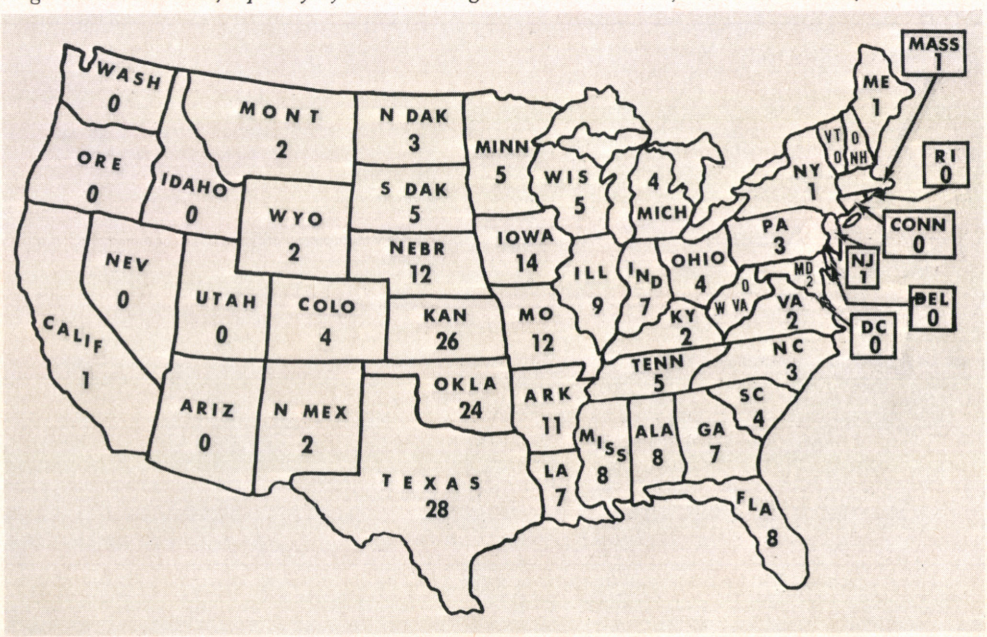
Average monthly tornado occurrence

seminating bad weather warnings promptly.

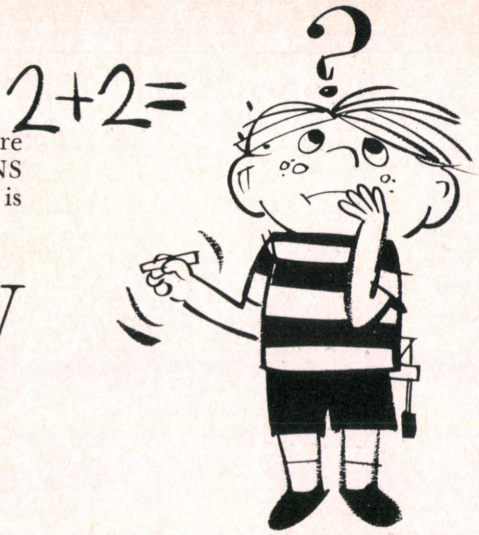
Check stacking procedures so that the best possible use can be made of available hangar space. Also check evacuation plans so that every flyable aircraft can be moved without unnecessary delay if this should become necessary.

Also, now is the time to inspect the physical equipment used to tie down or immobilize aircraft. Tiedown ropes should be checked for weak spots. Spoilers, particularly sandbag types, may have become rotten since last year. Replace them if necessary.

Average annual tornado frequency by states. Average based on a total of 11,053 tornadoes from 1916-1961.



More efficient teaching methods are being stressed by facilities at USAAVNS and USAPHS. One is



Teaching by TV

William H. Smith

THE RECENT announcement of an increase in student training at Fort Wolters, Texas, and Fort Rucker, Ala., has sparked a drive to improve the quality of training while decreasing training time and holding instructor personnel to a minimum.

Both schools are making plans along this line. For instance, they are installing closed circuit television to relieve instructors of some discussion duties and to improve the quality of instruction and increase standardization.

The educational television system at Fort Rucker will have three channels to permit simultaneous telecasting of three programs. Television receivers have already been installed in seventeen classrooms at the Aviation School, in both the new permanent classroom buildings and in several of the temporary buildings being used as classrooms. In addition, new classroom buildings now being constructed will have receivers.

At Fort Rucker, plans call for the use of instructional television in teaching many hours of the primary maintenance course, conduct of preflight inspections, conduct of cockpit checks, starting and runup procedures, and handling of inflight emergency procedures.

Other televised classroom instruction is being planned for the Department of Tactics and the Simulated Flight Division of Fixed Wing Training. Later, other courses will be included in the telecasts.

Fort Wolters will have a two channel system with receivers in all eight classrooms. As new classrooms are built, receivers will be installed. The subjects for television instruction at Fort Wolters have not been determined as yet; however, likely candidates are maintenance and flight instruction.

The two schools plan to go even further in their efforts to increase the speed and number of aviators who can be trained without too much of an increase in instructors. Recently Fort Rucker let a contract to develop a programmed learning sequence of instruction for the Helicopter Instrument Flight Course.

One of the problems in mass education is that the student is forced into one rigid lock step with the rest of the class. So many hours are set aside for study of this subject and so many hours for that subject. If a student is exceptionally gifted he can't go any faster than the rest of the class. If he is slow he can't get the extra instruction he needs to keep up.

Fort Rucker instructors hope that the use of programmed instruction, possibly connected with some semiautomatic teaching devices, will overcome this difficulty and allow for faster instruction where possible. Many large companies use programmed learning in teaching employees new skills and have found it remarkably effective.

Programmed instruction is actually one of our oldest teaching techniques, dating back to Plato. In this technique the subject is broken down into easily learned steps. The teacher makes the student take part by answering questions and engaging in the discussion instead of just listening to a monologue. Modern research and methods have sharpened and refined this procedure into a powerful tool.

If the American Institute of Research succeeds in successfully programming the Helicopter Instrument Flight Course, it will be the first learning sequence for an entire course in the U. S. Army.

The decision to try programmed instruction on a larger scale was taken at Fort Rucker only after much experimenting had been done to see if it was feasible. Parts of various subjects have been programmed and tested on students. In most cases, the student responded by shortening the learning time considerably.

Fort Wolters is also studying the possibility of using the programmed instruction method. They have made several tests and more are planned to determine advisability of adopting the technique.

At right is an example of a simple programmer. In this type the student is led through a series of small logical steps called frames. He fills in the blanks and turns to the next page. There he finds the correct answer and is stimulated to make another response.

In a more advanced type of programmer the frames are much larger and the student has more complex answers to give. If he responds correctly he advances to the next frame. If he does not give the correct answer he is referred to supplementary work until he is able to give the correct answers. In this way he is on his own and can advance according to his own ability.

When it's necessary to ditch the UH-1D remember it is not waterproof and will sink rapidly. It is necessary to clear the helicopter because it will _____. (sink rapidly)

Rolling the UH-1D on its right side with right-hand doors closed will provide the maximum flotation and escape period. To keep the helicopter floating long enough for you to escape, close the _____ -doors and roll the helicopter on its _____ side. (right-hand) (right)

New Trainer Device Tested

COLONEL E. P. Fleming, Jr., U. S. Army Primary Helicopter School commandant, tests the latest device to help train helicopter student pilots. P. C. Jacobs, inventor of the training aid, looks on. Called the Jaycopter Demonstrator-Trainer (JDT), it is a miniature captive helicopter that is connected to the controls by hydraulic lines.

Movement of the cyclic results in reactions identical to those in a real helicopter. Each movement is resolved into electronic impulses which are fed into the instrument panel and simulates a cockpit atmosphere. For safety, a plexiglass shield stands between the operator and main rotor. It is anticipated that the JDT may do the same for helicopter training as the link-trainer does for the fixed-wing program. Present plans call for experimental use with a limited number of helicopter students to determine its training effectiveness.

Captain Jack Walker

Scarcely had 1,175 STRAC paratroopers from North Carolina shaken the March snow from their boots before they were rocketing from USAF C-130B transports onto a sun-drenched drop zone in tropical Panama. How effective were they after this 2000-mile, 7½-hour flight? Commanders at all echelons must be aware of . . .

THE HIDDEN ENEMY

of Acclimatization

THE PARACHUTE assault was executed without a hitch. Although assembly along the jungle's edge was somewhat different from the numerous rehearsals along the pine forested woods of south Georgia, it too went as planned.

During the assault to the initial objectives it became apparent that the usual drive and aggressiveness of the troops was somehow strangely absent. Unit leaders noticed that it now took hours to move distances that had once taken only minutes. The dense undergrowth was a problem, but a much greater problem was silently affecting every man in the unit, acclimatization. This invisible enemy was draining the strength of trooper and commander alike. Suddenly, one of the world's best trained, best equipped, and most spirited fighting forces had been rendered a crippling blow.

* * *

We now envision dispatching troops from bases in CONUS to combat in far-flung regions of the world. Deployment is planned to take place in a matter of hours or days. This strategic picture is impressive, but to be realistic, consideration must be given to the physical shock of the men involved.

Although acclimatization to all climates must be considered in strategic planning, by far the most critical area is the tropics. No mere addition of special clothing or equipment can give the men the necessary edge required to meet the critical period of physical adjustment.

Acclimatization to heat can lessen environmental impact on a newcomer to a hot climate. During the process, complex physiological adjustments take place that allow the soldier to adjust to tropical conditions, move rapidly, and with less effect on his health than would otherwise be possible. A direct correlation exists between the method and duration of acclimatization used and the degree of success obtained. Methods of acclimatization fall into two main categories: artificial and natural.

Artificial acclimatization is accomplished through exposure in a "hot room," a chamber in which temperature and humidity are regulated to simulate the conditions of the assigned area. In tests conducted at Bethesda, Md., one group of subjects was exposed to "hot room" conditions for lengthening work periods on subsequent days, and another group for the same period every day. Both groups were assigned tasks requiring physical exertion and periods of rest while in the "hot room."

