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UNITED STATES ARMY AVIATION DIGEST

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SEPTEMBER 1960

United States Army

AVIATION DIGEST

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Something New on the Design Boards

A LIGHT observation helicopter will replace three aircraft now in the Army Aviation inventory, according to a recent announcement by the Department of the Army. Industry will be invited to submit design plans this year.

The new helicopter will eventually replace the L-19 (Bird Dog) observation plane, the H-13 (Sioux) and H-23 (Raven) reconnaissance helicopters. The project is part of a long-range Army Aviation program drafted by a special Army Aircraft Requirements Review Board.

Two different designs for the new helicopter will be selected from industrial competition. Testing of the designs is slated for 1963, when one will be chosen for production. Production and procurement is expected in 1964 or 1965.

The new helicopter will be powered by a turbine engine, weigh less and be smaller than the H-13, cruise at about 126 mph, operate for minimum of 3 hours without landing, and have a 400-pound payload (plus pilot and 3 hours' fuel) under hot weather conditions. The payload will be greater under good flying conditions. Its missions will be observation, target acquisition, reconnaissance, and command-control.

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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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Mohawk AO-1-AF

THE ARRIVAL of the AO-1-AF Mohawk for testing at the U. S. Army Aviation School marks a significant milestone in Army Aviation.

The Army's new tactical observation plane will be service tested by the United States Army Aviation Board. U. S. Army Transportation Aircraft Test and Support Activity will receive two Mohawks for logistical tests.

The side-by-side two-seater purchased from Grumman is distinctly different from current Army observation craft. For example, the Mohawk has two airspeed brakes, twin Lycoming T-53-L-3 turboprop engines, and a three-tail configuration.

The newcomer also boasts a cruise speed of 200 knots, a top speed in straight and level flight of over 281 knots, a maximum permissible of 350 knots, a cruising altitude of 25,000 feet, and a range of 1,453 nautical miles with drop tanks. The Mohawk weighs 11,859 pounds loaded, but maintains an effective STOL capability — thanks to flaps, slats, speed brakes, and reversible pitch props.

The primary mission expected of the Mohawk is visual observation, with responsibility for the bulk of the Army's AO operations. Secondary missions include utility, resupply, liaison, and day or night photography.

A bubble canopy provides maximum forward and downward visibility for the observers who must search out, detect, identify, and locate targets for the combat zone commander.

Coordinating these functions is a difficult job and will remain so, even for specialized observers the Army hopes to be training soon (see story of "Task Observe," AVIATION DIGEST, July 1959). The many features of the Mohawk should make this job easier and boost the capabilities and potential of the Army Aviation-Ground Force fighting team.

A quick look at the Mohawk's vital statistics may prove helpful. The wing span is 42 feet with a wing area of 330 square feet. The plane's overall length is 41 feet and the tail stands 12 feet, 8 inches high.

The Mohawk weighs approximately 9,519 pounds empty

Instrument panel as seen by pilot

and holds 1,950 pounds of fuel. Takeoff power is set at 1,005 equivalent shaft horse power for each motor.

This plane underwent extensive testing by Grumman. Landing and takeoff on short fields and turns in an extremely small radius were stressed. Landings have been made in about 300 feet with props at full reverse pitch and employing vigorous braking. The touchdown speed was approximately 55 knots.

Seated side by side in the cockpit with bubble canopy each crewman has unobstructed vision 22° down over the nose of the aircraft along the centerline of the seats. By moving the line of vision outboard, visibility is expanded.

The bubble side hatches increase downward visibility by the extent that the lines of sight of the aviator and observer converge at a point 36 feet below the plane. A transparent, jettisonable hatch allows complete vision overhead. Only 11° of rearward visibility is obstructed by the wing.

Efficiency and comfort have been obtained by maximum utilization of cockpit space. The instrument panel (consisting of the aviator's, observer's and center panels) slopes 15° forward to eliminate partial blocking of the instrument faces by their own bezels.

Flight instruments are duplicated for both crewmen; engine control instruments are located in a center panel, allowing both occupants to monitor them with ease. Each man also can easily reach all trim controls and a central throttle, propeller quadrant — making solo operations possible if necessary. A newly designed stick grip makes the left and right control sticks interchangeable.

Equipment for communications, navigation and photography is contained on a console between the occupants. Three overhead consoles provide for all the engine, fuel, and electrical master panels. It also includes the engine fire extinguishing switches.

Regulators for the oxygen system are located on the outboard side of the aviator's and observer's instrument panels. A first aid kit is mounted on the sloping bulkhead, along with pyrotechnic pistol, binoculars, a spotlight, and important circuit breakers.

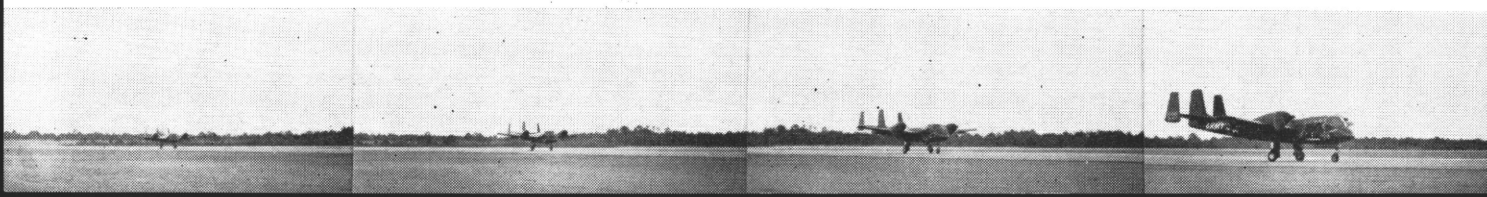
The cockpit is heated by engine bleed air cooled in a heat exchanger. Ventilation is provided by diverting ram air used to cool engine bleed air. The air conditioning system further provides air blast defogging of all transparent areas, camera compartment heating, and ram air cooling of electronic equipment.

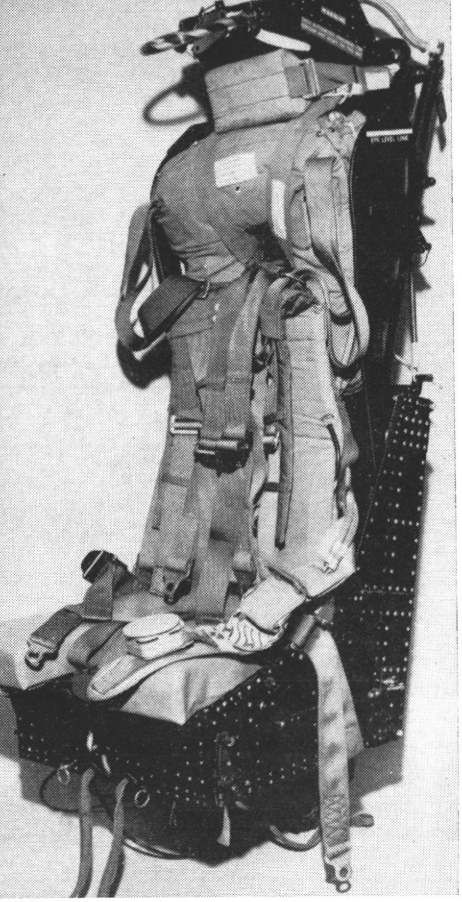
The Mohawk's crew can feel a bit more secure observing the enemy than Army Aviators could when flying missions in Korea and during World War II. Unlike its forerunners, the Mohawk contains 246 pounds of armor to protect its crew. This armor provides the cockpit with a 1-inch, bulletproof windshield, a ¼-inch thick aluminum floor, a ¼-inch aluminum side panel, and removable flak curtains above the floor on the fore and aft bulkheads.

The Mohawk's basic configuration reduces vulnerability. The self-sealing 295-gallon fuel cell and the engines are mounted above the wings. Other protection factors include dual longitudinal controls runs, separated as much as possible throughout the fuselage, and a cockpit area designed for 20 g's vertically and 40 g's fore and aft.

If the Mohawk is hit and

Army personnel who see this maneuver shake their heads at the





Crew can eject at all attainable speeds

has to be abandoned, the seats can be easily ejected to provide the crew a safe escape at all attainable speeds.

After ejection the parachute opens automatically and lifts the occupant from his seat. At high altitudes a barostatic control on the seat delays the opening. The occupant remains strapped to his seat and is steadied by a duplex drogue parachute while he descends to a warmer altitude. At high ejection speeds the opening is delayed by a g switch. The seat is fitted with a face curtain firing control that protects the occupant as he is ejected through the overhead hatch. An alternative firing handle is positioned in the leading edge of the seatpan. The overhead hatch can be jettisoned only by a control located in the overhead console. The seats are not ejected by this control.

The main parachute is stowed in a "horseshoe roll" shaped pack behind the occupant's shoulders and is combined with a back pad and harness system compatible with an integrated torso suit. Bail-out oxygen is automatically actuated on ejection.

Army Aviation is getting its first turboprop aircraft in the Mohawk. Each engine has a takeoff rating of 960 shaft horsepower and approximately 100 pounds of jet thrust at a gas producer speed of 25 240 rpm. The propeller shaft speed is approximately 1,678 rpm. Gear ratio between the power turbine and propeller drive is 12.46:1.

The three-bladed, variable pitch C.F.E. Hamilton Standard Hydromatic propellers are 10 feet in diameter, full feathering and have reverse pitch.

The engine nacelle is easily accessible. Two side cowl panels hinge up and a lower panel hinges forward, providing 360° accessibility.

All fuel control adjustments are easily reached. The powerplant, propeller, engine accessories and mount are movable as a unit and interchangeable between wings.

Engine anti-icing is provided by a flow of hot compressor bleed air through the engine inlet struts and inlet guide vanes, and by electrical heating for the propeller blades, spinner, and engine inlet cowling.

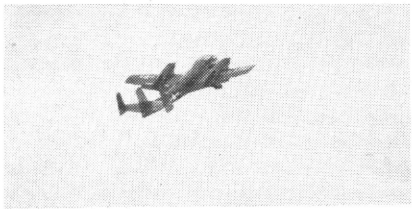
3-blade reversible props

The Mohawk is started by a starter-generator used with the plane's batteries or external power. The same system is used for air starts.

Photography promises to be one of the Mohawk's most important secondary missions. The plane can be equipped with one of three KA-30 cameras with lens cones of either 3, 6, or 12 inches. The magazine capacity in each case is 100 to 250 feet of film. The KB-10a camera (3-inch lens with 50 to 100 feet magazine capacity) also can be installed, but requires a special adaptor.

The camera mount is located in the fuselage midsection. It is remotely controlled by either crewman who can rotate it to the left or right, 15° or 30°

Takeoff distance over 50 ft.



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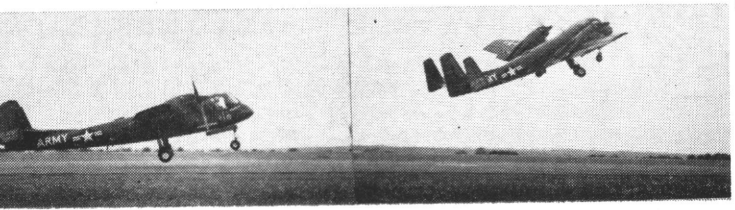
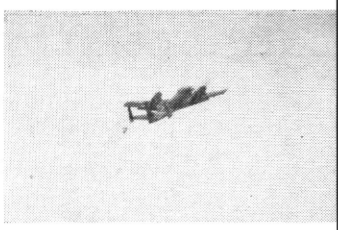
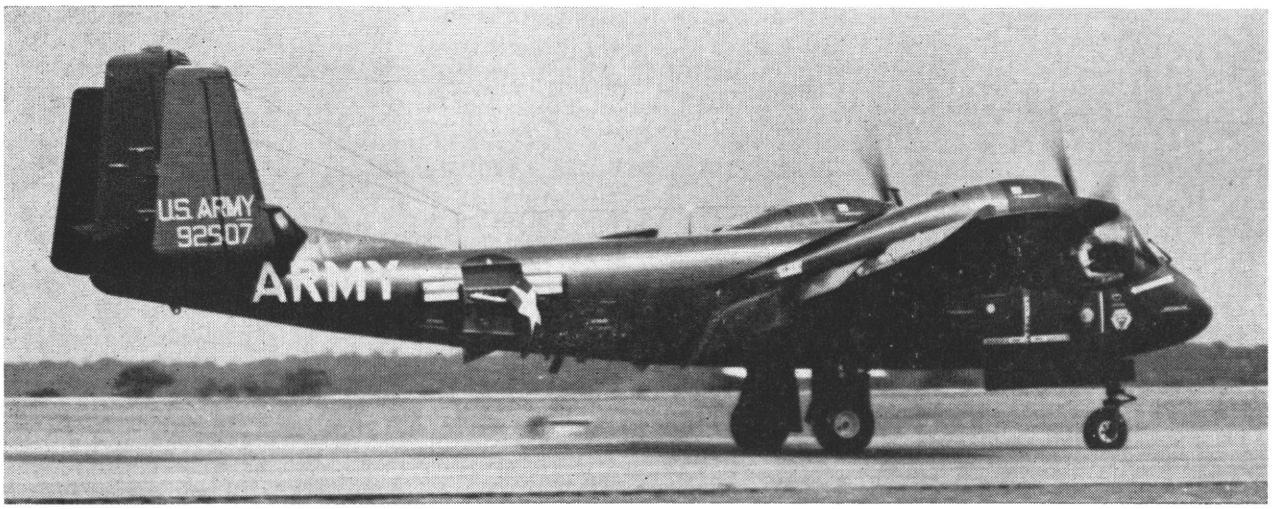


. . . obstacle is 793 ft.





STOL characteristics are aided by speed brakes

oblique and vertical positions. The control system consists of a cockpit console. During night photo missions flares may be fired individually or salvoed from pods attached above the wings between the engine and fuselage. Each pod holds 52 flares.

Items that may be carried under the wings are either two drop tanks capable of carrying 150 gallons of JP-4 each, resupply containers with a capacity of 1,000 pounds each, or wire dispensers.

Other versions of the Mohawk will carry either infrared mapping equipment or side-looking airborne radar (SLAR). The radar antenna is carried on an 18-foot cylinder externally mounted on the lower right side of the fuselage. The mapping equipment is carried internally. These surveillance systems are interchangeable between planes, but only one can be carried at a time.

A good STOL capability is provided by hydraulically actuated slats (integral with wing flap control) and speed brakes. The wing slats are arranged in four mechanically interconnected sections along the wing span. The slats operate in conjunction with the flaps. Flap movement can be continued independent of the slats to 45 degrees. A lock is provided for the zero degree position. At the outboard end of each flap a pushrod is attached to operate the inboard aileron droop incorporated with flap action.

The synchronized speed brakes are located in the aft section on the sides of the fuselage and swing on vertical hinges. Each is extended or retracted in three seconds by its own hydraulic cylinder and may be locked in any position. The brakes add greatly to the maneuverability of the Mohawk and are expected to play a major role evading enemy fighter planes. The gust lock lever which locks all flight controls in neutral is located so that the throttles cannot be advanced for takeoff when the controls are locked.

