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United States Army

AVIATION DIGEST

APRIL 1962 VOLUME 8 NUMBER 4

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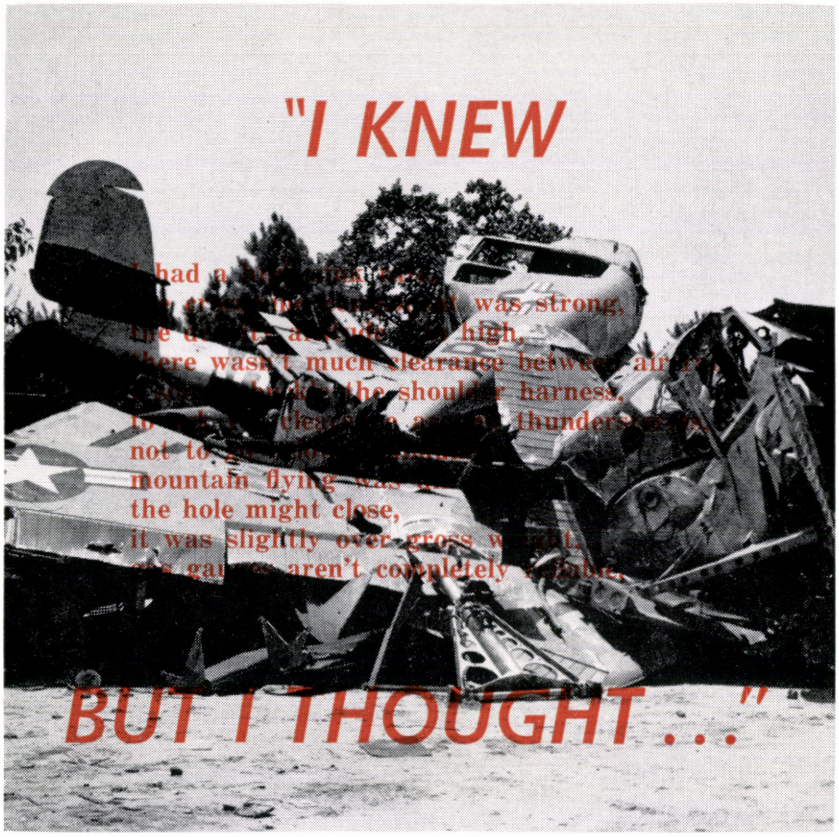

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other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

Manuscripts, photographs, and other illustrations pertaining to the above subjects of interest to personnel concerned with Army Aviation are invited. Direct communication is authorized to: Editor-in-Chief U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Fort Rucker, Alabama.

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Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, 27 November 1961.

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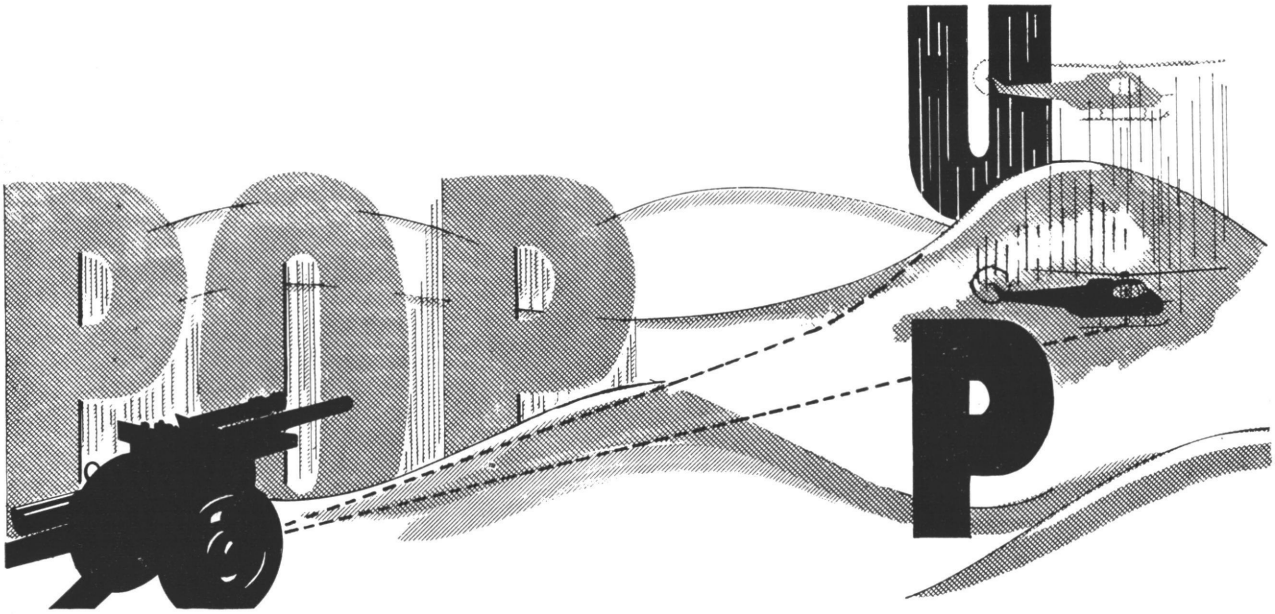


Colonel Raymond P. Campbell, Jr.

ANNUAL AWARD
Monthly Winner
CONTEST

ABE LINCOLN's Air Force. Few of us have heard of it. Even fewer realize the impact and influence it exerted on the strategic and tactical planning of both the Confederate Army and the Army of today. This flying armada, consisting of eight balloons and commanded by one Professor Thaddeus Sabiesky Lowe, not only paved the way for the "Army of the Air," but also gave birth to the tactics of the aerial adjustment of artillery fire.

These balloons were no more than elevated, drifting observation posts. By devising a system of coded signals (using flags) the observer successfully directed artillery fire against Confederate gun positions. This was both an awkward and time consuming process. However, it proved to be highly successful and it became the forerunner of our modern day method of adjusting artillery fire from the air.

The 20th century brought with it modern weapons and mechanization; but most important of all, it brought with it an invention of the Wright Brothers called the airplane.

Col Campbell is Director, Dept of Tactics, USAAVNS.

The airplane made perhaps its most significant military contribution in September 1914, during the initial stages of World War I. Two British lieutenants, flying an observation mission, chanced upon three German batteries in defilade. Using their wireless radio and Morse Code, within a relatively brief span of 45 minutes they were able to effectively employ artillery fire to neutralize the target.

Throughout and immediately following the First and Second World Wars and subsequently the Korean War, tremendous technological breakthroughs were achieved in the fields of radio communications, aircraft design and propulsion, and, not to be lightly regarded, the science of artillery fire direction. The wireless radio was replaced by modern FM voice communications. The old biplane gave way to the monoplane constructed L-19. The present day artillery fire direction equipment and techniques have permitted the massing of fires of many units and the firing of time on target (TOT) missions.

The battlefield of tomorrow will contain Army equipment and personnel with increased capabilities. We will have aircraft which can fly lower and slower and, if need be, higher and faster than ever before. Modern lightweight and longer range communications equipment, as is incorporated in the ARC 54, will permit us to communicate with an increased number of units. The field artillery will possess increased numbers of self-propelled weapons with longer ranges. The fire direction center will be supplemented with digital computers which will provide increased speed and accuracy in the delivery of fires. Teamwork and coordination between artillery and aviation will be present in all echelons of command, from the division artillery commander through the Army Aviator to the individual soldier.

We hear it often quoted that "Necessity is the mother of invention." Truer words were never spoken, particularly in the science of warfare. The nuclear age has forced us to develop new weapons systems, new aircraft, and most important of all, new ideas, concepts, and tactics for their employment.

Our present tactics dictate increased battlefield mobility. The reorganization of the army divisions (ROAD) points this out even more clearly with its increased emphasis on mechanization. ROAD has presented us with a new organization and also a new aircraft, the light observation helicopter (LOH). Tactical doctrine has dictated that it is to replace the L-19, L-20, H-13, and H-23. This rotary wing aircraft must be capable of performing all the missions of Army Aviation, as does its fixed wing counterpart. One of these missions, of prime importance to the ground gaining arms, is that of furnishing a platform for the aerial adjustment of artillery fire.

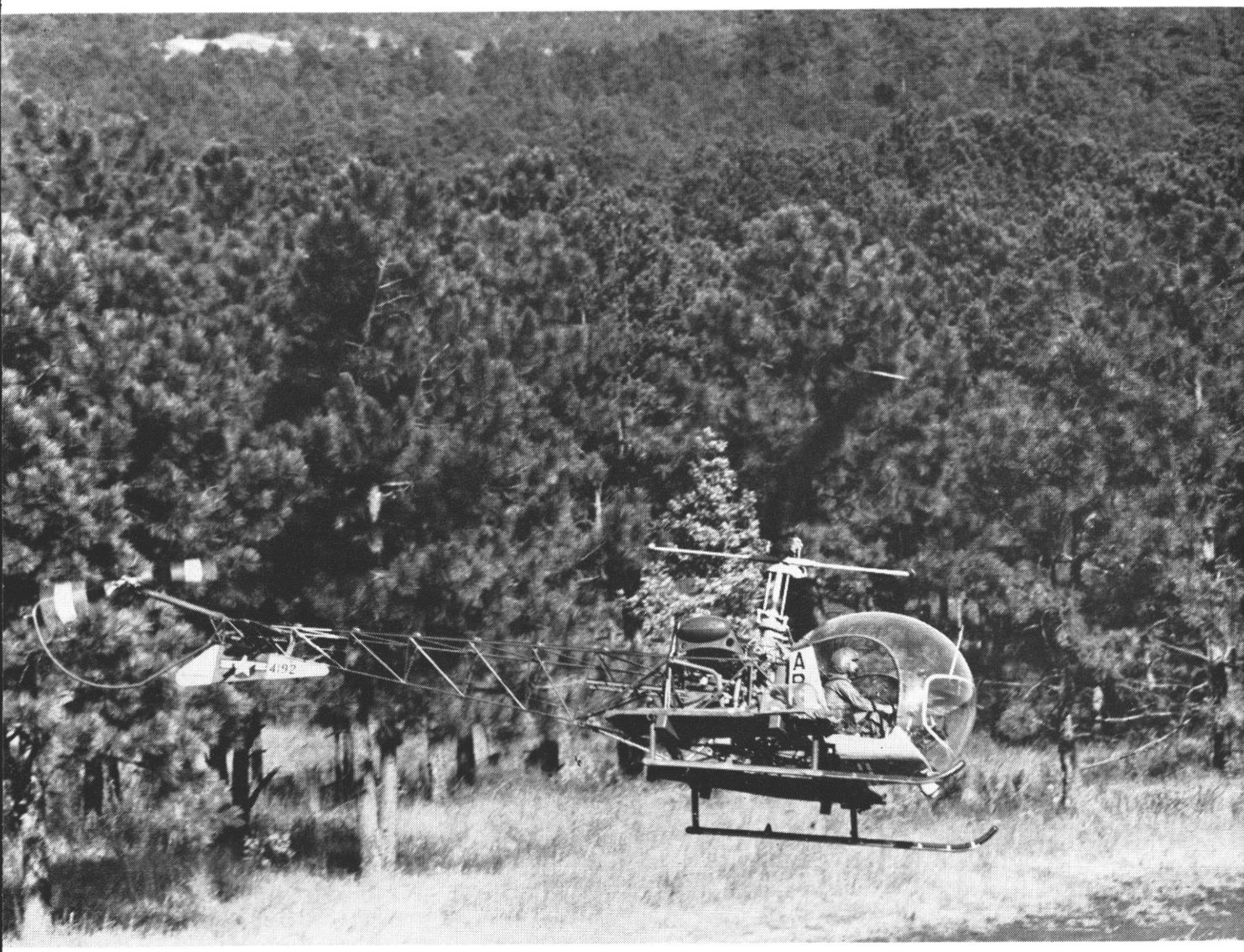
This aircraft should be of the utmost concern to both aviation and artillery, since the light fixed wing aircraft is soon to be passe, as far as tactical employment is concerned. Although the L-19 is being programmed out, this does not mean that the adjustment of artillery fires is a mission of the past. Because of the anticipated increased dispersion and mobility on the battlefield of tomorrow, if anything, the importance of this mission will be compounded.

Artillery and Army Aviation have progressed together, they must continue to exercise coordination in the development of techniques and tactics for the employment of this aircraft. Regardless of our era of sophisticated weapons, employed by a sophisticated enemy, we still must be capable of performing a basic mission: artillery fire adjustment.

Although the LOH is still on the drawing board, it will be a prominent member of our aircraft inventory in the future. Now is the time to develop the tactics and techniques for the tactical employment of this aircraft. Now is the time to decide where and how it will be employed on the battlefield. We should not even wait until the prototype is test flown, for this will be too late. Who is to say that tactical situations, generated by the many potential "brush fire" war areas, may not dictate that the present reconnaissance helicopter prematurely assume in a future conflict the responsibilities now borne by the L-19.

Although most of the information concerning the design characteristics and tactical employment of the LOH is still classified, one technique for artillery fire adjustment is neither classified nor radically new. This method, the "pop-up" technique, which uses your best defense, cover and concealment, has been tried and proved; however, its adaptation by helicopters is still very much in the experimental stage.

Bear in mind that the discussion of this method which follows is a technique. Other methods exist but there is a



Tried and proved "pop-up" techniques use your best defense, cover and concealment; however, its adaptation by helicopter is still in the experimental stage.

good chance that this technique will best assure your survivability.

The "pop-up" technique envisions that the aviator will fly behind existing terrain masks while the fire direction center computes the fire commands and while the weapons are being loaded and fired, thus reducing his vulnerability. Once the weapons are fired, there will be a time lapse while the projectile is in flight to the target. This time of flight, of course, varies according to the range between weapon and target. The aviator will adjust his time and rate of climb to afford himself good target observation several seconds prior to projectile impact. Once the round is observed, the aviator will perform an autorotation to a safe altitude behind existing terrain, simultaneous with the transmission of the subsequent fire request to the fire direction center. This technique would be used until "end of

mission." The aviator would vary his individual flight path and location of appearance to ensure the least time of vulnerability.

"Where will you emplace your machineguns?" "Where will you emplace your mortars or artillery?" Whenever you ask these standard tactical questions you will receive the standard canned reply, "It depends on the situation." To preclude this standard answer from appearing in this article, allow me to describe a type situation, which we may assume will normally occur in a non-nuclear war.

The enemy possesses a considerable amount of automatic air defense weapons, ranging from 20 caliber size through the missile family. A parity exists in the field of air superiority. The enemy infantryman possesses a weapon similar to our Red Eye. The terrain is rolling with an average amount of vegetation. The mission: furnish an LOH from the division artillery flight for artillery flight for artillery spotting.

This situation warrants considerable thought before you, the aviator, lift your LOH to a hover and proceed forward. In this case, seldom, if ever, would the Army aircraft penetrate the "upper air" of 500 feet or above (absolute). If you fly too high, the enemy search radar will lock on you and send a missile or a burst of 40mm rounds your way. If you fly too low and too close to the enemy, small arms fire will harass you; you also risk the danger of the infantryman firing some type of heat seeking missile at your aircraft. You must be able to see and at the same time be able to adjust artillery fire.

The solution to the situation follows. Due to the lack of air superiority and the presence of large numbers of enemy automatic air defense weapons, you will be forced to fly at a low altitude somewhere to the rear of the front lines. We foresee the LOH flying anywhere from 500 to 1500 meters behind the FEBA, at an altitude just high enough for the observer to view the target area for a maximum of 5 seconds. The use of the "pop-up" technique will be standard.

Quite naturally the need for an observer will be increased, due to the inherent problems of low-level navigation and orientation. The need for coordination between the aircraft and the ground elements will also be increased. The observer must know the approximate time of flight so he will be able both to see and orient himself with respect to the target area, yet expose himself for only a minimum amount of time. Once the observer knows the approximate time of flight, dependent upon the gain in altitude needed to see, he can have the pilot pull pitch from 5 to 10 seconds after he receives an "on the way." Another method to determine the time to pull pitch would be to increase the length of time from "splash" to impact.

A close examination of this technique reveals that the LOH is safe from the search radars of the air defense weapons. The low altitude and lack of line of sight prevents the aircraft from being picked up on radar. A minimum of exposure time prevents the effective firing of a heat-seeking missile by the infantryman. Your only real danger is from enemy small arms fire. However, this danger is minimized if an irregular flight path is flown with a minimum exposure time. Rifle and machinegun fire is ineffective at a fleeting, low flying aircraft. It is difficult to judge the lead-time and visualize the desired trajectory to hit an aircraft when it only appears for a few seconds in a constantly moving position. At the same time that we have provided some measure of defense for the aircraft and its occupants, we will still be able to accomplish the mission in a most expeditious manner.

Many variations of this method may be used. We do not discount the fact that the LOH may be flown similar to the manner the L-19 was used in Korea, at a relatively high altitude. With the definite trend toward rotary wing aircraft, the advent of the LOH, the Air Cavalry Troop, and the absence of fixed wing aircraft in the division artillery flight, the "pop-up" technique is most feasible. In the case of the Air Cavalry Troop, where reconnaissance and close support forward of the FEBA will be required, this is perhaps the only method available to them.

In a sense, you yourself are the field artillery gunnery team. Your eyes, the eyes of the pilot-observer team, are the eyes of artillery. Your brain and mouth comprise the fire direction center. Your thumb, which presses the mike button to transmit a fire request, is a portion of the hand which pulls the lanyard on the piece. You mortgage your life and the lives of others upon your ability to coordinate these portions of your anatomy. The "pop-up" technique may very well afford you the only opportunity to coordinate the four and thus permit you to LOOK AND LIVE.

It's a Selling Job, Too

Lieutenant G. Dennison

If Army Aviation is to grow, and evidence maturity during its growth, all persons affiliated with the program must be boosters . . . not boasters.

To boost our program we must stress

- **our real capabilities,** *not those we hope to have in the future, or the capability we can achieve only under perfect conditions;*
- **our real limitations,** *so that no one expects the impossible or underestimates our real capabilities;*
- **our ultimate goal,** *not a new Army Aviation Corps but integration into the using elements of the Army—instantly available and ready at the commander's desire.*

EACH ONE of us who wears the wings of an Army Aviator can be proud. We are specialists in a growing, vitally important field. Our responsibilities are many, but one of the most important is to sell Army Aviation to the ground commanders.

To sell it as a close support element, not as a small air force. This has been done in the past or we would not be witnessing the present upsurge in the aviation program. For this reason we will continue to grow.

We, as aviators, realize how important an asset our program is to a modern army. Unfortunately, some few ground commanders still think that aviation consists of an artillery adjusting cub or an isolated medical evacuation by a helicopter.

Every aviator must ensure that any ground commander with whom he has contact fully understands the mission capability and employment techniques of Army Aviation. This is our job. It is not an easy one.

Almost any combat support flight leader can cite instances of the improper use of his aircraft, such as an H-13 sitting idle during a 48-hour battle group field exercise. If the aircraft is used chances are it is used for only one of its possible uses, such as ferrying the staff to and from the garrison.

An aircraft and a trained aviator are valuable tools in the hands of a forward thinking battle group commander. With this team he has the capability of being more flexible and mobile than the regimental commander ever was. Most ground commanders realize this capability, but some apparently forget it. How many times have you seen a tactical commander use a ground vehicle for a reconnaissance when a helicopter was available? It is too common for us to be satisfied. Thinking only in terms of ground vehicular concepts is a difficult habit to break.

When your division goes to the field on its next exercise, look around and you will probably see and hear the following.

1. Commanders openly expressing their distaste for flying and using slower ground transport when time is of the essence.

2. A vehicular reconnaissance made when time is limited.

3. Combat support flight leaders used as messengers for administrative matters, meanwhile being excluded from staff and planning meetings.

Yet, here are men who can quickly carry the commander from unit to unit. They can provide effective column control, message pickups, wire laying, and radio relay. Also they can offer commanders such important assets as mass airlifts, resupply, and combat zone casualty evacuation. The commander's chance to provide greater maneuverability under conditions of nuclear warfare and the ability to move forces and equipment with greater speed are being wasted.

If the commander had the ability to remember all these items, a staff wouldn't be too important. Since he doesn't have that capability, his staff is invaluable. It is up to you as a combat support flight

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Lt Dennison is assigned to Co A, 1st B.G., 12th Inf., Ft Lewis, Wash.

