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MAY 1959

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UNITED STATES ARMY AVIATION DIGEST

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FLYING THE SUMMER HANDICAP

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United States Army

AVIATION DIGEST

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MAY 1959
VOLUME 5
NUMBER 5

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COVER

Army Aviation type flying has been compared in one respect to the civilian crop duster. There's a difference, however; when weather moves in the duster moves out and that's when the weather-minded Army Aviator really goes to work. The sturdy Bird Dog shown on our cover is about to get some weather time. The article on page 1 should help the pilot.

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The U. S. ARMY AVIATION DIGEST is an official publication of the Department of the Army published monthly under the supervision of the Commandant, U. S. Army Aviation School.

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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The printing of this publication has been approved by the Director of the Bureau of the Budget, 22 December 1958.

Views expressed in this magazine are not necessarily those of the Department of the Army or of the U. S. Army Aviation School. Unless specified otherwise, all photographs are U. S. Army.

Distribution:
To be distributed in accordance with requirements stated in DA Form 12.

"Even the least sky-conscious cannot overlook the powerful symphony of a lightning-filled thunderhead . . ."

Sverre Petterssen

FLYING THE SUMMER HANDICAP

Jay Lewis Quinn

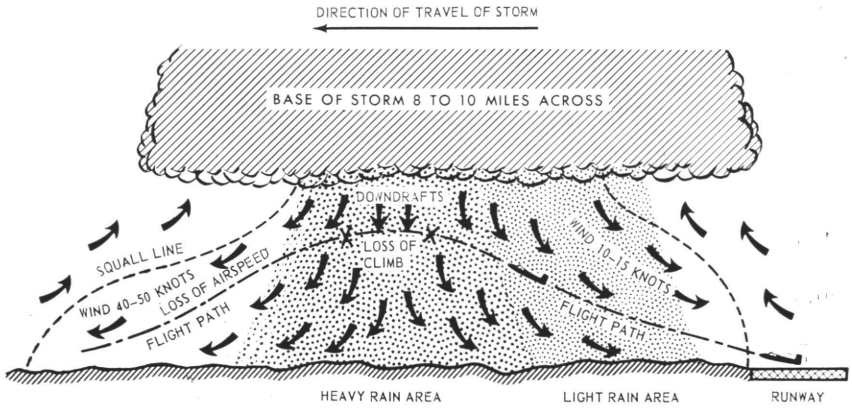
THE ARMY AVIATOR must often accomplish his assignment regardless of weather phenomena which, under ordinary circumstances, might constitute a valid reason for delay. Weather phenomena such as thunderstorms are considerably less hazardous to commercial airliners and jet aircraft than the light aircraft because most commercial aircraft are equipped with airborne radar, and jets can fly at altitudes in excess of 40,000, which will avoid most storms. But the pilot of light aircraft, without high altitude ability and radar facilities, must accept and prepare for this fickleness of weather as part of his flying chore.

Of all rainmaking clouds, the cumulo-nimbus or thunderhead is the most exciting. There are nearly 44,000 of them daily around the world.

According to available weather records, Tampa, Florida, is the storm center of this country, with an average of 94 thunderstorms a year. Santa Fe, New Mexico, is second with a yearly average of 73. Other cities are less frequently visited. The West Coast states average only one to four such storms a year.

Although most storms are generated in the daytime, many sections of the United States, including the Southwest, the lower Michigan peninsula, and an extensive area centered in eastern Nebraska, are plagued with night storms during the summer months. Thunderstorms are bothersome in the Central States during the months of July, August, and September. On the other hand, in the winter the greatest storm activity takes place in the lower Mississippi valley.

A new cell formation may be encountered shortly after takeoff if thunderstorms are prevalent in the area. This diagram shows the probable flight path in such case.

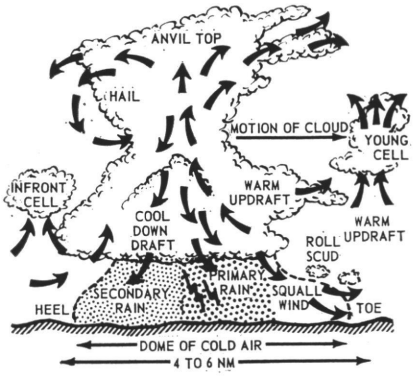


DEVELOPMENT

An unstable atmospheric condition is created when a mass volume of superheated, moist air rises from the earth's surface to an altitude of near stability. To replace this air mass, an equal amount of cooler air moves downward and inward in vertical and horizonal patterns.