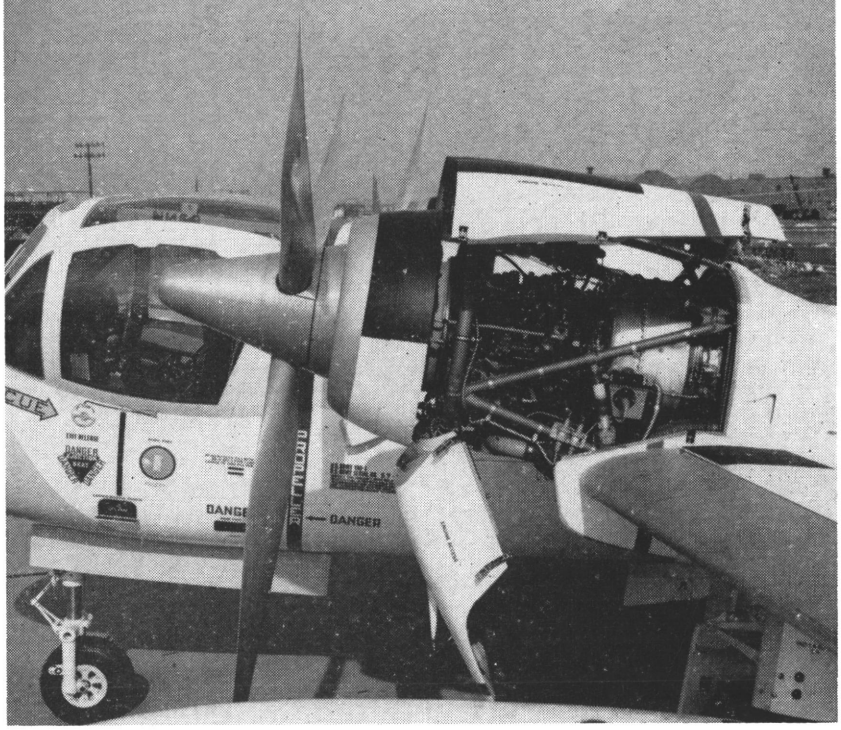
The retractable, tricycle landing gear with pneudraulic shock struts are equipped with low pressure tires to facilitate operation on unimproved airfields. The nose wheel rotates through 360°. Gear retraction is accomplished hydraulically with mechanical up and down locks.

The Mohawk originally was designed with a single T-type tail. However, tests proved that single engine control was not possible with this configuration. Three vertical fins and rudders solved this problem.

Fueling the Mohawk is simple. It is accomplished either through 3-inch gravity filler units or by single-point pressure fueling. Tiptank defueling requires a transfer of the fuel to the main tank. This can be done selectively at the fueling station by switching on one or both of the wing tank transfer pumps. The flow of fuel from the wing tanks can be controlled from the cockpit.

A dual fuel pump system operating from the main tank is a fail safe factor since one pump can supply both engines.

The Mohawk has a 28 volt D.C. electrical system including a parallel 300 amp starter-gen-



All major assemblies are interchangeable

erator driven by each engine; two voltage regulators; two reverse current cutouts and a 24 volt, 36 ampere-hour nickle-cadmium battery. Either generator can carry the entire load and the battery adds another safety measure by providing emergency power in event of a double generator failure. Two inverters supply a 115/200 volt A.C. electrical system. Normally the instruments are supplied by a 250 VA inverter. All other A.C. is supplied by a 2,500 VA inverter which can perform the functions of the 250 VA inverter.

The communications system consists of HF, VHF, and UHF transceivers. An intercom system is included.

Navigation equipment includes TACAN, MB receiver, and LF/DF, and new Doppler equipment. Transponder AN/APX-6B (IFF) and Coder Group AN-APA-89 identification are provided in the Mohawk and mark their debuts in Army Aviation.

Considering the missions of the Mohawk, it becomes apparent that the craft often may have to undergo emergency repairs under unfavorable conditions. Every effort has been made for maximum serviceability and maintenance. Quick access is provided to all equipment items.

All major assemblies are interchangeable. The entire wing panel, nose and tail sections, and wingtips are replaceable as units.

Special hoisting equipment provides an easy system for handling propellers and engines in remote areas. This mobile system consists of a hoisting davit, slings, and stands for the engines and props.

The prop sling loops around two of the blades and secures with snap hooks fastened into the sling hoisting ring. The davit forward hoist attaches to the same ring and lowers the prop.

The engine (minus propeller) is handled by fastening the sling to hoist fittings on top of the engine and attaching the davit hoist to the sling. The prop may be included if the hoist is moved further forward. The collapsible engine stand contains bolts for securing the engine.

Space provisions have been made for the ASW-12 automatic pilot, television camera, and recording equipment for forward looking radar.

The following chart handily sums up the performance of the Mohawk as determined by Grumman:

Maximum speed, 5,000 feet, military power, level flight	**281 kts**
Stall speed, sea level, landing configuration, 10% NRP	**59 kts**
Takeoff distance over 50-foot obstacle	**793 ft**
Landing distance over 50-foot obstacle	**847 ft**
Service ceiling, military power T.O. wt less 20% fuel (1)	**25,000 ft**
Rate of climb, 2 engines, MRP, sea level, T.O. wt. less 20% fuel	**2,950 fpm.**
Rate of climb, 1 engine, military power, sea level, T.O. wt. less 20%,	**1,050 fpm.**
Endurance at 200 kts, 5,000 ft. 2 hours without drop tanks.	
Ferry mission: (2)	
Range	**1,453 NM**
Time	**6.96 hrs**
Cruise speed	**200 kts**
Cruise altitude	**25,000 ft**

Notes: (1) Engine data extrapolated over 25,000 ft.
(2) With two 150 gal. external tanks

DO YOU KNOW THE ANGLES?

BIRD DOG, turning base into tactical strip, stalled and spun in. Pilot fatally injured. Aircraft destroyed.

Beaver developed engine trouble, dived into canal during attempted 180° turn. Pilot and 5 passengers fatally injured. Aircraft destroyed.

These terse TWX crash facts add seven (July 1960) victims to a long and growing list. Probably the most vicious killer in all aviation is the low-level banking stall.

Ask any pilot you know what happens to stall speed in a steeply banked turn. His reply will likely be, "It goes up, naturally." Probably he has imparted his total knowledge of the subject in that one sentence.

Though all pilots know stall speeds are higher in a turn, too few realize why or how much. Merely knowing that it increases seems to satisfy some pilots. But ignorance of the relationship between angle of bank and stall speed is the reason for the large number of stall/spin accidents. Do you know the why and how much?

WHY?

First, why is stall speed higher in a banked turn?

Stall occurs when design lifting capability of the wing is exceeded. Angle of attack, speed, drag, weight, and angle of bank all contribute toward reaching this design limit. Makes no difference if you're flying a delta wing supersonic stovepipe or a Bird Dog; they're sisters-under-the-skin.

You know that lift varies directly with speed—low speed, low lift. You also know that lift varies with the angle of attack — higher angle of attack, higher lift (up to the stalling angle).

What happens when you bend your wing into a steeply banked turn? To hold it, you have to haul back on the stick and your airspeed drops some. You also get that sit-down-harder feeling in the seat, which indicates additional g-

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This article was prepared by the United States Army Board for Aviation Accident Research.

loading on the airplane from the centrifugal force generated.

Now we have something to work with that indicates stall speeds are going to be higher in this turn: g-force, which makes the effective weights of the airplane greater than the actual weight, and hence requires more lift; the pull on the stick, which increases the angle of attack; and the drop in airspeed during the turn. They're all tied together.

As you can see, the lift required in a 30° bank is only slightly greater than the weight. In the 60° bank, the lift is twice the actual weight, but equal to the effective weight. The steeper the angle of bank, the greater the lift requirement.

To get this extra lift which will overcome the g-effect of centrifugal force, we pull back on the stick and increase the angle of attack of the wing. This increased angle of attack causes a rise in induced drag (which incidentally, is always higher at slower airspeeds). Increasing the drag decreases the airspeed.

See how this package all ties together? Low airspeeds and steep bank angles are not compatible. In the turn, you tell the wing it must produce more lift, and it does that—up to a point. It stalls out trying to produce beyond its capability.

Aviators seem to grasp the relationship between bank and stall faster and more completely when it is compared to a straight-ahead climbing stall. This probably results from a mental image of automobiles or bicycles straining to climb steeply graded hills. In effect, when you bank an aircraft, you are **climbing!** Imagine that each time you enter a bank you are tilting the horizon and climbing toward your desired heading. Now remember all the stall series you have practiced and it becomes very easy to understand this relationship.

There you have the **why** of higher stall speeds in a banked turn. Now let's discuss the **how much.**

HOW MUCH?

A simple thumb rule for angle of bank versus approximate stall speed increase: 30° bank is a 10 percent increase; 45° bank is 20 percent increase; 60° bank is 40 percent increase; 75° bank is 100 percent increase.

When you're overshooting the final turn for landing, will you wrap it up tighter or take it around? Just remember that above 60° banks, your stall speed goes out of sight in a hurry. It is here that the stall/spin accident occurs.

Now what have you learned? What kind of answer can you give the next generation aviator who asks you the question we began with: "What happens to stall speed in a steeply banked turn?"

You know that stall occurs when you exceed the design lifting capability of your wings.

An increase in gross weight raises the basic 1-g stall speed.

G in a turn acts as an effective weight increase.

In effect, you are climbing during banking turns. The steeper the bank, the steeper the climb.

Stall speed rises rapidly at steep bank angles.

In a 65° bank, your stalling speed is half again as high as with wings level (an amazing 150 percent of basic stall speed).

These rules are applicable to any aircraft and at any weight, so . . .

In a banked turn, it pays to know all the angles!

from the Falcon's Nest

DEPT OF PRI F/W
POWER ASSIST LANDING

AT THE TIME training of Primary students began at Fort Rucker, it became apparent that directional problems existed due both to the runways not being into the prevailing winds and the characteristics of the trainer, the TL-19 A and E. The trainer was designed as a tactical airplane, to be landed over barriers into short, rough strips, or perhaps on a narrow road. Such landings are made with power to touchdown.

Why, then, should we use a power-off approach, round-out, and touchdown in the Primary stage of student training? It is very difficult to teach a beginning student to recognize slight amounts of drift on the landing approach, round-out and touchdown. Experience shows that we must fly an airplane according to its characteristics and peculiarities.

Experiments were initiated to find an answer to this directional control problem. The number of directional control accidents indicated that a turning or swerving of the airplane took place after touchdown and during approximately 200 feet of the after-landing roll. This swerve started during the touchdown by the pilot's failure to recognize the airplane's drifting or crabbing, coupled with not contacting the ground in a three-point attitude.

With power applied at the beginning of the round-out, positive elevator and rudder control is maintained throughout round-out, touchdown, and after-landing roll. The small amount of power needed along with the thrust developed by the addition of power, tend to alleviate the swerve and cause the airplane to roll straight.

Additional benefits are gained through this technique. With slower landing procedure, student reaction time keeps up with the landing process. Positive three-point touchdowns are accomplished, giving additional directional control through the steerable tailwheel. The additional slipstream over the control surface makes for better reaction of the controls. Heavy braking action is unnecessary. Overcontrolling with rudder is reduced as the airplane slows down.

DEPT OF R/W

Helicopter Instrument Training has been a part of our program of instruction here at Fort Rucker since 1958. During this period many rotary wing aviators have earned their instrument ratings. The helicopters currently used for this training are the H-19, H-21 and H-34.

Beginning in October or November of this year, students attending the Helicopter Instrument Flight Course can expect to train in the new turbine-powered HU-1A.

DEPT OF P&NRI

Many division staff aviation officers are receiving the Aviation School Catalog of Instructional Material, according to our mailing list. However, their division aviation companies are **not** aware of its existence. This situation could apply to all command levels in both active and reserve units.

As long as Army Aviation continues to develop and refine its procedures, organizations, equipment, and techniques, the Aviation School will continue to make available Master Lesson Plans to organizations worldwide. These cover all resident instruction, incorporating current procedures, organizations, equipment, and techniques.

If your organization would like to be placed on regular distribution for the Aviation School's Catalog of Instructional Material and its monthly changes, write to the Commandant, U. S. Army Aviation School, Fort Rucker, Ala.

Work on the extension course entitled "Organizational Aircraft Maintenance Supervisor (Aviation)" has been initiated. This will be Common Subcourse 57, administered by the Artillery School, Fort Sill, Okla., upon completion and approval.

DEPT OF TACTICS

The Department of Tactics has submitted its final draft of Chapter 13, "Medical Air Ambulance Company and Helicopter Ambulance Medical Detachment," for FM 1-5, **Army Aviation Organizations and Employment** to the Department of P&NRI. This chapter pertains to Army Medical Service aviation units. It covers mission, capabilities, employment and organization in sufficient detail to provide unit and element commanders with necessary guidelines for day-to-day operations.

Recently, a Department of Tactics instructor was forced to ditch an H-13G helicopter. Although the procedure as prescribed in the flight manual was not followed, the ditching was successful. Since there was a passenger aboard, he elected not to roll the helicopter. Had this been done, and the person on top had been injured or trapped, the other would have had a difficult time clearing the aircraft.

By entering the water in a tail-low attitude, the blades struck the water behind the cockpit and stopped after two or three revolutions. As the helicopter settled in the water, the pilot exited through the left door and the passenger through the right. By this time the blades had stopped.

Since there is not much of an experience factor on this subject, the above is submitted for consideration by other aviators who may find themselves in a similar situation.

CDO

Aerial Combat and Reconnaissance Company has made two simple modifications on its H-13E armament system to enable aviators to arm or disarm, elevate or depress, charge, and fire their machineguns without releasing the flight controls. Only parts in the current military inventory are used.

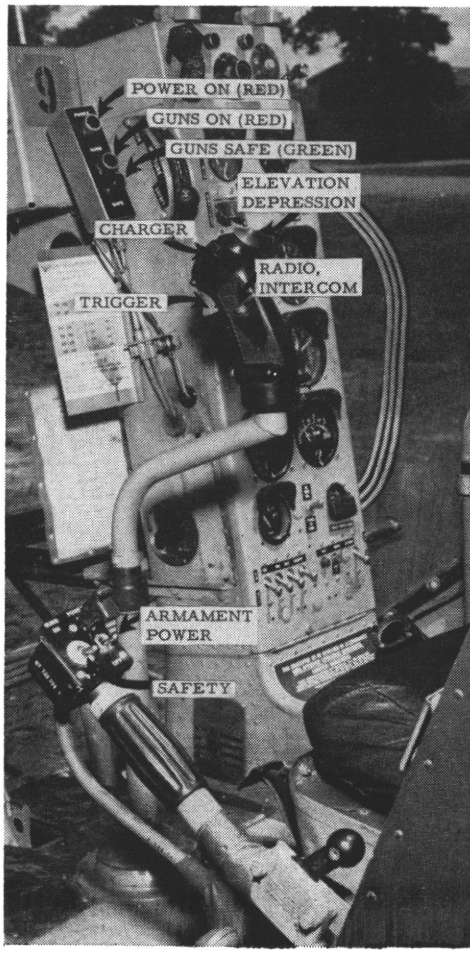
The lower arm box from the collective pitch stick of the H-13H model was placed on the collective pitch stick of the E model. The starter and light switches on the box were replaced with two switches which enable the aviator to arm, disarm, or place his weapons on safe without releasing the collective pitch control stick. It was previously necessary to release the control to reach the switches on the console.

The H-13 cyclic stick grip was replaced with the B-8 (H-34) grip, which ACR modified to incorporate fingertip control of firing, elevating or depressing, and charging of the machineguns. This eliminated another problem of releasing the control stick to reach for a switch. (Provisions for a radio switch also are included on the B-8 grip.)

Lights on the original master armament panel on the console were rearranged to indicate condition of guns.

"The Role of Army Aircraft in CBR Warfare," is currently being developed in study form. The study is to determine to what extent Army Aviation can assist in the conduct of chemical, biological and radiological warfare. It will recommend missions for Army aircraft in support of CBR operations and determine any special requirements for aircraft, training, and associated equipment during the 1960 to 1970 time frame. Recommendations as to modification of current operational Army aircraft and equipment will be considered as well as levels of assignment for

New modified armament system



specialized vehicles, if recommended.

Army Aviation can provide valuable support within the framework of the field army by providing rapid movement of personnel, supplies, and equipment. However, the primary consideration of this study is whether or not it is feasible, economical and tactically practicable to dispense chemical, biological, and radiological sprays and agents from Army aircraft.