Combat support flight leaders can help sell the commander on the potential inherent in Army Aviation support. It can help him accomplish his mission easier, quicker, especially in intra-Army mass airlift, resupply and combat zone casualty evacuation.

leader to become an integral part of that staff. This means close support of your unit when it is in garrison as well as the field. You can't give advice to the commander if he doesn't see you.

4. A communications breakdown and a potential solution to the problem—an aircraft for radio relay, message drop or liaison—sitting idle and forgotten.

5. A platoon-sized task force requiring speed being moved by ground vehicle when the helicopter transport company stands idle.

All of these difficulties could be eased or eliminated by using the services of the combat support flight leader. What can you the combat support flight leader do?

Good old common horse sense and a little patience will do a lot for the situation. Get the advice and backing of your superiors. Make the aviation commander and the division aviation officer aware of your desire to alleviate this situation. Let them work from the top while you concentrate on the battle group.

Volunteer to give the officers of your supported battle group an orientation on Army Aviation. Meet with them in their staff meetings, at their social engagements. Make yourself a part of their team.

Offer orientation rides to the commander, his staff, and company commanders. When they are in the aircraft you have a very susceptible and eager audience. A discussion of aircraft uses while making a road reconnaissance to the battle group's next training area could start the individual in the direction of a new thinking process. A sweep over a unit in the field quickly illustrates how poor most camouflage actually is. We have all seen this but some ground officers have not. Your passenger could be reminded that aircraft offers the unit commander a vantage point for inspecting the camouflage of his unit as soon as he has occupied a position.

On your return flight it would be easy to point out errors in the map and to mention the short time element involved in obtaining current aerial photos. Any thickly wooded area will show the need for aerial photos, and for aerial wire laying.

Radiological detection is a big part of our modern war games. The advantages of aerial surveys can be demonstrated by a rapid flight along a proposed division front.

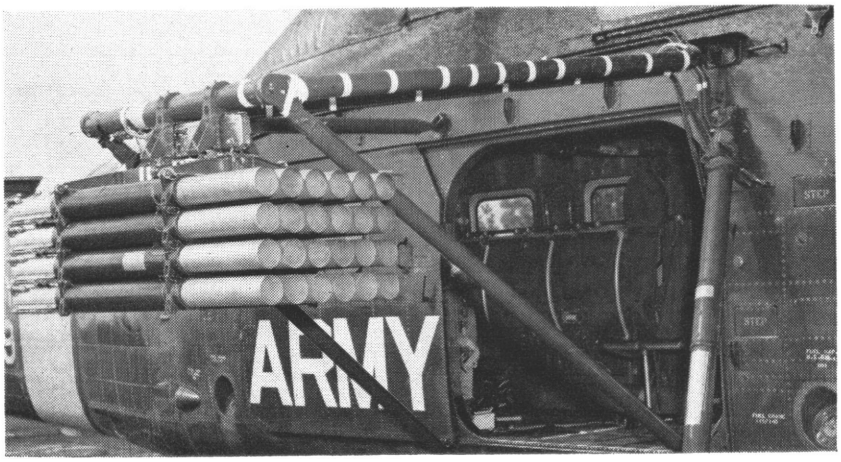
You can use innumerable methods to sell aviation. It is a slow process, but one in which we must all take a part. Only the Army Aviator can sell the tactical commander on the capabilities of our aircraft and ensure their inclusion in his operational plan of action.

Enthusiasm on your part and an understanding of his problems will create a better framework for a mutual exchange of knowledge.

An Army HU-1B Iroquois helicopter fitted with 48 aircraft rockets (left) has arrived at Fort Rucker, Ala., for firing and flight tests under the direction of Transportation and Ordnance Corps development teams. This aircraft has just completed developmental testing at Redstone Arsenal, Ala.

Pods mounted on either side of the HU-1B each hold four rows of six modified 2.75-inch folding fin rockets. Evaluation tests using the same pods on the H-34 Choctaw (center and bottom) have been completed

Development of a 2.75-inch Rocket Pod



by the U. S. Army Aviation Board at Fort Rucker. On the H-34 the modules of the pods are arranged in horizontal rows of six as compared to vertical rows of four on the HU-1B.

Both the Iroquois and Choctaw incorporate single electrical firing systems mounted on the pilot's cyclic stick. The rockets fire in pairs, allowing the pilot 24 shots.

Other armament being considered for the Iroquois include antitank guided missiles, grenade launchers, and machineguns.

Know Your Iroquois

Elton J. Smith

THE HU-1 series Iroquois helicopters were designed with an engine-rotor combination capable of producing the most compatible unity of rotor thrust (lift) and engine power. The rotor parameters are established, more or less, by the performance specifications, the criteria of which is to hover at 6,000 feet altitude on a 95° day and be capable of a guaranteed cruise speed of 100 knots at sea level on a standard day. The design performance was based on using an available Lycoming T53-L-1A engine (860 hp) in the HU-1A series helicopters.

At the present time all production models of the HU-1B series helicopters use a T53-L-5 engine rated at 960 shaft horsepower.

Beginning with an as yet undetermined serial number effectivity the HU-1B helicopters will be equipped with a T53-L-9 Lycoming engine. The rotor system, incorporating 21-inch chord blades, and dynamic components on the present HU-1B helicopters are designed to be compatible with the increased power from 860, available on the HU-1A, to 1100 shaft horsepower on the HU-1B.

As is the case in any helicopter, the Iroquois is capable of delivering a maximum thrust commensurate with rotor-engine limitations and the density of the atmosphere in which it is operating. Maximum thrust can be used to obtain maximum airspeed, optimum rate of climb, or, at some reduced airspeed, the maximum maneuver potentiality.

The pilot may employ the capabilities of the helicopter within maximum limitations and in accordance with the environment under which he is operating. The capabilities and limitations of the helicopter in stabilized flight conditions are clearly and accurately defined in the performance data published in the applicable -10 operator's manual. The rotor limits placard (airspeed limitations) is also based on the same stabilized flight conditions.

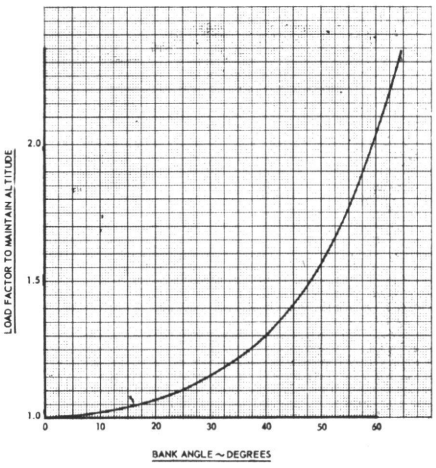
The rotor limits placard can be used to determine maneuver capabilities of the helicopter, such as angle of bank, gross weight, etc.

During maneuvering turns, a greater g load, which varies with the angle of bank, is exerted on the rotor. In a stabilized angle of bank a constant load intensity will result. As the bank attitude is increased, the weight imposed on the rotor will increase. For instance a 30° bank angle will produce 1.15 g's; a 45° bank angle, 1.4 g's; and a 60° bank angle, 2.0 g's. Based on the fact that the rotor experiences a 1.0 g load in level flight, it can readily be seen that this factor increases 100 percent in a stabilized bank of 60°. Figure 1 shows the load factor at any given stabilized bank angle between 0 and 60°.

The observed airspeed should be reduced during maneuvers in accordance with the rotor limits placard (fig. 2).

Figure 3 shows load factors imposed on the rotor at various gross weight conditions.

Figure 1



This article originally appeared in "Rotor Breeze." Mr. Smith is Chief Experimental Test Pilot, Bell Helicopter Company. He has more than 5,000 flying hours in helicopters, including more than 600 in the HU-1 series.

OPERATING LIMITS								
DENSITY ALTITUDE	CALIBRATED AIR SPEED - KNOTS							
	5000 LB		6000 LB		6500 LB		7200 LB	
RPM	6200	6400	6200	6400	6200	6400	6200	6400
SL	105	105	105	105	77	77	58	62
3000	100	100	98	100	74	74	49	59
6000	96	96	80	93	71	70	34	43
9000	89	92	63	75	56	66	—	29
12000	73	84	47	58	38	48	—	—
15000	57	67	—	42	22	32	—	—
18000	42	51	—	—	—	—	—	—
HOVERING — 5800 RPM								
AT 5000 LB - UP TO 16,800 FT. AT 6000 LB - UP TO 11,100 FT.				AT 6500 LB - UP TO 7,600 FT. AT 7200 LB - UP TO 3,800 FT.				
REDUCE AIR SPEED WHEN VIBRATION IS EXCESSIVE								

HU-1A

OPERATING LIMITS								
DENSITY ALTITUDE	CALIBRATED AIR SPEED - KNOTS							
	6600 LB OR LESS		7200 LB		8000 LB		8500 LB	
RPM	6400	6600	6400	6600	6400	6600	6400	6600
SEA LEVEL TO 2000 FT	120	120	109	112	95	101	86	95
3000 FT	116	116	105	108	92	97	82	92
6000 FT	102	106	92	97	77	86	68	80
9000 FT	90	94	79	86	65	76	-	-
12000 FT	77	84	66	75	-	-	-	-
15000 FT	64	72	-	-	-	-	-	-
18000 FT	51	61	-	-	-	-	-	-
FROM 0 TO 70 KNOTS USE 5800 TO 6600 RPM RANGE - S.L. TO 2000 FT. FROM 70 TO 120 KNOTS USE 6400 TO 6600 RPM RANGE								
REDUCE AIR SPEED WHEN VIBRATION IS EXCESSIVE								

HU-1B

Figure 2

Factors shown in condition 3 of table I reveal that a stabilized bank angle in excess of 30° would not be desirable, and that airspeed should be reduced to less than 48 knots (observed) for the HU-1A. Should it be desirable to continue flight at 50 knots, a bank angle of much less than 30° should be used.

Comparing each item of condition 3 of table II with the corresponding item of condition 3 of table I shows that the airspeeds and gross weights for the HU-1B are greater and not as critical as those for the HU-1A (increased chord blade).

A descending turn or autorotational turn at a given angle of bank and a stabilized rate of descent imposes the same g load on the rotor. Hence, if the turn is too abrupt (tight) and rotor limits are exceeded, further application of controls will not check the rate of descent if the turn is continued. To alleviate this condition the pilot must roll out of the turn to reduce the rotor load and provide control response to reduce rate of descent.

The permissible bank angles vs altitudes and gross weights shown in tables I and II will affect the turning radius of the helicopter. A light gross weight helicopter at sea level may make 180° turns within an area comparable in size to that contained within the boundaries of a football field. The same helicopter at normal gross weight and at a density altitude of 12,000 feet will require a much larger area to accomplish the same turn. Figure 4 is a pictorial presentation showing the distance in feet required to

Figure 3

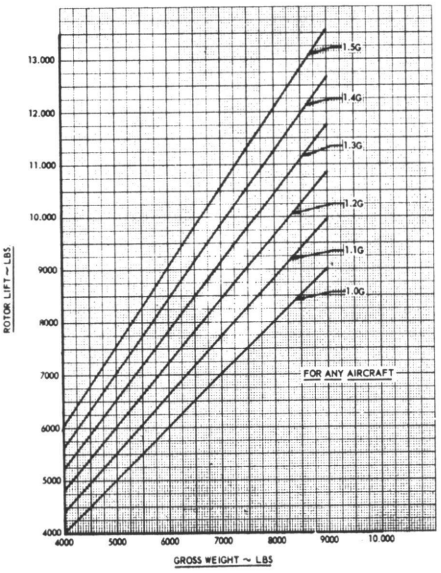


TABLE 1 (HU-1A)

G.W.	R.P.M.	Altitude Density	Flt. Cond. Stabilized	"G" Load	Rotor Load	Placard Air Speed-Approx.
1. A. 5000#	6400	Sea Level	Level Flt.	1.0	5000#	105 K OAS
B. 5000#	6400	Sea Level	45° Bank	1.4	7000#	60 K OAS
2. A. 6000#	6400	9,000' Density	Level Flt.	1.0	6000#	75 K
B. 6000#	6400	9,000' Density	30° Bank	1.15	6900#	50 K
C. 6000#	6400	9,000' Density	35° Bank	1.22	7320#	Less than 29 K
3. A. 6000#	6400	12,000' Density	Level Flt.	1.0	6000#	58 K
B. 6000#	6400	12,000' Density	30° Bank	1.15	6900#	Less than 48 K
B. 6000#	6400	12,000' Density	45° Bank	1.40	8400#	———

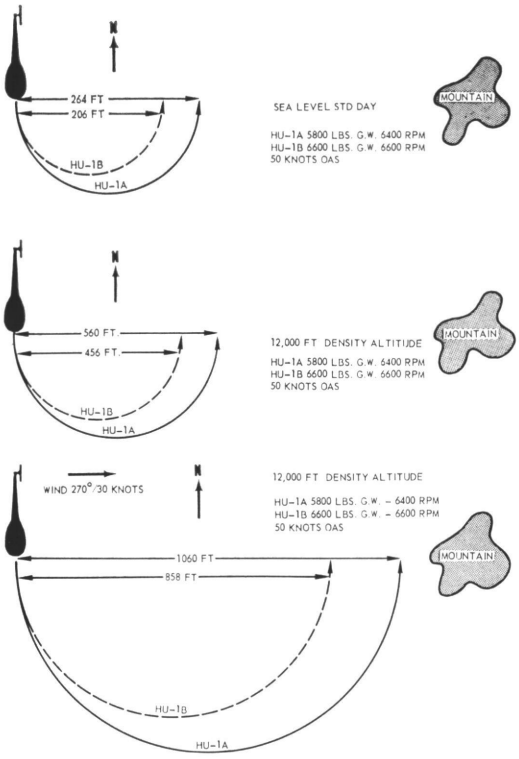
TABLE 2 (HU-1B)

G.W.	R.P.M.	Altitude Density	Flt. Cond. Stabilized	"G" Load	Rotor Load	Placard Air Speed-Approx.
1. A. 6600#	6600	Sea Level	Level Flt.	1.0	6600#	120 K
B. 6600#	6600	Sea Level	30° Bank	1.15	7590#	105 K
C. 6600#	6600	Sea Level	40° Bank	1.40	8580#	93 K
2. A. 6600#	6600	9,000' Density	Level Flt.	1.0	6600#	94 K
B. 6600#	6600	9,000' Density	30° Bank	1.15	7590#	82 K
C. 6600#	6600	9,000' Density	40° Bank	1.40	8580#	Less than 70 K
3. A. 6600#	6600	12,000' Density	Level Flt.	1.0	6600#	84 K
B. 6600#	6600	12,000' Density	30° Bank	1.15	7590#	Less than 70 K

execute a 180° turn at sea level and at 12,000 feet density altitude, using the same observed airspeed of 50 knots at a gross weight of 5,800 pounds.

The pictorial data, as presented, is based on the assumption that vertical turbulence is nonexistent. Under turbulent conditions a more conservative approach must be employed. Therefore, the degree of turbulence will dictate the degree of conservatism. In the Iroquois helicopters, an excessive 2/rev. vibration is a strong indication that rotor limits are being approached or have been exceeded. The 2/rev. vibration can be compared to the shudder experienced before a stall in a fixed wing aircraft. A severe 2/rev. vibration will be present in the HU-1 series helicopters before control response is adversely affected. The most effective remedy should an excessive 2/rev. vibration be experienced is to reduce collective, airspeed and/or angle of bank.

Figure 4



MAXIMUM ROTOR CAPABILITY
TURN RADIUS INCREASES WITH FORWARD VELOCITY
VALUES SHOWN ARE MINIMUMS

NOTE

A 2/rev. vibration is slightly higher than 10 cycles per second. It may be recognized as a vibration frequency which is too fast to count.

HANDBOOK CONTENTS

As stated previously in this article, the performance capabilities and limitations of the HU-1 series helicopters are clearly and accurately presented in the applicable -10 pilot's manual. These data are fully substantiated by both contractor and using activity test agencies and by contractor prepared substantiating data reports which are presented to the military flight test analysis branch. These data are obtained at various gross weights and at several different density altitude conditions.

So any pilot may duplicate these data, standard production helicopters are used for these tests. Duplication may be obtained provided the same technique is used, the same atmospheric conditions exist, and the engine is developing the specification horsepower. Optimum technique and adequate instrumentation will ensure that horsepower can accurately be determined. It is imperative that the tests be conducted in smooth, calm air to duplicate performance data.

When these factors are reduced to practice, it is feasible that different results may be obtained, which is often the case. Several factors, such as turbulence, downslope wind, etc., affect performance. A takeoff in a 2 to 3 knot downwind condition may, if power is already marginal, increase distance to clear a 50-foot obstacle by a substantial margin. A downslope wind, characteristic of hilly terrain, will also reduce the ability of the helicopter to perform in accordance with the data contained in the manuals. Turbulence seriously affects performance at times.

Due to the multitude of factors and the complexity of various problems the manual cannot fully cover all operating conditions. As an example, it is practically impossible to cover multiple emergencies in written material. For this reason it is well to remember that a handbook cannot be a substitute for sound judgment.

In summation, KNOW YOUR IROQUOIS, not only on a "sea-level-standard-day," but under any and all operational conditions you may encounter.

Full-scale wind tunnel tests of the HO-4 (Bell Helicopter Company's LOH model) have been completed at NASA's Ames Research Center, Moffett Field, Calif. The mockup was installed in the 40- by 80-foot wind tunnel upside down with tufts installed to facilitate airflow study and accurately determine fuselage drag. Complete test results will be published by NASA later this year.

CART OR HORSE --WHICH COMES FIRST?

Captain James W. Ford

WITHIN ARMY Aviation today a great amount of stress is being placed upon pilot standardization. Regulations require a current checklist be maintained in all aircraft and that these checklists be used. Other directives require the establishment of standardization boards and require yearly checkrides of all aviators to not only ensure pilot proficiency but also pilot standardization. With transitions to other aircraft, the procedures taught must be in accordance with the applicable aircraft -1 handbook. It is (or should be) an accepted fact that the one sure way of decreasing accident rates, thereby increasing mission effectiveness, is through pilot standardization.

But could it be that we are possibly getting the proverbial cart before the horse? Granted that Joe Aviator must be standardized as to procedures, but how about the aircraft that ol' Joe is required to fly? While we require Joe to take standardization checkrides, we continually destandardize his aircraft by installing a hodgepodge mixture of equipment and accessories.

What with the 14 (plus) models of aircraft, not counting the different series within models, now in the Army inventory, ol' Joe must be flexible. After a flight in an H-13, we schedule him for a flight in an L-20, L-23, L-19, or maybe an L-26, H-21, H-34. And so it goes. This sort of flexibility, which tends to turn the hair of aviation safety officers prematurely gray, is expected of ol' Joe. But do we have to compound matters by varying the instruments and dials which he must read and evaluate? Why should we require him to read airspeed in mph in an L-19 and in knots in an H-19.

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This variance is found not only in different types of aircraft but in aircraft of the same type, model and series, parked side by side on the same airfield and belonging to the same unit. How many of us "flexible" aviators have climbed out of one L-20 equipped with an mph airspeed indicator into one where the airspeed is read in knots? The same variance can be found in tachometers, altimeters, clocks, attitude in-

dicators. All of these items vary within one type aircraft, the L-20. To attempt to list all of the variables within all of the aircraft in the Army inventory would be a truly cumbersome task.

Just for fun, let's pull out our -20P for the L-20 and look up attitude indicators. On page 19, we find: INDICATOR, ATTITUDE, FSN 6610-247-9354. That was easy. But lo and behold, after a description of the instrument, we find it is interchangeable with five other instruments. Immediately following these "suitable" substitutes, we find another FSN for the same instrument and it lists five substitutes! Are all of these the same instrument? They may perform the same function, but they are different. Differences exist in the makeup of the stationary portion and in the movable or horizon portion.

Allow me to dream up a few situations that flexible ol' Joe may encounter during his normal flying and attempt to show where he may have problems.

- There is a 500-foot ceiling and after takeoff, he must, before he can effectively transition to IFR, figure out the face of the attitude indicator. Not too difficult, but it consumes precious seconds when Joe should have his mind free for other things.

- After flying an L-20 equipped with an airspeed indicator which reads in knots, he jumps into one where the indicator reads in mph. This is no big thing; we have all done it. But isn't it possible that it could be a big thing if Joe happens not to notice that tiny "mph" on the instrument and thinks it's knots when he comes in to land. Here again is a time when Joe's mind should be free for other things.