Artificial acclimatization was achieved relatively effectively in from 2 to 3 weeks. However, after daily exposure to the artificial hot climate was discontinued, the acclimatization began to lose its effect within 10 days and wore off completely in 6 weeks. It became apparent that to be conducted on a large scale, this method requires extensive equipment and results in many lost manhours of valuable training time. In artificial methods no effort is made to expose troops to native diseases of the anticipated area of deployment.

Natural acclimatization is accomplished by moving troops into an area similar in climate to the one into which the troops will be sent and exercising them by controlled steps of increasing load. During natural acclimatization, training can continue in military instruction and practice needed by the troops before they enter the combat area. This acclimatization process requires from 5 to 7 weeks for maximum effectiveness. The effect is usually lost after 7 or 8 weeks in a temperate climate.

British experiments indicate that nonacclimatized troops enter a tropical area at about 65 to 70 percent of maximum military effectiveness. During the first 2 weeks, as they are exposed to native diseases, particularly diarrheas, effectiveness drops to about 50 percent. Completely nonacclimatized troops reach maximum effectiveness after about 9 weeks in a tropical environment.

Artificially acclimatized troops enter the area at about 85 percent of maximum effectiveness, and in 1 week drop to about 75 percent as they also encounter native diseases. These troops reach maximum effectiveness after about 5 weeks. Naturally acclimatized troops enter the area at about 90 percent of maximum effectiveness. They are newly exposed only to native diseases and they reach maximum effectiveness after 1 week.

Similar experiments and combat experiences indicate that both natural and artificial heat acclimatization increase the effectiveness of forces fighting a tropical environment by reducing their vulnerability to exhaustion and disease. A comparison of both methods indicates the natural method to be superior in several respects. Final, more complete, and realistic training can be carried out. During natural acclimatization in the rear area of a combat zone, or in an area similar to the area of deployment, the troops may encounter most of the native diseases before going into combat and thus build some resistance to these diseases.

The 82d Airborne Division,

Capt Walker is Chief, Instructor Pilot Gunnery Qualification Section, Aviation Armament Division, Dept of Tactics, USAAVNS, Ft Rucker, Ala.

Fort Bragg, N. C., participates in an annual exercise in the Panama Canal Zone. This offers an excellent insight into a unit's attempts to counteract the problem of overnight deployment from temperate climates.

In the first two exercises, known as "Banyan Tree," one battle group departed Fort Bragg in temperatures usually in the 30s. About 8 hours later, after a nonstop flight into the Canal Zone, they jumped into temperatures in the 90s. The problem of acclimatization was apparent in the first exercise, and was reflected by both umpire and commander reports.

These problems manifest themselves in the inability of exceptionally well trained troops to perform in their normal manner. Cases of heat stroke and heat prostration were common. The most graphic evidence was that the troops just could not stand the physical strain required to perform such an operation. Only weeks before, these same troops had accomplished exercises at their home station requiring far greater physical strain.

After the experiences of Banyan Tree I, the 82d Airborne Division took steps toward troop acclimatization for Banyan Tree II. Troop sleeping areas were heated to very high temperatures at night, and most of the troops worked during the day in especially erected sweat tents. After deployment in the Canal Zone, this attempt was found to be of little value.

The 2d Airborne Battle Group, 504th Infantry, participated in Banyan Tree III. A determination to overcome the problem of rapid transition was met by a greatly increased physical training program. This program started 7 weeks before deployment. It included an increased calisthenics program, long runs, marches, and more rugged field training, with emphasis on physical endurance. Several companies of the battle group required an increased salt intake by the troops, starting one week before deployment. Detailed briefings were given to the troops on prevention of heat casualties, sanitation, and tropical living.

Awareness of the difficulties to come, coupled with the method of presentation of the entire exercise and jungle training to follow, resulted in a challenge to each individual and increased the appetite of the unit for the exercises to come.

The nonstop flight to drop zones in Panama was altered to include a two-day marshaling phase at Ramey Air Force Base, Puerto Rico, for all elements of the parachute assault echelon. Although short of the required acclimatization time, this period did afford mental adjustment to the climate and temperature that lay ahead in the maneuver area. The time in Puerto Rico also allowed the troops to prepare for the jump in a uniform more suitable to the climate than the one required by the Fort Bragg winter.

Special training before Banyan Tree III was well worth the effort

Highest possible efficiency of units ca
training is programmed — preferabl

expended; it resulted in greatly increased effectiveness of the participating unit. Umpires and instructors at the Jungle Warfare School spoke very highly of the rapid adjustment by the troops to their new environment. Cases of heat stroke were few, and unit effectiveness was maintained.

Can we expect to employ troops in vastly different environmental conditions and require maximum efficiency? Obviously not. But there are many means of reducing losses to climatic factors.

Before employment, acclimatization, preferably natural, will increase unit effectiveness. Should the tactical situation, time of deployment or logistics prevent natural acclimatization, other measures must be used. Immunization of personnel provides a direct approach to prevention of disease. When effective, it can provide almost absolute protection against the most common diseases. For protection against diarrheal and skin diseases, personal sanitation procedures must be carried out by the individual soldier and enforced by the chain of command.

Personal sanitation requires the following measures to prevent skin diseases, enteric infections, and ingestion of parasites:

- Body cleanliness and care. Keep the feet, neck, groin, and armpits clean and dry; wash hands; wear shoes and dry socks.
- Proper use of insect repellants and mosquito netting.
- Proper use of suppressive drugs to prevent malaria.
- Avoid contaminated food and water; prepare and eat meals carefully; and keep mess equipment clean.
- Proper waste disposal and water discipline.

The effectiveness of personal sanitation depends on the amount of accompanying area sanitation, the quality of the soldiers' previous training, and facilities for bathing and washing or exchanging clothes. Important is the strictness of enforcement of personal hygiene by unit commanders, especially with the difficulties encountered during combat and rapid movement.

A thorough indoctrination and detailed briefing, as to the problems anticipated in the area of operations, must be given to all personnel.

An increased physical training program should be incorporated into the daily life of the unit whose possible missions require worldwide deployment.

The world cold war posture dictates possible employment of United States forces on short notice to all areas of the world. This may require entry of units into areas of vastly contrasting climatic conditions.

We have many resources to help prepare our units to meet the hidden enemy of acclimatization. These resources must be used to the fullest if the commander is to expect an effective unit upon arrival in an area.

e expected when special acclimatization nder natural environmental conditions

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

aircraft ACCIDENT PREVENTION survey·1966

"Basically, the survey is nothing more than simple common sense expressed in the form of this rule: Look for everything which CAN cause trouble Get rid of it before it DOES cause trouble And see that it STAYS got rid of"

SURVEY SENSE
U.S. ARMY AVIATION DIGEST
August 1964

"Overruns on all runways need repair."

"Low shoulders and holes close to all runways and taxiways."

"Drainage ditch too close to taxiway and intersection with transit ramp."

"O-1 and U-6 aircraft parked in proximity to taxiway, making taxiway unsafe."

"Clear zones not established as required by TM 5-251. Terrain drops off sharply at landing pad in direction of takeoff pads. Clear zones contain wires, telephones poles, and trees. Attempts to prepare clear zones adjacent to field were inadequate. Lanes were cut in the trees, but tree stumps still remain, surfaces are rough and uneven, and cut trees still litter the area. Overruns on the west side of the field have a sharp 7″ curb at the departure end. Aircraft were seen to strike gear on the curb during takeoff."

"Records of refueling vehicles indicated last filter change was during July 1963. No record of required servicing or maintenance of filters kept."

"Refueling crews received little to no formal training."

"Refueling vehicles were not properly marked. One vehicle was not clearly marked with type fuel and another was marked with grease pencil on masking tape. No vehicle was marked to indicate whether fuel contained TCP."

"Facilities for obtaining local weather observations were not available."

"GCA approaches to one airfield rely on weather from another airfield several miles away."

"Clearance officer accepted and signed aircraft clearance (DD Form 175) when flight obviously could not proceed to destination on IFR flight plan without resulting in fuel exhaustion."

"Weight and balance clearance form (DD Form 365F) not required by clearance officer."

"Ambulance equipped for only minor injury patients."

"No survival gear available for issue."

"Fire bottles, chocks, and miscellaneous items of equipment were left lying around parking ramps. Designated storage areas were provided, but unused."

"Operations officer could not produce preaccident plan."

"GCA emergency radio inoperative."

"Operator in oil dump area found washing down pump with mixture of JP-4 and gasoline."

"First third of runway found very rough. It holds water and is deteriorating due to failure of subsurface or base."

"Infrequent contact between flight surgeon and aviators."

"Flight personnel observed in low quarter shoes, short sleeve shirts, and without gloves."

"No field diagram displayed in flight planning room."

"Local flying hazards not displayed in flight planning room."

"VFR transmitter out and no pilot-to-forecaster communications available."

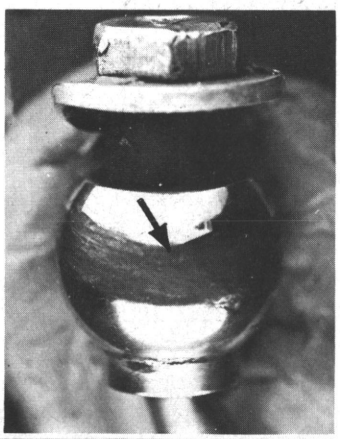
"Direction finding equipment inoperative."

"Medical corpsmen not trained in rescue from all types of aircraft located at airfield."