At the request of the United States Army Aviation School, the Army Aviation Branch, United States Army Chemical Corps Training Command, Fort McClellan, Ala., recently demonstrated the smoke-laying capabilities of the L-19 aircraft. The volume of smoke produced by the L-19 equipped with either two M-10, E-33, or E-37 tanks is great enough to screen a company sized airmobile (ACR) operation for 5-10 minutes during the critical landing phase. It is not great enough to support a battle group size operation. However, this same equipment appears capable of providing sufficient smoke for screening the attack of a roadblock or strong-point by a small unit (company or platoon)—ground or airmobile — not having the immediate support of mortars or artillery.

An improved tank and smoke agent can give Army aircraft an even greater coverage capability. Other possibilities include use of helicopters equipped with fog oil type smoke generators as well as use of fixed and rotary wing aircraft for dispensing of chemical decontaminants.

A Letter from a Mechanic's Wife

"Three copies of your Mechanics Bulletin have come into my hands and I want to tell you of my appreciation for this little magazine and the purpose it is fulfilling. I feel that I can write with authority because my husband is an aircraft mechanic and I have heard little but aviation talk for nearly all my married life—considerably more than a quarter of a century.

"For too long the aircraft mechanic has been laboring under two misconceptions: (1) the general concept that a mechanic is a workman of lesser intelligence and ability, and (2) his concept of himself influenced by this general verdict.

"It wasn't always this way. In its earlier days aviation was the great adventure. It was a new world of exploration and the lines between the explorers were not so sharply drawn. Mechanics, pilots, designers, financial backers, all were in it together, contributing equally their time, ingenuity, and patience, and sharing equally in accomplishment and in disappointment.

"Success brought bigness and with bigness came the anomaly of expansion appearing as increasing personal limitation. Everyone was classified, departmentalized, with sharply outlined fields of activity. Differences were emphasized. One heard the reference, 'only a mechanic.' It seemed that the mechanic was to become an overspecialized automaton. Then I found your Mechanics Bulletin and the assurance that this can never be!

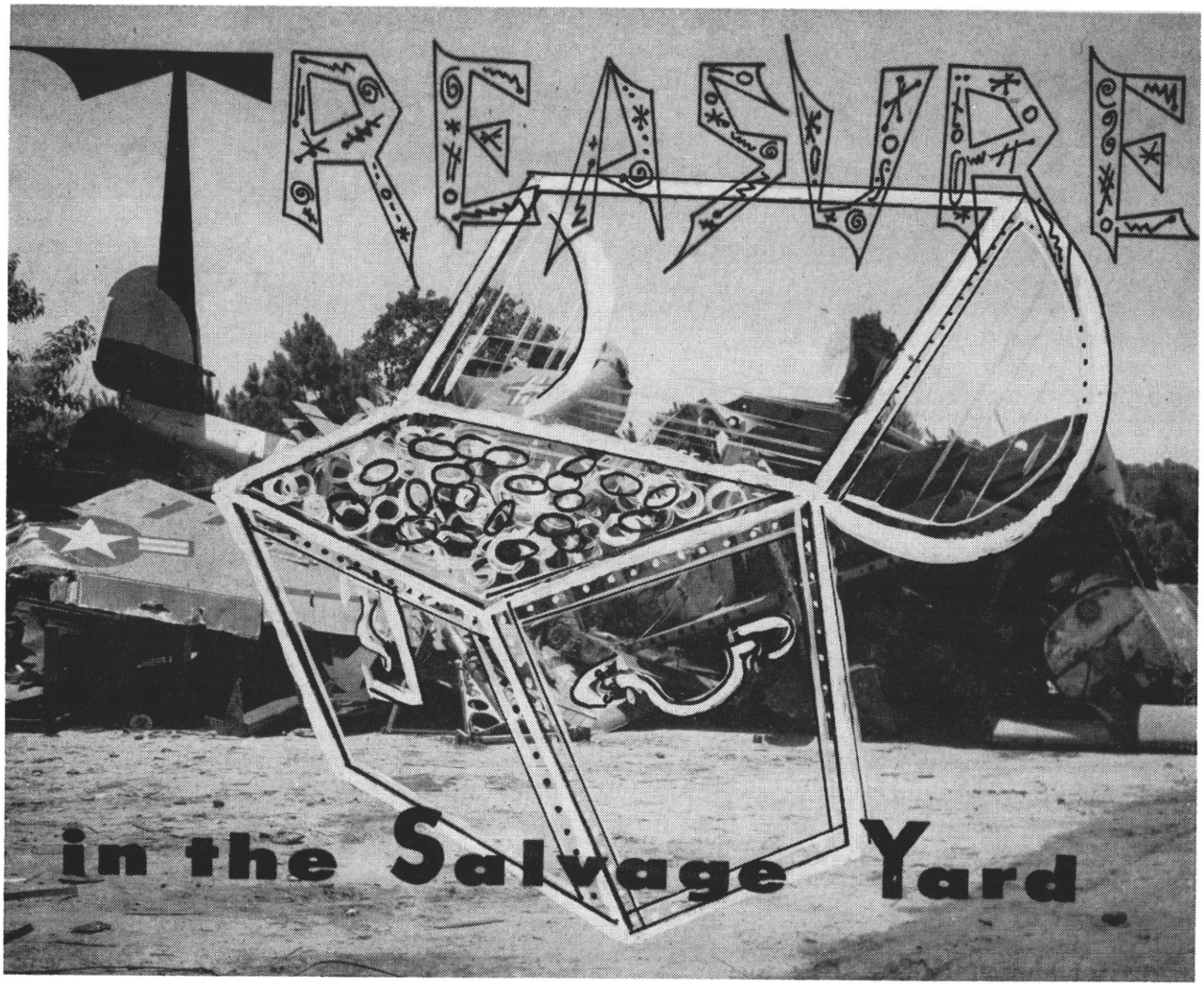
"I am not technically minded and many of the articles in the Bulletin are beyond my comprehension. But the very articles that leave me floundering indicate a readership with the broadest possible understanding and mechanical know-how. The readers are men with a high order of intelligence and a dedicated sense of responsibility. To them are entrusted equipment worth millions of dollars and lives that are beyond price. They command our deep respect. I glow with pride that my husband is one of them.

"My thought turns gratefully to this wonderful country in which we live. Here the rights of man are so safeguarded that a technical education of the sort indicated in the Mechanics Bulletin can be the experience of all who really want it. Here, to a greater extent than in any other country, man has the freedom to partake of and to develop all the qualities bestowed by an all-good God; the freedom to be the man he wants to be.

"We cannot be reminded too often of these facts, and your little publication must be of continuing and expanding value as it adheres to the great purpose of appreciating and enhancing the work and the worth of the aviation mechanic."

Sincerely yours,
(Name withheld by request)

(This letter is a reprint from the AVIATION MECHANICS BULLETIN published by the Flight Safety Foundation.)



Lieutenant Carl G. Midgett, Inf

OFTEN INSTRUCTORS in on-the-job-training or school classes need a training aid to make a point clear. While you labor solely with words, that "unavailable" training aid may be only a few blocks away. A trip to your nearest salvage yard might uncover a virtual treasure of training aids.

The Department of Maintenance at Fort Rucker has salvaged many parts needed to improve its classroom instruction. Some of the training aids its instructors have devised from salvaged materials are described.

The Primary Maintenance Division teaches landing gear systems, including hydraulic systems, pressure type bleeding of the brakes and replacing brake pucks in the wheels. Instructors from the division went to the salvage yard and collected landing gears from aircraft that had crashed, ground-looped, or sustained damage due to hard landings. These landing gears were mounted on frames for the instructors to use in demonstra-

Lieutenant Midgett is assigned to the Aircraft Systems Branch, Primary Maintenance Division, Department of Maintenance, USAAVNS. He is fixed wing qualified and instrument rated.

tions and the students to work on during practical exercises (Photo No. 1).

The Aircraft Structural Repair Section, also a part of the Primary Maintenance Division, obtained an empennage section complete with tailwheel assembly. This is used to teach the mechanics to make aircraft skin patches in the sheet metal (Photo No. 2). They also have an L-19 fuselage and a wing section, both found in the salvage yard.

The Rotary Wing Section of the Intermediate Maintenance Division made a partial cutaway model from a salvaged H-13. Different parts of the rotor head assembly were color coded (Photo No. 3). Now the students can follow control movements by watching the colors.

One of the most up-to-date training aids in the Department of Maintenance is a large magneto mockup built here at the Aviation Center to illustrate the internal parts of a magneto mechanism. Of course this wasn't found in the salvage yard, but you may find the magnetos that would be just the thing you need to teach bench timing.

Another new training aid we have here at the school didn't come from the salvage yard either, but was built by the Engineers from an original idea of Major General Easterbrook, Commandant of the Aviation School. The General thought it would assist the Department instructors to have a turntable large enough to hold an L-19 or H-13, thereby allowing one instructor to conduct the class without the use of assistant instructors. This is another step forward in the increased utilization of instruc-

Photo No. 1, top **Photo No. 2, center**
Photo No. 3, bottom

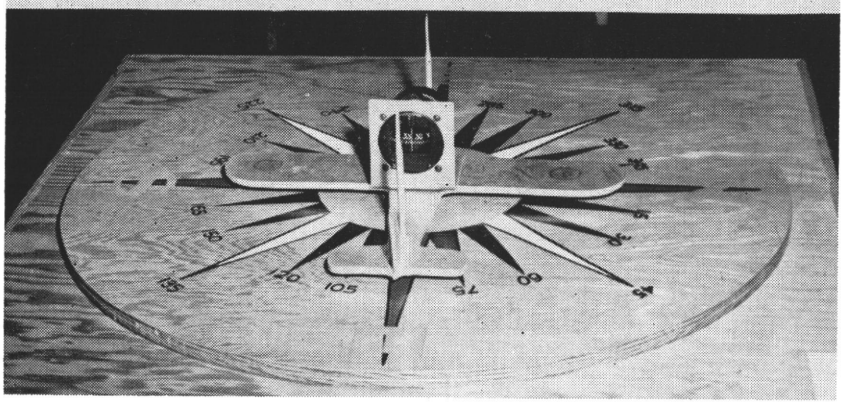
tor personnel.

Many other training aids here at the Army Aviation School have been developed through imagination and initiative. We certainly do not recommend crashing aircraft to obtain training aids, but the chances are you'll find anything from engines to instruments in the salvage yard. So go take a look.

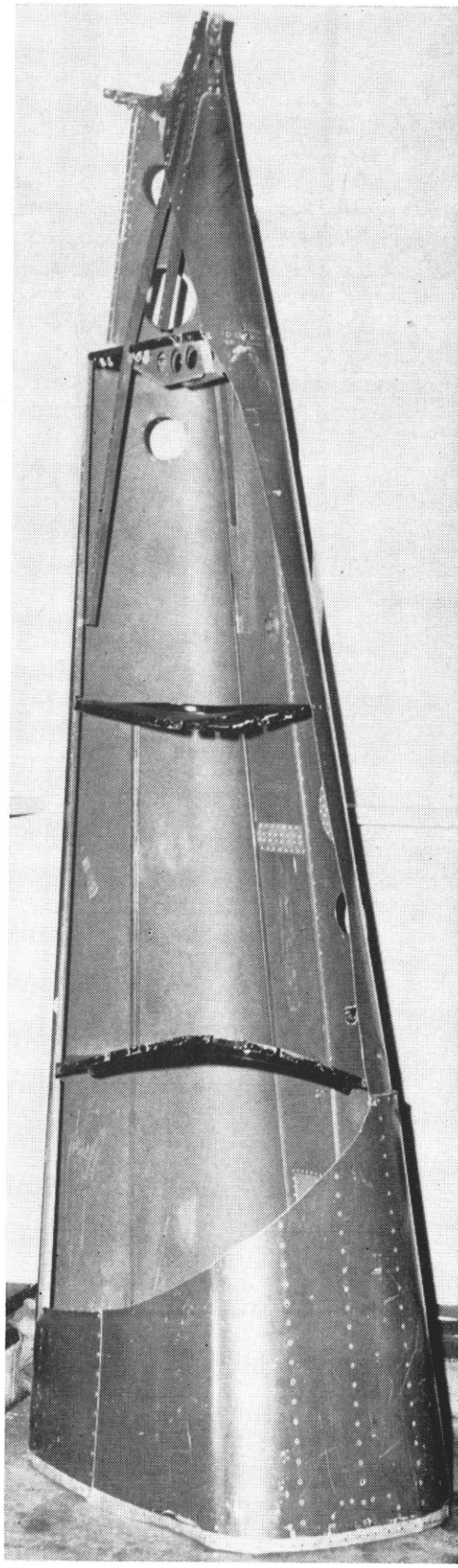
Now probably the question pops into your mind, How do I go about getting these treasures? Paragraph 13, AR 755-7 deals specifically with this type of issue and spells out in detail the course of action to be taken to obtain property in possession of the Property Disposal Officer. Procedures probably differ in some areas, but here at the Aviation School and in the Third Army area it is not too difficult to obtain these salvaged parts.

First, fill out Form DD 1149 (Third Army Area DA 1546) and submit it to the Property Disposal Officer, who is under Center Quartermaster. On this form you write a certificate stating, "I certify that above item(s) will be used (as) (to make)_____, a purpose other than for which they were originally intended." This procedure is for parts that are classified as scrap. Normally a wing, fuselage, etc., would be considered scrap.

The unserviceable items have to be issued to the Tech Services Officer and, if accountable, picked up on their property book and reissued out to the using organization.



Top: A valuable teaching aid, H-13 or H-19 on a turntable. Bottom: Compass swinging taught the easy way



Empennage used to teach internal structure

I know many of you make CR flights that take you into Air Force or Navy bases. They might have something you could use. Why not look around the next time you fly into one of them? From strictly hearsay, I understand that it's not too difficult to get an item from the Air Force. Normally their salvage is not accountable, so there are no funds involved.

Can a person from Fort Benning or any other post come to Fort Rucker and get salvaged parts? Certainly; all he has to do is to have the Training Aids Officer at his post fill out the DA 1546 or DD 1149 and send it to the Property Disposal Officer here at Fort Rucker. If it's available in the salvage yard, he will issue it to you.

We want the best aviators and the best maintained aircraft available. Good training aids often mean good training. Perhaps you can find a treasured training aid in your salvage yard.

Maintenance Time Saver

J. R. Brackin

A ROVING PARTS bin for common usage items has reduced the maintenance time on L-19s undergoing periodic inspections at Lowe AAF, Fort Rucker, Ala. Such a bin can be inexpensively made at most maintenance shops.

Supervisors at the Lowe inspection hangar observed that each mechanic was losing up to 30 minutes a day by having to interrupt his job to obtain needed parts. "Free stock" hardware bins were located within the hangar, but the worker had to walk a considerable distance to pick up a bolt, nut, washer, gasket, or similar item. Each trek took only three or four minutes per man, but the total time consumed amounted to many manhours each shift.