- After flying an L-20 equipped with a suction-operated heading indicator (D. G.) where the heading is shown by numbers mounted on a horizontal card and the numbers increase from right to left, we put him in an L-23 with an electric heading indicator where the heading is shown by numbers in a circle on a vertical plane and the numbers increase from left to right.

I wonder why he sometimes turns the wrong way when flying on the gauges? If you have ever flown these two aircraft, you know why he sometimes turns the wrong way.

When we are picking up the pieces and the board has convened, it is poor ol' Joe who is tabbed with poor judgment or "Pilot Error." But who is really at fault? Is it possible that the instruments, or the aircraft, or

we who are responsible for the procurement and acceptance of the equipment installed in his aircraft could be listed as contributing factors? A slightly different type of indication on an instrument at a critical time could be the start of the dreaded sequence of events that invariably leads to an aircraft accident.

After this harangue on instrument and indicator standardization, one may ask, and rightfully so, What can be done about it? Well, we can just sit back and hope that eventually things will straighten out, or why not use AR 700-41 in conjunction with DD Form 1275 and submit the sometimes slow operating but usually dependable UR.

Paragraph 3a of referenced AR states: "The conditions for submitting an unsatisfactory report will include the following:

(1) A condition or materiel deficiency constituting a hazard to personnel, equipment, and missions."

If this is perhaps too drastic, we might use subparagraph (7) which states: "(7) Circumstances other than those above, but considered to be of sufficient importance to warrant reporting or as directed by The Transportation Supply and Maintenance Command."

One can argue that a small

variation between instruments is not a "hazard to personnel, equipment and missions," but this same person must admit that mistakes can be made as long as humans are involved. With today's complex Army aircraft, one small misinterpretation can be costly—costly not only when considering the price

tag for the aircraft, but how about ol' Joe? In 1959, the U. S. Navy estimated that replacing a 32-year-old married aviator costs in excess of one million dollars! This is pretty expensive when you compare it with the cost of an airspeed indicator or attitude indicator.

After lengthy deliberation, I do not see how we can hope to effectively progress toward the desired and much required aviator standardization if we do not attempt to standardize the aircraft these same aviators will be expected to fly. Only then can we hope to put the horse in its proper position in front of the cart.

Logistical Employment of Army Aircraft

Major General Richard D. Meyer

NO PEACETIME maneuver or exercise has ever exercised the logistical arms and legs of the maneuver force. The absence of actual or simulated ammunition consumption, insistence on maximum availability of every piece of equipment, and the compressed time schedule of every major exercise operate to eliminate or defer the logistical problem from the play.

In a smaller sense, these same factors have tended to restrict the application of the quite significant logistical or administrative support capability of our own aircraft in day-to-day operations as well as in maneuvers. In the absence of a requirement to move significant quantities of supplies, our aircraft are usually held in standby for an occasional troop movement at the best; or at worst for VIP limousines.

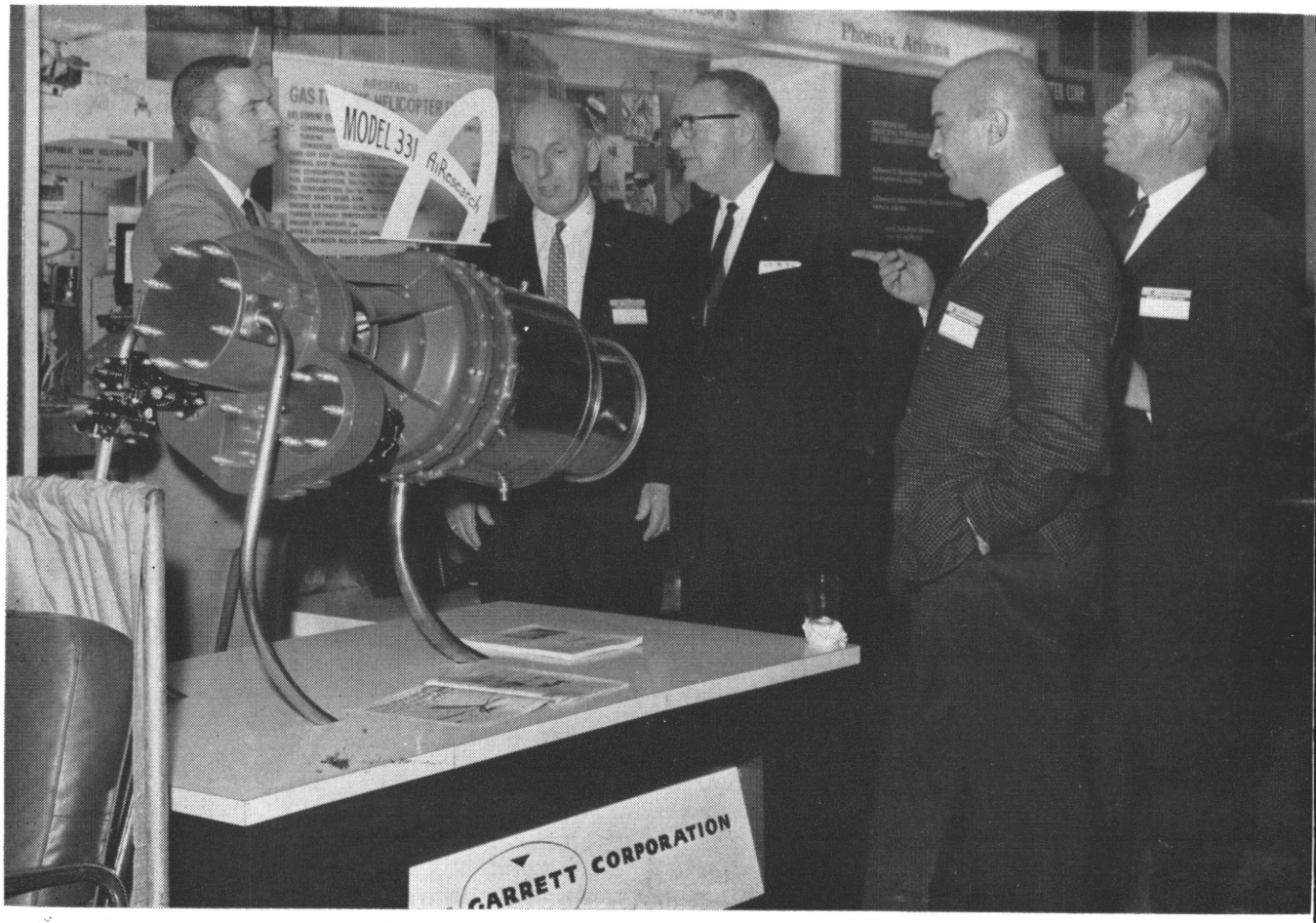
We can look forward in the next couple of years to operational units of CHINOOK and CARIBOU aircraft. The time has come to establish normal logistic mission requirements and operational concepts for this new Army capability. This is not to argue the exclusive assignment of these aircraft to logistic missions, but it is to argue that a modern Army must have a modern transport system.

Some time ago, a study approved by the DCSLOG, DA, demonstrated a requirement for a normal day-to-day capability to move 100 tons per division force per day by Army aircraft. Within the field army area the average mission radius was taken at 75 miles. With this sort of capability, it can be shown that we could well begin to replace Army truck companies on about a 1½ to 1 ratio by aircraft companies.

Of course, if we assume an excellent roadnet of "autobahn" characteristics, or a high-powered commercial transport net in operation, the economics of any kind of airlift are not apparent. On the other hand, any unexercised military capability grows flabby and weak.

In summary, then, it appears we are long overdue in creating, and exercising in peacetime and in maneuver, our administrative-logistic airmobile distribution system. This system should have its procedures and doctrines developed as a matter of urgency; the requirements for its use should be ground into such basic documents as the Leavenworth type field army, the theater type mobilization corps force, and so on. We must look into our contingency plans to determine what secondary benefits would accrue in a possible reduced requirement for engineer construction. The ramifications are many; we must develop them to the extent we can, rather than to force improvisation on a field commander in combat.

General Meyer is Deputy Chief of Staff for Logistics, Hqs, USCONARC, Ft Monroe, Va.



Choppers in Mufti

Pierce L. Wiggin

SAFETY—SALES—SENSE, in this order, are three MUSTS for successful commercial helicopter operations," said Association President Hal C. Conners at the opening session of the 14th annual convention of the Helicopter Association of America, held in Dallas, Texas, 21-24 January 1962. With the possible exception of sales—and Army Aviators who have carried novices for their first helicopter rides might argue the point—this philosophy is well suited for military helicopter operations.

With 321 commercial operators using 995 helicopters in this country, and a few with relatively large fleets, it doesn't require an understanding of higher mathematics to see that most of them have to get along with one aircraft. When you're in this position, or when you depend on a safety-conscious public for revenue, an accident —even a minor one—can spell disaster. That's one reason why, despite freak subzero temperatures, snow, and fifth-floor

ceilings, these operators poured into Dallas more than 300 strong. They came from every section of the United States and Canada, from Europe, Scandanavia, and South America. They came to learn new ways to make their operation SAFER and more profitable.

How do these people go about making their operations safer? Guest speaker Morten H. Hancke, president, Scancopter, Oslo, Norway, described how his firm had done just this while flying over some of the world's most hazardous terrain.

Leaving his father's auto repair garage in 1947, Hancke scraped together the necessary capital and bought a light American helicopter similar to the Army's H-13. Though a pilot himself, he did not feel that he had enough experience for the type of flying he envisioned for his company, so he hired pilots, insisting that they have a minimum of 1,500 helicopter flying hours. Hancke felt that this much flying time would assure the successful, accident-free operation of his copter for any type of flights his customers might demand.

Unfortunately, things just didn't work out that way. The young firm was plagued with costly accidents from the start, and Hancke had to seek more and more financial backing. Finally, on the point of giving up, he decided to try a system of strict supervision and checkouts. He restricted his pilots to only the types of missions they had demonstrated they could handle. And he insisted on a thorough checkout for each pilot for each new type of mission, plus continuing periodic checks.

How well Mr. Hancke succeeded may be judged by the fact that Scancopter now operates five helicopters from four fixed bases in Norway, two of which are north of the Arctic Circle. The firm takes on jobs today that would have given its pilots the screaming-meanies back in the early days—and it does these jobs in an accident-free, profitable way.

One of the most interesting meetings at the convention was a pilot's forum. As might be guessed from Mr. Hancke's success story, the major topic of discussion was STANDARDS OF PROFICIENCY. The concensus of opinion among operators and pilots was that some method of stringent and accurate checkouts for ratings is needed, if helicopters are to be exploited to their full potential. Though there was a wide variance of opinion about how many flying hours a pilot should have, there was complete agreement on the need for checkouts and demonstration of ability for each type of operation, plus periodic rechecks. Some operators go a step further and limit their pilots to operating one type of aircraft.

What can military operators learn from these civilians? Even if the idea of pilots with 1,000-1,500 hours proved to have merit, it couldn't be applied in the military services where pilots have to be trained from scratch. True. But with a little advance planning, there's seldom any reason why aviators, particularly at unit level, can't have the benefit of a checkout and continuing standardization for each type of terrain and each type of mission. In fact, many Army units are now providing such a program. These are the units that enjoy SAFETY—SALES—SENSE.

Combat Intelligence--II

The Role of Army Aviation in the Field Combat Intelligence System

Major Robert N. Dempster

IN THE AUGUST 1961 issue of the DIGEST, an article appeared entitled "COMBAT INTELLIGENCE, Airborne Sensors Improve Intelligence Capabilities." Although there was no deliberate coordination in the preparation of the August item and this offering, the two deal with a common subject. The first article provides essential background for this discussion and provokes several questions. The treatment of some of these questions will be the substance of this article.

Has Army Aviation been formally assigned the responsibility of providing the field army combat intelligence system with information?

A reflexive response to this question is, of course, in the affirmative. We may feel it should be obvious to anyone that since the Army is operating aircraft, the vehicles will logically be employed to acquire intelligence information. However, for purposes of winning arguments with individuals in uniforms of other hue, it is possible to document the responsibilities of Army Aviation in this field.

Department of Defense directive entitled "Clarification of the Roles and Missions of the Department of the Army and the Air Force Regarding Use of Aircraft," dated 18 Mar 57, specifically gives Army Aviation the mission of "Observation, visual and photographic reconnaissance, fire adjustment and topographical survey." "Army Aviation Guidelines FY 1961-FY 1970," a Department of the Army publication, dated 10 May 1961, lists "observation" as one of the six major functional fields of Army Aviation. Still another, but not the last, Department of the Army publication entitled "Field Army Combat Surveillance 1960-1970," dated September 1958, describes in some detail the responsibilities of Army Aviation elements in the acquisition and transmission of intelligence information. ("Field Army Com-

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bat Surveillance 1960-1970" is currently under revision; it is expected that the revised document will be published on 1 May 1962.)

From time to time, discussion arises concerning the word "observation." One common position is that the word encompasses only visual and photo sensing. If this were so, the various documents which assign roles and missions to Army Aviation would require change to cover the employment of radar and infrared sensory systems. However, the definition of the word "observation" as given in AR 320-5 quite clearly applies to information gathering activities conducted by aircraft and does not restrict the means to be employed, i.e., visual, photo, electronic, or otherwise.

What is the delineation of responsibility between the Air Force and the Army in the collection of information through the employment of aerial vehicles?

There is no clear-cut answer to this question at this time. In August 1958, the Department of the Army transmitted to the Department of the Air Force a document describing in detail the field army requirements for tactical air reconnaissance. This document described the anticipated Army operational environment and specific quantitative and qualitative information requirements to meet the needs of all echelons. The objective of the document was to determine the extent to which the Air Force could fulfill these requirements. It may be inferred that the Army would base its development of integral aerial information collecting systems on those portions of the stated requirements which the Air Force would be unable to fulfill. A definitive answer to this document has not yet been received by the Army although the subject is under active consideration.

At the present time it may be expected that the Army will employ organic aerial information collection means to the extent of their technical and tactical capabilities. Requirements beyond these capabilities will be fulfilled upon request by the Air Force or other supporting service as heretofore.

What is the ultimate objective for Army Aviation in the collection of combat intelligence information?

In 1957 a Department of the Army level ad hoc committee studied field army combat intelligence. The results of this study were compiled in a document entitled "Field Army Combat Surveillance 1960-1970" published in September 1958. This report now represents Department of the Army doctrine for the design of a field army combat intelligence system. Included are specific information requirements of commanders at all echelons from battle group through field army. These requirements are stated in types of information such as personnel, weapons, vehicles, etc. The document further specifies criteria for reports relating to the information subjects. These criteria include levels of accuracy and detail, frequency of observation, speed of transmission of information, and other factors. The objective for Army Aviation in the collection of combat intelligence information is to meet or exceed these stated requirements in all cases where aerial vehicles may be applied.

Where can guidance be found for the employment of aerial information collection means?

Most doctrinal information on current and future airborne sensory systems is contained in USCONARC publications. USCONARC pamphlets and other types of documents relating to these systems are generally entitled as "Organizational and Operational Concepts for the Aircraft, Drone or Surveillance System."

Detailed guidance for the employment of aerial surveillance platoons in the divisions and the armored cavalry regiment is contained in Department of the Army Training Circular No. 17-7. This document was prepared by the U. S. Army Armor School.

For technical information, the current Index of Technical Publications will reveal a few technical manuals available. Additional technical information may be acquired from the U. S. Army Combat Surveillance Agency, Arlington, Va., or from the U. S. Army Combat Surveillance and Target Acquisition Training Command, Fort Huachuca, Ariz.

Is there really a significant improvement in the capability to acquire combat intelligence information today as compared with the period of the Korean Conflict?

Today there are marked improvements in the capability of Army Aviation to perform the observation function by all means.

In the visual observation field, a research effort by the Aviation Unit of the Human Resources Research Office has evolved greatly improved training methods for aerial observers. The effect of this effort (TASK OBSERVE) is to pro-

duce observers directly from training, with a degree of proficiency equalling experienced observers of the Korean period.

In the field of aerial photography, we have cameras in the hands of users with mounts designed for the aircraft in which they are carried. These cameras have a night photography capability and features which compensate for relative motion between aircraft and ground. These features were not available during the Korean period. Other advantages of the new cameras are improved resolution and greater film capacity.

Electronic means of observation such as the radar and infrared sensory systems provide the capability to detect both stationary and moving subjects of interest to the combat intelligence system. These systems function when visual or photographic observation is ineffective. Some of these systems are presently in the hands of using units.

These systems in the hands of users represent the first steps in a very active program. Greatly improved systems are in various stages of development and test. Some are very close at hand.

Air defense operations conducted by the enemy may modify the effectiveness of these means. Up to this date, however, the vulnerability or survivability of Army observation aircraft has not been validly determined and may never be determined except in actual hostilities. At present, and for the foreseeable future, the collection of intelligence information from Army aircraft remains a major function of Army Aviation and commands the interest of tactical users of aviation.

Recovery Crew

A NEWLY-MODIFIED Army Sikorsky H-37B helicopter from the 19th Trans Co, Ft Benning, Ga., was recently used to recover an Air Force H-43B helicopter from a densely wooded area near Loring AFB, Maine. The H-43B made an emergency landing as the result of a malfunction.

WARNING!

THIS SEAT CONTAINS EXPLOSIVE CHARGE!

John A. Kendrick

THE ABOVE phrase has resulted in the birth of a whole new generation of curiosity seekers. This message can be found posted both on and near the Army's newest "hot seat" — the Mohawk's Martin-Baker ejection seat. Curiosity among the uninformed can be fatal and since we are not endowed with the proverbial "nine lives," let us read on.

The Martin-Baker seat was designed to be a lifesaver, not a killer. A thought provoking analogy of the ejection gun's main charge would be to compare it to that of a 20mm shell. The drogue gun is almost as lethal. Its firing mechanism is no more complex than the average gun and can be triggered just as readily. Consequently the seat should be maintained, sat in, and respected as such.

Safety precautions cannot be overemphasized, and good maintenance practices play a vital part in the extreme demands of this emergency escape device. The occupant, as well as the mechanic, should be thoroughly acquainted with the many facets of the ejection, separation, and survival sequences.

The writer believes that an aviator could spend 60 seconds when entering a Mohawk in a glancing inspection at various seat components and then feel assured that his seat would function reliably if needed. It is with this thought in mind that this article is motivated: to highlight the most important features to better understand the maintenance and operational performance aspects of this lifesaver. It is not intended as a substitute or shortcut for a formal indoctrination.

Inasmuch as the seat consists of many units, all very essen-

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tial in the sequence of its operation, this article is divided into six major components to facilitate explanation for pilot preflight and the maintenance of the seat.

EJECTION GUN

The ejection gun is comprised of three telescoping tubes, outer, intermediate and inner, mounted vertically against the aft cockpit sloping bulkhead. The outer tube, or cylinder barrel, is attached to the cockpit floor and to the bulkhead. During ejection, the intermediate tube, having extended its 37-inch stroke, remains with the outer tube in the aircraft. The inner tube, which has a 33-inch stroke, carries the seat from the aircraft. Guide rails or tracks on each side of the outer tube provide for proper alignment of the seat during installation and as the seat traverses during ejection.