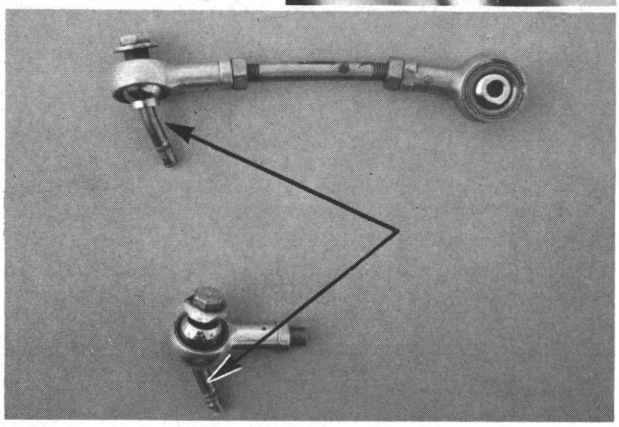
"APH-5 helmets not available for aircrew personnel."

"No running water in dispensary."

"No auxiliary power available for control tower."



Badly corroded ball of rod end caused bearing seizure



Absence of washers (arrows) did not cause bearing to fail, but could have prevented link failure and accident if safety of flight message had been complied with

"Control tower has no means of controlling taxiway and runway lighting intensity."

"Maintenance TMs have not been posted and condition indicates little or no use."

"Standard forms not available for use in scheduled inspections and maintenance."

"Maintenance TWX file is not current and maintenance TWXs have not been complied with."

"Discrepancies were not carried forward in aircraft forms. No record of corrections."

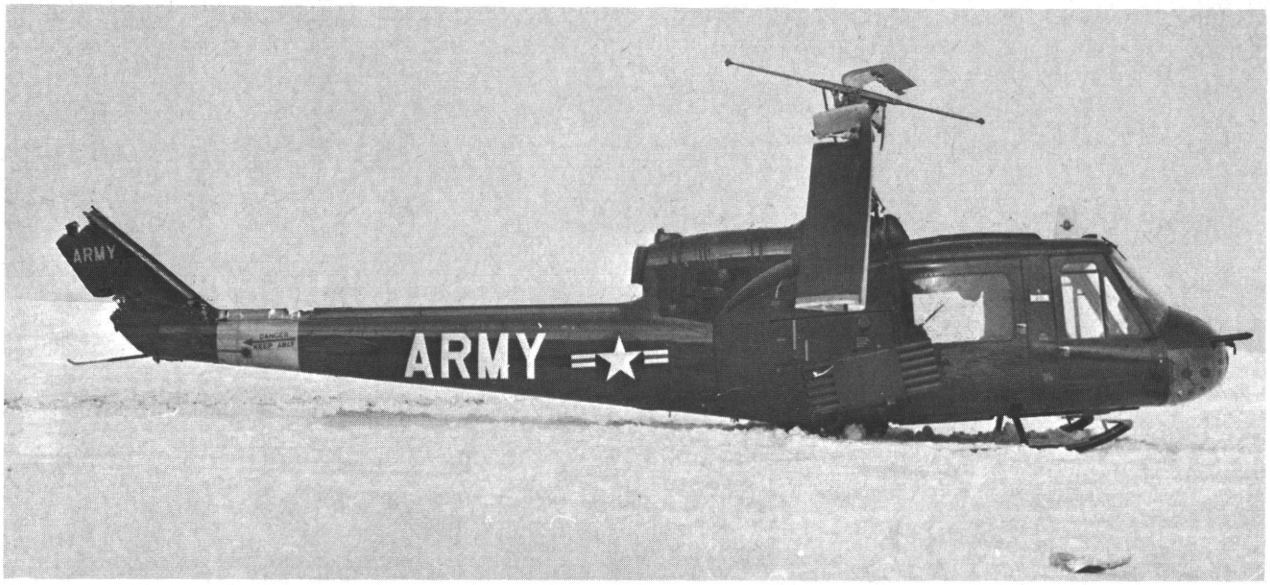
"No record kept of torque wrench calibration. Other precision tools are not maintained properly."

"Sample bottles not available for checking fuel samples."

All of these were recorded during the1965 aircraft accident prevention surveys. Past accident experience has proved that well planned prevention surveys will uncover discrepancies which if found soon enough and corrected will prevent accidents. Following are some of the 1965 Army aircraft accidents which could have been prevented by prevention surveys and effective corrective action:

Survey questions: *"Does the unit maintain a current maintenance TWX file? Is it separated by type, model, and series aircraft? Are the TWXs complied with upon receipt?"*

Accident: It was a night checkout training flight in a UH-1B, with an instructor pilot, pilot, and crewchief aboard. They were at an indicated altitude of 2,000 feet and the airspeed was 80 knots. Suddenly they heard a loud banging and grinding noise. The helicopter began to fishtail and vibrate



Huey came to rest upright after main rotor blades struck ground. Note absence of tail rotor.

severely. It dropped into an extreme nose low attitude and started a turn to the right. The IP took control, found that he had no tail rotor control, and entered autorotation. This stopped the turn and the IP found he could hold a straight ground course with cyclic.

The cyclic became mushy and the IP saw that he had lost considerable rpm. He rolled in throttle to regain rpm and the helicopter again fishtailed and turned to the right. When he had regained operating rpm, he entered autorotation once more. At that point, the pilot turned on the searchlight and the IP concentrated on finding a landing site in the snow below.

He kept 80 knots airspeed until he was at approximately 100 feet, then started to flare and reduce airspeed. The helicopter touched down with airspeed in a right turn and there was very little impact. The IP had in full right cyclic, but the Huey rolled to the left and the main rotor blades struck the ground. As the blades hit, it returned to an upright position and came to rest. There were no injuries, but damages to the helicopter exceeded $66,000.

Cause: Failure of the tail rotor pitch change link due to seizure of the rod bearing. The bearing path on the ball of the rod was found badly corroded. When the bearing seized and the link failed, the tail rotor blade was freed and developed a high propelling force, acting on the splined shaft, which drew out the hub retainer nut, followed by the tail rotor hub and blade assembly.

This was not the first accident of this type. A similar accident happened during October 1963. After the first accident, it was found that a washer placed between the pitch change link and pitch horn would prevent the bending of the link rod in the event of bearing failure. During November 1963, USAAVCOM sent a message to the field (AMCPM-IRFO-11-0228) calling for inspection of all tail rotor pitch change links and the installation of an additional washer below the rod end bearing before the next flight. This message was not complied with for the UH-1B which crashed 16 months after the safety-of-flight message was sent out.

Survey questions: *"Does the operations officer display an interest in flight safety promotion? Does the operations officer review DD 175s and local clearances and issue clearances?"*

Accident: An aviator requested a U-6A for night flying to accomplish portions of hood and night annual minimums. He was assigned a copilot and a flight to deliver a helicopter repair part to a destination 135 nautical miles away. He was given a sectional chart showing his destination and instructed to fly over the town to alert the helicopter crew before landing at the airfield.

The pilot and his copilot went to operations to file their flight plan and the pilot decided to file a composite IFR and VFR flight plan. He completed his flight planning at approximately 1625 hours. En route time was estimated to be 1 hour and 30 minutes, with a departure time of 1700 hours. At 1630 hours the flight plan was presented to the assistant operations officer at base operations. He checked, approved, and signed it.

They took off at 1702 hours and the flight proceeded on schedule to their destination. When he arrived over what he believed to be the destination airport, the pilot made the requested passes over the town and flew on to check out the strip he had selected. He made two passes over the field, the lowest of which was approximately 400 feet above the surface.

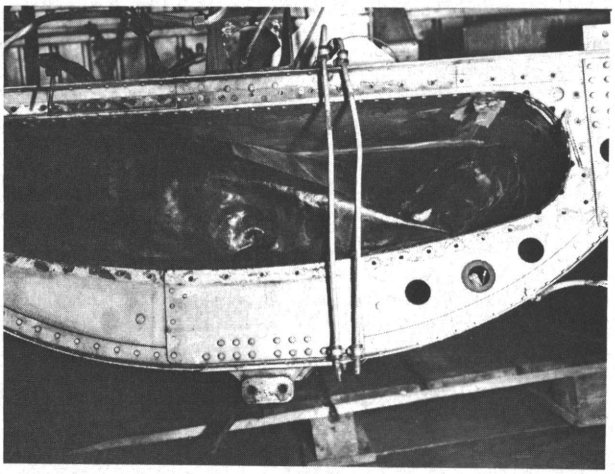
He established his approach for a landing to the west and the Beaver touched down in a slight tail low attitude, rolled 270 feet, and the right main gear struck a concrete drainage pipe cover. The gear folded back parallel to the fuselage. The propeller struck the ground and the airplane came to rest after traveling an additional 94 feet. Neither pilot was injured, but the U-6A sustained major damage.

Cause: It turned out that the town was using another airport several miles away and the airport

Beaver hit concrete drainage cover during night landing at unlighted, uncontrolled airport

the pilot landed on was undergoing repairs. This was not known to base operations at the home airfield as a NOTAM had not been issued. The accident investigation board concluded that the primary cause of this accident was failure on the part of the pilot to devote adequate attention to the flight factors of official sunset time, destination facilities, and reconnaissance of an unfamiliar and uncontrolled airfield.

The board listed as a contributing factor: "Approval by base operations personnel of a flight plan filed to an unlighted, uncontrolled airfield with an ETA approximately 30 minutes after official sunset."