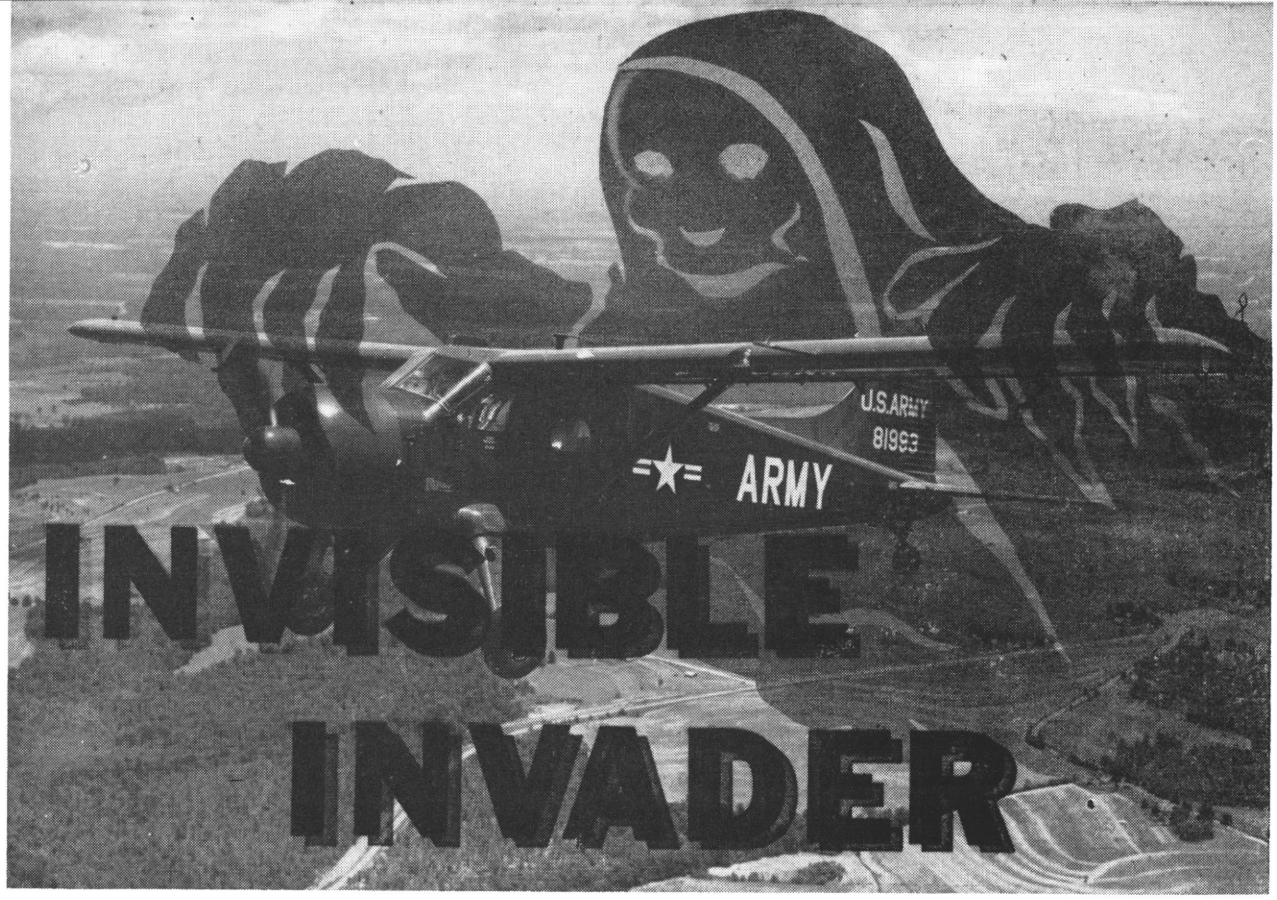
A plan was devised to allow mechanics to stay on the job and obtain "bits and pieces" and general supplies at their work stations. A discarded cafeteria cart was adapted to make a portable base for a free stock bin. A wooden stock bin was cut in half and mounted back-to-back to provide 84 storage spaces (each about 4½ inches square) for nuts, washers, screws, bolts, and the like.

A rod across the top of the bin suspends assorted sizes of color coding, masking, and upholstery tapes, and safety wire. One end of the bin is devoted to a display of the various clamps required for L-19 aircraft maintenance. The opposite end has an arrangement of gaskets, "O" rings, and related parts.

Identification tags for removed parts also are included on the bin. Package goods, such as tailwheel main leaf, eyebolt and thru-bolt, that are known chargeout requirements for each aircraft are prepacked and immediately available.

The roving parts bin is moved from crew to crew at least once a day by a supply production parts expeditor and enables the crew chief and/or mechanics to resupply their toolbox rollaways as needed. This permits the mechanic to stay at his job station continuously, and an optimum output can be maintained.

Mr. Brackin, who devised the roving parts bin, is the supervisor of supply for the Hayes Aircraft Corporation at Lowe AAF, Fort Rucker, Ala.



INVISIBLE INVADER

Richard K. Tierney

THE SERGEANT AWOKE with a throbbing headache and a thick feeling of nausea churning in his stomach. He dismissed it as airsickness and glanced at his watch. They had been flying an hour and a half.

Suddenly the sergeant noticed a bluish-red coloring under his fingernails. "Carbon monoxide!" he said aloud. He stood up and immediately experienced a sensation of dizziness and a feeling of confusion. He stumbled forward to the cockpit and informed the captain, who instantly turned off the heater and opened the windows.

The H-34 was landed at the first opportunity and a check of the cockpit and cargo compartment with a carbon monoxide detector kit revealed a saturation of the deadly gas in both areas. It was estimated that after an hour and a half in flight the air in the cargo compartment had been .045 percent carbon monoxide and the percentage in the cockpit was about .028 (see chart 1).

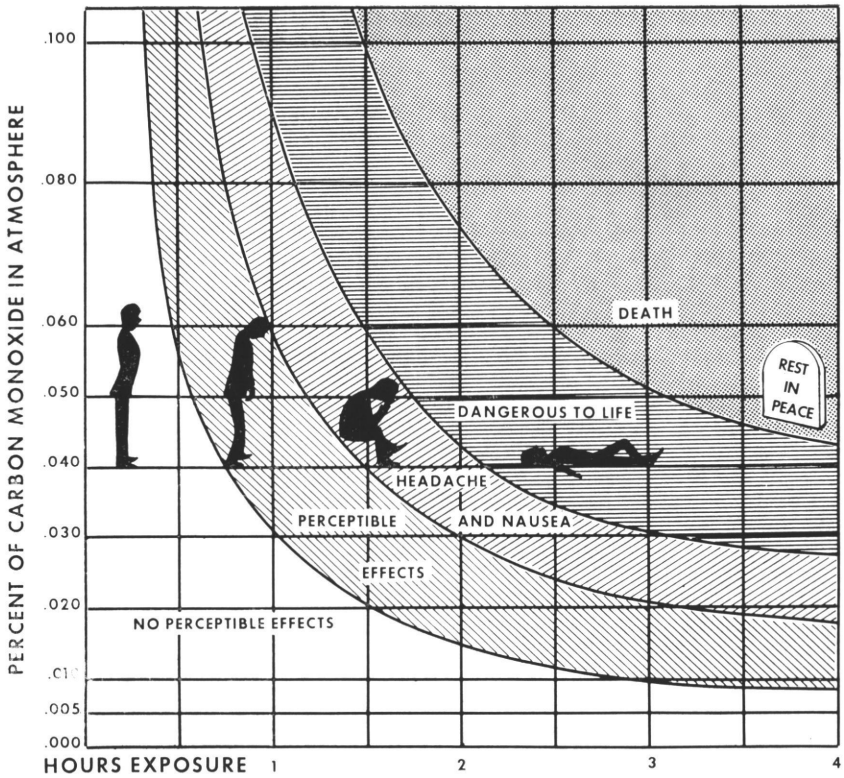
This story is fiction, but easily could be fact. The possibility of carbon monoxide endangering personnel in **any** type of Army aircraft is always present, especially in cold months when windows are closed and heaters are on.

Carbon monoxide is difficult to detect without proper equipment. It is an odorless, colorless gas formed by combustion of any carbon-containing material —as in gas engines and various types of heaters. There are numerous ways carbon monoxide can invade cockpits or cabins when you consider the many combinations of defects that might occur in heating and exhaust systems and other openings to the cockpit (see CRASH SENSE, Aug. 1960 issue of DIGEST).

Currently the Army requires detector kit checks for carbon monoxide only in L-19s, L-20s and U1-As (see respective -6). However, some authorities feel that all Army aircraft should be checked periodically with appropriate detector kits, such as pictured in figures 1 and 2.

The Aviation Medical Advisor of the U. S. Army Aviation School recommends that all Army aircraft be checked periodically for CO with detector kits.

It is a simple matter to order and use carbon monoxide detector kits. Those pictured in figures 1 and 2 carry a Federal Stock Number of 6665-283-0654



Effects of carbon monoxide for a given time on human beings. Data from Bureau of Standards technical paper 212.

and may be ordered through chemical supply by any unit authorized organizational maintenance tool sets required in Army Aviation (either set "A" supplemental, FSN 5180-323-4948; set "B", FSN 5180-323-4979; or set "C", FSN 5180-323-5037).

A third type detector kit (FSN 665-618-1482) also listed as a chemical item, is available through chemical supply. Similar to the kit pictured in figure 1, its nomenclature reads Detector Kit, Carbon Monoxide, Colormetric, M23. All of the above mentioned kits require indicating tubes (FSN 6665-276-7545) which should be requisitioned with the detector kits through chemical supply. Each box contains 12 tubes.

Instructions for use of the kit pictured in figure 1 are on the back of the card enclosed with the indicating tubes (figure 1, lower right). The same indicating tubes and instructions apply to the kit shown in figure 2. A more detailed set of instructions for the operation of this kit is included in the container case.

Basically, the two kits illustrated work the same. Both use a glass indicating tube to measure the amount of CO present. After the glass tip is broken off, the tube is attached to the aspirator which draws air through the indicating tube. A change in color of the agent within the tube indicates the presence of carbon monoxide.

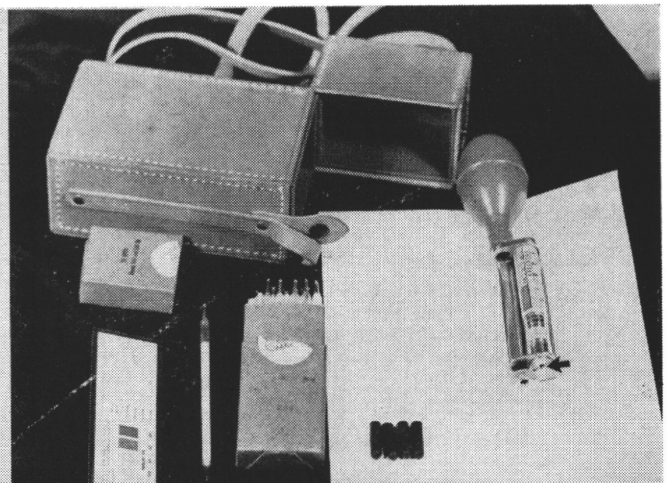
In figure 1, if carbon monoxide is present in the air the yellow spot (arrow) in the tube will turn darker shades of green depending on the amount of CO present. A reading of the CO percentage is then made by comparing the color change with the color chart on the instruction card (figure 1, lower right). The rubber tubing (left) can be attached to the open end of the indicating tube to enable the test to be made at a distance from the check area.

In figure 2, as air is drawn through the tube, a color reading can be compared with the revolving color chart attached behind the tube breaker barrel. Black rubber caps (lower right) come with the kit and may be used to preserve the usefulness of a broken indicating tube for 8 hours. The color chart (lower left) is not needed with this kit.

The M23 kit works similarly to the kit pictured in figure 1.

Figure 1

Figure 2



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ACCIDENT RESEARCH

TWX exc

H-23C FUEL EXHAUSTED during flight. Aircraft made autorotation into railroad yard and right skid caught on track, causing main rotor to strike boxcar. Major damage. No injuries.

L-19E STALLED, struck tree and crashed during attempted go-around. Aircraft destroyed. Minor injuries to pilot and observer.

L-19A ENCOUNTERED DOWNDRAFT and crashed into mountain during search and rescue mission. Major damage. Pilot suffered bruises. Injuries to observer undetermined.

L-19A ENGINE LOST POWER during flight. Forced landing completed with no damage. Power loss caused by fouled plugs.

H-19D MAIN ROTOR BLADE damaged when landing area marking panel was blown into rotor system by downwash.

H-13E ROTOR STRUCK TREES during practice for demonstration in confined area. Resultant hard landing caused bounce and loss of directional control. Tail rotor blades, tail boom, leading edge of both main rotor blades dented; skids and cross tubes bent. No injuries.

U-1A PROPELLER STRUCK RUNWAY during touch-and-go landing. Incident damage to propeller tips. Caused by excessive forward pressure prior to lift off.

H-21C TAIL CONE scraped during tail-low landing.

H-21C LANDING GEAR DRAGGED through trees during low-level flight. Brake line broken at wheel cylinder.

L-20A TAKEOFF ABORTED from field strip. Aircraft crossed ditch and ground-looped. Left landing gear collapsed; propeller bent; and left elevator damaged.

H-13H FELL THROUGH during practice autorotation. Aircraft destroyed. Pilot suffered back injury. Crew chief suffered minor injuries to left side.

L-23D LEFT MAIN LANDING GEAR lock hook assembly failed during takeoff. Tips of left propeller struck concrete runway. Takeoff completed and wheels-up landing performed at another airbase. Propeller tips bent; exposed antennas broken; and rivets in nose compartment radio bracket severed.

L-20A ENGINE FAILED during flight. Attempted road landing aborted due to vehicle traffic. Aircraft crashed and destroyed. No injuries. Cause of engine failure: split in No. 1 cylinder wall.

H-13E LANDED HARD during practice autorotation. Major damage to main rotor blades, tail rotor section and right skid. Tail boom severed. No injuries.

H-21C ROLLED DOWN HILL during attempted mountain slope landing. Front rotor blades struck tree and aircraft was purposely rolled on side to prevent further rolling. Major damage to fuselage, power train, flight controls and rotor blade systems. No injuries.

H-13G FELL THROUGH during attempted power recovery from practice autorotation. Suspect partial engine failure. Cause undetermined pending investigation. Damage to cross tubes, main rotor cable assembly and main rotor hub. No injuries.

pts from july and august

TWO H-21Cs DRAGGED tail cones during slope landings. Incident damages. No injuries.

L-19E STRUCK TREES during road landing. Major damage to wings; right fuel tank ruptured; fuselage dented; plexiglass broken. No injuries.

H-19D CENTERING MECHANISM of right nose gear failed to align nose gear during running landing. Bulkhead bent at landing gear mounting bracket.

H-34 ENGINE FAILED during service flight. Forced landing completed with no damage. Cause of engine failure undetermined pending analysis.

L-20A LANDED SHORT during night approach. Skin damage to tail cone. No injuries.

L-20A STABILIZER STRUCK BUSH during night landing. Aircraft veered into rough terrain. Tail section buckled; right stabilizer and elevator torn off; stringer and left landing gear damaged. No injuries.

H-23D STRUCK GROUND in tail-low attitude during practice 180° autorotation. Main rotor flexed down and severed tail boom. No injuries.

L-23D LANDED on wet grass and rolled into barbed wire fence at end of runway. Minor damage. No injuries.

H-13G LANDED on road with 7-foot embankments following loss of power after takeoff. Major damage to tail rotor and main rotor systems. Cause of loss of power undetermined pending investigation. No injuries.

H-13E ENGINE FAILED during landing approach. Main rotor flexed down and severed tail boom. Major damage. No injuries. Suspect faulty fuel system.

L-19A ENGINE FAILED during formation flight over water. Pilot bailed out and aircraft sank in ocean. No injuries.

L-19A ENGINE FAILED during flight over beach. Beach was heavily populated and aircraft was landed in lake water. Pilot suffered minor bruises and scratches. Major damage to right wing, flaps, engine cowling, windshield, engine mounting, engine firewall; and water damage to all instruments. Cause of engine failure: oil pump failure.

TWO H-13Gs STRUCK PINE TREES during low-level reconnaissance flights. Canopies broken. No injuries.