The upper cross member of the seat is locked to the ejection gun by the top latching mechanism. This latching mechanism requires a critical and positive engagement since it locks the seat onto the ejection gun in the Mohawk. In addition, its action during ejection disengages the seat from the gun as the inner tube thrusts the seat upward. If the latch mechanism is not properly locked, it is possible for the seat to become disengaged when subjected to negative forces (i.e., inverted flight). **A point to remember during maintenance: the top latch mechanism, if properly engaged and bottomed, will be indicated by ¼ to 2 free turns of the knurled nut. A pilot should see this knurled nut safety-wired and lead sealed to ensure that the seat is properly installed (fig. 1).**

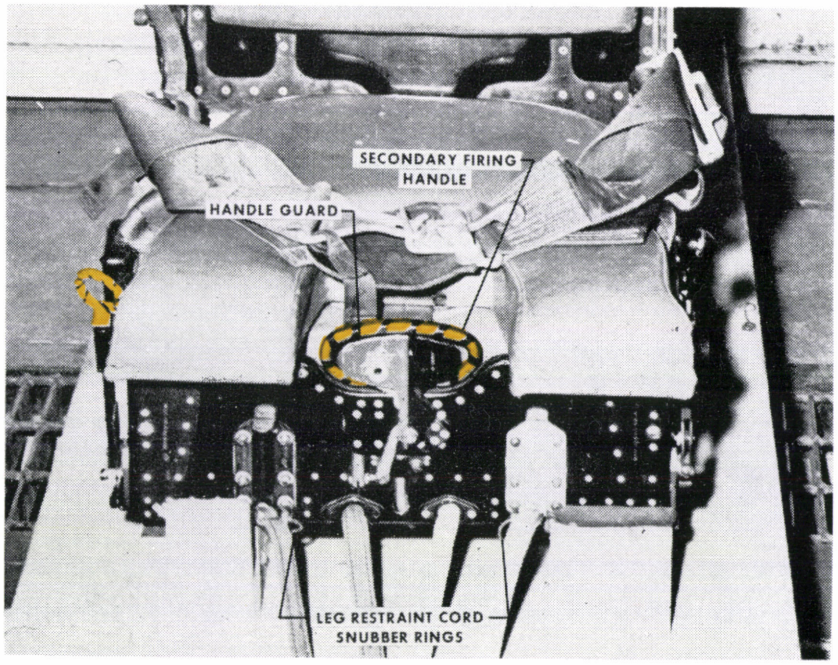
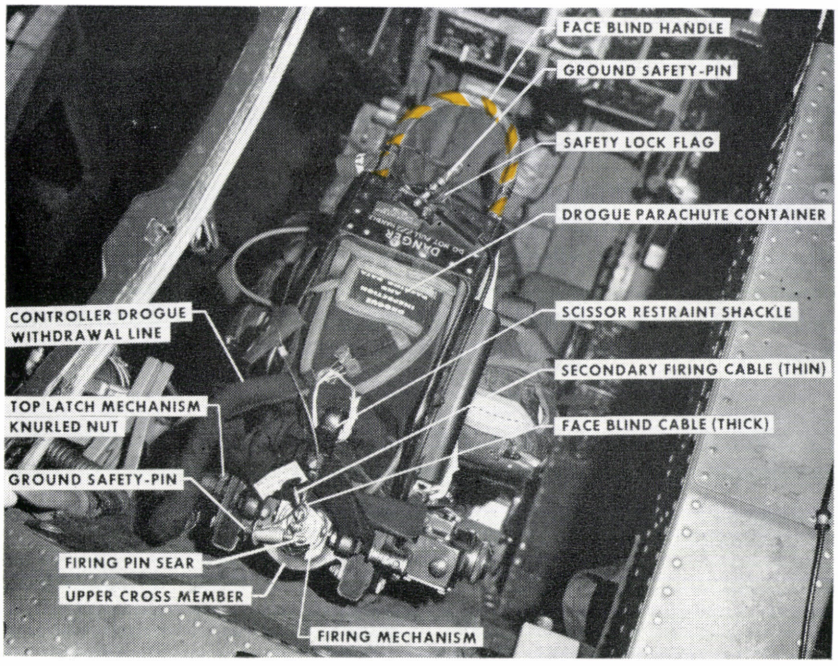


Figure 2

Figure 1



Three explosive cartridges, one primary located on top of the ejection gun and two secondary each equally spaced at the aft side of the gun, are used to propel the seat. The primary cartridge is placed inside the inner tube and the firing mechanism, which contains the firing pin, compression

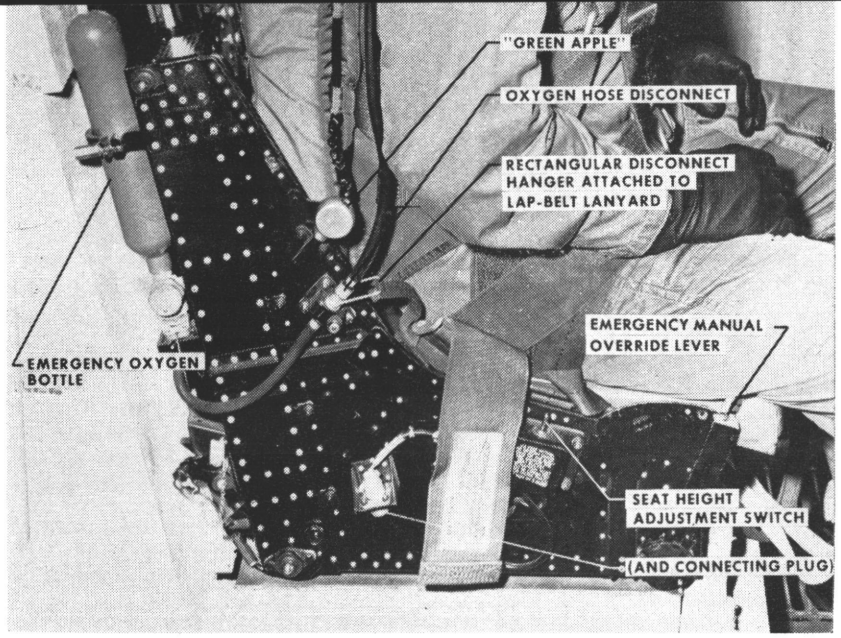


Figure 3

spring and sear, is screwed in above it. The face blind cable (thicker cable) is attached to the sear first with the secondary firing cable (thinner cable) attached over it. **The crewchief removing the ground safety-pin, and the occupant before flight, should check to see that these cables are connected and in that order. Remember: Thin on top and thick on the bottom.**

FACE BLIND

Normal ejection is accomplished by pulling the overhead face blind handle. The face blind is stored in the area forward of the drogue parachute container and the handle is retained in the container by two spring-loaded locking plungers. When installed properly, these plungers should be flush with the outer surface of the container. If the plungers are not fully inserted into their orifice, the handle could inadvertently become dislodged, resulting in possible seat ejection. More than one pilot has neglected to properly adjust his seat height and has come out of a loop or roll with his helmet knob caught in the face blind handle.

A locking mechanism, mounted on top of the face blind container, is provided to lock the face blind handle. The red tab or flag of this lock must be pressed down to unlock the face blind, and should be done before takeoff (fig. 1).

SEAT BUCKET

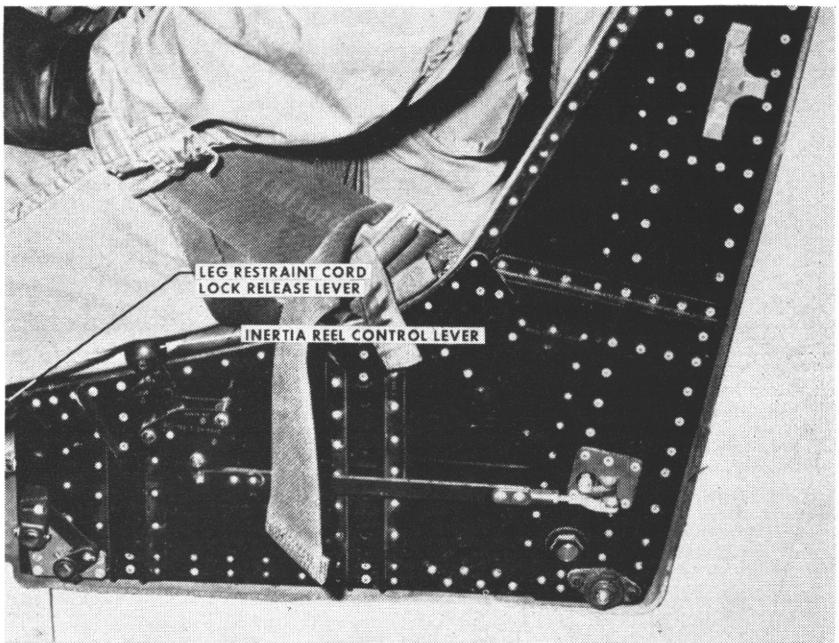
The seat bucket supports the occupant and is the only part of the seat that moves during height adjustment. It can accommodate a PK-2 pararaft survival kit under the seat cushion. In addition, the seat bucket contains the following controls.

The secondary firing handle, located front and center, is used as an alternate means of ejecting should the occupant be unable to reach the face blind handle. A two position, detented, red and black colored guard, when in the "up" position, safeties this handle (fig. 2). When rotated 90° to the right, it unlocks and clears the handle so it may be grasped by the occupant. **During preflight, an aviator might quickly cycle this safety guard to ensure its freedom of movement.**

A two position, spring loaded, manual override handle is located on the right forward side of the seat bucket (fig. 3). When moved up and aft to the unlock position, it releases the lap belt seat attachments, shoulder harness from the inertia reel, leg restraint cords, and also locks the face blind and secondary firing handles. **An aviator should make sure this handle is in the forward locked position. A firm pull on the lap belt and shoulder harness loop straps at their seat connections will tell if the handle had been actuated.**

A two position, dual leg restraint cord lock release lever

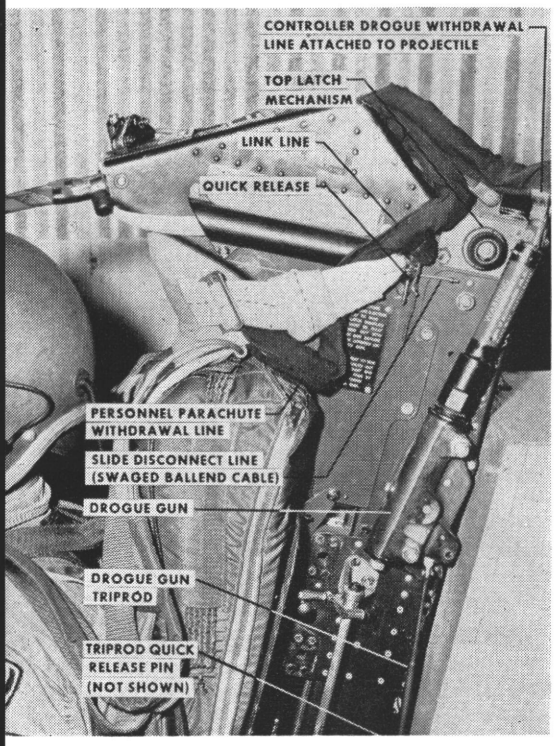
Figure 4



is located on the forward left side of the seat bucket (fig. 4). When moved aft, it releases the cords from the seat bucket. **A tug on the leg restraint cords could mean the difference between a clean ejection or a possible leg injury.**

The inertia reel manual control lever is located on the left side of the seat bucket (fig. 4) aft of the leg line release lever. When in the locked position (full forward), the harness loop strap will retract, but cannot extend. When the control lever is cycled through the aft position, the loop strap locking snubber releases as the control lever returns to the mid or autolock position. The harness loop strap can now be extended or retracted. If subjected to an inertia force exceeding 5 g's, acting forward and/or up, the loop strap will retract and lock. **A complete cycle of this handle is recommended after strapping into the seat, with the occupant pulling fore and aft on the harness loop strap to check for binding.**

Figure 5



A two position toggle switch, located on the right side of the seat bucket, controls height adjustment (fig. 3). **This switch is wired to a plug which separates during ejection and therefore should not be safety wired.** Since the plug is plainly visible below the toggle switch, it can be easily checked (fig. 3).

Two spring loaded leg restraint cord snubber finger rings are located on the lower forward portion of the seat bucket (fig. 2), and when pulled allow the occupant to control the slack desired on the leg restraint cords. This slack should be adjusted, individually, to allow for each rudder pedal in the full forward position. The upward movement of the seat during ejection takes up the slack holding the occupant's legs aft against the seat bucket. The lower end of the leg restraint cords terminate at roller brackets secured to the cockpit floor by quick release pins. The roller brackets contain soft rivets which will shear by the pull on the cords after the occupant's legs are against the seat. **A crewchief might feel better knowing that he had checked the hook-up of the quick release pins.**

The emergency oxygen bottle, located on the right side of the seat (fig. 3), automatically supplies approximately 10 minutes of oxygen, regardless of altitude, to the occupant upon ejection and is actuated during the initial upward movement of the seat. An actuating knob (green apple) on the right side of the seat provides a means of supplying the emergency oxygen should it be needed as a substitute for the regular aircraft's system. When separation occurs, a lanyard attached to the lap belt pulls on a quick disconnect fitting to disengage the hose from the seat. **A check should be made to ensure that the rectangular disconnect guide on the end of the lanyard (fig. 3) be as near parallel to the hose as possible.** This guide has in the past been susceptible to bending by the occupant or by personnel performing cockpit maintenance. If bent it could impede separation of the hose from the seat.

DROGUE GUN AND DROGUE PARACHUTE

The drogue gun (fig. 5), located on the seat's left vertical beam, consists of a barrel which houses the projectile and cartridge and a body which contains the firing mechanism. As the seat leaves the aircraft, a sear attached to a triprod is extracted, actuating the firing mechanism. After a half second time delay, the projectile is fired and the withdrawal sequence is begun, transmitted from one component to the next by a series of connecting lines. The projectile extracts a 22-inch controller drogue which withdraws a 5-foot stabilizer drogue. The stabilizer drogue terminates at the scissor restraint shackle on the top of the seat. Connected to the same shackle is the link line used to withdraw the personnel parachute.

A 10-second check by a crewchief or aviator on these components would be time well spent. **Proceeding from the upper to the lower extremities (fig 5), check that the controller drogue withdrawal line is attached to the projectile, and routed over the link line and all other lines to the scis-**

sor shackle at the top of the seat.

The link line emanates from the scissor shackle and extends down each side of the drogue chute container, secured there by quick release pins. Make sure these pins are inserted, and that the static line slide disconnect cable (fig. 5) (swaged ballend cable) is visible at the left release pin.

The left link line is attached to the personnel parachute withdrawal line by a screw connector enclosed in a fabric cover. **The link line screw connector should be felt to ensure that it is properly connected to the personnel parachute withdrawal line. Check to ensure that the drogue gun barrel is safety wired and lead sealed to the body.** This is the only indication that the gun is loaded, since one operation precedes the other during maintenance. **Finally, check that the sear is inserted and the triprod attached to the ejection gun cross member.**

TIME RELEASE MECHANISM

The time release mechanism, heart of the Martin-Baker seat's phenomenal performance, is located on the right side of the seat (fig. 6) and is actuated by a sear and triprod in much the same manner as the drogue gun. This mechanism houses two spring loaded plungers, a g controller for precluding actuation above 4½ g's, and a barostat which prevents actuation above 15,000 feet.

As the rack plunger (shorter of the two) completes its stroke it forcefully releases the shackle plunger. This action commences the entire separation sequence of the occupant from the seat. Simultaneously released are the dual leg restraint cords and lap belt lugs from the seat bucket, and the shoulder harness loop strap from the inertia reel. It also opens the drogue shackle scissor, allowing the drogue chute to pull the link line and withdraw the personnel parachute.

A check to see that the triprod is attached and the sear is inserted should be mandatory. To determine the mechanism has been properly serviced and cocked, one need only notice that the plungers are partially extended (approximately one-fourth inch) out of the lower portion of the body. If the plungers are extended, about 4 to 6 inches, the time release mechanism is not cocked. Recently, a Mohawk pilot fell out of his seat during inverted flight. It was ascertained that the time release mechanism had not been properly cocked, which resulted in an inadvertent actuation while inverted, thereby releasing the lap belt, shoulder harness, and leg restraint cords.

The barostat, which is secured only finger tight, should be safety-wired and lead sealed to ensure it has not been tampered with. The g controller should also be lock-wired in the aforementioned manner. **A maintenance note: Never attempt to change any of the settings within the g controller unless authorized.**

QUICK-FIT HARNESS

The remaining link in this chain of sequence is the occupant's quick-fit harness, portable and completely adjustable. Since the harness is directly connected to the parachute riser straps (by two "rocket-jet" fittings and therefore bears the weight of the occupant once the chute is deployed), the strap portion should be checked for fraying,

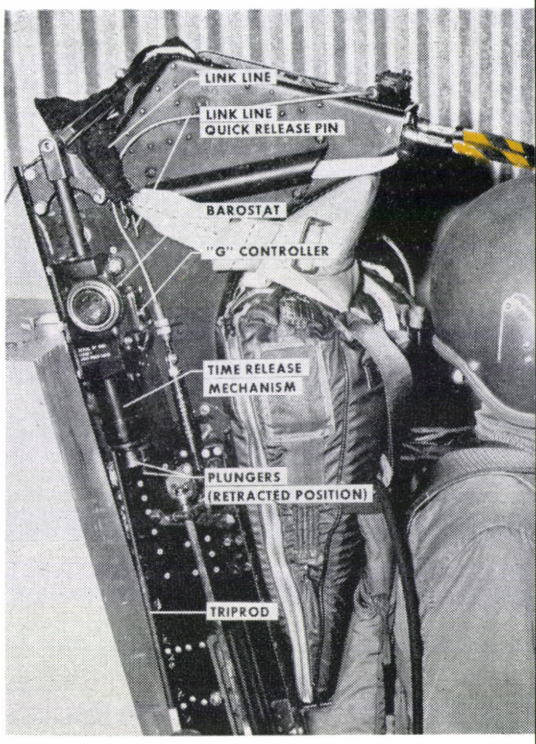


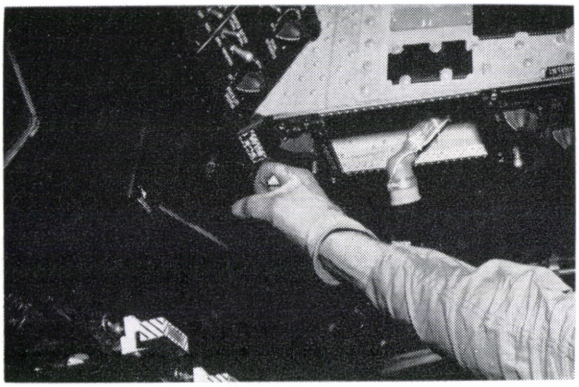
Figure 6

cuts, and deterioration.

While donning this harness the occupant should tightly draw all adjustment straps. Two vertical straps emanate from the harness just below the "rocket-jet" attachments. Provided to support the occupant during ditching or crash damage, they must be connected to the lap belt buckle.

The old cliche that a chain is only as strong as its weakest link was never more befitting. Knowledge of your ejection seat sequence "links" is an insurance policy for a safe delivery back to "ol' Terra," via the express route. Should you elect to take this ride you will be one of many who have already done so in the Martin-Baker seat. To ensure your comfort and success, depicted on the following pages are the various escape procedures from the Mohawk.

Your ticket has now been punched!



If time permits, jettison overhead canopy by rotating jettison handle clockwise, then pull down.

Position body straight in seat with head back against headrest. Grasp face curtain handle located over occupant's head with both hands palm down.

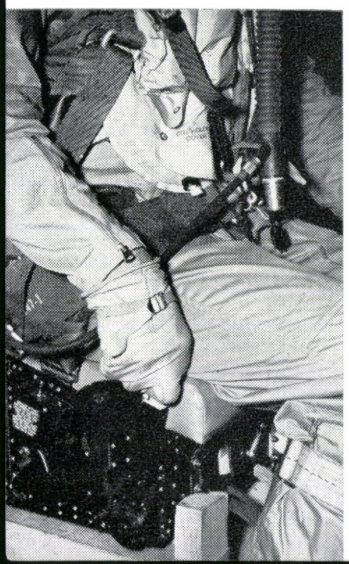
Pull face curtain down over helmet and face. Pulling face curtain initiates a completely automatic ejection, emergency oxygen supply, stabilization and deceleration of man and seat, personnel parachute deployment, and finally man-seat separation.

Emergency Ejection Procedure (Top)

MARTIN-BAKER EJECTION S

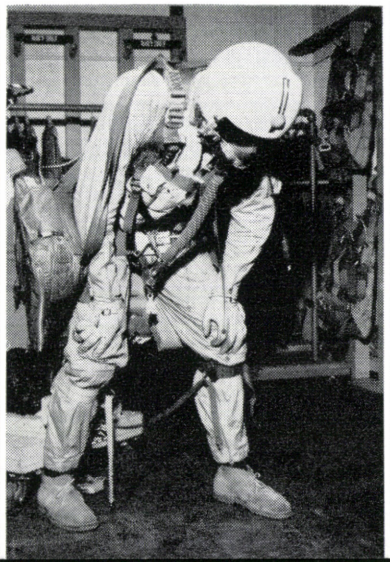
PHOTOS BY GRUMMAN

Grasp manual override release lever ring located on top forward R. H. side of seat bucket.



Pull manual override release lever up and aft. This action releases lap belt assembly, shoulder harness loop strap and leg restraint cord from the seat.

Push away from the seat before attempting to deploy the parachute. The static line separates the drogue withdrawal line from personnel parachute.



When clear of seat, grasp parachute "D" ring located over left shoulder, on L. H. parachute riser.