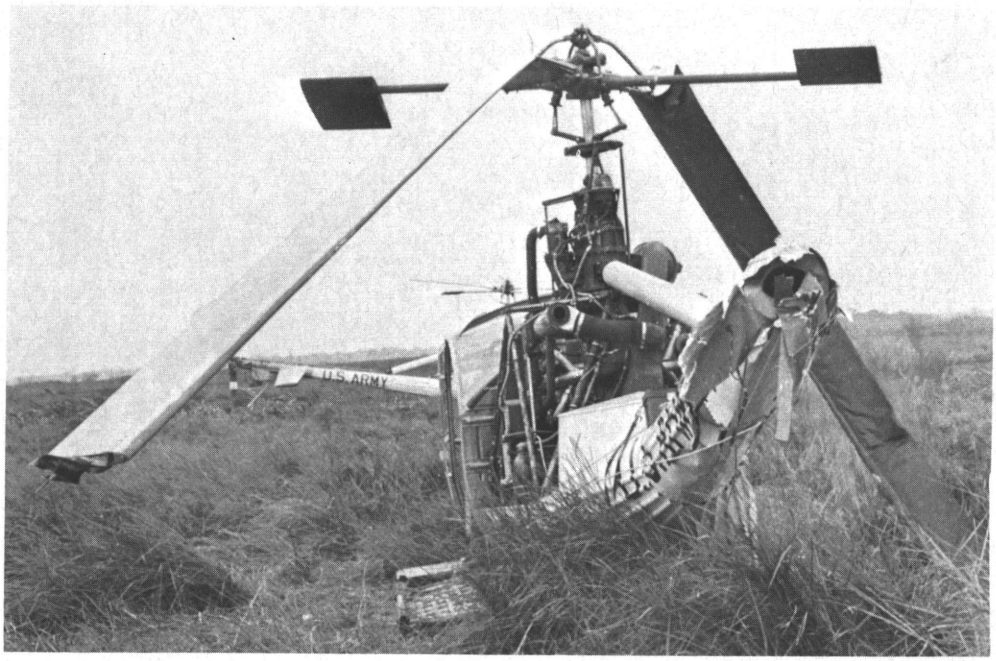
Collapsed fuel cell reduced tank capacity by 8 gallons and caused fuel exhaustion

Survey questions: *"Are checkout requirements for each aircraft specified in writing, to include hours and maneuvers? Is a pilots' training file available for each type of aircraft? Is a pilot standardization board set up and functioning? Are frequent safety-of-flight spot check inspections performed by supervisory and quality control maintenance personnel? Do the aircraft forms show all discrepancies and are these discrepancies promptly corrected?"*

Accident: An OH-23F aviator was completing a 1 hour and 50 minute reconnaissance flight at 250 feet when he heard a decrease in engine rpm. He started a precautionary landing, regained engine rpm, and continued a powered approach. At about 150-200 feet, the engine failed and he entered autorotation.

Touchdown was made in level attitude with an estimated speed in excess of 20 knots. The helicopter traveled in a straight line for 104 feet, then the tail came up and the main rotor struck the ground and tail cone. The helicopter spun 100° to the right and collapsed both skids. The aft section of the tail boom, the tail rotor gear box, the tail rotor, and the battery were thrown 70 feet. The pilot and his passenger escaped injury, but the helicopter was damaged beyond repair, at a cost of $75,341.

Cause: Engine failure was caused by fuel exhaustion due to a collapsed fuel cell which shorted



Helicopter was severely damaged. Pilot had not practiced low level autorotation or autorotation to touchdown for 14 months.

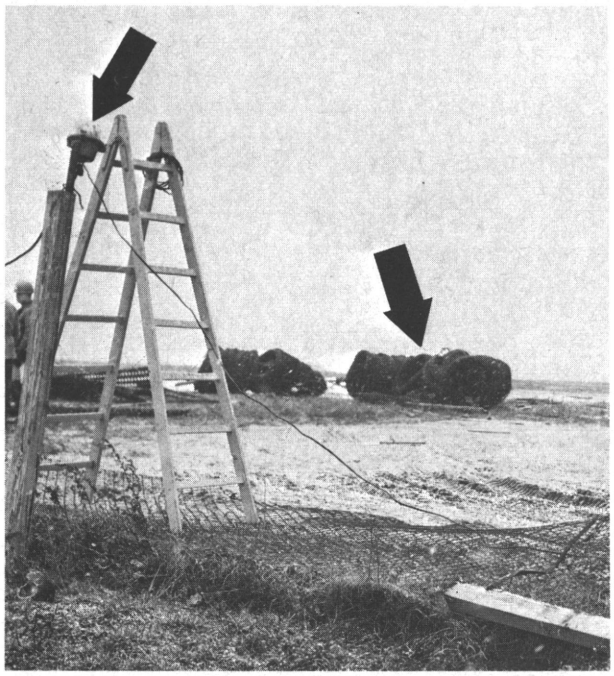
the capacity of the tank by 8 gallons. The fuel gauge was inoperative and the pilot had no way of knowing that he did not have a full load of fuel at takeoff. DA Form 2408-14 for this helicopter showed that the wrong type connectors were installed on the fuel probes. *This item was carried forward for 9 months through four periodic inspections.*

The pilot's decision to make a running autorotation to an unknown and unimproved area, and his failure to comply with approved autorotative procedures were listed as primary causes for the accident. *He had not practiced low level autorotations or made an autorotation to touchdown since he had been transitioned into the OH-23F 14 months prior to the accident.*

Survey questions: *Are clear zones observed? Is clear zone in compliance with criteria? Is clear zone preparation satisfactory? Is there an overrun area? Is the overrun in compliance with standards? Are POL dumps in compliance with clear zones around them?*

Accident: An OV-1C approached the airfield from the east at 1,000 feet for a landing on runway 28. The pilot flew parallel and to the right of the runway, then made a left turn across the runway and entered a left downwind approximately 1,200-1,500 feet from the approach end.

He made a steep left turn to final and, immediately after rolling out, saw that he had a high rate of descent and would not make the runway.



Left gear hit obstruction light on pole and was knocked off by impact with rolled wire as aircraft crashed through fence

Mohawk came to rest off left side of runway after landing short in POL area

crash sense

Realizing that applying power would not prevent the airplane from touching down short, he closed the throttles and placed the Mohawk in landing attitude.

The left gear hit an obstruction light mounted on a 7 foot fence post. The airplane then touched down 52 feet from the fence post in a POL storage area. It rolled forward and crashed through a barbed wire fence. Immediately after it knocked the fence down, the left gear struck a bundle of 28 rolls of concertina wire and was torn out of the wing. The Mohawk continued on a straight course for a distance of 998 feet, then turned 90° left and came to a stop. The pilot escaped injury, but damages to the OV-1C totaled $186,592.

Cause: The cause of the short landing was the steep angle of bank used by the pilot to align himself with the runway when he saw that he was overshooting the runway during the turn from base to final. This caused a high sink rate and resulted in the short landing.

Here is what the aircraft accident investigation board had to say about the POL dump:

"Even though the aircraft touched down 468 feet short of the runway, no significant damage would have been incurred if the area had been free of obstructions. The POL storage area in this location presents a safety hazard to aircraft landing on runway 28 or departing on runway 10. If any aircraft should lose power on takeoff and crash into the POL area when POL tankers are present, not only would there be a loss of life, aircraft, and POL tankers, but the probability of extensive damage to buildings close by would be high.

"The board was informed that two hours prior to the crash, a 5,000 gallon aviation gasoline tanker was parked in the exact spot that the aircraft made initial touchdown. The right wing of the aircraft cleared a 5,000 gallon tanker by approximately 25 feet when it touched down. It was the unanimous opinion of the investigation board that this POL area should be relocated."

Survey questions: *"Are MWO, TB, and TM compliances kept up-to-date? What action is taken if compliances are not up-to-date?*

Accident: A CH-34C, with two passengers and a crew of three aboard, departed one field site en route to another field site.

Approximately 5 minutes after takeoff, the IP noted abnormally high manifold pressure readings and checked the mixture control and carburetor and cylinder head temperatures. The mixture was full rich and the temperatures were normal. A few seconds later, the engine began to run rough and made chattering metallic noises. The engine rpm dropped to 2000 and the IP entered autorotation. He made a 90° right turn toward a narrow valley in the mountainous and heavily wooded terrain below.

The engine appeared to be running smoothly at approximately 1200 rpm and the IP increased the throttle until the rpm reached 1900. At that point, the engine ran rough again for a few seconds, then failed completely. The IP made a 60° autorotative turn to the left toward the bottom of another narrow wooded valley and a dirt road which lay at the base of a steep hill to his left. The helicopter touched down on the road, severed its tail cone, rotated 110° to the right, and came to rest in a gully beside the road. All aboard escaped injury. Damages to the Choctaw amounted to $110,000.

Cause: This accident was caused by failure of the articulating rod in no. 6 cylinder. Rod failure caused extensive damage to the skirts, connecting rods, and pistons of four cylinders. Both halves of the crankcase were extensively damaged. Maintenance records for this helicopter showed seven MWOs overdue for compliance. Some were more

Engine failed over heavily wooded mountainous terrain. MWO for installing magnetic chip detector and warning light had not been complied with.

than two years old. Among these was an MWO calling for the installation of an engine magnetic chip detector and cockpit warning light.