The large volume of continually rising, warm, moist air is cooled to the saturation point. These currents of rising air, called updrafts, course away from the earth in turbulent spirals, sometimes at a speed of 25 to 50 mph. As the air is cooled, the main body of the storm boils upward, while decks of strato-cumulus and alto-cumulus clouds are flung outward in all directions. A thunderhead, signaling an impending storm, is thus developed.

Thunderstorms have a life cycle of three parts, which are dependent upon the direction and force of the predominant vertical flow: cumulus, mature, and dissipating. A pilot's ability to recognize these stages can help him to determine whether he will have a safe, although uncomfortable flight, or to expect a harrowing beating in his attempt to continue his course.



Rain area within footshaped dome of cold air beneath the storm

CUMULUS

Updraft is characteristic of the cumulus or primary stage. The velocity of the updraft may be 100 to over 6,000 feet per minute. The summit of the upward current in a storm cell has been as high as 25,000 feet from ground level. The amount of precipitation in this phase of the storm increases in proportion to the altitude attained by the rapidly rising currents.

Small droplets of water are formed below the freezing level, growing in size as they are carried further aloft in the updraft. It is not unusual to find snow at the freezing level. This snow and water gradually become too heavy to be supported by the rising currents and either drop below or are pushed outward through the rising air. Rain is the usual indicator of transition from the cumulus to the mature stage of a thunderstorm.

MATURE

In the mature stage the cell undergoes some changes with the descent of the rain. Where updraft formerly existed, the air now begins to move in the opposite direction. This movement, called downdraft, spreads in vertical and horizontal patterns. The rapidly descending masses of downdraft and the still active updrafts agitate each other at rates of speed up to 6,000 fpm. This high rate of speed of clashing air currents occurs near the center of the storm cell. The consequence is turbulence, the most serious hazard of storm flying.

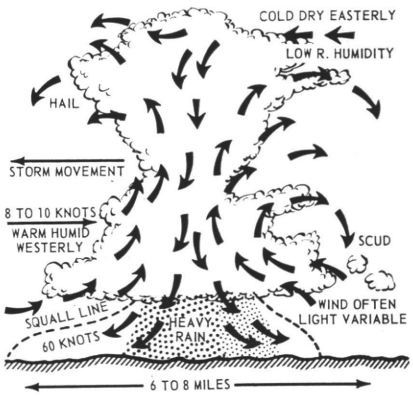
TURBULENCE

Turbulence is to be expected. To the pilot who picks his way through the storm cell, turbulence is an experience of sickening bumps, drops, and bounces spiced with flashes of lightning. It represents a flying hazard that can hardly be overemphasized.

Turbulence can be gusts and drafts, both of which are equally trying to the aviator. Gusts, normally caused by small vortices of swirling air currents, subject the plane to sharp acceleration without changes in altitude. Drafts, caused by the rapid, violent upward and downward motion of the air currents, displace the craft in vertical flight. The stage of development of the storm cell determines the direction and strength of the drafts. In the early stages of the storm, the motion is largely upward and in the late stages, mostly downward. It is at the height of the mature stage that the drafts are most violent and hazardous.

BUFFER ZONE

The moving air of the downdraft doesn't come to rest at the earth's surface, but changes direction of motion as would any jet stream hitting a flat surface. The vertical motion of downdraft is converted to a horizontal motion. Enough of its force is retained, however, to cause the violent surface gusts so frequently experienced shortly before and during the rain.



Strong downdrafts reach to ground level

Due to the "buffer" effect of the terrain and its effect upon downdraft, and the fact that this area usually marks the point of updraft acceleration, pilots are universal in selecting 6,000 feet above terrain, or as close as practicable, as the preferred altitude for storm penetration.

DISSIPATION

When the downdraft area of the storm increases, due to a decrease in warm air being fed into the thunderhead, the end of the mature stage is reached. Rain continues to fall. Thus the third and final stage of the storm begins in a period of increasing downdraft and lessening turbulence. This is the stage of dissipation.

In this stage, the downdraft increases until eventually the entire storm cell is one of downward air currents. The rain

Mr. Quinn was a military member of the staff of the U. S. ARMY AVIATION DIGEST prior to his release from active duty last fall.

gradually ceases and the storm activity ends.