If for any reason the face curtain handle cannot be reached, or if actuation does not effect ejection, release face curtain handle, keep body straight in seat with head back against headrest and grasp secondary firing handle located on forward top center of seat bucket.

Pull up secondary firing handle. Actuation of secondary firing handle results in completely automatic ejection same as described in sequence three.

Release parachute riser quick disconnects (rocket jet fittings) only after feet have touched ground or water.

Inflate life jacket, release lap belt buckle, deploy and inflate raft, enter raft and remove parachute harness.

AT PROCEDURES (MOHAWK)

Post-Ejection Emergency (Below)

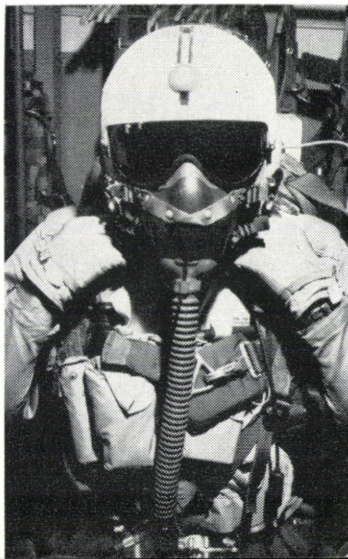
The time release mechanism prevents parachute deployment above 10,000 $^{+5000 \text{ ft.}}_{-0000 \text{ ft.}}$ altitude. If your ejection was initiated at 15,000 feet altitude or less, and your parachute has not been deployed within two seconds after the seat left the aircraft, the following procedure for manual parachute deployment should be followed.

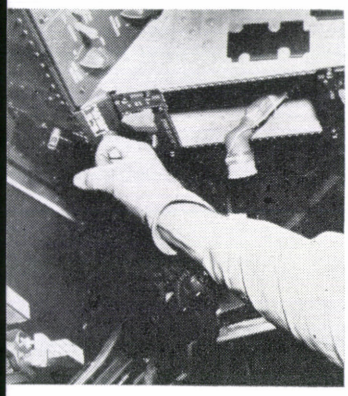
Pull down with maximum effort on parachute "D" ring for personnel parachute deployment.

After parachute deployment, attach survival clasp to survival kit strap fittings.

Release lap belt buckle for convenient access to raft.

Release parachute riser quick disconnect (rocket jet fitting) only after feet have touched ground or water.





Prior to impact, lock shoulder harness and jettison overhead canopy to provide an alternate exit.

After impact when aircraft forward motion ceases, grasp manual override release lever.

Pull manual override release lever up and aft. This action releases lap belt assembly from the seat, and also safties the face curtain handle and secondary firing handle.

Release parachute riser quick disconnects (rocket jet fittings).

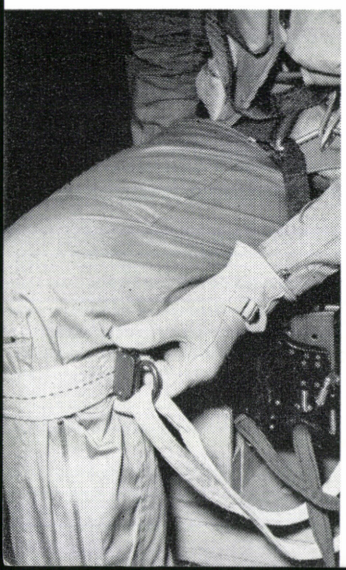
If possible crash-land or ditch aircraft rather than attempt an over-the-side manual bailout.

Crash Landing-Ditching Procedure (Top)

MARTIN-BAKER EJECTION

PHOTOS BY GRUMMAN

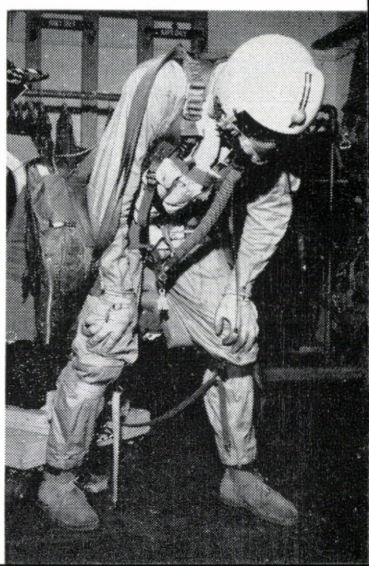
Release leg garter.



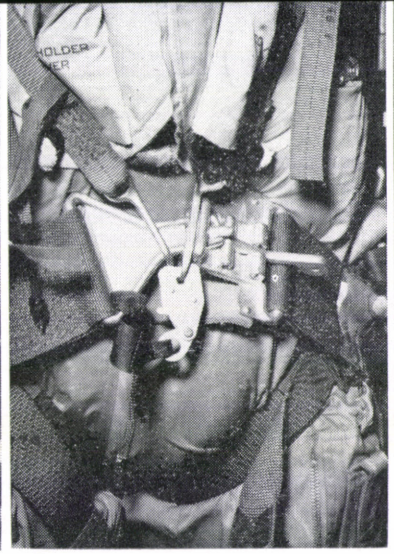
Grasp manual override release lever ring.

Pull up and aft.

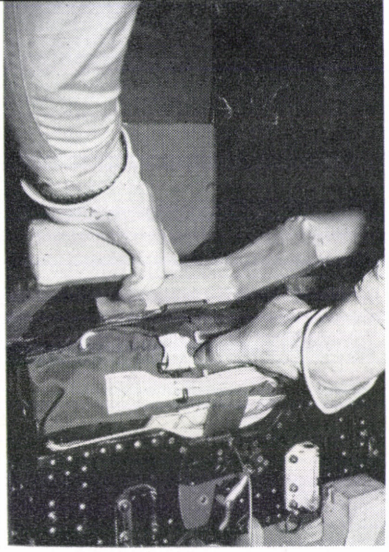
Push away from seat and exit from the aircraft.



Release leg garter quick disconnects.



Evacuate aircraft with lap belt assembly attached to harness.



If time permits, disconnect oxygen and communication leads and lap belt buckle. Stand up, face aft, lift up seat pan and squeeze PK-2 container quick disconnect.

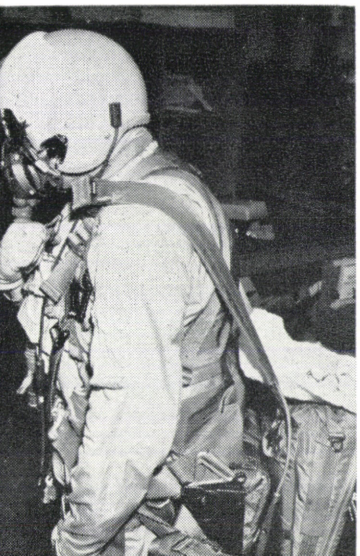
Grasp yellow handle and pull raft from container. Exit aircraft.

SEAT PROCEDURES (MOHAWK)

Manual Over-the-Side Bailout (Below)

Evacuation of Mohawk in flight by methods other than the ejection seat is extremely hazardous and should only be used as a last resort. Failure to follow the procedure outlined here exactly will be catastrophic.
Note: The propeller should be feathered on the side of the aircraft where manual bailout will be attempted to enhance the success of this hazardous maneuver.

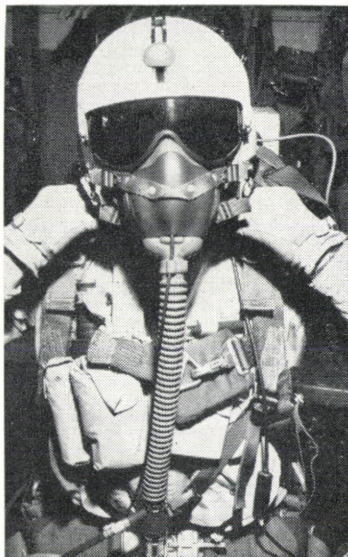
When clear of aircraft pull parachute "D" ring down.



After parachute deployment, attach survival kit clasp to survival kit strap fitting.

Release lap belt buckle for convenient access to raft.

Release parachute riser quick disconnect (rocket jet fitting) only after feet have touched ground or water.



GROUND CUSHION—

WHAT IS IT? . . . OR IS IT?

Major Joseph A. Gappa, Jr.

AFTER A RASH of landing accidents, the aviation officer at a certain airfield called his instructors together in the post theatre. "These accidents," he said, "have got to stop!"

Casting a stern look over his audience, he continued, "And the first thing you're going to have to learn is how to see those gusts at the end of the runway."

From the darkness at the rear of the theatre, a shrill voice piped: "What color are they?"

Amusing? Well, maybe, but we've all heard and read—and most of us have swallowed—a term that's no less wrong. In fact, it has even wormed its way into training literature. PRINCIPLES OF ROTARY WING FLIGHT, TM 1-260, September 1957, reads on page 25:

Major Gappa is Chief, Engineering Section, Analysis and Research Division, USABAAR. A graduate of the U. S. Military Academy, he received his master's degree in aeronautical engineering from Georgia Tech.

"Normally, the helicopter will tend to sink between the time it moves off the GROUND CUSHION and the time it picks up translational lift."

From this, you get a mental picture of a compacted canopy of air caused by the churning rotor of a helicopter close to the ground. And with this picture, it's easy to see how you might slide off the side of the slippery mushroom as forward flight begins. Forward flight over relatively smooth terrain, that is, because this concept won't hold water when your aircraft is hovering over confined areas, tall grass, or other types of surfaces—surfaces which should in fact assist in COMPACTING air and building a GROUND CUSHION.

While the term "ground cushion" may help simplify and explain ground effects, it is technically wrong and Army Aviators should know why. This article will attempt to give a straightforward explanation of ground effects and put an end to the "ground cushion" myth.

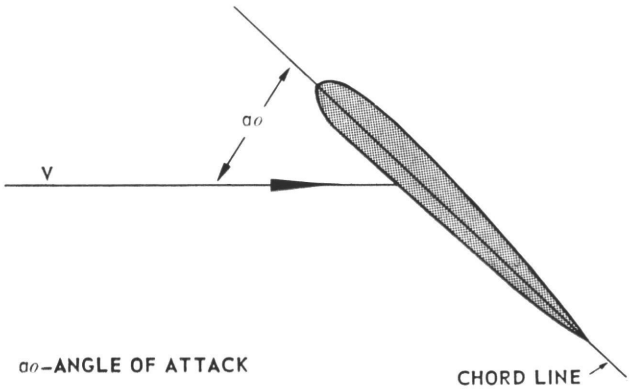


Figure 1

First, you should understand several definitions and principles of aerodynamics shown in the following sketches: Figure 1. To produce a certain lift coefficient, an airfoil section must have a certain angle of attack between the chord line and the average relative wind. The average relative wind is represented as a vector (V) with an exaggerated angle of attack.

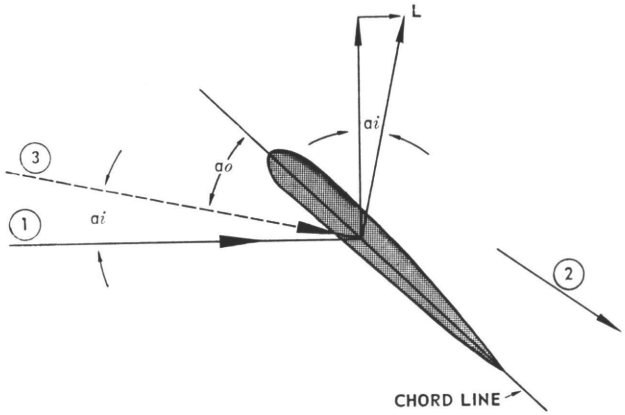


Figure 2

Figure 2. Free-stream velocity is the velocity of an undisturbed fluid (or air) relative to a body immersed in it.

This sketch shows:

1. Free-stream velocity vector at some distance from the airfoil section.
2. Free-stream velocity vector at some distance behind the airfoil section.
3. Average free-stream velocity vector at the aerodynamic center of the airfoil section.

As some arbitrary amount of lift (L) is developed, the direction of 1 changes to 2 behind the airfoil section, and the average of the two becomes the average relative wind 3. The angle (a*i*) represents the **average** change in direction of 1 in moving from position 1 to position 2. When the average relative wind is considered, we must, in effect, incline our airfoil by an additional angle (a*i*) to produce the lift we would have had without downwash. Downwash is the vertical downward component of the airflow induced by, and behind, an airfoil.

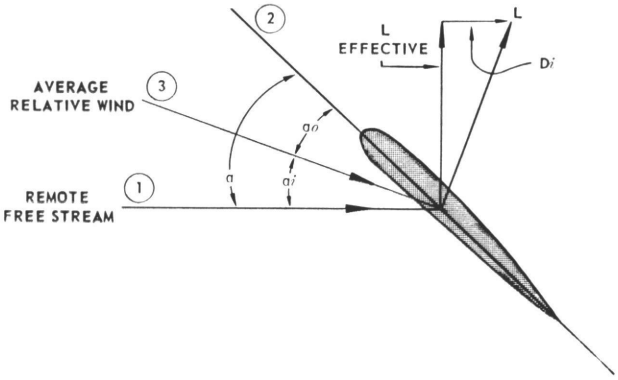


Figure 3

Figure 3. Thus, a must be the sum of a*i* and a*o*. Due to the induced angle of attack (a*i*), any lift developed suffers an unavoidable loss, induced drag (D*i*), since the lift is measured perpendicular to the **average relative wind.** The inclined lift vector (L) has an effective vertical component and a **rearward** induced drag component (D*i*)—or drag due to lift. If D*i* could be reduced, we could enjoy increased performance with a corresponding drop in power requirements. But, as long as downwash remains an inherent result of an airfoil producing lift, getting rid of the downwash will be impossible.

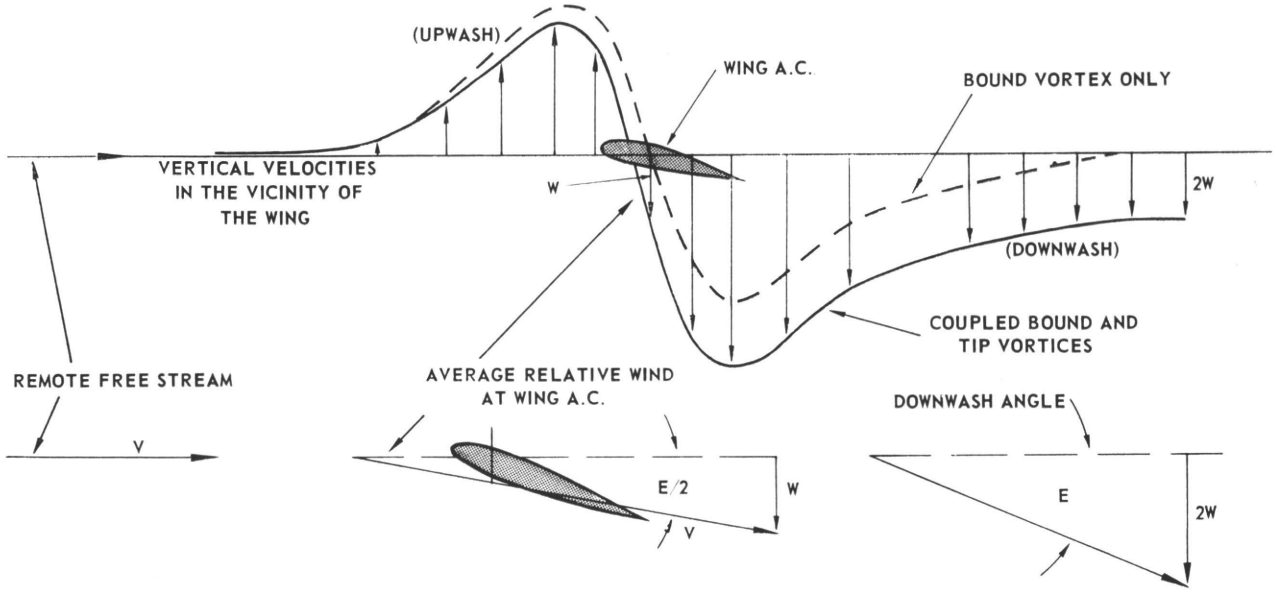


Figure 4

Figure 4. Schematic drawing of upwash and downwash, shown as the free-stream flows over the airfoil section. Effects of bound and tip vortices are shown, along with the measurement of the downwash angle at the aerodynamic center of the airfoil section. Under some conditions, downwash can be reduced. One of these, operation of aircraft close to certain types of terrain, leads us into ground effects and an explanation of the nonexistent "ground cushion."

Figure 5. Figure 5 shows that the average downwash is W at the aircraft. At some distance behind the airfoil section, the downwash is 2W.

Figure 6. Suppose our aircraft (fixed or rotary wing) is operated close to the ground and the downwash velocity is physically restricted by the terrain. This reduced downwash velocity will reduce a_i, and as a_i decreases, our lift vector becomes more and more near vertical. This, in turn, reduces induced drag. Obviously,

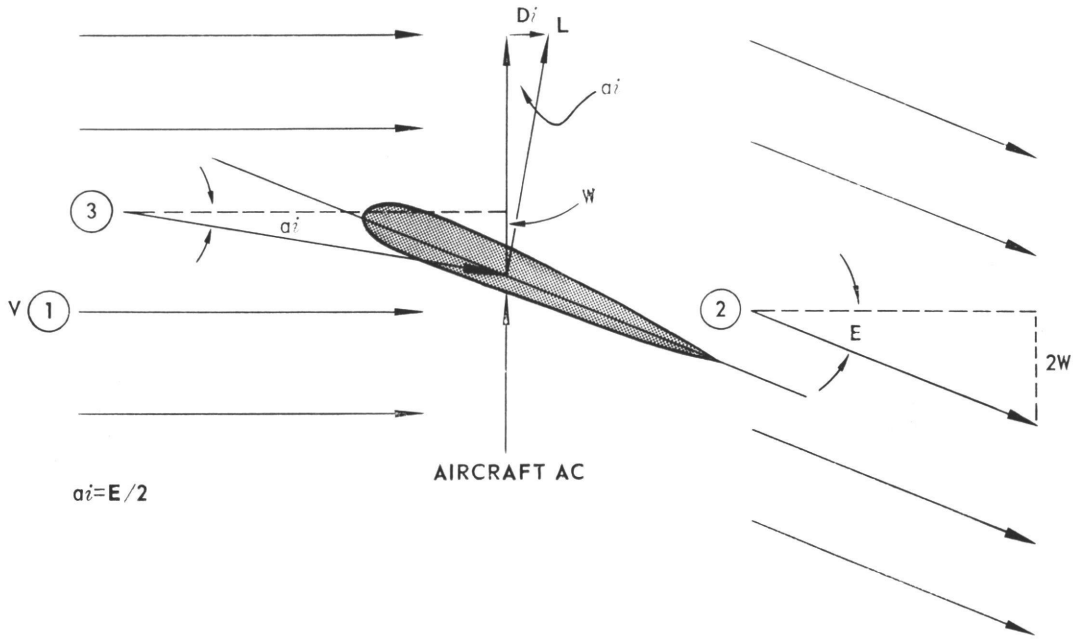


Figure 5

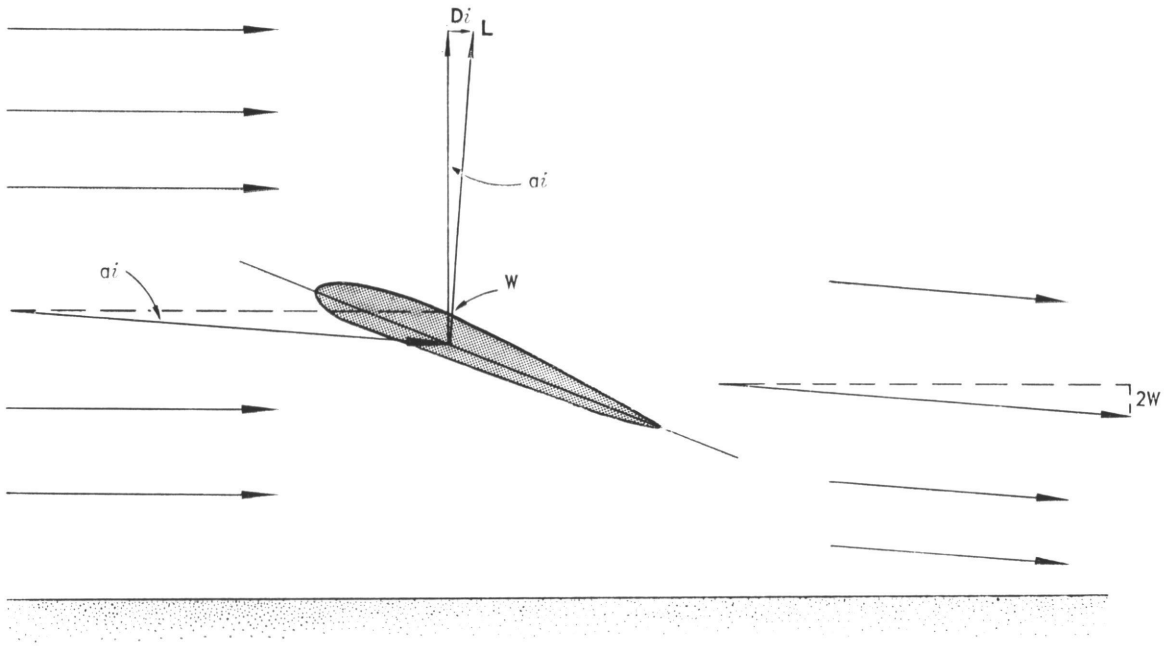


Figure 6

with a reduction in induced drag, our power requirements are less. This is the true answer to why we have ground effects — the answer to how, with reduced power, we seem to be riding a cushion.