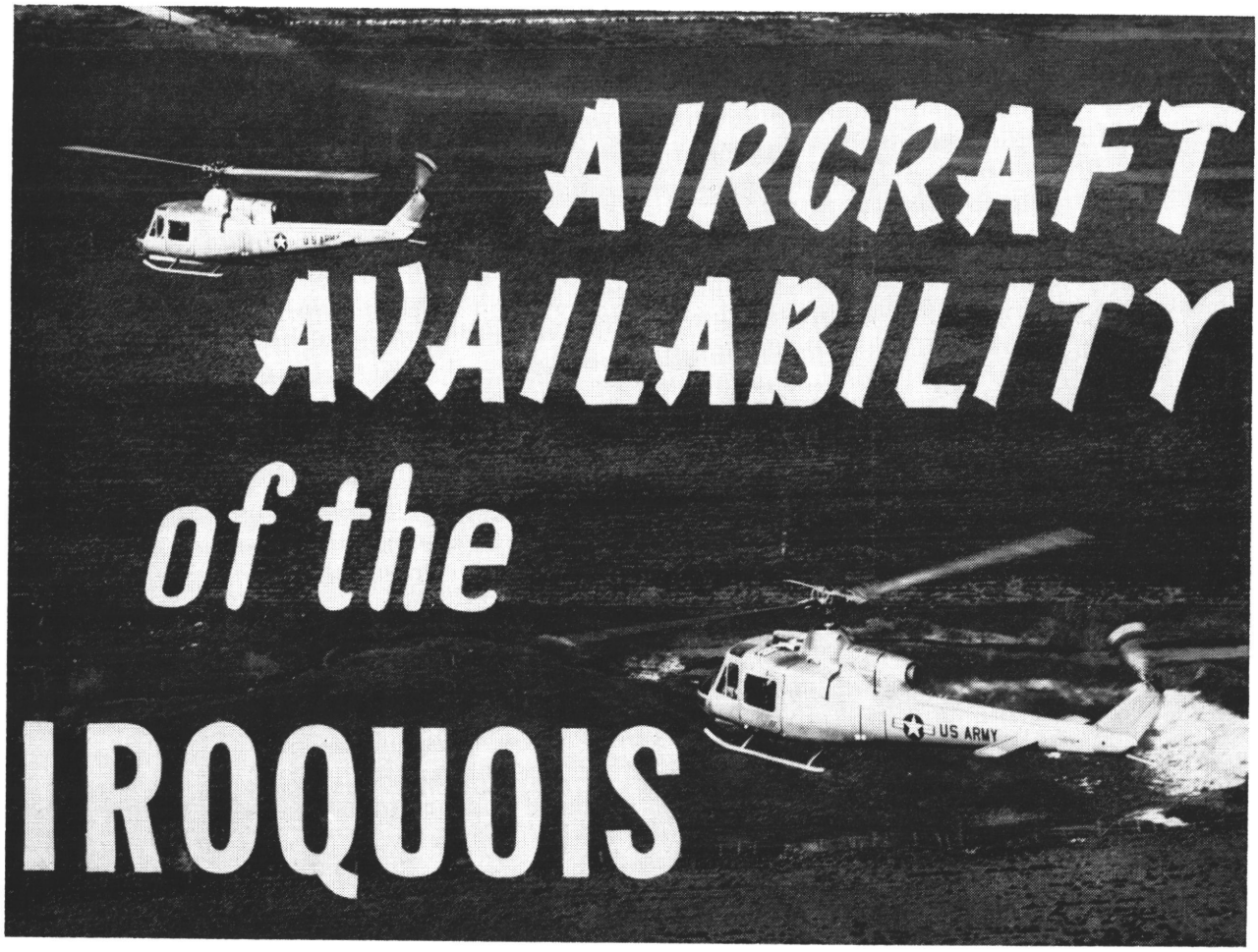
L-19A VEERED TO LEFT and crashed during road takeoff around curve. Major damage to all components. No injuries.

H-13H TAIL ROTOR STRUCK foreign object during flight. Directional control lost due to antitorque failure. Aircraft destroyed. No injuries.

L-19E LANDED SHORT and struck embankment, shearing left gear. Major damage to left wing and aileron, left landing gear, propeller, elevator and horizontal stabilizer. No injuries.

H-13G BOUNCED during touchdown from practice autorotation. Main rotor flexed into tail boom. Major damage. No injuries.

L-19A TAXIED into open manhole. Major damage. No injuries.



AIRCRAFT AVAILABILITY of the IROQUOIS

CWO Richard N. Cullen, TC

AIRCRAFT AVAILABILITY has been a primary concern of the commander since aviation began. The problem of programming aircraft for missions is compounded by the percentage of total aircraft capable of safe flight. Using past performance and maintenance records as a guide, many years of research and development have gone into the fixed wing program to reach the present point of reliability in predicting aircraft availability.

The Army's F/W and R/W programs have yet to reach the point where exact availability can be determined in advance, but these goals are nearer attainment with the development of new aircraft, powerplants, and more modern maintenance techniques.

Maintenance will be greatly improved with the Army's new HU-1A gas turbine powered helicopter. It was specifically designed to incorporate many new ideas and simplified maintenance techniques. Army specifications required an aircraft that would permit operations under combat conditions with as little maintenance as practicable. Such provisions as these were made for ease of maintenance in the field: rapid unit replacement of major components; a minimum requirement for special tools; rapid assembly and disassembly; ready transportability by air

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Mr. Cullen is an instructor with the HU-1A section, Department of Maintenance, USAAVNS. He is rotary wing qualified.

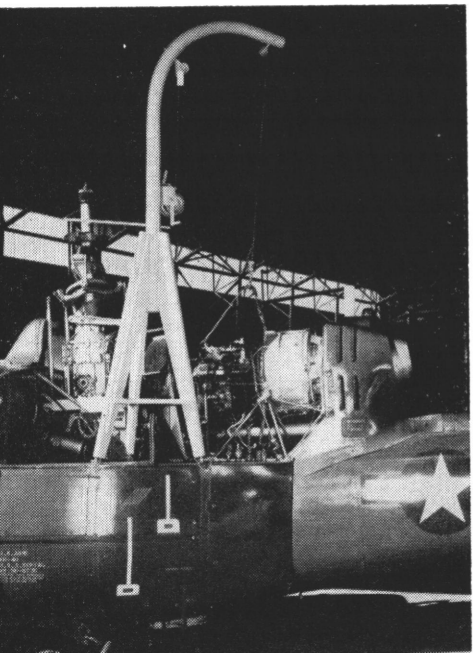
or other means.

To illustrate some of the new design features and techniques incorporated, let us compare the HU-1A maintenance requirements with some of the ordinary maintenance problems at organizational level. Normal daily requirements of the Iroquois is a "Daily Inspection" as compared to the "Post Flight" or old inspection requirement. The Daily Inspection consists of a complete visual inspection of the aircraft. It includes lubrication, evidence of excessive wear, inoperative systems, and possible malfunction or problems that may occur later.

I shall elaborate on lubrication just a little. One lubricant (turbine oil — MIL-L-7808C) is used for the main rotor assembly, tail rotor gear box, 42° gear box, transmission, and engine. To check, simply look at the sight gauges for everything except the engine. It is checked by a dip stick. We are only concerned with two types of oil: turbine oil and standard aircraft hydraulic fluid—(MIL-0-5606). The helicopter also requires two types of grease (MIL-G-25537 and Multifak EP2). One of these is a special type used at 300 hours, or on reassembly of the couplings or drive shaft splines. The other is an all-purpose grease to be used on rod ends, swash plate, etc. The intervals of greasing vary from 50 to 1,000 hours. The most frequent part to grease is the trunnion bearing of the tail rotor hub, which is 50 hours. Under normal operating conditions, the Daily Inspection should not take more than one manhour.

HU-1A incorporates many new ideas . . . simplifies maintenance

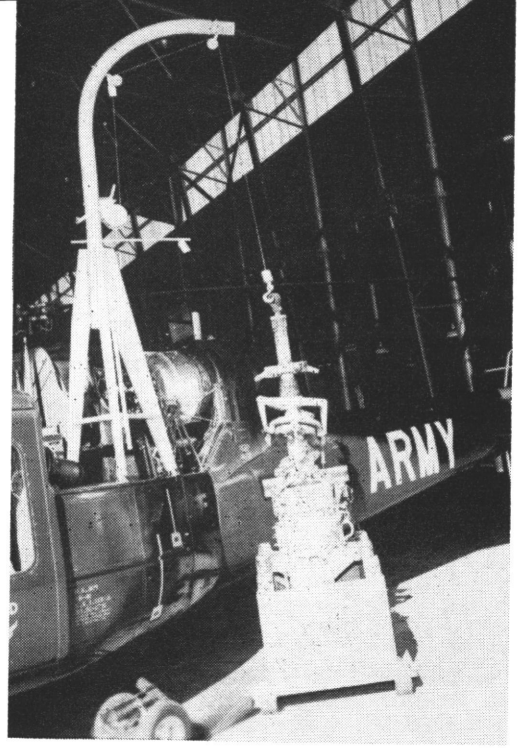
Powerplant can be changed in a matter of minutes



The next inspection required is the Intermediate Inspection, which comes after 7 days or 15 flying hours, whichever is sooner. It is basically a combination of requirements for checking equipment for verification of satisfactory functioning, plus searching for defects or evidence of possible defects. This is a thorough inspection of all nuts, bolts, safeties, and indications of possible malfunctions. Under normal conditions, it should be completed in three hours.

The Periodic Inspection is an overall examination of the condition of the aircraft. This inspection is due after 100 flying hours or 90 days, whichever is sooner. It is more detailed than the Intermediate Inspection and should normally consume approximately 13 hours.

Major components of the helicopter can be changed in a relatively short time. Using a built-up engine, the powerplant can be removed and replaced by two qualified mechanics in a matter of minutes. If the accessories must be changed, the job requires approximately 8 manhours. Removal and replacement of the main rotor assembly is also an easy task, since no balancing or alignment is necessary on the new prestressed hub; only blade tracking is required. The transmission is mounted to the airframe by four mounting bolts and a lift link. In removing the transmission, these five items must be removed plus the hydraulic pump and two marmon clamps on the drive shafting. A special hoist is used to remove and replace the main ro-



Special hoist is used

tor, transmission, and engine.

Removal, replacement, and rigging of the tail rotor assembly can be accomplished in a very short time. The tail rotor drive shafting is easily removed and replaced. All five sections of tail rotor drive shafting are interchangeable.

Special tools required for organizational maintenance are the mast retaining nut wrench, cyclic stick centering fixture, hoist, and slings. The hoist is a lightweight portable type which will easily fit inside the cargo compartment of the helicopter for transportation. It will lift the main rotor assembly, transmission, or engine and swing it into position for lowering onto a special stand; it may also be used for installing the same.

Smaller items, such as timing the stabilizer bar dampers on the aircraft, are accomplished in a very short time. Tools required are common wrench, screwdriver, and a watch with a sweep second hand.

All gear boxes have been designed so that the oil need not be drained from the box when the magnetic plug is removed for checking. Nor will the oil drain through the magnetic plug opening.

The HU-1A trim system incorporated in the cyclic and antitorque control consists of three magnetic brakes and three tube assemblies. The magnetic brakes are interchangeable by repositioning the actuator arm.

Let us take a closer look to see why some components require less maintenance than items used in recips. Due to relatively few moving parts, very little can go wrong with the engine. It has no magnetos, timing, points, cylinders or rings, air filters to be cleaned, or spark plugs to foul out.

The main rotor hub saves considerable time, not only in removal and replacement of the hub but also in removal and replacement of a single blade. On other type helicopters, considerable time is required daily to lubricate, with grease, the main motor assembly. All lubrication on this hub is accomplished by turbine oil contained in reservoirs mounted on the hub.

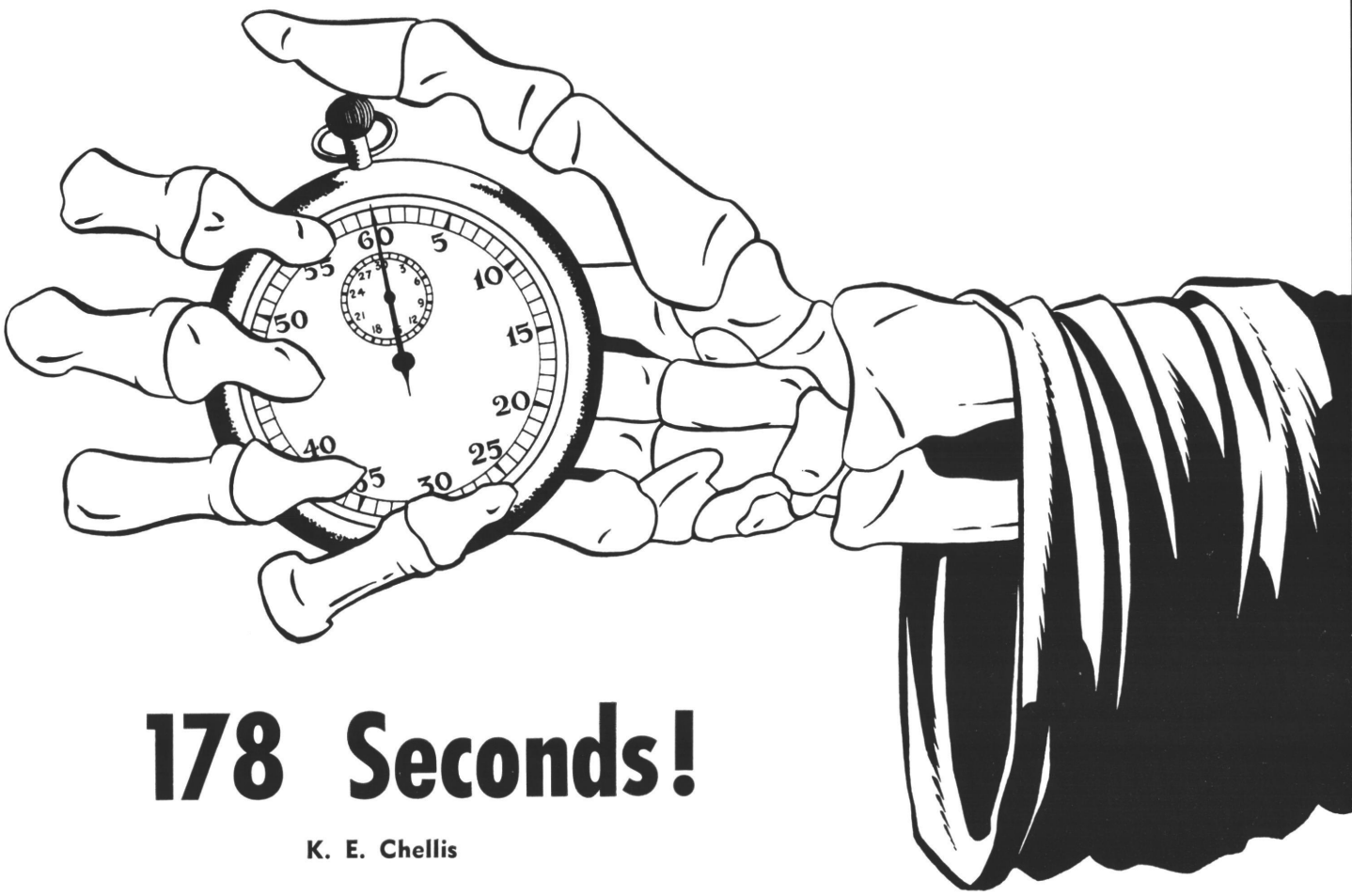
Time-saving adaptions on the transmission include the mounting of accessories. All mounting pads are semi-permanently shimmed; therefore a new unit may be installed on the original shim without checking gear pattern or backlash.

In the tail rotor system, all sections of drive shafting are master balanced and interchangeable. The sections are held together by the use of a curvic-coupling, a radial bearing, and marmon clamp. The couplings and bearings are lubricated on assembly and at 300 hour intervals. Tail rotor blades may be changed individually.

You can now see that the new concept of design has increased the available flight hours and decreased the manhours required to maintain the helicopter. It is a definite step in the right direction. We can expect further refinements in the years ahead. Perhaps then aircraft availability will cease to be a problem the commander must consider.