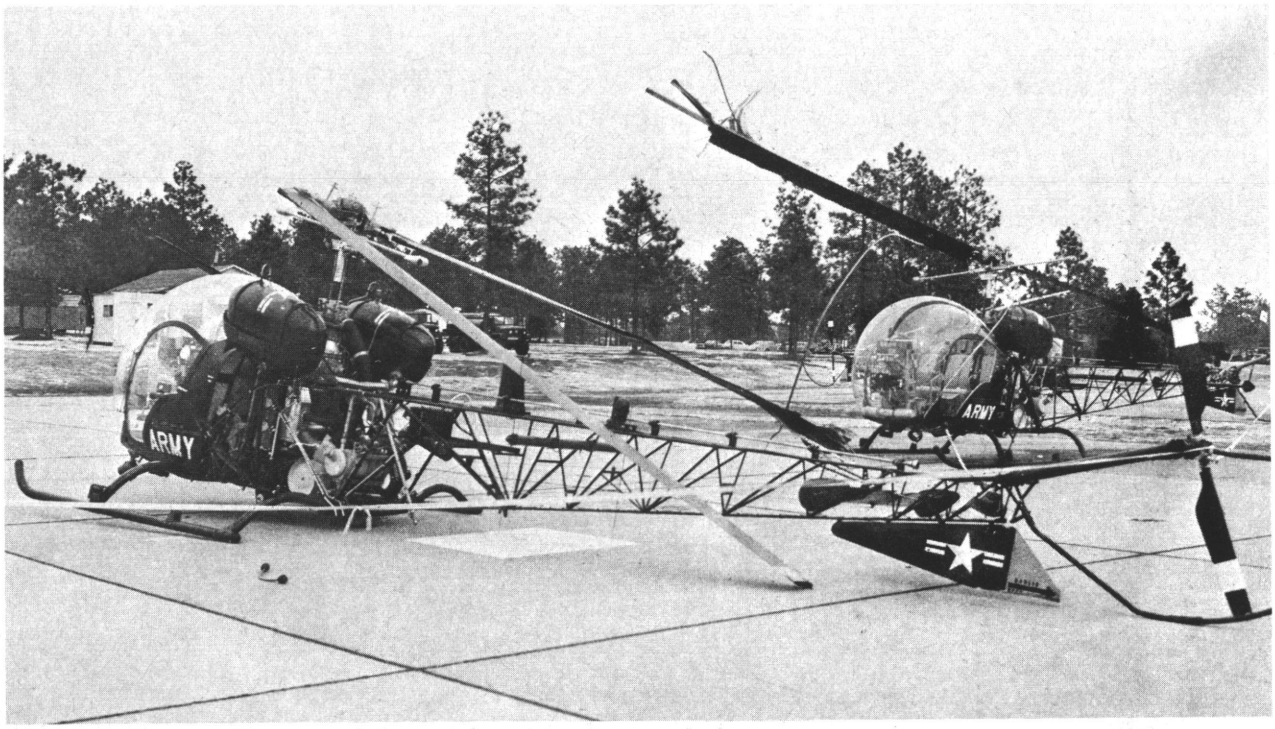
Survey questions: *"Are the types, strength, and sizes of parking areas and aprons suitable for assigned aircraft? Visiting aircraft? Is clearance from edges of aprons to fixed or movable obstacles as set forth by criteria? Are proper hand signals used by alert personnel for taxiing and parking aircraft?"*

Accident: An OH-13S pilot returned from a flight and found his designated parking spot occupied by another helicopter. The crewchief saw the pilot hovering past and looking for a place to park. He ran out to an adjacent helipad, attracted the attention of the pilot, and pointed to the spot that was picked for him to park. He did not attempt to guide the pilot because, in his words, ". . . Each pilot usually has his own preferred way to approach."

As the pilot attempted to hover between two parked helicopters, his main rotor blades struck the main rotor blade of a parked OH-13S. There were no injuries, but damages to the two helicopters totaled $27,710.

Cause: Pilot attempted to hover between two parked OH-13s with an available lateral hovering

past accident experience has proved that well planned prevention surveys will uncover discrepancies which if found soon enough and corrected will prevent accidents



Main rotor blades of hovering OH-13S (left) overlapped main rotor blade of parked OH-13S

clearance of 29′ 10½″. The rotor diameter of the hovering helicopter was 37′ 1½″.

Survey questions: *"Is current weight and balance data maintained on all assigned aircraft? Do crews plan flights properly?"*

Accident: A UH-1D was the lead helicopter in a platoon of four which had just landed to pick up infantry troops. After eight men were loaded, the helicopter got off the ground, but was unable to take off due to a decrease in power and rpm. One soldier was off-loaded and the Huey started again. The pilot attempted to pick it up and make a cyclic climb, gaining airspeed.

When he reached the end of the helipad, the terrain dropped off fast and he suddenly found himself at treetop level with not enough power or airspeed to maintain flight. A main rotor blade hit a treetop and the helicopter started down. The pilot flared at the last moment and settled into trees about 500 feet beyond the end of the helipad. The pilot sustained serious injuries and the aircraft commander and one passenger sustained minor injuries. The Huey was destroyed at a cost of $206,632.

Cause: The primary cause of this accident was found to be supervisory error by the aircraft commander who directed the pilot to take off after the pilot recommended that more weight be removed. Gross weight of the helicopter at takeoff exceeded the –10 recommended maximum gross weight by 272 pounds.

Survey questions: *"Are pilots given periodic briefings on the latest techniques and procedures? Are aircraft operator checklists available? Are they used?"*

Accident: A U-8D pilot made a straight-in approach to runway 36, but received no indication that the right main gear was down and locked. While still on the approach, he recycled the gear and got the same indication.

Continuing the approach, the pilot made a touchdown on the left main gear and nose gear to determine the status of the right gear. He felt the right gear give way and made a go-around, attempting to use the emergency procedure to pump the gear down.

When he landed the second time, the right gear collapsed and the airplane swerved off the right side of the runway. Damages to the U-8D amounted to $3,245.

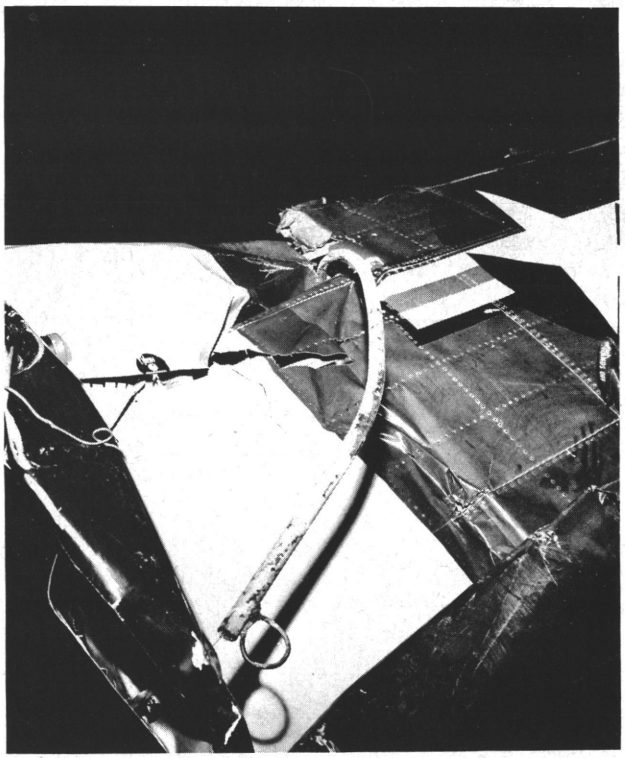
Overweight UH-1D burned after settling into trees during attempted takeoff

Collapse of right gear and accident could have been prevented by use of checklist and correct emergency gear extension procedure

Cause: At no time on his initial approach did the pilot have an indication that his right gear was down and locked. He had enough fuel aboard to remain in the air and use the correct emergency procedure for lowering the gear, but he did not attempt to pump the gear down manually prior to his first landing. When he made the first touchdown, the actuator and bracket were turned to the outboard side of the nacelle, bending and breaking the torque tube. With the torque tube broken, neither the mechanical nor emergency extension system could be operated. The cause of the failure of the right gear to indicate down and locked during the initial approach could not be determined because of the damage done during the first touchdown.

Survey questions: *"Does the aviation safety officer have other main duties? Does he keep current on all phases of the field's activity, such as training, instrument proficiency, formation flying, refresher flying, new regulations, strip work, barrier practice, etc? Does he periodically inspect, make suggestions, and follow up on training programs? Is a record maintained of these inspections? Is a vigorous effort made to visualize and anticipate hidden hazards to flying?"*

Accident: A U-6A pilot started a barrier takeoff to practice for a demonstration. The airplane be-



Metal barrier pole, approximately 1/2 inch in diameter, penetrated and wrapped around left wing

crash sense

came airborne approximately 90-100 feet before it reached the barrier and the left wing struck the barrier pole, a 60 pound metal pipe approximately 1/2 inch in diameter, at a point 6′ 1″ inboard from the wingtip and 5′ 6″ below the top of the barrier pole.

The barrier pole cut into the leading edge of the left wing approximately 12″ and folded along the top and bottom of the wing, with the barrier flags trailing behind the wing. The Beaver continued to fly a relatively straight ground track for about 200 feet, in a moderate 15°-20° left wing low, nose high attitude, with the barrier pole still attached to the wing. The left bank angle steepened to approximately 75° and the left wingtip struck the ground, separating from the fuselage. The airplane crashed and burned, killing the pilot and his observer passenger.

Cause: The aircraft accident investigation board listed the primary cause as pilot error, stating that the pilot had made an abrupt maneuver, inducing an excessive angle of bank in his attempt to make a forced landing after striking the barrier. The board also stated that the pilot failed to compensate for the added induced drag and weight of the barrier pole.

After the accident, the investigation board computed a required distance of 784 feet for the U-6A to clear the 21 foot barrier. The takeoff run was started 645 feet from the barrier—139 feet short.

In its review of this accident report, the Army headquarters stated:

"Concur in the primary and contributing cause factors as listed.

"Testimony compiled and submitted by the accident investigation board indicates that lack of command supervision was an additional contributing cause factor. Board testimony indicates:

"Information gathered by the board does not indicate that a thorough analysis and briefing of prevailing flight conditions (density altitude, required aircraft ground roll, etc.) was conducted.

"The first aircraft (an O-1) to attempt a takeoff failed to clear the barrier and, in fact, notified the control tower facility that the barrier was too close. In spite of this, the U-6A was cleared to take off with no further action taken by supervisory personnel.

"The use of a 60 pound metal pole to support the barrier string in itself indicates a lack of foresight on the part of supervisory personnel. A lighter, more flexible pole, perhaps bamboo, would have been a safer solution.

"The placement of the barrier poles with only 8 feet clearance at each wingtip, with the aircraft on exact center line, left too small a margin for error.

"Concur with the recommendations to prevent recurrence, except that action should be taken to establish and define supervisory responsibility in future demonstrations of this type."

Survey question: *"Are aircraft inspected thoroughly before flight?"*

O-1A forced landing: Engine lost oil in flight. Caused by failure to safety oil filler cap.

Beaver crashed and burned after striking 60-pound metal barrier pole

Excerpts from 1965 Army Aircraft Incidents, Forced Landings and Precautionary Landings

Survey question: *"Are sample bottles available for checking fuel?"*

OH-23D forced landing: Engine ran rough and failed after takeoff. Caused by fuel contamination.