Why, then, the tendency for a helicopter to sink as it moves forward?

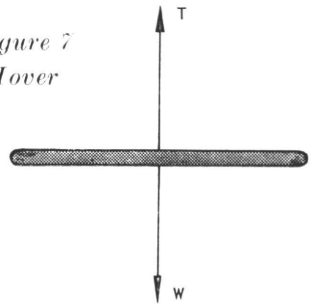
Figure 7 shows that the thrust vector equals the weight vector and rotor lift sustains the weight of the helicopter. When the thrust vector is inclined as shown in figure 8, the effective lift is less than the weight of the aircraft and the helicopter will sink until the thrust increases enough for effective lift to equal total weight. Thrust may be increased by increasing collective pitch, assuming enough power is available, or by acquiring translational velocity and increasing lift through forward velocity, as shown in figure 9.

These same principles apply to a fixed wing aircraft in a level flight, steady rate turn.

Figure 10. To maintain a steady turn, effective lift must equal the weight; and centrifugal force must be balanced by the horizontal component of lift.

Since induced drag is the predominant component of total drag during hovering or slow speed flight, the effects of reducing induced ground effects, is the answer to why the aircraft has a tendency to sink as we move from negligible forward velocities, where induced drag predominates, to velocities where parasite

Figure 7
Hover



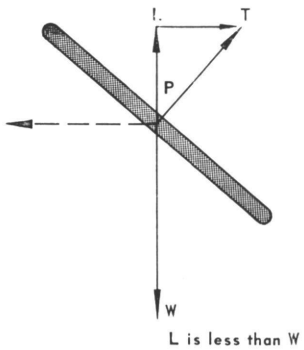


Figure 8

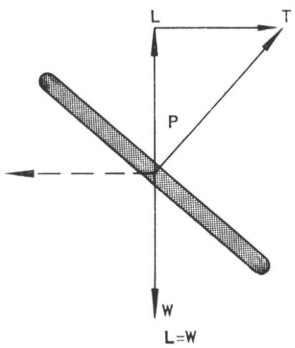


Figure 9

Forward Flight

T — represents thrust developed by the rotor(s)
W — represents total weight of the helicopter
P—represents an angle of lift vector
L — represents effective lift

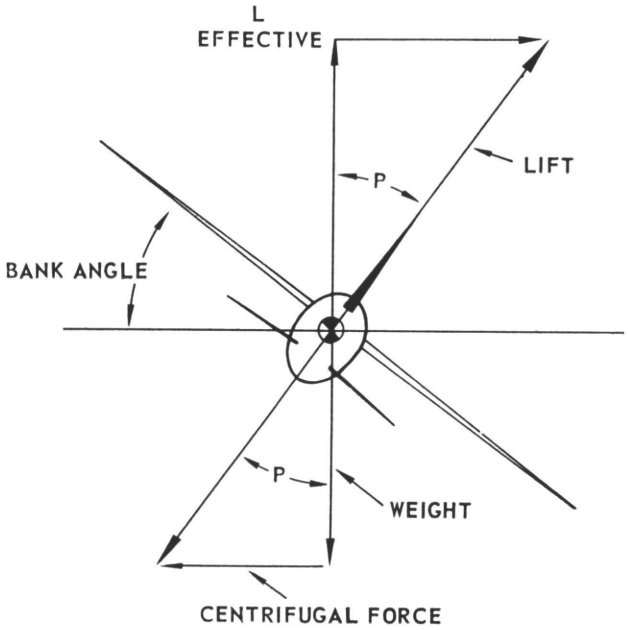


Figure 10

and profile drags build up rapidly.

In summary, the sensation of "sliding off a ground cushion" is caused by:

- GROUND EFFECTS — lowering induced drag (drag due to lift) when operating near certain types of terrain and subsequently moving into a region where parasite and profile drag become progessively more predominant.
- INCLINED ROTOR THRUST VECTOR—which reduces effective lift.

How far above the ground do we find ground effects? One-half the rotor diameter, or one-half the wing span are generally accepted guidelines for noticeable ground effects. Ground effects decrease more rapidly, with height above the ground, when in forward flight than when in hovering flight. The decrease in ground effects is very rapid as forward velocity increases.

To those of you who still insist you're riding a "ground cushion," watch out for that gremlin —the one with the valve remover!

New Helicopter Remote Control Flight System Developed

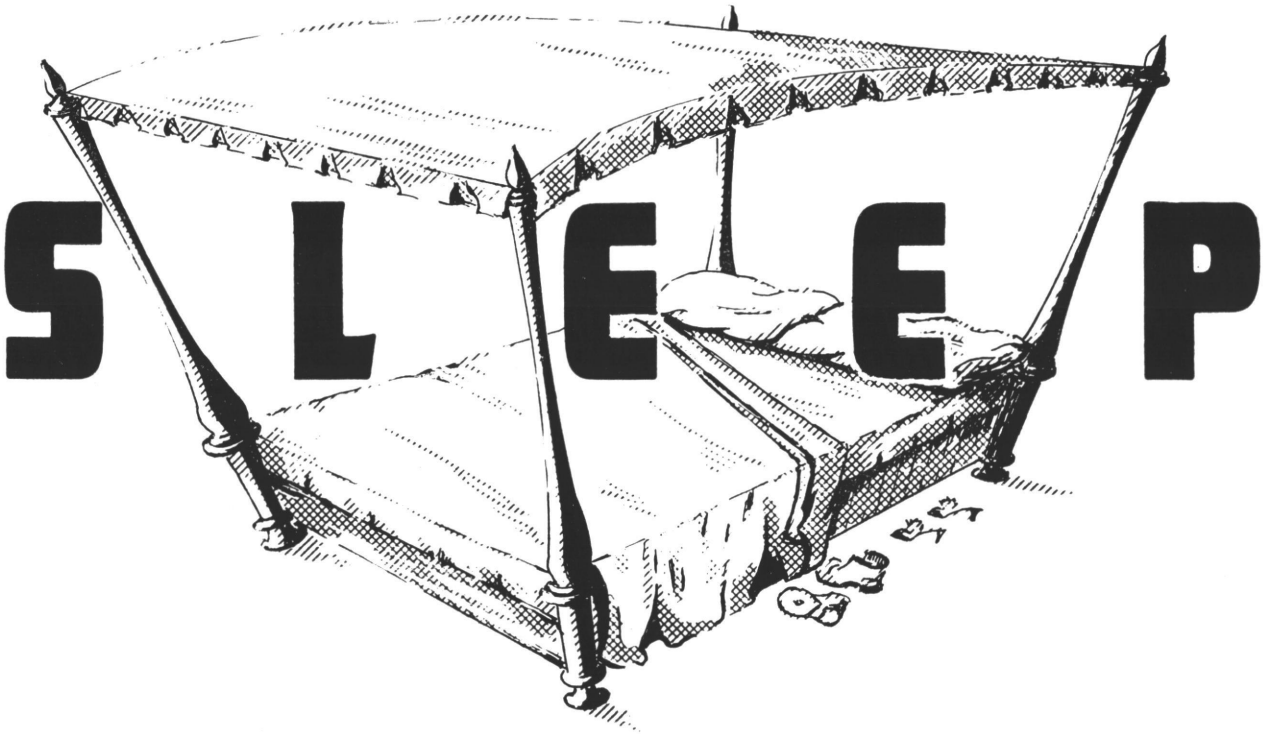
BELL HELICOPTER Company has developed an electronic remote control flight system for helicopters which operates through all regimes of rotary-wing flight. Operators need not be trained pilots.

The Bell remote control system can be installed as a kit in any single-rotor helicopter without disturbing the craft's standard manual control system, according to Bell sources.

This means that a helicopter equipped with the drone control system can be flown normally with pilot and normal payload or as a drone with even greater payload, depending upon conditions of the mission.

Bell engineers have installed the system in two Army H-13E helicopters under terms of a contract with the U. S. Navy. These two drones have been flown hundreds of times, including flights in 30 mph crosswinds, at altitudes up to 8,000 feet, and as far as 15 miles away from the ground control unit.

Conceivable missions might be helicopters lifting of supplies behind enemy lines, even under heavy antiaircraft fire; hovering monitors transmitting television and radar information about enemy troop and equipment movements; assessing the effects of nuclear explosions and radiation surveys; and serving as decoys, probing and exposing enemy positions, and drawing fire away from piloted helicopters.



William H. Smith

THE POETS have called sleep "great Nature's second course" and the "chief nourisher in life's feast." But over the past 20 years laboratory experiments have been unlocking the secrets of sleep, and there is much more to it than what the poets pictured.

For instance, the importance of sleep has been elevated. Living organisms have as much need for sleep as for food, air and water. We sleep more to rest our brains than we do to rest our muscles. But no one really knows exactly why the brain requires sleep, or for that matter what sleep is.

The cerebral cortex — gray matter—of the brain seems to benefit especially from sleep. It is there that the higher faculties of imagination, reasoning power, judgment, and conceptualization are found.

Recently personnel of Walter Reed Army Institute of Research in Washington, D. C., conducted extensive studies on sleep. More than 100 soldiers volunteered to help. Much information was gained concerning jobs requiring constant alertness — guard duty, signal men monitoring communications devices, aviators, radar screen scanners, and so on.

They found that the cerebral cortex emits electric brain waves at the rate of about 10 a second while we are awake. As we fall asleep, these waves gradually slow down to the rate of two or three per second. Billions of tiny nerve circuits close down and our plane of consciousness sinks.

Under prolonged sleep loss our entire nervous system begins to behave like a motor that needs a tuneup. The system misfires, runs normally for awhile, then falters again. What actually happens is that among our normal short, snappy brain waves will be found momentary stretches of the sleep pattern. This makes us drop off into "micro sleep." For brief snatches we'll be sound asleep, even though our eyes are open and we think we're wide awake. Our heartbeats slow down, our consciousness blanks out, and some of us even have dreams.

Tests showed that "micro sleep" lasts about 1/10th of a second and occurs at the rate of two or three an hour. As hours of sleep loss mounts, the lapses

take place more often and last longer, perhaps 2 or 3 seconds. As the tired brain gets even more fatigued, it craves sleep so hungrily that it will sacrifice anything to get it. It is then that we can't resist "micro sleep" for a few seconds, even while flying through a thunderstorm.

Another serious effect of sleep loss is its effect on memory and perception. Many of those who took part in the experiments found it impossible to retain information long enough to relate it to the task they were supposed to perform.

Those of us who work at jobs in which we are required to hold many factors in our minds at once might well ponder the risks of loss of sleep. A tired man may be able to get through routine tasks, but can he as an aviator integrate wind direction, airspeed, altitude, and glide path to make a safe landing?

In the research on sleep it also became evident that lack of sleep caused other disturbances. These disturbances are similar to those produced by alcohol, narcotics, and oxygen starvation. Perceptions grow fuzzy, our sense of timing is off, our reflexes are a little late, and values slip out of focus.

Most of us pay another price when we stay up later than we should. This is irritability. Lack of sleep is frequently the real trouble when we lose our temper unnecessarily. Lack of sleep can make normally cheerful people feel moody and depressed. Intensified by still more lack of sleep, a normally patient aviator may lose his temper at a time when he should be calm and collected.

The amount of sleep an individual needs is a question that has plagued scientists for years. They really don't know exactly. Although some people get along on less, most of us will be healthier and live longer if we get a full 8 hours.

The amount of sleep needed will depend to a large extent on what we do for a living. Mental workers require appreciably more sleep than those who do manual labor. This is because it takes longer to replenish the nervous energy expended by brain work. It should be noted that aviators and highly trained mechanics are classified as mental workers.

Even your dreams have not been spared the prying eyes of the scientist. They have discovered that dreams allow the cerebral cortex to take a rest. Studies have shown that if we do not dream, we become exhausted and irritable. This is true even when we have had our usual amount of sleep. Under normal conditions, we dream several times a night. The so-called nondreamers among us simply forget their dreams. We spend one to two hours a night dreaming. Dreams occur during light sleep and not during deep sleep. The time element of dreams is similar to the actual event. It is most interesting that two third of them are in black and white and the rest in full color.

While the scientists were worrying with the problem of those who do not get enough sleep, they did not forget those who sleep more than is considered necessary. One startling discovery was that too much sleep can be just as deadly as too little sleep!

Here is what happens. During sleep CO_2 (carbon dioxide) builds up in the blood, replacing oxygen. If we should sleep too long, the CO_2 would begin to act as an anesthetic, causing us to sleep even longer, thus making the concentration of CO_2 greater still. However, you needn't worry. We've got a built-in mechanism that keeps us from dangerously oversleeping. This is fortunate because it is estimated that 16 straight hours of sleep could actually kill some people. (Reference attributed to Dr. Herbert Suher, Duke University, TRUE Magazine, Nov 1961.)

But suppose there is the situation where you don't really want to sleep, or can't sleep, before making a flight. Is there something you can take that will keep you awake? Well, there is always coffee. The important drug in coffee is caffeine. The amount of caffeine in two cups of coffee appreciably affects the rates of blood flow and respiration. In small amounts it may be considered a nervous system stimulant and will keep most people awake for a few hours. But in excessive amounts, caffeine may produce nervousness, inability to concentrate, headaches, and dizziness.

What then is the answer to the sleep problem? It is simply that the proper amount of sleep for you is necessary every 24 hours if you are to remain alive in this flight business. Even a slight reduction in the amount of sleep (25 to 50 percent) can induce significant mental impairment without any subjective feelings or physical clues. One should make every attempt to sleep or at least to nap just before going out for preflight, because the longer you've been awake before starting a task, the greater the danger of "micro-sleep."

IFR--Are You Ready?

Captain Lyman W. Vassey and Captain Leon H. Wiggins

AFTER A NICE dinner, Capt Non Proficient sat in his favorite chair in his home at Fort Checkout reading the local newspaper. The 8 o'clock news had just reported that the hurricane 200 miles to the southeast was steadily moving to the northwest. It was predicted to reach the Fort Checkout area about 1400 hours the following day. The skies were now 300 feet overcast with a visibility of less than one mile. This presented no immediate problem to Capt N. P. He felt rather secure against the rain that was now beating even harder against his windowpanes. His comfort was interrupted by the ringing of the telephone.

"Hello, Capt Non Proficient."

"This is Capt A. Lert, operations officer. You have been selected to fly an L-20 aircraft to Camp Haven on the Hurricane Evacuation Plan. You will report to Major Ramrod by 2100 hours at Fort Checkout operations. Be prepared to stay for several days."

"Yes sir," said Capt N. P. As he hung up the phone many thoughts ran through his mind, along with the fact that he had less than 1 hour to report to Major Ramrod.

"Hurricane evacuation! Great Scott! This will be an IFR flight! How did I get selected for this? I have a desk job and only fly 4 hours per month. I haven't flown instruments under the hood, much less weather, since my last checkride 5 months ago. And it has been about that long since I posted Jeppesen changes. Maybe I had better call and cancel out. Can't do that though. I can't even think of a single excuse except that right now I'm downright dangerous. Well, I'd better throw a few things together and get on out there. I just hope that I get a good copilot who is current in instrument procedures. Sure let myself get into a mess this time."

At 2100 hours as some of the confusion of getting 108 pilots assigned to evacuate 54 Beavers to Camp Haven subsided, Major Ramrod started his briefing. When he had finished, eight hands went up. All eight aviators had the same request: "Assign me a copilot who is current on instrument flying procedures." All eight stated that they were not qualified to take an IFR flight without practice. After another hour's delay and much switching and reshuffling, the flight finally took off for Camp Haven. After the hurricane passed Fort Checkout, the flight returned without incident.

Why were these eight aviators not qualified to fly instruments? Ground duty? Desk job? Is this an excuse? To remain on flying status every aviator must fly 80 hours a year minimum regardless of the type job assignment. How can these Army Aviators prevent this lack of proficiency next year? As long as his 759 or card file shows he has a current instrument rating, the aviator is subject to being scheduled at any time for flights into IFR conditions.

It is possible to stay proficient all year round. It takes some planning and a little effort on the aviator's part, but it is worth it to be current and available to fly any type mission on a moment's notice.

Most Army Aviators keep a calendar of some sort to remind them to do certain things on certain days, a schedule in other words. An aviator assigned to a nonflying job, but maintain-

Capt Vassey is recorder-secretary of the USAAVNS Instrument Flight Examining Board. He is a Senior Army Aviator assigned to the Standards Division, Director of Instruction, USAAVNS.

Capt Wiggins is a flight commander and instrument examiner in the Instrument Division, Dept of Adv F/W Training, USAAVNS. He has over 2,100 hours flight time.

ing flying proficiency should schedule his flying in much the same manner as planning his needs. After placing the required activities of his job on the schedule he then works out a suitable flying schedule. A typical schedule for the month of April might look like this:

2 April 62—1400 to 1700—Fly Hood

13 April 62—0800 to 1100—Fly Hood

19 April 62—1900 to 2200—Night fly (cross country)

27 April 62—1100 to 1200—Link (approaches)

Your calendar would look something like this:

APRIL 1962

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2 1400-1700 Hood	3	4	5	6	7 0700-1200 Insp
8	9 FIELD PROBLEM	10	11	12	13 0800-1100 Hood	14 0700-1200 Insp
15	16	17 0700-1000 Gas Chamber	18	19 1900-2200 Fly Night X-Country	20 Good Friday	21 0700-1200 Insp
22 Easter	23 Instructors School	24	25	26	27 1100-1200 Link	28 0700-1200 Insp
29	30					

Now that you have your flying schedule for the month made out, stick to it! Plan all other duties so that you can keep your schedule. You have planned 8 hours for the month of April. Next decide how you can get the maximum training benefit from each of these flying hours. On 2 April your flight can be cross-country, either under hood or actual instruments from Fort Checkout to an airport with an instrument landing system, perhaps less than an hour away. Approaches can be made upon arrival, using all the facilities of the field, weather permitting. If you are flying with a buddy acting as safety pilot, the changeover for him to fly back is made upon landing. You have accomplished two things: minimums toward your cross-country time plus credit for hood time, in addition to maintaining your proficiency.

The next daytime cross-country flight should be planned to some other place for diversity of training. This could be done on 13 April. File IFR even though flying VFR conditions. Keep your position reporting up-to-date. Air Traffic Control Centers and approach controls will appreciate this. Work those ETAs. Do all the work yourself; don't just sit there and "drive" under the hood while your safety pilot works all the radios and figures the time and makes the reports.

A night cross-country can be planned for 19 April. This can also be terminated with a couple of approaches at your destination before returning, say one ILS and one VOR or ADF approach. There will still be time for three or four touch and go's at either destination or upon return. Again you will benefit, not only for night time but cross-country as well.

The synthetic trainer (link) time on 27 April can be devoted to practicing instrument approaches only. Do no basic maneuvers; keep the trainer in the side straps and concentrate on the radio procedures and approach procedures.

If weather, such as numerous thunderstorms or icing conditions, requires that you stay in the local area on any of the flights, then work all the approaches available within the local area. You can get some diversity in training shooting the same approach but entering from different directions. Call for a GCA between one of your touch and go's. The point is: don't waste time on something that is not beneficial to you.