. . . to exchange main rotor, transmission, and engine

If you are tempted to take off in marginal weather without instrument training, read this article first. If you decide to go anyway and lose visual contact, start counting down from



178 Seconds!

K. E. Chellis

How long can a pilot who does not have instrument training expect to live after he flies into bad weather and loses visual contact with the ground? The Institute of Aviation of the University of Illinois sought to answer this question back in 1954 when it was developing a curriculum for the AOPA 180° Rating, a system designed to enable nonprofessional pilots to fly out of bad weather, under a grant from the AOPA Foundation, Inc. Twenty student-subjects were allowed to fly into simulated instrument weather. All of these "guinea pigs" went into graveyard spirals or roller-coasters. The tests differed in only one respect: the time required for the different subjects to lose control of their planes. This interval ranged from a maximum of 480 seconds to a minimum of 20 seconds. "The average time was 178 seconds — two seconds short of three min-

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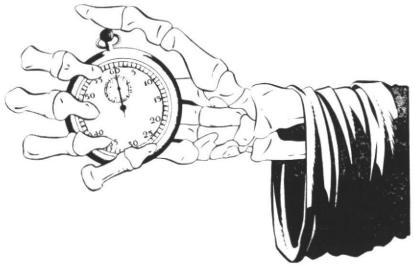
From the May 1960 issue of THE AOPA PILOT.

utes," the Institute said in its report of the experiment. K. E. Chellis of Tallahassee, Fla., forcefully tells what those 178 seconds mean to the pilot. Author Chellis is a flight instructor and a certificated 180° Rating instructor.—The AOPA Pilot.

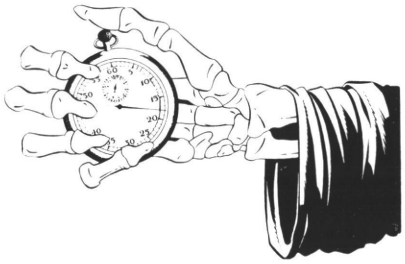
The sky is overcast and the visibility poor. In fact, that five-mile reported visibility looks more like two now. You are no longer able to judge the height of the overcast. Your altimeter says you are at 1,500 feet and your map tells you that there is terrain up to 1,200 feet beneath you. There might even be a tower around here some place, for you are not exactly sure just how far off course you are. But you've flown in worse weather than this, so you go on.

You unconsciously ease back on the wheel just a bit, to clear those not too imaginary towers. Then with no warning you are in it. You stare so hard into the milky white mist that your eyes hurt, but you see nothing. You fight the feeling that is in your stomach, and swallow, only to find your mouth dry. Now you know you should have waited for better weather. The appointment was important but not that important. Somewhere a voice is saying, "You've had it—you've had it!"



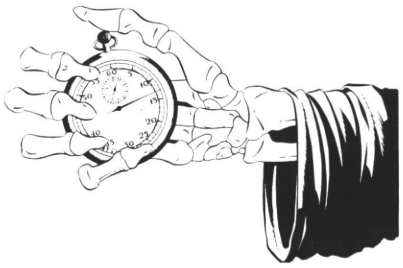
You Now Have One Hundred Seventy-eight Seconds To Live

Your airplane is still on an even keel but your compass is turning slowly. You push a little rudder and add a little pressure on the wheel to stop the turn, but this feels unnatural and you return the controls to their original position. This feels better, but now your compass is turning a little faster and your airspeed is increasing slightly. You scan your instrument panel for help but now it looks almost unfamiliar. You are sure you will break through in several minutes. This is just a bad spot. But you don't have several minutes left.



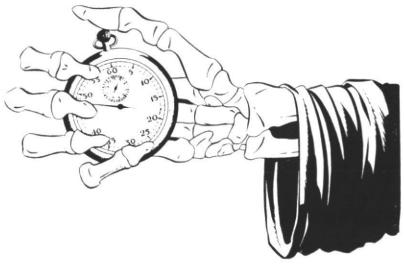
You Have One Hundred Seconds To Live

You glance at your altimeter and are shocked to see it unwinding. You already are down to 1,200 feet and instinctively you pull back on the wheel. But the altimeter still unwinds, the engine is revving too fast and the airspeed is almost to the red line.



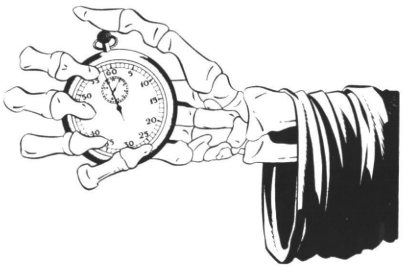
You Have Forty-five Seconds To Live

Now you are sweating and shaking. There must be something wrong with the controls, for pulling back on the wheel only moves the airspeed indicator a little farther into the red. You can hear the wind tearing at the airplane.



You Have Ten Seconds To Live

Suddenly you break out of the overcast. There is the ground. You can see the trees rushing up at you, and you can see the horizon if you turn your heard far enough. It's at an unusual angle, you are almost inverted. You open your mouth to scream—but you are too late.



You

Have

No

Seconds

To

Live

It's all over, son.

CRATE 'EM OR... FLY 'EM?

Lieutenant Colonel John L. Briggs, Arty

WHEN AN ARMY AVIATION unit has to move a large number of aircraft "from here to there," it brings up the question of whether it's better to "crate 'em or fly 'em." Experience at the U. S. Army Primary Helicopter School, Camp Wolters, Texas, has proved conclusively that flyaway deliveries pay off in almost every case and for any type of aircraft.

Camp Wolters personnel recently ferried 130 H-23D helicopters from the Hiller factory at Palo Alto, Calif., to Wolters. They saved $222,718 and 1,560 aircraft days by flying instead of shipping them in. Other benefits resulting from the flyaway delivery included the training acquired by the crew ferrying the aircraft and the condition and almost immediate availability of the helicopters upon arrival at Wolters.

A carefully documented study of all experience data on the actual flight delivery of these H-23s was made. "Aircraft days lost" were computed from the date of final acceptance test flights at the factory to the date that the aircraft were ready for training use at Wolters. Every gallon of POL, every penny of the taxpayer's money, every minute of time, and even trade stamps were included. Against this data,

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actual time and cost figures on crating and shipping by rail or van were obtained from the factory and government transportation experts. Estimated uncrating and test flight times also were included. (See box for comparative figures.)

Once a plan for an en masse flyaway is decided upon, an SOP should be established. In a flight delivery program TMC will notify the gaining unit when to pick up the aircraft and will give fund citations for costing the trip. During the Palo Alto-Wolters operation, TMC sent a "canned" message for each trip. These TWXs contain cost accounting and shipping number information and are cited as authority in unit travel orders.

The kit TMC provided for the flyaway contained SOP for ferry pilots, SF 44 (five copies), a list of POL credit cards, and an addressed envelope to be returned to TMC. It was augmented by a letter of instructions and maps with route distances and heading markings annotated. A briefing of all involved in the operation included issuance of orders, advance per diem (whose wife ever allows him enough extra money for a six-to-seven-day trip that is going to touch on such points as San Francisco, Palm Springs, Los Angeles, Phoenix, and El Paso?) and a TR for those going by commercial air.

The Wolters plan involved two trips a month to meet the mission delivery requirement of 10 helicopters per month. A ferry crew consisted of one pilot for each aircraft to be picked up, a mechanic and an escort pilot. The mechanic is provided in event something becomes unglued en route. Actually, other than routine maintenance, the mechanic had to replace parts only twice during the entire operation.

THE SCHEDULE

The following schedule was prepared for the ferry crew:

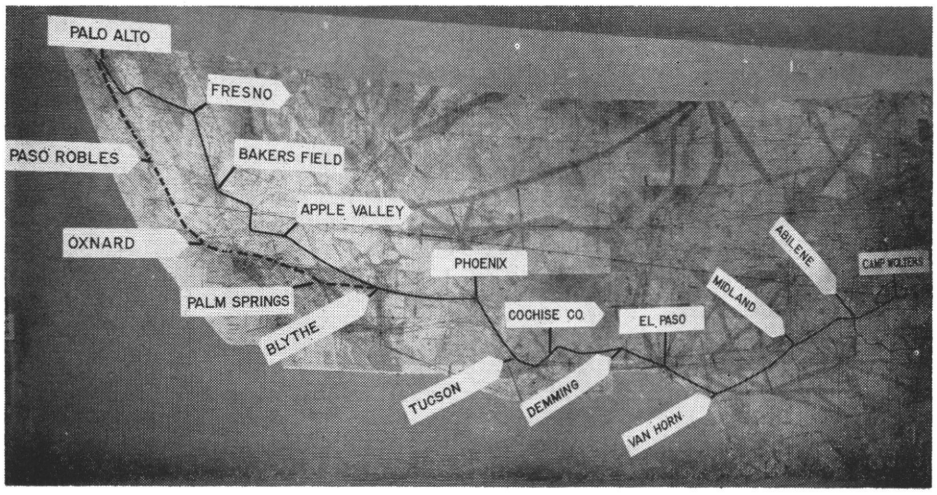
Monday morning: An L-20 with pilot, mechanic, two ferry pilots, spare parts, tools, and all flight kits to depart Camp Wolters, arriving at Palo Alto shortly after noon on Tuesday. (Monday night RON at the crew's discretion.)

Tuesday morning: The remainder of the ferry crew to depart Fort Worth by commercial air for San Francisco, arriving at Palo Alto in the evening.

Wednesday morning: Check aircraft, test fly, and move to Palo Alto airport for early Thursday morning takeoff prior to plant opening time.

Thursday morning: Depart Palo Alto for Palm Springs or Los Angeles, depending on the weather, utilizing the coastal route via Paso Robles, Santa Maria and Los Angeles, or on the inland route via Bakersfield. There are advantages and disadvantages both ways. Los Angeles is always loaded with VFR traffic flying IFR conditions; the Bakersfield-San Joaquin Valley route involves mountain flying. The first leg of the flight should be short and a shakedown in nature. During this leg the crew should

Map of inland and coastal route of flyaway



smoke out any mechanical defects, pilot defects (clear out the San Francisco fog), and determine fuel consumption on all aircraft to provide a pacesetter for the remainder of the flight.

Friday morning: Depart Los Angeles or Palm Springs for Phoenix or Tucson (depending on who in the flight has relatives where), with fuel stop at Blythe, Calif. Use the field west of Blythe, not the cropduster strip east which is too crowded for refueling space.

Saturday morning: Depart Phoenix or Tucson for El Paso with fuel stops at Cochise County or Deming.

Sunday morning: Depart El Paso for Camp Wolters. This is the longest single day's flight, with fuel stops at Van Horn or Carlsbad, Midland and Abilene. Upon arrival at Wolters, shut down, greet the family, and get ready to put in a day's work for a day's pay on Monday morning.

LESSONS LEARNED

Here are a few lessons learned from the Palo Alto-Wolters flyaway.

Make sure your escort aircraft has radio equipment compatible with the helicopter's radios. This may require the installation of auxiliary equipment in the escort aircraft.

Avoid fixed gas pits whenever possible on fuel stops. They are too time-consuming. None have hoses long enough to accommodate five aircraft, and the pilots are required to jockey the aircraft about. This cuts into rest and coffee time.

The helicopters should take off first on each leg, while the L-20 pilot brings fuel consumption statistics up to date and pays for the gas. The L-20 pilot then departs and flies by or through the helicopter flight, checks navigation, relays weather information, and arrives at the next fuel stop in advance of the helicopters to make POL arrangements. This is a big time saver.

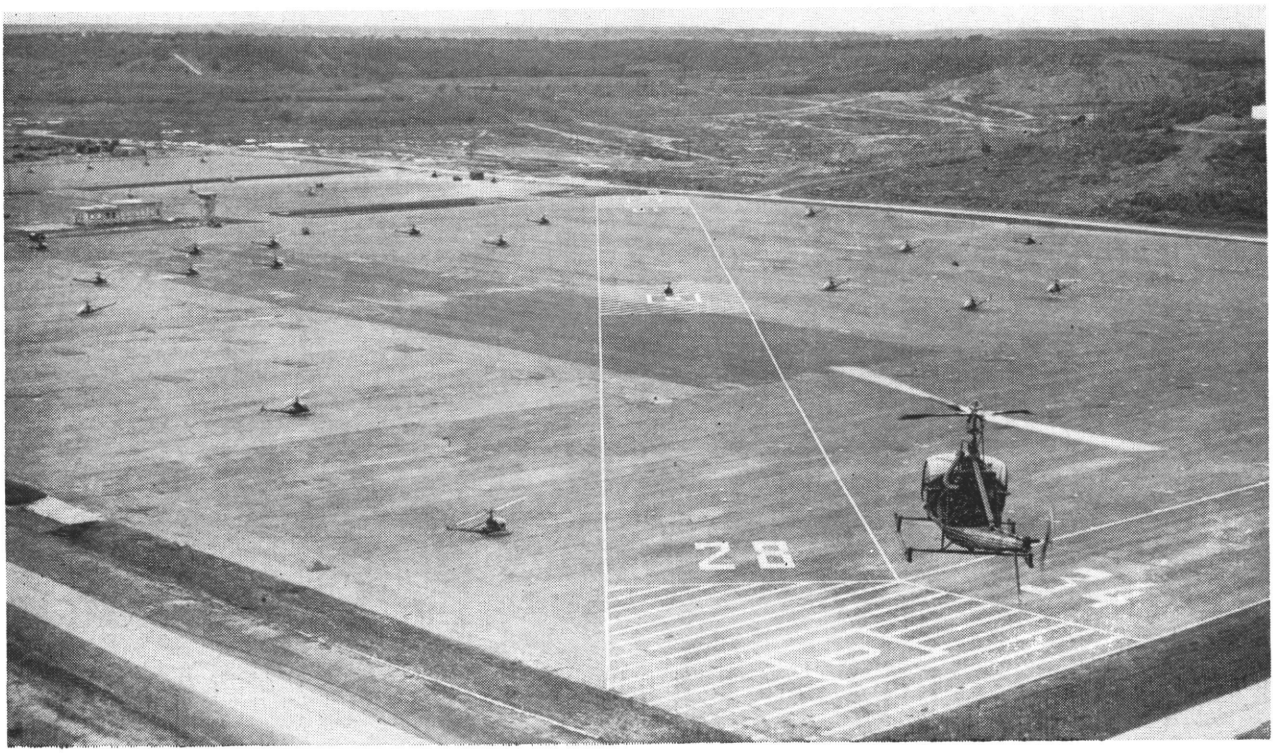
Organization of flight personnel with assignment of trip duties is suggested as follows:

POL officer: Handles all refueling, signs gas tickets, and keeps the record of all transactions. The POL officer should be the pilot of the escort plane.

Flight planning and weather officer: Files and closes all flight plans, keeps current running account of weather situation, briefs pilots of the flight prior to each leg and during the fly-through. The escort plane pilot also should assume these duties.

Transportation officer: Arranges transportation for the entire flight when required, usually upon arrival at the RON point. The transportation

Camp Wolters — the end of 1,335 mile flyaway from the factory



officer should be one of the helicopter pilots. On most of the Wolters flights the individual with the most "rat hole" money was picked for this job. He paid all the bills and claimed reimbursement on his voucher (underscoring important for staying out of Leavenworth). Note: With large groups, using a shuttle system and depending on the distances, it can prove more economical to the government and convenient to the crews to use U-drive-it automobiles (not convertibles for doing the town).

Billeting officer: Arranges overnight accommodations for the entire crew, less individualists. He should be one of the helicopter pilots.

Maximum effort should be made to allow the helicopter pilots as much rest as possible at fuel stops. The escort plane pilot should see to this.

If some alert gasoline vendor gives trading stamps with the sale, try to make a deal with him to reduce the cost of the fuel in lieu of taking the stamps. Failing this, take the stamps and turn them in to your post P&C officer with the gas tickets. P&C officers are authorized to turn trading stamps over to special service officers who can use them to procure troop welfare items. (Don't let the wife hear you have the stamps.)

In summary, single aircraft pickup is expensive and should be avoided if possible. In addition to expense, it might be inadvisable if the trip is over desolate or dangerous terrain, especially since escort aircraft would not normally accompany one helicopter.

COMPARATIVE STATISTICS

The following chart shows the results of the study in a nutshell and should dispel any doubt as to the best method to use:

	Crate & Ship	Flyaway
Acft days lost:	2,600	1,040
Total cost:	$261,895.40	$39,881.74
Savings in time:	1,560 Acft days	
Savings in cost:	$222,718.26	

(The total cost under "Crate & Ship" above is for rail. Van costs were $260,029.90. Complete breakdown listed in chart of comparative statistics.)