Survey question: *"Does the unit have an education program which provides maintenance personnel with information concerning unsafe shop and maintenance practices?"*

UH-1B incident: On a maintenance test flight, the pilot heard a loud noise during a hovering turn and landed immediately. The FM antenna base separated from the tail pylon and struck one tail rotor blade and one main rotor blade, causing incident damage to the blades and antenna. Investigation showed that only three screws were installed in the FM antenna base. Two of the screws were the proper size and one screw was too small. None of the three screws were completely tightened. Work had been interrupted at that point and the incomplete antenna installation was overlooked when work was resumed.

Survey questions: *"Are beacons, obstructions, and locations of hazardous conditions adequately identified by lighting and marking? Are grass areas adjacent to runways, taxiways, and parking areas kept properly mowed?"*

U-8D incident: Right wheel dropped into hole while airplane was taxiing to runway. Incident damage to no. 2 propeller. Hole was concealed by grass and not marked.

Survey question: *"Is a maintenance quality control system in effect to ensure proper and timely maintenance?"*

UH-1D forced landing: Tail rotor drive shaft quill failed during test flight and helicopter made violent turn. Pilot autorotated to successful forced landing. Caused by installation of aluminum washer in place of required steel washer on tail rotor drive shaft quill.

Survey question: *"Are complete daily inspections conducted?"*

UH-1D forced landing: Engine failed at hover. Caused by fuel starvation due to loose fuel line at output side of fuel filter.

U-8D precautionary landing: Heat indicator for no. 1 engine rose rapidly above red line to 90° when carburetor heat was applied at 9,000 feet in climb. Control arm and cable for carburetor heat found separated. Bolt, nut, and part of cotter pin found in nacelle. Inside of nut was worn smooth and bolt threads were worn. Assembly had not been changed since installation.

Survey questions: *"Are provisions made for adequately checking fuel filters installed in POL dumps? On refueling vehicles? Do filters provide adequate filtration to ensure that contaminated fuel does not enter aircraft?"*

O-1B forced landing: Engine failed in flight. Caused by fuel contamination. Gelatinous substance found in fuel.

Survey questions: *"Are MWO, TB, and TM compliances kept up-to-date? What action is taken if compliances are not up-to-date?"*

OH-23D precautionary landing: Clutch slipped during low altitude power recovery from practice autorotation and engine oversped to 3550 rpm. Needles were rejoined and helicopter was landed with power. Caused by clutch failure. Aircraft was not modified with separated oil system.

Survey questions: *"Are complete daily inspections conducted? Are aircraft throughly inspected before flight?"*

A ratchet, extension, and 9/16″ socket were found in the wheel well of an Army aircraft that had just completed an IFR flight with 22 passengers aboard.

CH-37B incident: No. 1 engine failed in cruise flight at 400 feet. Altitude could not be maintained and helicopter was landed in corn field, collapsing gear in soft ground. Incident damage to gear and underside of fuselage. Caused by water in fuel system.

Survey question: *"Are the aircraft maintenance TMs up-to-date and are they used by maintenance personnel performing maintenance?"*

CV-2B precautionary landing: Hydraulic oil overflowed from vent line onto hot cylinder of no. 2 engine, causing external fire. Engine was shut down and propeller feathered. Propeller was unfeathered after landing, overflow ceased, and fire was extinguished. Caused by overfilled hydraulic reservoir.

CH-21C forced landing: Engine lost power in cruise flight and altitude could not be maintained. Caused by makeshift rubber strip glued inside carburetor air duct as cushion between duct and carburetor air door. Strip came loose and was drawn against air screen, cutting off flow of air to carburetor.

Survey questions: *"Do crews plan flights properly? Is fuel consumption carefully planned?"*

TO-1D incident: Engine stopped during cross-country flight. Airplane was landed in small clearing and propeller struck ground. Incident damage to propeller. Caused by fuel exhaustion. Improper leaning procedure caused fuel consumption to be higher than normal. Pilot was navigating VFR by Jeppesen charts and was unaware of two emergency airports on flight route.

Emergency Equipment Maintenance

Survey question: *"If special equipment, such as the Martin-Baker ejection seat, armament, etc., is installed in unit aircraft, do trained specialists maintain this equipment?"*

Following are some of the discrepancies found during a Martin-Baker seat updating program:

"Primary sear filed off."

"Twisted sears (primary gun tube) ."

"Lower attaching points for seat not locked."

"Sticker clips not locked."

"Time life on face blinds expired."

"Main parachute withdrawal line not mounted inside restraint straps."

"Ejection gun tubes stuck together. Caused by clamping tubes too tight in vice and clamping in the wrong place."

"Blanking bolts missing on ejection gun."

"Water seals missing on auxiliary cartridge."

"Drogue gun cartridges overtorqued. Base of cartridge crushed."

"Too much tolerance on slippers."

"Oxygen hoses deteriorated."

"Pip pin missing on oxygen system."

"Bungee cords deteriorated on time release and drogue gun."

"Conduit for lower firing cable clamped to snubber box for leg restraint lines. This causes stretching of the conduit and exposes cables to damage. Cables should be free."

"Unauthorized work being done to torque tubes in lower part of seat."

"Broken new manual override handles replaced with old handles. Old handles do not permit complete unlocking of upper restraint, lower restraint, and leg lines."

"Unauthorized hardware used to replace bolts on scissors shackle and scissors attaching points. Special Martin-Baker bolts required."

"No. 10 American bolts used to replace rivets on headbox. This could cause entanglement of drogue chutes."

"Too much oil in ejection guns."

"Cable override for face blind locking mechanism adjustment tampered with and out of adjustment. Safety missing on adjustment."

"Barostats not properly timed."

"Hole for barostat plunger taped up to prevent operation of barostat."

LETTERS

Continued from page 1

in operating instructions. Otherwise, the controls should be left alone. There is too much chance of the pilot failing to notice that something has or has not been done. This extends to some other operations also, preflight inspections for example. A divided preflight can be a mighty haphazard thing.

No, I have not personally experienced any accidents or near accidents because of unsolicited assistance, but I do consider it a hazard. Unwanted helpfulness contributed to a night helicopter accident here in Eighth Army last year. The pilot, hovering through a dusty area under guidance of a ground crewman, was blinded and became disoriented when his aviator passenger turned on the landing light. I am sure there are many other examples in USABAAR files.

I would like also to call your attention to a minor editorial mistake on page 1 of the Digest. The editor, in commenting on a letter from Captain Wordley J. Kline, Jr., concerning flight clothing, stated that Captain Kline was replying to a question in an 8th U. S. Army Newsletter. This is an error. The only letter of that type published by Headquarters, 8th Army, is an Aviation Safety Letter, which I draft for the signature of the Aviation Officer. This letter is directed to aviation supervisory personnel and, so far, we have not included any discussion or questions on the problem of who wears what. This is not to deny the importance of proper and adequate flight clothing; it's just that we are concerned with more pressing topics.

Some of the arguments regarding wearing of flight clothing bring back memories of World War II days when some artillery liaison pilots griped about having to wear boots. The theory was advanced that low quarter shoes afforded a better feel of the rudder pedals. In the Ardennes during the winter of 1944-1945, the same pilots were observed to don the boots without urging and then put on overshoes. Those L-4 cockpits were cold.

CLARK C. BOHANNAN
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8th U. S. Army
APO San Francisco 96301

• *Sorry, the editor reversed Army and division in referring to the Newsletter.*

Sir:

The "Army's New Sidearm" by Captain R. L. Webster, Jr., in your November 1965 issue disturbs me.

Your Aviation Digest has consistently published fine professional articles and it surprises me to find such an unprofessional piece. In the first place it is impossible (and of course totally unnecessary) to put a .45 on half-cock and have the thumb-safety on at the same time. Second, there is a very fine .45 cartridge that holds a lot more bird-shot than a .38 special (or a .357 magnum). Third, Lieutenant LTBA, III, will certainly starve to death trying to shoot grouse double action pulling the trigger on a revolver. He'd be luckier still to hit a man firing double action. Then assuming he *did* hit his black clad grinning adversary, the effect of a .38 would probably only change the grin to a snarl. LTBA would be lucky to find a needle and thread to sew himself back together after snarling black clad got through with him.

Fourth, about the third time the author fires his ear splitting .357 magnum, *when he needs it,* he'll be flinching so badly he can't hit anything with it unless he throws it. Fifth, in order to hit anything with any degree of accuracy with a revolver you've got to cock it with your thumb for each shot. This is a time consuming process. In combat you don't have that time; try it and you're dead. Sixth, in a fire fight you can't unload the expended cartridges and put fresh cartridges back into a revolver fast enough to stay alive (to say nothing of being limited to only 6 shots; 5 if you're safety conscious and carry an empty chamber under the hammer).

* * *

A quick look at the ballistics tables will show . . . that the .45 is the superior cartridge. But there's more to it than that. The sectional density of the .45 caliber bullet as opposed to the .38 puts the .45 way out in front of the .38. The formulas are too complex to go into here; but I would encourage anyone who thinks he has found a cartridge better than the .45 to do some research and read the board reports on the various tests that have been conducted, including for example the cadaveric. Very interesting and enlightening.

The .45 birdshot cartridge is superior to the .38 shot round as I've already pointed out. Personally, I can't see how a person could tell from a distance the difference between a .38 flare or tracer and a .45 flare or tracer, except that the .45's might be a little brighter. In over twenty years of shooting the .45 (and many others) I have never experienced nor seen a .45 *misfire.* I have seen both pistols and revolvers malfunction or suffer stoppage due to (1) lack of lubrication and (2) fouling due to repeated shooting coupled with lack of thorough cleaning. Mind you I said *both* pistols and revolvers. The moral here is if you've got a gun, keep it clean and keep it lubed as if your life depended on it. The contention that a revolver is incapable of jamming or malfunctioning is false.

* * *

An interesting point is the fact that the .38 official police revolver with 4-inch barrel is 9¼ inches in length and with its bulky cylinder and protruding grip it is far more uncomfortable to carry in a shoulder (pilot's delight) holster than a flat compact 8½ inch long .45 pistol.