You have approximately 8 hours planned now. If this schedule is followed, and flying time used well, you should have no worry in the future about being proficient or current. This is not programmed just for the month of April of course, but for the 12 months of the year, based upon your needs. Make your schedule around the first of each month. However, don't attempt to program the whole year in one day.

Some considerations that are noteworthy:

When possible schedule an aircraft in which instrument flying can be accomplished: an L-20, U-1A, L-23 or TL-19D,

or instrument equipped helicopter if so rated. Try to get the most complex type in which you are proficient.

Accord all category aircraft or helicopters in which you would not fly instruments a lower priority.

For example, give the L-20 or L-19D a higher priority than the L-19A. This is not to infer that basic contact flight review is unimportant. To the contrary, basic control of the aircraft is paramount and a part of your training time should be devoted to it. But after you have honed your basic contact maneuvers to a sharp edge of proficiency, don't just bore holes in the blue. Make as many flights as possible cross-country, flying hood or actual instruments.

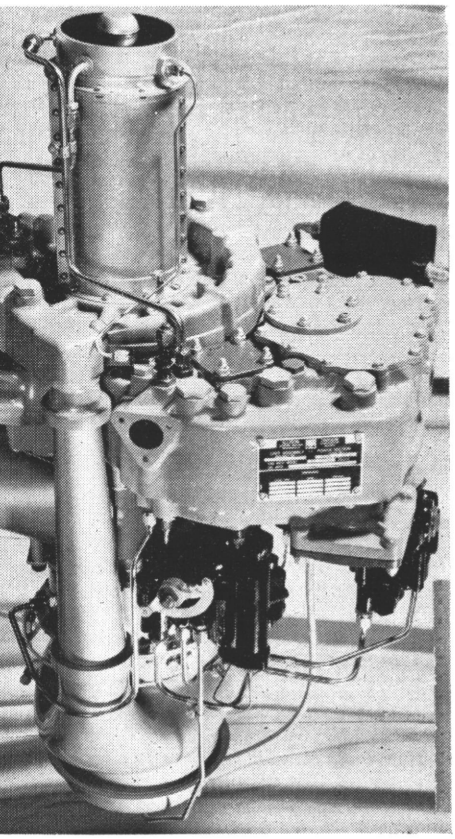
A favorite trick of many conscientious aviators is to file IFR even when going VFR by themselves just to keep in practice with reporting, ETAs and management of an instrument flight. Flying under the hood of course cannot be done without safety pilot or observer.

Every arrival at an airport should be terminated with an instrument approach. This requires about 10 extra minutes. Do a minimum of local area tooling or pattern touch and go's. Use as much free time as possible in the synthetic trainer practicing instrument procedures, and techniques.

Whenever you fly your CO, file an IFR flight plan and let your CO wear a headset. You will get instrument training from the flight and at the same time show your CO there is more to flying than getting in the airplane and going. Educate him and at the same time keep up your proficiency.

Make every minute count toward your instrument proficiency. You have been retained on flying status to maintain your flying proficiency and are paid accordingly. It is worth the extra effort to stay on flying status. Be a professional with a professional attitude whether you fly 4 hours or 40 hours a month. Be ready and able to go on a moment's notice in any flight conditions that permit the accomplishment of the mission.

And by the way, don't just sit around waiting for that next flying assignment to come to you. Sometimes you can hurry things along by looking around. Bring your proficiency with you!



LOH Powerplant

AN ARMY contract for further developmental work on the 250 horsepower T63 gas-turbine engine to power the light observation helicopter was recently awarded the Allison Division of General Motors Corporation.

Under development since June 1958, the T63 in its turboshaft configuration has been selected to power a new four-place helicopter to be chosen from prototypes to be produced by three major airframe companies.

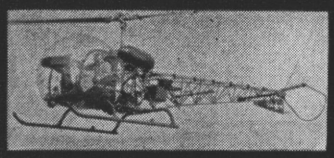
The T63-A-5 is scheduled for its 50-hour preliminary flight rating test this month. During September 1962, the A-5 version, which has the engine exhaust vented upward to eliminate possible brush-fire or personnel hazard, will undergo its 150-hour qualification run preparatory to the official preliminary flight rating test.

Present schedules called for six ground-test engines to be shipped during March to the three companies involved in the LOH competition — Bell Helicopter Company for its Model D-250; Hiller Aircraft Corporation for its Model 1100, and the Aircraft Division of Hughes Tool Company for its Model 369. Five aircraft of each type will be purchased by the Army and thoroughly evaluated before the award of a substantial production contract.

L-19 BIRD DOG

H-13 SIOUX

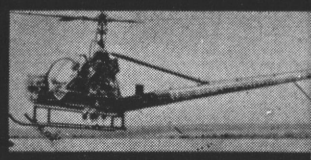
U-1A OTTER



TWX

THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

Ex



HU-1 IROQUOIS

H-34 CHOCTAW

H-23 RAVEN

H-13G SETTLED INTO TREES after night take-off. Major damage to main rotor, engine, engine mount assembly, airframe, transmission, and cabin. No injuries. Cause undetermined pending investigation.

H-13E TAIL ROTOR STRUCK WATER during practice autorotation. Incident damage to tail rotor blades.

AO-1 COWL FASTENER CAME LOOSE in flight, allowing upper nose cowling of No. 2 engine to move forward. Aircraft landed without incident.

L-20A STRUCK AUXILIARY POWER UNIT while taxiing. Incident damage to propeller and landing gear fairing.

H-34 STRUCK GROUND and rolled on left side during attempted landing in snow. Aircraft destroyed. No injuries. Visual contact with ground was lost during landing attempt due to snow blown up by downwash.

L-20A STRUCK FIRE HYDRANT while taxiing. Incident damage to landing gear.

L-19A STRUCK LIGHT while taxiing at night. Incident damage to propeller.

L-19A ENGINE FAILED during attempted go-around. Aircraft landed on strip and overturned due to excessive use of brakes. Major damage to all components. Pilot sustained minor head injury. Engine failure caused by fuel starvation.

U-1A VEERED TO RIGHT during landing rollout on snow covered lake and collided with empennage of parked U-1A. Minor damage to landing aircraft. Major damage to parked aircraft. No injuries.

H-37 RIGHT GEAR SANK in soft spot of sod during running landing. Gear locking pin sheared and aircraft came to rest on right auxiliary tank and bottom of fuselage. Major damage to loading ramp, auxiliary tank, and landing gear. No injuries.

H-19C VIBRATED SEVERELY during landing approach. Vibration was followed by immediate loss of power. Aircraft crashed and burned. No injuries. Suspect malfunction of tail rotor pitch chain mechanism.

H-23D STRUCK BOULDER during landing approach in dusty area. Incident damage to tail rotor blades. No injuries.

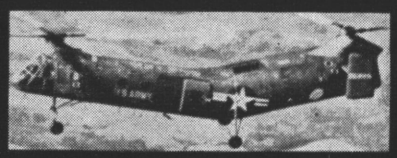
TL-19D STRUCK TREE during low reconnaissance. Incident damage to right horizontal stabilizer. No injuries.

HU-1A ENGINE OIL PRESSURE DROPPED in flight. Aircraft completed precautionary landing with no damage. Caused by materiel failure of oil line from governor gear box to bearing lubrication lines.

H-34C OIL TEMPERATURE INCREASED rapidly from 70°C to 110°C. Heavy smoke and oil emitted from exhaust stack and metallic scraping noises heard. Aircraft completed forced landing with no damage. Caused by failure of exhaust or intake valve pin in No. 7 cylinder.

H-23D STRUCK POWERLINE during attempted go-around with low rotor rpm following power recovery from practice autorotation. Aircraft landed hard on rocky terrain. Major damage to all components. Pilot sustained broken back and internal injuries.

AO-1 MOHAWK H-21 SHAWNEE L-20 BEAVER



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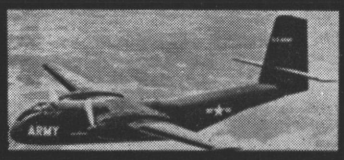

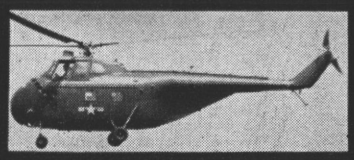

L-23 SEMINOLE H-37 MOJAVE AC-1 CARIBOU H-19 CHICKASAW

L-20A STRUCK FENCE during go-around. Go-around was completed and aircraft landed safely. Major damage to landing gear and elevator. No injuries.

H-21C SETTLED TO GROUND after maximum performance takeoff and rolled on right side. Aircraft destroyed. No injuries. Strong gusty wind with extremely tubulent air considered a factor.

L-19A LOST OIL PRESSURE in flight. Aircraft completed precautionary landing on strip. Carbon sludge found in oil line.

L-19A BLEW OVER while taxiing behind C-119. Minor damage to left wing and elevator. No injuries.

HU-1A FELL THROUGH FLARE during attempted 180° practice autorotation and struck ground. Tail boom broken off. Major damage to tail rotor drive shaft and skids. No injuries. Density altitude — 2,250 feet at airport with elevation of 30 feet msl — may have been factor.

H-19D STRUCK TREES during takeoff from confined area. Aircraft completed takeoff and landed at nearby strip. Incident damage to main rotor blade tip caps. No injuries.

H-13H SETTLED AND CRASHED during low reconnaissance of hilltop landing site. Aircraft destroyed. No injuries. Variable winds and heavy to severe turbulence considered a factor.

L-23D STRUCK SEA GULL during landing approach. Center panel of windshield broken out. Pilot sustained minor facial scratches. Aircraft completed landing with no further damage.

H-23D STRUCK WIRES during low-level navigation flight. Pilot glanced at map while crossing open field and lost altitude to approximately 25 feet above terrain. Wires were seen too late for corrective action. Partial control was maintained and aircraft landed in clearing. Major damage to main rotor blades, tail boom, tail rotor blades, and cross tubes. No injuries.

H-37A HOVERED OVER PARKED L-19As and downwash buckled wings of two L-19s.

L-20A WINGS ICED OVER during IFR flight. Aircraft was forced to descend and was vectored to new destination. Weather prevented landing at assigned destination. Aircraft ran out of fuel and landed in plowed field. No damage. No injuries.

HU-1A SHOOK VIOLENTLY and engine overrevved during turn from base to final. Aircraft completed landing with no damage. Highest engine rpm estimated at 7250. Suspect engine governor failed to high side.

HU-1A CRASHED in trees at approximately 9,200 feet on 45° mountain slope during search-rescue flight. Engine failed at 11,500 feet and aircraft crashed during autorotation. Aircraft destroyed. Copilot sustained minor injuries. Cause of engine failure undertermined pending investigation.

AO-1 CRASHED during go-around from simulated single engine approach. Aircraft apparently lost power, made low left turn and crashed in open field near airport. Aircraft destroyed. Instructor pilot and pilot killed. Cause undetermined pending investigation.

From The USAAVNS

USAAVNS is exploiting the use of the Polaroid camera equipment as a teaching vehicle in the early stages of pilot flight training. During these phases it is difficult for the student to isolate the attitude of his aircraft from the total environment of rapidly changing, unfamiliar sights, sounds, and sensations.

It is felt that an immediately available pictorial record of the aircraft's attitude while executing a maneuver will provide the student an objective basis for realizing his performance during the instructor's critique period. The superiority of a tangible photographic record to the instructor's usual word picture follows proved audio-visual principles of learning.

To increase the benefits from this approach, the use of video tape recordings is being considered. This will capture the entire complicated sequence of events making up a maneuver, as opposed to the brief moment in time recorded by a photograph and permit an even more detailed critique.

The use of Polaroid equipment in student pilot training is initially confined to departments of Primary Fixed Wing Training and Advanced Fixed Wing Training. To obtain maximum return in the shortest period of time and to form a basis for further requirements of Polaroid equipment, the plan will be implemented as follows:

- Phase A Training: The Polaroid camera (model 110B) will be mounted in the L-19 cockpit on a detachable mount at one side and slightly to the rear of the front seat. The camera will be positioned at student eye level and will approximate the student's sight picture. Exposure will be made by the instructor in the rear seat through shutter release cable extension. During critical points of various maneuvers a picture is taken depicting the student's sight picture in relation to the horizon, the instrument panel and the ground. During debriefings, the instructor emphasizes the student's mistakes or strong points through interpretation of the photographs.
- Phase B training: This phase will utilize a three-camera arrangement in introducing the barrier approach and landing to the student. Camera #1 will be mounted in the L-19 cockpit the same as for "A" phase. It will be actuated by the instructor pilot during the approach to the barrier. As the aircraft crosses the barrier, a photoelectric cell mounted on a vertical pole adjacent to the barrier will trigger camera #2. Camera #3 will be mounted at eye level in the vicinity of the panel and will be triggered by a second photoelectric cell at the moment of touchdown.

Camera #1 in the cockpit, will show a photograph of the approach to the barrier. Camera #2 will photograph the aircraft in relation to the barrier at the time of crossing. Camera #3 will show a profile of the panel, the aircraft and the barrier at time of touchdown. The three photographs will be used in conjunction, to show sight picture during the student's approach in relation to clearance and attitude over the barrier, and in relation to the resultant touchdown. The student will be able to see the complex relationship of sight picture during the approach, barrier clearance resulting from this particular sight picture, and the distance required to touchdown.

DEPT OF MAINT

Operation TAPER (The Army's Plan for Equipment Record Revision) was introduced at Fort Rucker on 1 April as a test station. Army-wide the new system will begin phase-in on 1 July 62 and will be fully implemented by 1 January 63.

The ground work was started 15 November 1961 by USAMB (U. S. Army Maintenance Board), Fort Knox, Ky. The purpose of this conference was to evaluate and correct the preliminary draft of instructions for preparation and processing of the DA 2408 series that pertain to Army aircraft flight and maintenance records.

During January 1962, Lt Col A. V. Juliano, USAMB, visited Fort Rucker and conducted a briefing on Operation TAPER for all personnel involved with Army Aviation.

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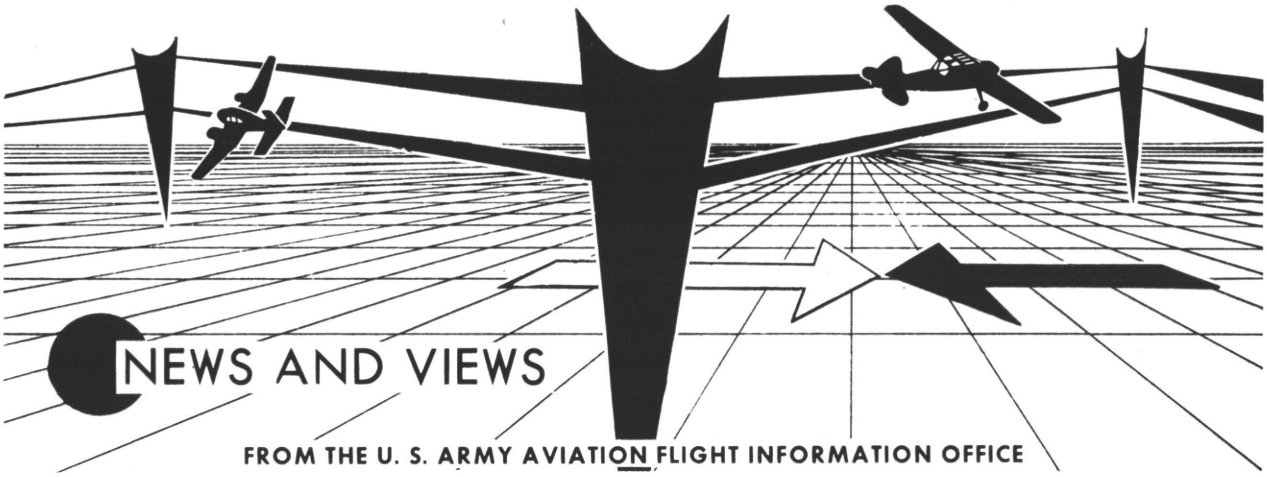


The Army's Flight Information Program

THIS IS THE first article in a new series designed to acquaint the Army Aviator and other interested readers with the Army's Flight Information Program. We hope to stimulate thinking in all facets relating to the navigational phases of aviation as well as encourage the use of better instrument flying techniques.

The U. S. Army Aviation Flight Information Office, or USAAFIO as we are more commonly called, was born out of necessity within the Signal Corps in 1955 with the mission to develop and provide the growing Army Aviation Program with flight information data. Assigned were one officer and one civilian assistant. The only available source material until that time was existing Air Force publications supplemented by CAA documents.

Later on in 1955, Jeppesen & Co. of Denver, Colo., was contracted to provide us with an "off the shelf" manual, which means the publication is sold as is without any additions or deletions. Commonly called the "Jep" manual it was then designated TM 11-2557. The reason for selecting a commercial manual at that time was that other existing publications did not provide sufficient coverage of all airfields that Army Aviation considered necessary for use. As an example, we needed information about the small civil airports as well as military aviation installations.

From this modest beginning USAAFIO began to take on additional responsibilities in answer to growing demands. The TD was increased to 3 officers and 14 civilians who were needed to carry out the functions of several programs. For instance, the flight check program was inaugurated to certify Army installed electronic navigational aids. Under this yearly cross-servicing agreement with the FAA, we also assist in the preparation and approval of instrument approach procedures. In addition, we offer technical assistance in site selection of navaids.

As Army airfields and facilities began to expand we published the **Army Aviation Flight Information Digest.** This weekly publication was designed to satisfy a requirement to list permanent NOTAMs and publish specific information about Army airfields which must be used in preflight planning.

For operational, statistical and historical uses, we compile and publish a summary of

Army Aviation Air Traffic Activity, worldwide. The data in this report is generally used to classify airfields and justify the installation of electronic navigational aids.

To provide guidelines for the implementation of these various programs, we developed and continually monitor the revision of ARs 95-9, 95-14, 95-24, and 95-185 as well as National Agreement 127 with the Federal Aviation Agency.

USAAFIO's staff assignments include active participation in national and international committees, conferences and boards which develop standards and specifications for aeronautical charts and publications used by military and civil aviation. The most recent accomplishments in this field include the 1:250,000 aeronautical chart soon to be released and the FAA/DOD produced low, intermediate, and high altitude en route charts similar to those now being used in the test and evaluation of the U. S. Coast and Geodetic produced flight information kit. Speaking of the evaluation which was recently completed, it was a part of our constant effort to monitor Army Aviation's changing requirements for flight information data. More will be written about the test and evaluation in the next article.

Foremost, our mission is to provide a service to Army Aviation. Besides burdening aviators with weekly revisions we strive to offer other services or assistance through direct contact with each Army Aviator and Aviation facility or unit. We are constantly making visits to aviation units and offer any assistance we can to improve the flight information program. Three Flight Information Detachments located in key areas overseas monitor the pulse of overseas commands and are readily responsive to any change in requirements.

As part of our service program, we also solicit comments, suggestions, recommendations and even gripes from aviators through a simplified medium known as the "Cap'n Sharp Comment Card." (If you have a problem about air traffic control procedures, navigation, use of charts or anything you feel needs an answer "drop" us a Cap'n Sharp card; we promise to do our best to help you.)

At this point you may be wondering what our qualifications are. We have three Army Aviators assigned, all instrument qualified with well-rounded backgrounds. There are five air navigation specialists, each with an average of 18 years experience in cartography, air navigation, flying, air traffic control, communications, and airfield facility operations. Assisting them is a management analyst to supervise the distribution of publications; a statistical clerk; and publication clerks familiar with aeronautical publications of all types.

You now know what USAAFIO is and generally what we do. In the next article we will talk more about the U. S. Coast and Geodetic Survey produced flight information kit. Many of you were more than passively interested in the test and evaluation and would probably like to know more about its background.

ATTENTION CRASH RESCUE CREW!

JUST BECAUSE the victim of a crash isn't breathing when you reach him, don't give him up as gone. Several cases have been reported in which head injuries — usually concussion — have caused victims to stop breathing, while their hearts were still beating a healthy pace.

The answer is artificial respiration — and keep giving it until normal breathing is restored. A blow to the head may numb the breathing control center, stopping the victim's breath and causing oxygen starvation. When this happens, there's a good chance he may die if artificial respiration isn't given until the breathing control center has a chance to recover.

These cases aren't found too often, but they are easily recognized. If the victim isn't breathing but his heart is beating, give him ARTIFICIAL RESPIRATION — and keep giving it!

WHAT DO WE DO NOW?