Crating & Shipping

Disassy, crate, factory	2 Days
Shipping time	15 Days
Uncrate, assy, destination	3 Days
Total per acft	20 Days
Total 130 acft	2,600 Days
Distance (rail)	1,922 Mi
Distance (130 acft (rail)	249,860 Mi
Distance (van)	1,750 Mi
Distance 130 acft (van)	227,500 Mi
Shipping cost per H-23 (rail)	$701.22
Shipping cost per H-23 (van)	$686.87
Shipping cost total (rail) (per H-23D)	$2,014.58
Shipping cost total (van) (per H-23D)	$2,000.23
Crating cost per acft	$1,250.00
Crating cost total 130 acft	$162,500.00
Uncrate assy, destination, per acft	$ 63.36
Uncrate assy, destination, 130 acft	$8,236.80
Total cost, 130 acft (van)	$260,029.90
Total cost, 130 acft (rail)	$261,895.40

Flyaway

Pilot travel	2 Days
Receive, test fly, factory	1 Day
Flight	4 Days
Inspect, destination	1 Day
Total per acft	8 Days
Total 130 acft	1,040 Days
Distance H-23D	1,335 Mi
Distance 130 acft	173,550 Mi
Distance L-20, one trip	2,691 Mi
Distance L-20, all trips	67,275 Mi
Distance total flight	240,825 Mi
Flight time, H-23D, av trip	21.1 Hr
Flight time, total 130 acft	2,743 Hr
Flight time L-20 av trip	30.1 Hr
Flight time, all trips, L-20	752 Hr
Flight time total	3,495 Hr
POL Av H-23D	16.8 GPH
POL total H-23D	46,082 Gal
POL Av L-20	22.2 GPH
POL total L-20	16,694 Gal
POL total	62,776 Gal
POL cost H-23D	$ 306.77
POL cost, total H-23D acft	$14,335.17
POL cost L-20, per trip	$ 239.63
POL cost, total L-20 trips	$5,541.98
POL cost, total	$19,877.15
85 commercial air tickets	$ 8,383.24
Per diem 157 persons, 7 days average	$11,621.35
Total cost, flyaway, 130 aircraft	$39,881.74
Average cost, per flt of 5 acft	$ 1,533.91

Five Part / Multiple Part Manual

Lieutenant William R. Troy, TC
Lieutenant Gene A. Truitt, Inf

ACROSS THE COUNTRY, in maintenance shops everywhere, this question is fairly common: What's the deal on this Five Part Manual? Nearly everyone has heard about it, but few have seen or used it yet.

To begin with, the term "five part manual" is actually a misnomer derived from the five echelons of maintenance covered in a basic set of publications for the Army Aviation field.

Designed to replace the old TM 1 series, the new manual system includes a family of publications to provide all of the information necessary for any given echelon of maintenance to carry out its mission. Because instructions for third and fourth echelon maintenance have been combined into one manual, there are only four manuals to cover the five echelons of maintenance. So, the term "Multiple Part Manual" would be more accurate for this new system.

The multiple part manual system will become effective for all Army aircraft as soon as conversion is completed. Many individuals accustomed to the old system will naturally view a new system with misgiving; however, most people agree that this new system is a change for the better. One of the biggest and most obvious improvements is the combining of material previously found in a variety of TMs and ARs.

A new numbering system will also be used. The letter designation "TM" for "technical manual" will be retained. The first number will be that of the preparing technical service, (in the case of Army Aviation 55, designating Tranportation Corps) followed by a dash and the four-digit numeral representing the Federal Supply Classification (FSC) assigned to the equipment covered. Then follows three numerals which indicate the particular equipment in the FSC group or class. This begins with 200, and successive TMs in the same class will be 201, 202, etc. The last two numbers will represent the echelon of maintenance.

As an example, let's use the numbering system for the HU-1A: TM 55-1520-207-20.

55- Preparing technical service (in this case Transportation Corps).

1520- FSC class of equipment (aircraft, rotary wing).

207- Numerical sequence (eighth TM for TM 55 series within class 1520).

20- Echelon of maintenance (organizational).

Repair parts lists, when published separately from maintenance instructions, will carry the suffix letter "P." Other than this letter, these manuals will have the same basic number as the TM with which they are used.

FIRST ECHELON MAINTENANCE

Part 1, -10, contains instructions for operators and crew members. This manual replaces the -1 and -5 Handbooks of Instruction. It contains the Aircraft Inventory Master Guide which gives specific information relative to maintaining the current DD Form 780 Series. The Pilot's Flight Information (formerly in -1 handbooks) describes the aircraft and gives operating procedures and flight characteristics. The old Weight and Balance Handbook has been incorporated into the new -10 also. It includes such information as the definition of terms and instructions for use in completing the standard balance control forms. The -10 also includes instructions on how to load, unload, and secure cargo.

SECOND ECHELON MAINTENANCE

Part II, -20, incorporates organizational maintenance instructions. This manual obviously replaces the -2 handbook and, in addition, includes in-

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spections requirements. This will take the place of the -6 handbook.

A chapter is included on the storage of aircraft. The Maintenance Allocation Chart (formerly the -18) is also available to define the maintenance functions to be performed at each echelon of maintenance. The Repair Parts and Special Tools List (-20P) appears in this manual as Appendix III. Containing maintenance support data, it replaces -4 and -4-20P.

THIRD AND FOURTH ECHELON MAINTENANCE

Part III, -34, contains the essential information for the field maintenance level. However, material in the -10 and -20 is not repeated in this manual; therefore, they must be used in conjunction with this one. It replaces the -2 and -3 at this level. Both third and fourth echelon information has been incorporated into this one manual. A chapter is devoted to structural repair, a list of repair materials by stock description gauge, commercial design and specification of all repair material required for repairs outlined in the Structural Repair chapter.

The -34P is shown as appendix III to this manual and is used to order items with "F" or "H" maintenance level code.

FIFTH ECHELON MAINTENANCE

Part VI, -50, coupled with the preceding manuals will provide complete maintenance instructions for depot maintenance activities. This TM has additional structural repair information not authorized at field level. It gives the procedure for preservation and packaging of aircraft for shipment to any climate. It also contains complete overhaul instructions for components, along with two lists of overhaul instructions; one for government-furnished parts and one for contractor-furnished equipment.

The -50 also has an Appendix III devoted to Repair Parts and Special Tools List (-50P). It includes all breakdowns and information listed in the -20P and -34P, making only the -50P necessary at Depot Maintenance Level.

This briefly is a look at the multiple part manual system. When these publications arrive at your organization, stop and take a good look at them. You'll probably like what you see.

You can requisition these new manuals through normal AG publication channels as soon as each is listed in the DA pamphlet 310-4. Some are available now: -20P, -34P, and -50P for the HU-1A. In order to maintain these handbooks in current status, requirements may be entered on DA Form 12-5 in the column headed "Operators and Crew Members Instruction for the Respective Aircraft."

TEFLON

USE OF TEFLON hose in Army aircraft is increasing rapidly. While this durable product has many advantages, it also contains some pitfalls that should be pointed out to Army mechanics.

Many are not familiar with teflon hose, despite authority for its installation in Army aircraft by Supply Bulletin 1-15-13 in October of 1957. General usage evolved slowly while the regular inventory of rubber hose was available. However, this stock is diminishing rapidly and teflon hose will be encountered much more frequently. A look at its characteristics may prove helpful.

Teflon is a durable fluorocarbon plastic discovered about 22 years ago. It is compounded from a tetrafluoroethylene resin and is excellent as a protective coating on almost everything from greenhouses to aircraft parts.

The hose is made by molding the plastic compound into the desired tube-shaped size. Steel wire then is braided on the outside for protection and strength.

Teflon easily withstands pressures and temperatures ranging from $-65°$ F. to $+500°$ F. This makes it desirable for use in modern aircraft systems where intense heat and pressure occur.

But, teflon hose has some bad points. It takes on a semi-permanent set when exposed to high fluid pressures and temperatures. If it is bent or twisted in this manner, kinks may develop in the tubing and be hidden by the braiding. The hose could then easily fail in flight.

Teflon hose is strong, but the mechanic should remember not to bend or twist it beyond its limits. A bent and set hose should never be straightened; bending opposite to the set plane should be avoided. Hanging or supporting objects from teflon hose also causes failures.

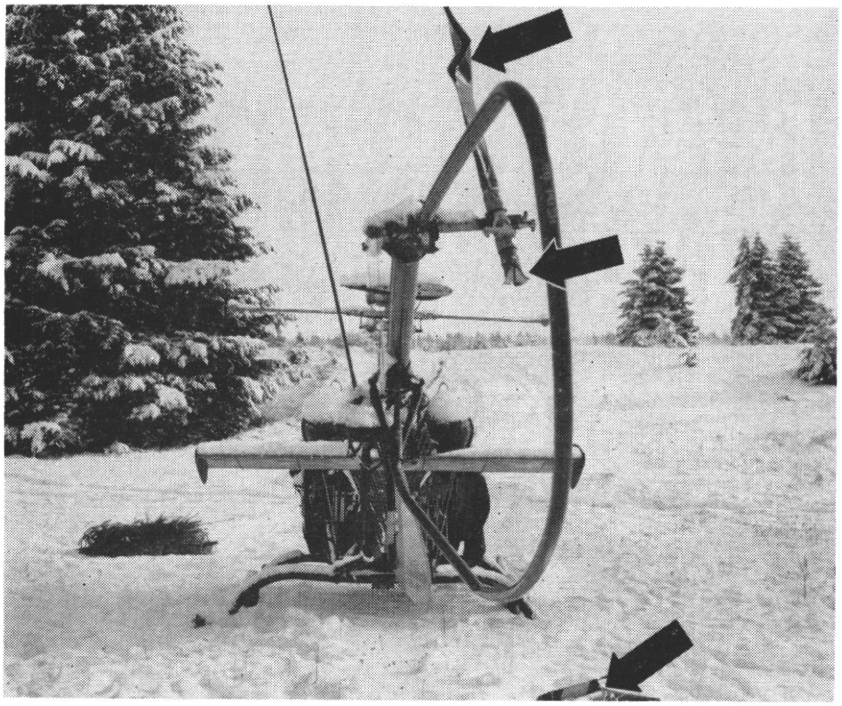
CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

AUTUMN

ONE DAY she's in a bikini, your eyes glued to her tanned and animated figure as she splashes in surf or pool, blond, brunette or auburn pony-tail bouncing behind. Tear a page from the calendar and you see her dashing across the campus, clad in wool skirt and sweater, bobby socks and saddle oxfords. This change is the signal to retune your weather thinking.

Whether you're stationed in the short days of the northern hemisphere, or the longer days of the southern, one thing is sure: it's time for a change! Hot equatorial air, enjoyed or cursed during the summer months, shoots skyward, drifts toward the north polar region and sinks into the icy coldness of the long Arctic night. It spreads across the globe in a series of fast moving cold fronts into the Gulf of Mexico, the Mediterranean and China Sea, bringing a winter brand of woes to Army Aviators.



White trap

SNOW

Snow started to fall at 1130 hours, continued steadily until after 1600 hours and began to gradually subside. A thick blanket of white covered the terrain and blended into heavy, low-hanging clouds at the horizon. The Army Aviator was flying a Sioux in support of a battalion field training exercise.

A decision was made to move the aircraft to another area where a gun cover was available to protect it from the falling snow. The aviator picked the Sioux up to a hover and moved forward. Suddenly he spotted an unmarked communication wire between the trees directly in his path. He flared the aircraft and started a right turn in an attempt to miss the wire. The Siuox went into a nose-high attitude and the tail rotor guard struck the ground. The tail section bounced upward, causing a main rotor blade to flex down and break a dynamic stop cable. One tail rotor blade was lost and the other crumpled. The aircraft was landed with no further damage.

Unmarked communication wires are difficult to spot under the best conditions of visibility. Blanket them with snow, string them through trees, and an effective trap is set for even the most sharp-eyed pilot. Investigation revealed that the wire which caused this accident had been strung three days before, with no consideration for any type of marking.

One of a flight of five, the Shawnee pilot taxied out behind the others for takeoff. He watched the other aircraft take off, picked his Shawnee up to

Visibility, zero

Snowbank

a 10-foot hover and prepared to make a 90° turn to line up with the runway. A Beaver was parked on the right side of the runway, making it necessary for the Shawnee to turn around it. During this turn, the aircraft lost forward speed and approximately 4-5 feet of altitude. Swirling snow, picked up by the downwash, engulfed the Shawnee and caused the pilot to lose visual contact with the ground. He applied power for takeoff when he estimated the aircraft was over the center of the runway. The aircraft bounced and lurched to the right. The pilot immediately applied right pedal, maximum power, and left cyclic. He decided to land and let the swirling snow settle before attempting another takeoff. But it was too late. The aircraft touched down, lurched to the right again and rolled to its side.

The L-26 pilot arrived at the airfield at 0500 hours for an intended 0600 hours departure. Snow had fallen most of the night and the runway was covered by 4 inches of snow and 6-7 inch drifts. It was still snowing.

Determined to make the flight, the pilot obtained a truck equipped with a snowplow from nearby post engineers. He instructed the driver to clear the taxiway and make 4 trips up the runway, stating that the snowplow's 12-foot blade would clear his takeoff path.

While the snowplow was at work, the pilot and copilot went to the weather station and operations to obtain their flight clearance. At approximately 0630 hours, the truck driver reported that he had cleared a strip approximately 35-40 feet wide down the length of the runway. Neither pilot nor copilot made an attempt to physically examine the runway condition.

The aircraft was taxied out and the runup completed. The pilot opened his window and wiped the snow from the windshield. He decided against the use of flaps and applied takeoff power, using the snowbank on his left as a guide for an attempted visual takeoff. The aircraft rolled straight down the runway and the nosewheel lifted off at approximately 740 feet. Some 1,000 feet farther down the runway, the left main wheel struck a 15-20 inch snowbank and pulled the aircraft to the left. The aircraft skidded from the runway and came to rest at the bottom of a steep shoulder approximately 130 feet from the runway.

Moral: Takeoff and landing surfaces demand an equal share of preflight.

The ground was covered with snow. Weather conditions were: ceiling, 700 feet overcast; visibility, 5 miles, with fog. The Raven pilot departed on a training flight, flew to a parade field and began a practice autorotation. During the flare, the tail rotor struck the ground and directional control was lost. The pilot, not knowing that the tail rotor was lost, applied power and pitch. This caused

How far is down?

the aircraft to turn violently to the right, and he took off power and pitch. Maximum pitch was applied as the aircraft approached the ground for the second time. However, there was not enough rotor rpm to cushion the landing. The aircraft struck hard, bounced and turned 180° to the right, coming to rest in an upright position.

Low ceilings, fog, and snow often blend into an indistinguishable white mass; autorotations require an exacting degree of depth perception. Moral: Put off until tomorrow what you can't practice with accuracy today!

Two Seminole aviators departed their station at 1130 hours for a long cross-country flight. Flying IFR, they reached their first fuel stop and landed some 3 hours and 20 minutes after takeoff. Weather forecasters advised that their destination was below minimums and recommended they file to overfly the original destination in hopes the weather would improve and permit a landing.

A new flight plan was filed and the aircraft departed at 1507 hours, flying IFR at an altitude of 10,000 feet. Weather forecast for the new destination was 3,000 feet scattered; 8,000 feet scattered; visibility, 5 miles in haze. The aviators contacted their original destination en route and learned that it was still below instrument minimums. However, they were advised that a nearby airbase was reporting clear skies and 15 miles visibility. The aviators decided to change their flight plan and make the airbase their destination. When they landed at the airbase at 1908 hours, they were advised of a NOTAM which declared that no aircraft could enter their original destination airspace after 2400 hours. Discussion with weather personnel at the airbase revealed that their original destination weather had improved to a 500- foot ceiling, with 1½ miles visibility in ground fog. It was forecast to improve.