Another point that should receive serious attention from anyone subject to flying over or otherwise entering a combat zone is ammunition resupply. Get involved in a fire fight, be LTBA and need some ammo, it is doubtful that your friendly supply sergeant will have any .357 magnum cartridges handy just for you and the fact that .38 specials will fit in your .357 won't make a difference to black clad when he shoves his bayonet in your guts.

To anyone contemplating flying over remote or hostile areas or otherwise possibly engaging in combat I would suggest they secure a good reliable TOE issue .45 government model automatic pistol. Have a competent armorer or gunsmith check it over, if you will, for that extra feeling of confidence it will give you. Learn to shoot it. Keep it clean, lubricated and ready. (If you absolutely insist on having a revolver this suggestion is still valid if you hope to reach retirement or ETS whichever comes first.)

As concerns being ready in situations where combat is imminent, the safest and most practicable way to *carry* a loaded .45 is with a round in the chamber, hammer on full-cock—yes I said full-cock—with the thumb safety on. When the thumb safety is on, the weapon is entirely safe: 1) the trigger can't be pulled. 2) The slide can't be inadvertently opened. 3) If the weapon were to accidently be dropped striking the hammer it will not discharge (as is the case with some revolvers the latter on full-cock, half-cock or hammer down making little or no difference). 4) The .45 is ready for instant use with the mere flick of a thumb. 5) Others seeing the hammer on full-cock don't toy with your weapon. It's also a handy visual reminder to you to clear your weapon before putting it away, e.g., returning from a mission.

* * *

The proven factual advantages of the .45 over any .38 are so great and numerous that I cannot envision a really sound basis for authorizing a TOE change for Army Aviators to be issued .38s. While the USN, USMC, and USAF pilots may use the .38, to say that Army pilots should also use it makes about as much sense as advocating that because the Air Force separated from the Army and wear blue suits, so should go Army Aviation.

MAJ JOHN L. HASTIE
Headquarters, 2d Bn, 8th Inf
Fort Lewis, Wash. 98433

• *Above is our condensation of a letter from Maj John L. Hastie. While we have received many letters and comments on the article "Army's New Sidearm," the .38 has been accepted and is being issued to specially selected TOEs that include flight crews.*

The article "Stay Alive with Your .45" by CWO Ernie L. Greening will be of interest and value to those who have and will continue to have the .45 as their TOE weapon. CWO Greening's article illustrates several ways to fire the .45 and increase your chances to stay alive in a survival situation.—Ed.

. . . there's only one man who knows why he violated the dictates of learning and common sense . . .

TRUE PILOT ERROR

Gerard M. Bruggink

MODERN PSYCHOLOGY has done so much to explain the breakdown of normal human behavior (whatever that is) that we can literally get away with murder, as long as the semblance of an excuse and a well-remunerated lawyer are present. What has this growing insight into the human error mechanism done to help us solve and prevent accidents that seem to originate in the cockpit?

We've been told to get off the pilot's back and to stop using the painful term "pilot error." We are daily reminded that our accident investigations are failures because, at best, we can only pinpoint WHAT the pilot did wrong, not WHY he did it. To maintain our self-respect—and our jobs—we hide our ignorance behind inoffensive recommendations that call for engineering or procedural changes. In other words, we keep the pilot's halo shining by inferring that there were no bad guys in the cockpit at the time of the mishap.

Who are we fooling, besides ourselves? Do we really know so little about what makes a pilot do the wrong thing when, supposedly, he should have known better?

Let's first discuss what makes a man do his job the right way. It doesn't take a course in management to realize that we must give him the necessary knowledge, skill and tools. What is less well understood is that the proper use of these three ingredients is governed by the man's attitude. Without getting involved in the tons of material written on the subject, we can say that a man has the proper attitude when he has the WILLINGNESS TO COMPLY WITH WHAT HE HAS LEARNED AND WHAT SOUND JUDGMENT TELLS HIM TO DO. It is our contention that true pilot error exists only where this willingness to comply was absent—where the man follows his ego, rather than his reason. We further contend that there's only one man who knows why he violated the dictates of learning and common sense—the pilot, if he's still alive.

Our use of the unscientific term "common sense" may raise a few eyebrows. We admit that we know that an authoritative textbook on aviation psychology asserts that, "Probably no notion could be more erroneous than the notion that we have common sense and that it can be trusted." Our only justification for the use of this term is that everybody knows what we're talking about—it's just another name for good judgment. And almost everybody prides himself in possessing same.

Now back to this willingness-to-comply thing. You are driving your Cadillac on the turnpike between Dallas and Fort Worth. As a good, law-fearing citizen, you keep your speed right at the legal limit. While your thoughts are still in the cockpit—where you got a snide remark from an approach controller about an hour ago—you are formulating an angry letter to the regional FAA man. Suddenly, you notice that a VW is passing you. This minor insult would have been acceptable but for the fact that the youngsters in the VW eye you with haughty smiles. In a few seconds, you are staring at the ugly tail end of the defiant beetle.

What are you going to do now? Your ego cries out for revenge, without regard for the consequences. Reason tells you to ignore the challenge and to stay right where you are in your traffic lane. But your usual willingness to comply with what you have learned and what sound judgment tells you to do is smothered by the humiliation you suffered in the last few hours. So, you go in hot pursuit. As you leave your lane, you hit a car on your right and there is a great gnashing of gears and tires.

The highway patrolman who scribbles your defensive story in his notebook listens, smiles, and gives you a ticket. You protest and threaten him with your lawyer. He keeps smiling. He knows that you know you did something against your better judgment. He is not even interested in what made you act that way. If you told him about those kids in the VW, he would probably say "Boys will be boys" in a way that would make you doubt your own age.

Why did we pick a highway accident to illustrate the common mechanism of "operator error"? To be frank, we felt it was the only way to approach a pilot's so-called irrational acts without aggravating him. The example we gave is universal. It applies to any accident situation where, with hindsight and hidden remorse, we have to admit that we ignored our better judgment and learning.

A few years ago a helicopter fell out of the sky for no apparent reason. The only hardware irregularity found was a possible engine failure. But aircraft don't suddenly stop flying just because an engine fails. Since dead men can't talk, the competent accident board made a thorough examination of the pilot's personality and background. The findings would have delighted any aviation psychologist in need of documentation for a lecture on emotions and stress reactions. They also could have served as the basis for a dripping human interest story in the Sunday paper. One of the board members speculated that the pilot was in such a mess, mentally, emotionally, and physically, that he might have been unable to fight off any suicidal impulses

once the emergency occurred. It was recommended that pilots with problems ground themselves.

Why do we always need the spectacular or the sensational to reach a (debatable) teaching point? If every pilot with marital, financial, or health problems grounded himself, we would be back in the bicycle shop where it all started. If we told a pilot to beware only of those stress reactions that are neatly labeled and catalogued in our textbooks, he would probably say, "Mister, I don't work in a nuthouse. I'm in the flying business!"

The completely ignored fact is that it doesn't take Hollywood-style stresses to make us ignore our better judgment. The slightest inflation or deflation of our ego may induce us to jeopardize human lives and costly equipment. Suppose you're making an ILS approach and notice that you are slightly low over the middle marker. You have already decided to increase power when your copilot points an apologetic finger at the altimeter. He doesn't really want to criticize you but, at the same time, he hates to be blamed in case things go wrong. You ignore his gesture—and your own better judgment—by leaving the power levers alone. The aircraft touches down within the first 50 feet of the runway. During the rollout you tell your assistant "Why don't you take her in?" with the blasé air of a man who is wasting his time on kid stuff.

What have you accomplished? Next time your copilot thinks the master of the ship is going to get in trouble he'll act like a dummy and sit bravely, but silently, through the crashing ordeal. Naturally, the accident board will make some acid comments on the copilot's failure to act, and hide your errors behind a barrage of gripes about the unreliability of modern instrumentation, navigational facilities, or whatever played a role. But deep down in the caverns of your conscience you know that you caused this accident when you killed the team concept of flying and shared responsibility in your cockpit.

Pilot error? Yes, and of the purest, unadulterated kind. Can this type of error be uncovered by a thorough accident investigation? NO. We don't need the Fifth Amendment to shut up and protect our ego. Can true pilot error be prevented? YES. Even if we put on an act before our colleagues and the accident board, we can't fool ourselves. That means that at least once in a great while—when we get involved in a self-induced mishap or near-miss—we are forced to recognize the weakness in our make-up that suppresses our willingness to stick to our learning and sound judgment. But why wait for an accident to develop this self-knowledge? We can study and learn to control this judgment-destroying mechanism in practically every phase of our daily activities.

If this begins to sound like revival talk, it is simply because the true pilot error accident stands for lack of self-discipline and touches, therefore, on human behavior in general, as well as morality. We don't believe that a man who ignores his better judgment at home or on the road with the slightest provocation could be a striking example of composure under airborne stress. There's nothing that sets a pilot aside from the rest of mankind. The hallmark of professionalism in any field is discipline.

Personally, we're getting kind of tired of our stale and apparently ineffective approach to cockpit error prevention. We fill our periodicals with horror stories of pilots who used poor judgment, but we seldom get beyond a stereotyped demand for more research, more training and more supervision. We rarely get to the heart of the matter because we can't read a man's mind, be he dead or alive. Why don't we get off our high horses and admit that we can't differentiate between an honest mistake and true pilot error, except in cases of shameless exhibition of lack of self-discipline, such as buzzing accidents. Let's also admit that a pilot should not be crucified for making an honest mistake. By the same token, let's not treat an accident-involved pilot as a criminal whose guilt can only be disclaimed by accusing society, his parents, and our school system.

What else is there to say after beating pilot error to death for the nth time? There is only one more admission to make: the most insidious killer in aviation—true pilot error—is beyond the control of safety programs and safety experts.

Only one man can rightfully appeal to the pilot's integrity, professional pride and reason—his immediate supervisor. He must do this in terms that leave no doubt about the pilot's ultimate and total responsibility for the use of his own good judgment. Naturally, the supervisor himself must be of the highest caliber and should practice what he preaches.