DURING 1957, as lightning began to strike Army Aviators with ever-increasing frequency in the form of orders to a Safety School and then to duty as Aviation Safety Officer, the then embryonic U. S. Army Board for Aviation Accident Research began to receive inquiries with equal frequency that distilled down to the simple question: "What do we DO?"

The stock answer was equally simple: "Prevent crashes."

By return mail came inquiries asking, "How?"

The reply to the latter inquiry was far from simple. Complex studies were published for selected types of Army aircraft. An accident investigator's handbook was created. Again and again pitchmen hit the road and exhorted captive audience. Truly, ". . . the excitement was tense."*

And as the sound of the prang continued to be heard in Army Aviation, it was still accompanied by the plaintive plea, "What do we DO?"

Today, with the truly magnificent achievement during the past 5 plus years in crash prevention** by Army Aviation an established fact, it is amusing to reminisce over the anguish this continuing question caused in the souls of the pioneers in the business.

*Apologies to Stanley Holloway.

**Crash prevention is used in lieu of aviation safety because safety and accident go hand in glove. Most so-called accidents are about as accidental as lighting a fire cracker and holding it until it goes off.

This article appeared in the January 1962 issue of APPROACH, The Naval Aviation Safety Review. It and the doctrines it outlines are so appropriate that we have taken the liberty of substituting Army terminology and publishing it in this issue of the U. S. ARMY AVIATION DIGEST.

Aviation safety per se, was then, and is today, an intangible concept. Selling an Army Aviator a tangible object such as a shiny, fire-engine red convertible is one thing. Selling him an intangible concept such as "Fly safe" is another.

Time went by, experience increased, a certain maturity formed in the "research outfit at Rucker." Direct and specific answers to the twin questions "What do we DO?" and "How?" were never printed in a form that succeeded in stopping the questions. Daily the "research outfit at Rucker" ingested blizzards of paper; classified, studied and filed them; and based on distillations thereof, published corresponding blizzards of paper to the field.

In retrospect it seems that a pattern developed in our efforts. Roughly this pattern was:

INFORM Army Aviation personnel of the fact that our crash rate was too high.

DISCOVER through investigations, research, and statistics the causes of our high rate of accidents, past, present, and future, and disseminate this information.

TRAIN aviators, crewmen, and maintenance personnel in operating practices known to be effective in preventing crashes.

DESIGN aviation equipment with built-in crash prevention items discovered from disaster history, i.e., eliminate Murphy's Law.

OPERATE within the capabilities of aviators, crewmen, and equipment.

EMPLOY the talents of the specialists provided, namely the Aviation Safety Officer.

EDUCATE all personnel in Army Aviation, academically and otherwise, in all matters bearing on crash prevention.

It is now 1962. Once again teams from USABAAR are on the rubber chicken circuit, thumping the tub for crash prevention. Once again, the Aviation Safety Officer stands up in the captive audience and once again the welkin rings with the perennial question, "What do we DO?"

Herewith the gist of the circa 1962 answer:

The magnificence of the achievement by Army Aviation in attaining the present accident rate cannot be denied. The prime movers in this achievement have been the commanding officers at unit level. It is high time they received just credit. In the past they surely received their share of the blame for high rates.

In answer to the query, "Just how low do you want the rate to go?" the only answer is, "To ZERO." Now don't stand up and say, "Easy, put the birds in the barn and lock the door." This won't hack it. Some plumber will drive an L-19 through the flock and you'll be right back at a high rate of damage. No. We want full-scale operations without accidents.

With today's low rate, it is difficult to conceive the significance of X number of disasters per 100,000 units of operation. Most of us have difficulty understanding just how large a number 100,000 really is.

When you look at the sky on a clear, cloudless night, you can see only 5,000 stars with unaided eyes. This helps a little toward a concept of the size of the number 100,000. Then consider X occurrences per 100,000 hours again and you'll realize that the crashes that generate today's disaster rate in Army Aviation can be considered in the "isolated incident" category. Ah, but the total!

Statistically speaking, a single fatal crash* per 100,000 flight hours belongs in the isolated incident category. (But don't try to tell the victim he's an isolated incident. One life is all we have.) Our present rate of crashes is close to the rate that persons of a certain age, weight, living habits, and temperament keel over in front of audiences due to heart attacks or other odd-ball reasons.

When the crash rate gets down this low, the problem of recognizing, identifying, and remov-

*Crash is used in lieu of accident because a spade should be called a spade. A crash is a crash is a crash, Gertrude notwithstanding.

ing potential causes of crashes becomes difficult, but not impossible. (When we were busting them up like peanuts, the problem was relatively simple, i.e., check the mags before takeoff; before landing, lower the casters . . . it sliiiiides so much better.) Crashes are prevented by getting ahead of them and removing possible causes before they become actual causes.

Herewith the prescription for preventing crashes in 1962:

- Every unit has available the services and talents of the specialist in crash prevention—the Aviation Safety Officer.
- Every unit command should employ these services daily.
- When the crash preventer comes up with an idea for preventing a crash, support him with all the prerogatives of command. (No matter how far out in left field the idea may sound, hear him out. Preventing an isolated incident occasionally requires some far-out reasoning.)

In the final analysis, crash prevention is an all hands job. The aviation safety officer is there to see to it that all hands are working as a team and preventing crashes. The safety officer is effective in direct proportion to the command support he receives. See to it that it does not lack in policy guidance, command attention, and above all, command support.

Continued from page 40

On 9 January 1962 a representative from Department of Maintenance departed for Fort Knox, Ky., to assist in writing lesson plans to be used in implementing Operation TAPER. Upon completion of the lesson plans, several teams will be used in instructing throughout CONUS and overseas installations.

Operation TAPER is about to become a reality.

(A full report on the new system will be published in the May issue of the DIGEST.—Editor.)

DEPT OF TACTICS

Instruction in the Reorganization Objective of the Army Division (ROAD) has been incorporated in the OFWAC tactics program of instruction. Satellited with this instruction are subjects including the Division Aviation Battalion and the Air Cavalry Troop. These blocks of instruction will be integrated in the ORWAC tactics program by mid-February.

All aviation personnel are invited to attend classes covering these new organizations. Interested persons should contact DOI Scheduling for appropriate scheduling data.

A common-subject packet containing the latest information on Army Aviation in the Field Army and the new ROAD concept has been completed, and is now available.

Revision of FM 1-100, Army Aviation, is complete. The initial draft copy has been completed and will be delivered to other Army service schools for field review on 1 April 1962. The revised manual will conform to the latest doctrine and policies of the new ROAD concept.

The recently developed XM-1 machinegun kit is being installed on an H-13E helicopter by the Department of Maintenance. The gunnery committee of the Research and Doctrine Branch has test-fired this weapons system in preparation for anticipated instruction to instructor personnel from Camp Wolters, Texas and a Special Warfare Group from Fort Bragg, N. C.

The new kit is an improved version of the earlier fixed and flextype models.

The OFWAC 3-day field exercise (317) conducted during the tactics phase of fixed wing training has undergone complete revision to conform with the latest ROAD concepts of Army Aviation. Each fixed wing class is organized (structurally) and operated as a division aviation battalion during the conduct of the field exercise.

Future ORWAC (rotary wing) classes are scheduled to participate in the revised exercise upon approval of USCONARC. The exercise will be combined for ORWAC and OFWAC classes during the tactical phase of training of both classes, schedules permitting.

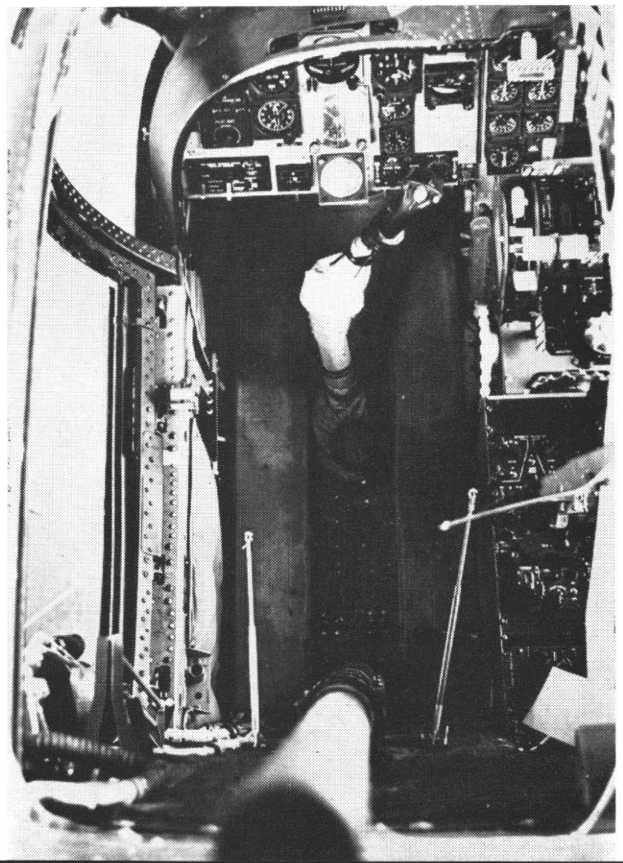
Added features to the field exercise is the battlefield illumination requirement to be integrated with OFWAC 62-1. Also, during the OFWAC 62-1 field exercise, the 6th Aviation Operating Detachment from Fort Bragg, N. C., on TDY with the Department of Tactics, will control all air traffic concerning the exercise and assist with the battlefield illumination requirement.

CRASH SENSE

CRASH SENSE is honored to welcome Mr. Clarence Stockwell to its pages this issue. A veteran of 22 years flying experience, Mr. Stockwell has been a civilian flight instructor with the U. S. Army Aviation School for the past 8 years. Fixed and rotary wing qualified, he has flown 87 different types of aircraft and has approximately 11,000 flying hours.

As many of you may have heard, Mr. Stockwell recently had the dubious honor of being the first to eject from a Mohawk in flight. Here, in his own words, is his story of this experience with the Martin-Baker ejection seat.

mohawk ejection



"Captain Jonah B. Davis and I took off at approximately 9 a.m. We rendezvoused with another Mohawk and flew formation, practicing climbs, descents and turns in the slot, and in left and right echelon. After approximately 45 minutes I took control and broke out of formation.

"My memory at this point is a little foggy, but I believe I banked away, dived, then brought the nose up to level flight, pulling approximately 2 g's. We were at approximately 4,000 feet and the airspeed was indicating between 240-250 knots. I remember being uncomfortable in the seat and leaning forward to shift my position.

"Just as I leaned forward, the seat went off. I felt a sudden jolt and my head snapped down, causing my chin to strike my chest and throwing my helmet off. I remember a fleeting glimpse of the cockpit disappearing away from me.

"The next thing I remember was that the chute had just opened and I was oscillating

approximately 30° either side of vertical. After three or four of these pendulum type swings, the oscillation stopped. I looked up to check the chute, but my eyes were full of blood. I remember wiping the blood out of my eyes and looking down at the ground. It seemed a long way down.

"I wondered what had happened to the aircraft. Did we have a midair collision? Had we blown up in flight? I looked around for signs of a crash, but saw nothing.

"I took a quick inventory of arms and legs and happily found them all in place. I wiggled my legs and moved my arms; they worked fine, but my back hurt. I tried to get comfortable in the harness and couldn't. It appeared to be holding me in a bent position and this seemed to make my back hurt worse.

"I must have blacked out a few moments on the way down because I don't remember the whole drop. Apparently, the wind was very slight as I could notice very little, if any, drift. I started trying to remember all the things I had ever heard about parachute landings—keep the feet together—knees slightly bent—pull down on the risers.

"At this point, I saw that I was coming down into a large group of trees. There was a plowed field to the south and I slipped the chute in that direction. This frightened me because it appeared the chute was about to collapse. When I let the risers go, I did some more oscillations, but these were much milder than the ones when the chute first opened.

"At approximately 150-200 feet, the impression of vertical speed struck me suddenly. I appeared to be dropping rapidly and this was the worst scare I had during the entire descent. It was so frightening, I looked up to see if the chute was still open. The sight of the fully blossomed canopy was very reassuring.

"I looked down again and saw that I was going to land near a fence. I took hold of the risers, set my feet together and bent my knees. As I hit, I rolled on my left side, and the parachute caught in a small tree. I think I must have blacked out momentarily from the shock of landing. I don't remember taking the harness off, but the next thing I knew it was off and I was standing near the fence. I walked over to the fence and stood there watching a farmer on a tractor approach me. I was in pain and it seemed like it was going to take the farmer forever to reach me. My back hurt so bad that I walked a few feet to a road and lay down.

"The farmer checked to see that I was all right and then went for his pickup truck. He helped me into the truck and drove me into town.

"I remember talking with the farmer during the ride. I asked if he had seen any crashes and he answered, 'No.'

"We arrived at a small clinic and got out of the truck. I tried to walk and couldn't. The farmer and a passer-by helped me into the clinic where the doctor gave me a shot to ease my pain. While he was stitching the cuts on my face, someone called Fort Rucker, and a short time later the chopper arrived to carry me back.

"I think the most important thing about this whole experience was that it proved the seat will work. Personally, I would like to see the explosive charge reduced by approximately 25-30 percent. I don't think the present charge is necessary for the type of flying done in this aircraft. As I understand it, the present charge is designed to give the seat zero altitude capability at speeds of 100 knots and above. Aside from contour flying—at speeds approximately 200 knots—we seldom have 100 knots airspeed at low altitudes. During takeoffs and landings, speeds are considerably below 100 knots.

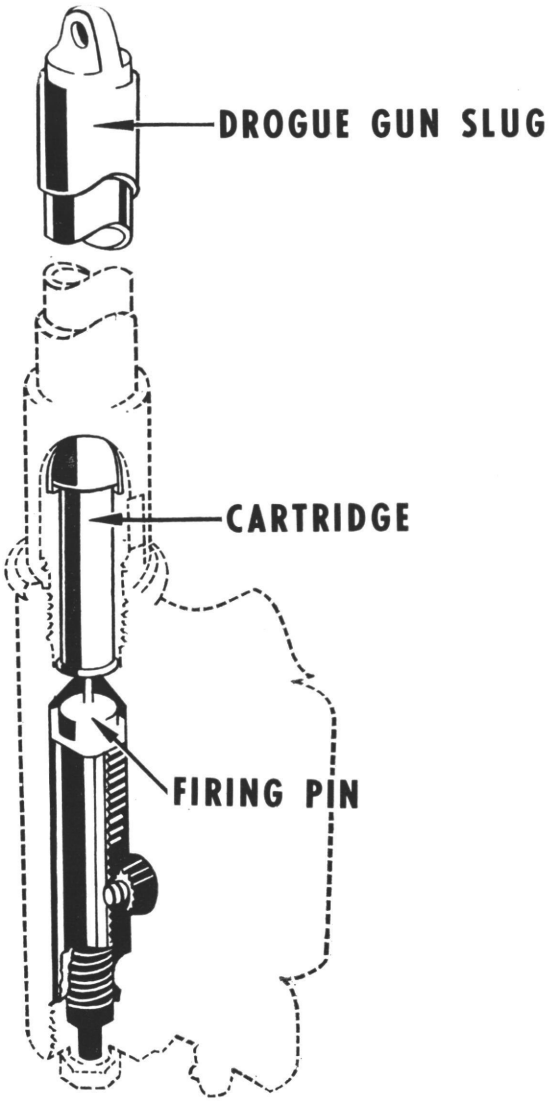
"I would also like to see a 28-foot canopy take the place of the 24-foot canopy. This would help to soften the shock of landing for people like myself who weigh 200 pounds or more.

"My advice to Mohawk aviators is to fly with the oxygen mask either fully on or fully off. I had just unsnapped my mask and it was hanging loose immediately before the ejection. I believe this is what caused the cuts on my face."

His many friends in Army Aviation will be happy to learn that Mr. Stockwell expects to be fully recovered and back on flying status by the time this is published.

To find the cause of Mr. Stockwell's impromptu ejection, investigators had to turn to the field of ballistics. Patiently eliminating all other possible causes, they directed their attention to the drogue gun and that's where they struck pay dirt.

The head of the cotter key which retains the drogue gun slug in the barrel was sheared and found in the cockpit. This particular type of cotter key is not used anywhere else in the



aircraft, so its presence in the cockpit proved that the drogue gun fired out of sequence while the seat was still in the aircraft. Additional evidence supported this conclusion. The next step was to find out why.

This is what the investigators found: Though still safetied, the drogue gun barrel was loose and the cartridge had been inserted without cocking the gun. The coarse threads of the loose barrel permitted a small amount of movement and the firing pin of the uncocked gun pressed against the soft copper primer cap of the cartridge under 10-15 pounds of spring tension.

Constant vibration of the cartridge in the loose barrel against the firing pin caused it to penetrate the primer cap. Of English design, the drogue gun cartridge does not require a shock load to ignite. The firing pin only had to penetrate the primer cap .007 of an inch, then BOOM!

The drogue gun slug was projected through the canopy and into the slipstream. This, in turn, extracted the controller drogue chute, the stabilizer drogue chute, and the remainder of the lanyard. As the lanyard drew taut, it pulled against the primary and secondary firing cables with enough force to draw the sear from the firing pin of the primary charge and fire the seat.

Two old wives' tales laid to rest by this incident are the ones about the man left behind getting burned from the blast and a fear that the metal framework around the canopy might cause injuries to flailing arms or legs. Captain Davis suffered no ill effects and was able to bring the aircraft back and land it without incident. Mr. Stockwell, though not expecting to eject and improperly positioned in the seat, cleared the metal framework with no sweat. Though he sustained a cut on the back of his head, this is believed to have been caused by broken plexiglass and would probably have been prevented if he had been properly positioned and had retained his helmet.

Possible fixes to prevent inadvertent firing are new drogue gun barrel torque values, improved maintenance procedures to ensure the drogue gun is cocked before the cartridge is inserted, and different routing of the primary and secondary firing cables.

Mr. Stockwell's misadventure should take a load off the minds of Mohawk aviators who have been flying around wondering if the ejection seat would really work. It does. It worked in this case, even though the drogue gun fired out of sequence. And it will work for you!

SAFETY THOUGHT

Although night flying is different from daytime flying, many aviators don't realize just how different it is. They cling to their daytime flying habits after darkness falls. Have you evaluated your night flying habits lately?

Maybe the Pilot Needed a Fiberglass Pole!

The Sioux was loaded with some critically needed wire and one passenger. Pilot aborted his first into-the-wind run because of high trees, and decided to take off downwind. He easily cleared a 15-foot tree barrier. Then the aircraft lost rpm as it approached taller trees. The pilot made a 180° pedal turn to make a forced landing among the smaller trees. Major damage occurred as the aircraft settled to the ground. The main rotors struck small trees and the rear cross tube was bent.

High spirits are commendable but aerial gyrations should be confined to individual abilities.

You Wrote These Safety Captions

Plan or these may be your last steps?

It must be okay—I saw a 20 taking off when I drove up.

The last mile?

Send me in, Coach; I'm ready

Even the birds are walking.

If you'd like to remain in this picture, make safety a permanent fixture.

If you have unusual photos or drawings adaptable to this type of safety message, please send them to the editor.

please don't feed the CARIBOU

SP-4 John F. Vaughn from the Department of Maintenance at Fort Rucker gave us this one. . .

"While a student and I were inspecting the sump of the No. 1 engine, we found what appeared to be a piece of thin metal lodged in the sump. We checked closer, found more of the material, then blew out the sump with a high pressure air hose and found still more wads of it.

"The oil screen on this engine was pulled and nothing was found there, so we were sure the material didn't come through the pump."

The wads of material were sent to a laboratory for identification. Here is the lab's report:

"The material was examined and the following facts established:

"The sample contained large amounts of oil and carbonaceous material.

"After solvent removal of the oil and carbonaceous matter, the remaining material was identified as aluminum and paper in the form of small pieces of aluminum foil with paper backing.

"The bits of foil were fitted together, and the embossed trade-mark 'CADBURY' was deciphered. This trade name was identified as belonging to Cadbury Brothers, Limited, Bournville, England, a large chocolate manufacturer. Their products are imported and sold in numerous retail stores in the United States.

"It was concluded that the sample had been the aluminum foil wrapper from a bar of Cadbury chocolate."

How the wrapper got into the sump is anyone's guess—probably during an engine overhaul. The important point is that the vet has limited all Caribou to a strict diet of aviation gasoline. Anything else makes them sick, so . . . PLEASE DON'T FEED THE CARIBOU!

Sp-4 Vaughn points to sump where wrapper was found.