The aviators filed another flight plan for their original destination and departed the airbase at 2008 hours, WITHOUT REFUELING. En route, the aviators found headwinds much stronger than forecast and it was necessary to revise their ETA. They arrived over the destination beacon, contacted GCA and reported 40 minutes of fuel remaining. The radar controller notified the aviators that the airfield was below minimums and advised that the GCA pattern would be a box type, close to the airfield. During the approach, the controller also advised that their alternate airport was at minimums.

Below minimums

The aviators elected to make an approach to their original destination, planning to proceed to their alternate if they could not land. The GCA approach was begun at an altitude of 3,200 feet. As the aircraft was vectored around to final, there was confusion about instructions received from the controller. The aviators understood him to say, "Maintain 2,300 feet." They immediately began a descent and a turn to the final heading. The aircraft crashed and burned approximately 5 miles from the end of the runway. Both aviators suffered compound skull fractures

and numerous lacerations. One also had a broken ankle. The flight surgeon estimated that one aviator would not be able to fly again for a year and the other for more than 6 months.

These were highly experienced aviators. One had more than 8,000 hours flying time and the other more than 4,000 hours flying time. Both held special instrument tickets.

What could have induced aviators of this type into the conditions which caused this accident? First, there was the urgency of a high priority mission, probably the dominating factor which caused this gamble in the face of high odds. It may explain why the aviators failed to refuel at the second stop, despite IFR en route flight conditions; why they failed to eat at either stop though facing 7-8 hours total flight time; why the decision was made to attempt an approach with the airfield below minimums when the alternate was already at minimums; why they decided to descend to 100 feet above the ground and face a flight violation.

Other possible contributing factors, according to the flight surgeon were: "A possible combination of borderline hypoxia (the aviators were flying at 10,000 feet after dark, without using available oxygen), mild hypoglycemia, and fatigue could have contributed greatly to this accident by reducing the pilots' physical and mental efficiency."

ICING

A Raven pilot took off in the following weather conditions for a service flight: ceiling, 800 feet, obscure; visibility, ¾ mile in light snow and fog; temperature 29° F.; dewpoint 27° F.

Because of the indefinite ceiling and low visibility, the aviator flew at an altitude of approximately 140 feet. Fifteen minutes after takeoff he heard a thump which appeared to come from the main rotor head, and the nose of the helicopter pitched up. There was a loss of power and he went into immediate autorotation.

The aviator pulled pitch about 10 feet above the ground and the power surged. The aircraft skipped twice and bounced back into the air. At this time, engine power dropped abruptly again. The aviator kept a level attitude and headed generally into the wind. He was unable to regain enough rotor rpm for a gentle touchdown and the aircraft landed hard, bounced, and slid to a stop.

The aft and forward spring assembly and tail boom were damaged beyond repair.

Engine failure was caused by the formation of ice on the carburetor intake screen. This condition results in an over-rich mixture. The aviator, though monitoring carburetor heat closely, flew into snow and freezing weather with the carburetor air intake bypass closed. Moral: The -1 makes for excellent and informed reading.

These are a few examples of what can happen during cold weather flying conditions. It should be evident that an understanding of winter weather, a knowledge of -1 cold weather operating procedures, and strict adherence to regulations could have prevented each of these accidents.

If this issue of CRASH SENSE is successful in its purpose, you will now find yourself closely reviewing all available weather references and -1's for the aircraft in which you are qualified. When you have finished, here are some Air Force suggestions which may help you to avoid common pitfalls:

For VFR flight under cloud ceilings, calculate clearance over obstructions from sea level heights and not just reported ceiling heights. **Most weather reporting stations are at airports built on level areas considerably below surrounding terrain and obstruction crests.**

Be certain that sufficient fuel is aboard for flight and alternate, considering winds and allowing for 25 percent stronger winds than forecast. **The 25 percent leeway is to allow for forecast error and for the zigzag course that results from wind variations en route.**

Choose alternate airports on the lee side of nearby terrain (where practical). **Downslope winds warm adiabatically, causing evaporation of clouds and reduced precipitation, resulting in favorable ceilings and visibility.**

Where dewpoints en route are reported below 32° F. at surface stations under clouds where rain and/or sleet is occurring or forecast to occur, do not file VFR to avoid IFR in icing conditions above. **When rain strikes metal aircraft surfaces in cold dry air, evaporation causes rapid cooling and severe clear icing may occur quickly.**

Where snow is forecast or listed as a possibility at destination, select an alternate where snow is definitely not expected and proceed to it without delay if destination goes below minimums in snow. **When snow reduces visibility to below minimums, it also reduces the radar capabilities of**

GCA (especially wet snow) by blurring the scopes. Snow intensity is difficult to forecast and heavy snow often persists for a long period of time.

Where IFR flight altitude is to be below the height of terrain within 100 miles of course, check flight altitude winds closely and cancel flight if winds are excessive (over one-third of the airspeed). **Strong winds over high terrain and through mountain passes produce turbulence, icing, and great variations in velocity. Large drift corrections added to these hazards make navigation a very difficult task. Lost aircraft may quickly drift into the higher terrain.**

Check runway conditions closely and cancel flight where destination has ice-coated runways and temperatures are near freezing and/or rain or freezing rain is falling. Also cancel flight plan if fresh wet snow is on the runway or forecast to be on the runway. **Ice and snow on runways are dangerous for landings and takeoffs. Snow is particularly slippery when temperatures are near freezing; wet snow on the runways offers little friction. Ice is always slick; and when wet with rain, it offers practically no friction.**

When first suspecting that you may be lost, attempt orientation in such a way that wind drift will not carry the aircraft into terrain or other obstruction that extends above your altitude. **Strong upper winds are usually a factor in causing aircraft to become lost. The first precaution upon becoming lost must be to avoid obstructions.**

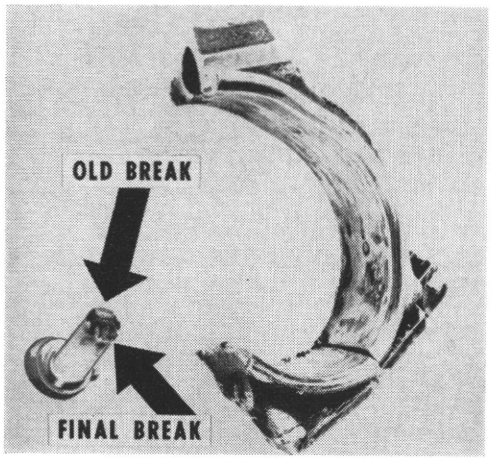
Where weather at destination is reported below minimums in winter, proceed to alternate without delay. **In winter the sun's heating is far less than in summer. Often, weather deterioration and continuing poor conditions occur in the daytime.**

At night, where the runway lights are visible, but appear fuzzy and/or the visibility is reported below minimums in ground fog, proceed to alternate without attempting to land. **One-sixteenth of a mile is 330 feet. While lights may be vertically visible through several hundred feet of dense fog, when landing in such fog, the pilot lowers the plane to near treetop level and the runway is suddenly obscured.**

When in regions of suspected icing, during climbing or letting down and upon landing, keep a safe margin of airspeed and keep a minimum of extra exposed surfaces, such as wheels and flaps. **Ice accumulation reduces dynamic lift and thus increases stalling speed. Extra exposed surfaces add to the amount of ice accumulation.**

IT COULD HAPPEN TO YOU

Is Somebody Else Having Your Accident?



Connecting rod cap bolt

The Sioux pilot heard a loud noise in flight. Severe vibrations followed. He immediately began an autorotation and selected a forced landing site. The aircraft landed, slid to a stop and rocked forward on the front part of the skids. The right front skid failed and the main rotor struck the ground, causing the aircraft to roll to its right side.

The in-flight noise and vibrations were caused by failure of a connecting rod cap bolt. Analysis of the bolt revealed an old initial break, probably caused by an engine overspeed during a prior flight.

Fortunately, the aviator in this accident escaped injury. But it takes little imagination to develop a mental picture of what could have happened.

Professional pride which can prevent your writing up an engine overspeed or a hard landing in DD Form 781-2 is a two-edged sword. If you're ever tempted to just forget all about it, remember the Golden Rule—**IT COULD HAPPEN TO YOU!**

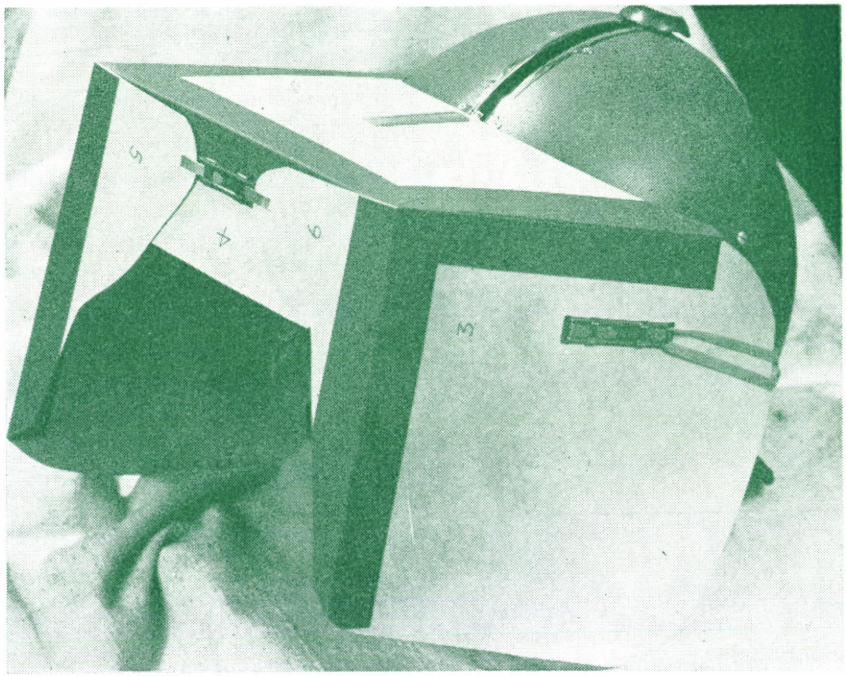


Figure 2b

or Jepp case and can be put into use in less than a minute without removing the helmet. The hood is made from two file guide dividers, ACCO paper fasteners, masking tape, and two rubber bands (fig. 2b). Total cost: less than 50¢; replacement costs are negligible.

(Mr. Roundy tried aluminum but it was too heavy for comfort.)

(The Department of Rotary Wing Training at USAAVNS, Fort Rucker, unofficially evaluated this helmet. Their conclusions were: 1. they found it too bulky for use in the H-34 cockpit configuration; 2. in the H-21 they had to tilt their heads too far backward to read their instruments; and 3. it will probably last from four to six months with normal care. The low initial and replacement cost, however, might offset these three disadvantages.)

Unfold hood so that the rubber bands are on the outside.

Fold the front part (part 4) down (fig. 2b); then fold the front side pieces (parts 5 and 6) to the center so that they are to the outside of part 4. The fastener is then inserted into each of the holes provided in the two side pieces (parts 5 and 6), and bent to the outside on each side piece. The hood is now ready for attachment to the helmet.

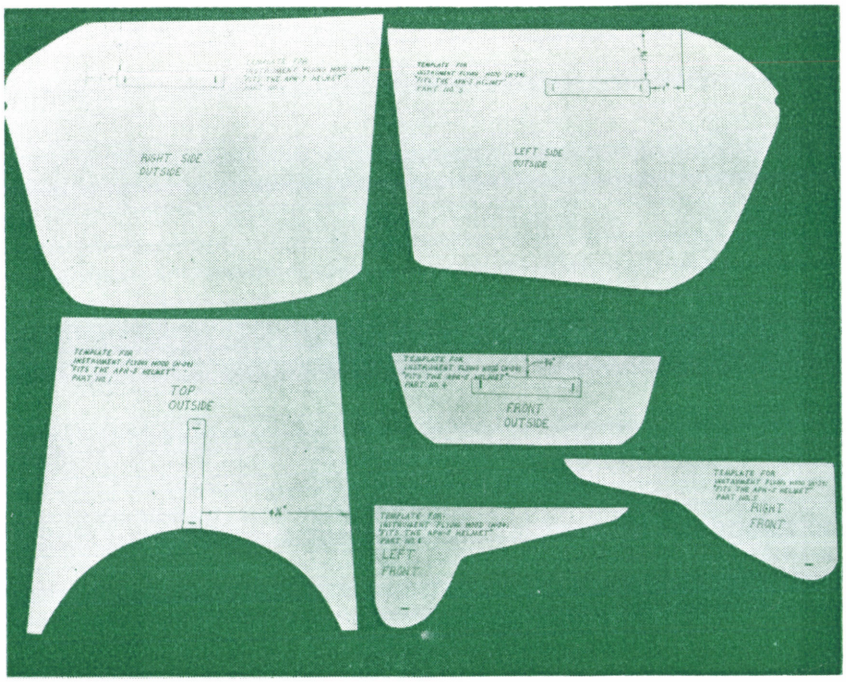
The hood is placed to the front of the helmet so that the fastener with hook is hooked into the bottom of the slot provided on the helmet for the visor.

The hood is fastened to the helmet by rubber bands. The notch is butted to the front of the rubber tip with the rubber band looped over the rubber tip to hold the hood in place. The hood is now ready for use. Slight adjustments can be made by shifting the position of the helmet on the head. For wider vision additional slots in parts 5 and 6 will help.

The device shown as fig. 1 on the back cover of the March issue of the DIGEST was designed as an interim measure until a more suitable hood is found. The Department of Rotary Wing Training is continuously evaluating various designs in an effort to find a better hood for helicopter instrument instruction.

Do you have a better solution?

Templates for economical R/W instrument hood



Other Hoods

SINCE PUBLICATION of the March issue of the U. S. ARMY AVIATION DIGEST, which devoted the back cover to the problem of hooded flight using the APH-5, your editor has been alerted to another Fort Rucker solution recommended to USCONARC as a standard expedient.

This version uses the 1-F-10 Channel Vision Hood and can be accomplished with five sections of rolled absorbent cotton, ½ inch thick and 1½ inches long, and nine strips of masking tape, 3 inches long. Attachment is made by 1) removing the wing brackets from the 1-F-10, 2) placing the rolls of cotton at the center and each side of the hood to make a protective padding for the forehead, and 3) placing the extended arms of the hood between the helmet and the temples and inserting until flush with the forehead. (See fig. 1)

This modification of the Channel Vision Hood for fixed-wing flight is easy and inexpensive; however, it is not suitable for rotary-wing use. The Department of Rotary Wing Training at USAAVNS states that the 1-F-10 is not satisfactory for helicopter instrument instruction because its short length does not satisfactorily limit the pilot's visibility without the use of a dangerous number of blackout panels in the helicopter.

Figure 1

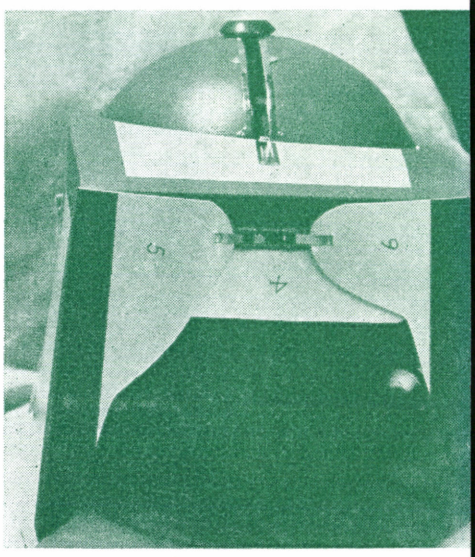


Figure 2a

Another possible solution was received from CWO William D. Roundy, Headquarters Co., 57 Ordnance Group, (AMMO) APO 227, New York, N. Y.

His instrument flying hood is designed for use in the H-34 Choctaw, but with slight modification to parts 4-5-6 (fig. 2a) it can be adapted to any type aircraft. An important feature is that the safety of the helmet is always present. There is no weight problem; the hood has been worn for two hours without discomfort.

This hood is easily, quickly, and economically made. It is convenient to carry in a brief

Continued on inside back