If this task seems as hopeless as rebuilding the morale of a whole nation, it is only because we tend to forget that men who enjoy the freedom of the skies have the makings of good character.

To take the gleam out of the eye of the pilot on the examiner's couch, we venture a final wish: let's swap some of that showmanship, touchiness, and impatience in our cockpits for a sound dose of self-restraint and humility. This would at least stop our obsession with ghosts that are trying to wink at us.

It is hoped that all commanders will study their aircraft operations in the interest of improved combat effectiveness because

Accidents Are Expensive

EXCLUDING Vietnam operations, the United States Army sustained a loss in excess of $24,000,000 and 59 lives in 351 aircraft accidents during FY 1965. An additional $500,000 was lost to aircraft incidents (mishaps below accident classification criteria). This substantial depletion of combat resources was influenced by several significant factors:

Human error in aircraft operation.

Materiel failure.

Failure in the developmental cycle of aviation equipment which produced unsatisfactory equipment or engineering flaws.

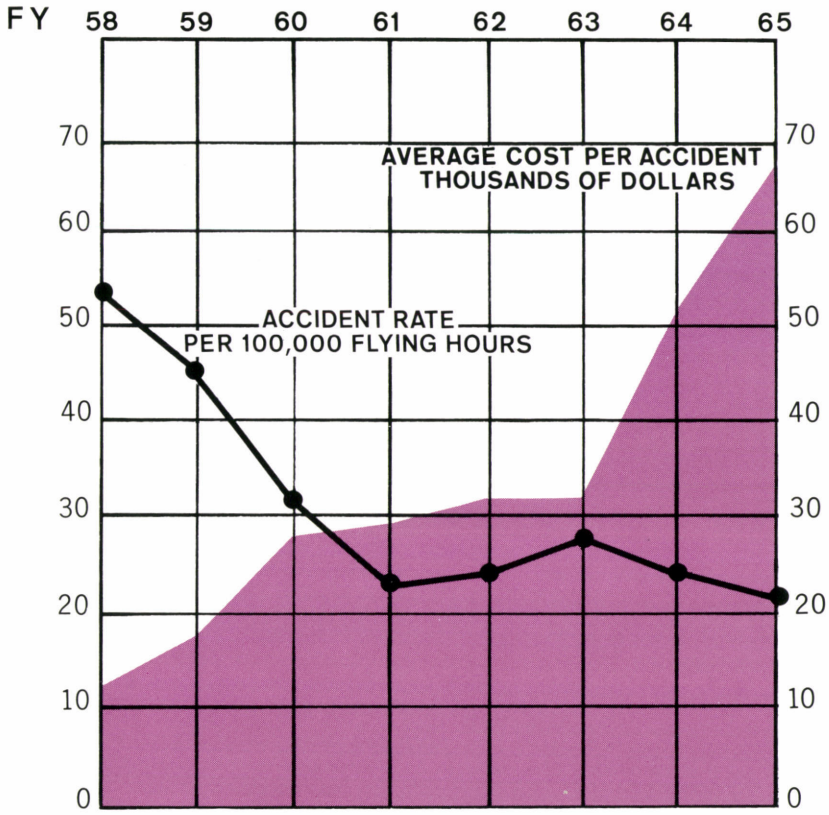
An inadequate approach to the training and proficiency level of aviators to operate new and complex equipment.

A tremendous increase in the unit cost of new aircraft.

A lack of regard or deliberate disregard of recognized safety procedures in administrative and tactical operations.

Expansion of Army Aviation will bring a corresponding increase in the number of aviation personnel, aircraft, and flying hours. In addition to a measurable decrease in levels of experience, these factors will increase aircraft accident potential and exposure.

FISCAL YEAR	RATE	AVERAGE COST
1958	54.3	$13,000
1959	45.5	17,000
1960	30.3	27,000
1961	24.9	28,000
1962	29.3	31,000
1963	28.9	31,000
1964	24.1	51,000
1965	21.9	68,733

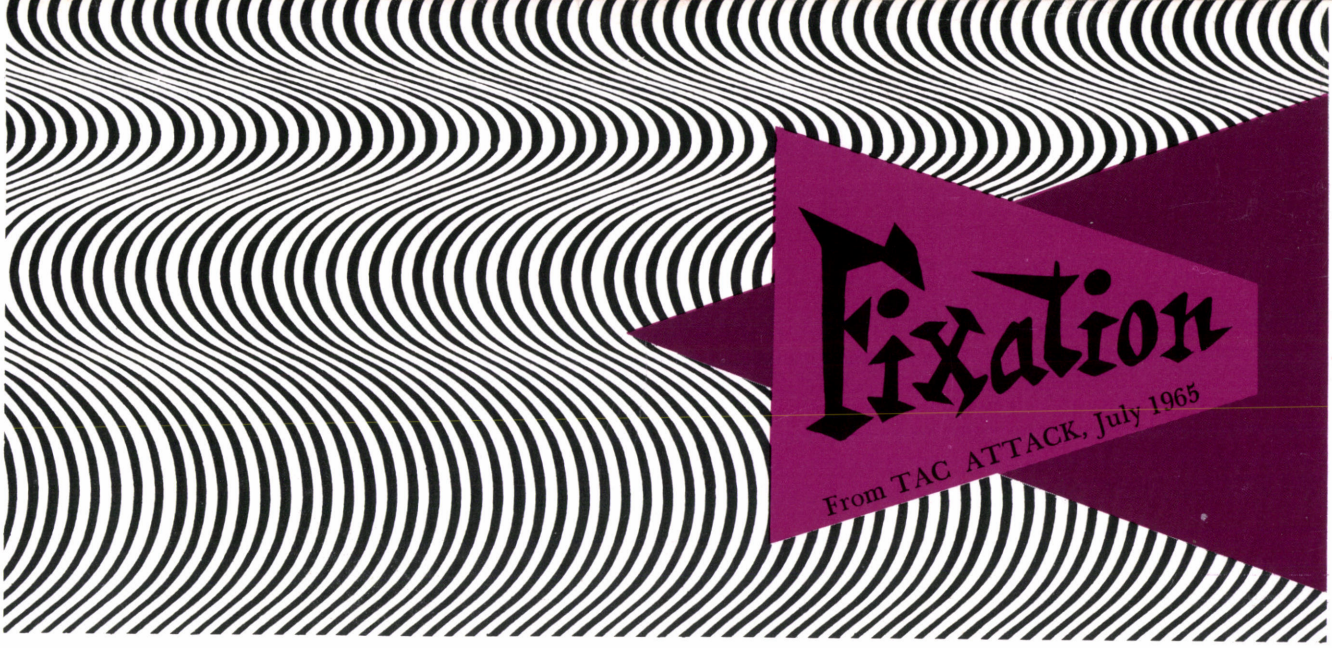


The principal method of comparing annual accident experience is to compare the accident rate per 100,000 flying hours. The following chart and graph show Army aircraft accident experience by rate and average cost per accident for the past eight years.

While the accident rate has decreased during these eight years, the average cost per accident has steadily increased. This is the result of the addition of new and far more costly aircraft to the Army inventory. For example, the equipment cost of one OV-1C Mohawk destroyed by accident exceeds the cost of approximately 120 O-1A Bird Dog aircraft. The cost of repairing aircraft damaged by accident is directly proportionate to the severity of the accident and the original cost. Thus, the average cost per accident can only rise as new aircraft are added and older aircraft phased out.

It is hoped that all commanders will study aircraft operations in the interest of improved combat effectiveness.

—*Command Aviation Safety Review*
USABAAR



IT WAS A dark, gray afternoon at 8,000 feet. The crew had bumped along in turbulent clouds for almost three hours. As rime ice built up on the prop hubs and wings, they checked carburetor heat; it was working. The freezing level was reported 2,000 feet below them, but the outside air temperature was holding right at freezing.

They had just reported station passage and received latest weather from the ground station, when the left engine sputtered and gave up. Both pilots went for the carburetor heat, but it was on. It must have iced up anyhow. It looked as if all they could do was feather the engine, declare an emergency and turn back to the town they just passed.

The weather was certainly not improving. As they completed the turn and prepared for the single-engine descent, the right engine coughed and stopped. They bailed out as the aircraft descended thru 3,500 feet.

The crew met with the accident board the next day. Their description of the flight thru freezing clouds sent one board member to get a complete rundown on the weather while the others went to examine the wreckage.

When they arrived at the scene they found that the aircraft had made an amazingly good, uncontrolled wheels-up landing. They found both outboard wing fuel tanks full, both inboard tanks intact and empty and both fuel selectors set on inboard tanks. The engines, despite weather and icing, had quit from fuel starvation.

What caused this crew to become so totally engrossed in the weather situation that their normal and emergency procedures went blank? Every bit of their training should have been screaming at them to CHECK FUEL!

The accident board immediately recommended that the bold face emergency procedures be changed to require crews to switch to the fullest tank when an engine quits. This would help only if the crew is not too deeply submerged in a fixation with other matters.

The only change from completely normal routine on this flight had been the weather. This crew's attention had been channeled by their environment. Icing was their primary concern. They had been thinking about and taking action to prevent icing-induced engine failure. When the first engine DID fail, their fixation was complete . . . the second engine failure was almost anticlimatic.

Unlike blue fingernails that alert you to a lack of oxygen, there are no tried and true, pat answers for alerting you to a fixated attention.

Perhaps the answer is knowledge and experience. When you have coped with a particularly unpleasant or hazardous phase of flying enough times, you can better evaluate it . . . place it in its proper perspective. There are only so many actions you can take to protect or insulate yourself from the hazard. When you have taken these actions your experience tells you what the probability is. You then relegate this immediate concern to its proper priority among your flying chores and CONTINUE TO FLY THE AIRCRAFT.

The one positive action we can take to fight channelized attention, or fixation, is to recognize it, discuss it, be ready for it. Question your thoroughness when you are in a tight . . . Is there something I've left out?