WEATHER PHENOMENA

The weather phenomena accompanying a thunderhead which are of prime importance to the aviator occur largely in the mature stage of the storm. Many accidents have resulted when a pilot unwittingly flew into a mature thunderhead which was masked by clouds and darkness, then lost control of his airplane and crashed. This can happen in a treacherous warm-front thunderstorm which may be obscured by a lower cloud deck separating the front from the slowly retreating cold air below. In such a frontal storm, a pilot can wander into the cell from smooth instrument flight in just a few seconds.

On the other hand, the common cold-front thunderstorm is generally easy to see from any direction of flight. The thunderhead associated with an approaching squall line is the most violent of all and sometimes will carry a tornado. In general, all thunderstorms present the same face, differing from each other only in intensity and the weather conditions they carry, such as hail, turbulence, and lightning.

LIGHTNING

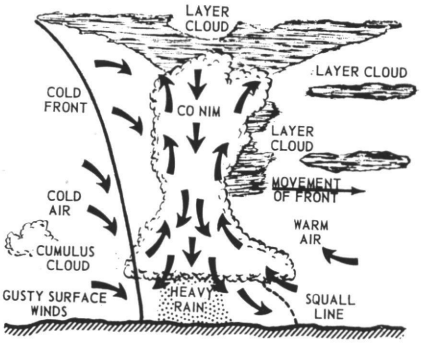
Lightning begins to flash in the latter part of the mature stage as the droplets of water, no longer updraft-borne, fall into the strong vertical currents below and are split apart, becoming electrically charged. When sufficient charge has collected, a spark of electricity, or flash of lightning, jumps from cloud to earth, from earth to cloud, or from one cloud to another. The length of the lightning stroke varies from a fraction of a mile to several miles; its diameter ranges from an inch to one foot. The thunder that follows lightning is produced by the sudden heating and rapid expansion of surrounding air.

Although lightning damages or destroys a yearly average of $18,000,000 in earthbound property, aircraft damage is usually minor. There are recorded incidents of lightning shattering windscreens, exploding parts such as tail cones, and affecting radio apparatus. Too, the aircraft can be magnetized to the extent that errors result in compass readings. Lightning blindness, a common and somewhat serious complaint, often affects the pilot's vision from 30 to 50 seconds. In that brief time, instrument reading may be impossible.

However, lightning is more a psychological and neurological evil to the pilot than a physical danger. Captain "Pappy" Hayes, a Civil Air Transport pilot, flies the squall line between Nagoya and Tokyo, Japan. "We really hit those 'anvil-heads,'" says Pappy. "Lightning pops all over the sky, but it's overrated. I've been hit so bad we could smell it. Most of us have been hit several times but no CAT pilot has ever suffered appreciable damage to an aircraft. Nevertheless, we avoid any buildups we can and particularly altitudes around the freezing level. That doesn't mean that lightning is a ray of light on the pilot's horizon—but, if you're a worrier, spend it on turbulence where it is needed."

ICE

The prospect of icing up is another story. Ice is found at



Frontal type thunderstorm

or above the freezing level in the areas of heaviest turbulence during the mature phase of the storm. The altitudes within a few thousand feet of the freezing level, either above or below, are especially dangerous.

SNOW

Snow can be found at all levels above the freezing level. It is particularly important to the aviator and presents a unique problem. The penetration shock of a wing can cause snow accumulation on the leading edge of a wing to form rime ice.

PRESSURE

Pressure will fall abruptly as a storm approaches, then rise as quickly with the rain to return to normal at the storm's end. This pressure fluctuation often causes significant altitude errors in the altimeter. A test conducted shortly after World War II revealed an error of 140 feet. The storm-flying pilot should keep constantly aware that any given altimeter reading during or prior to a storm is unreliable.

HAIL

Most thunderstorms produce

rain, thunder and lightning; they produce hail as well, and one in 400 is so violent as to generate hailstones of remarkable size. Hail forms when exceptionally strong vertical currents rush upwards through the cumulo-nimbus cloud carrying large raindrops into the freezing zone. The rain is frozen into ice particles and descends again into warmer regions. There it takes on another coating of water and once more is tossed aloft. This process may be repeated many times. The greater the speed and force of the currents, the longer the hailstone will stay in the storm cell and the larger it will grow. Eventually, the newly formed hailstone becomes too heavy to be held aloft by the currents and drops to earth.

Estimates indicate that currents must be close to 70 mph to sustain a hailstone 2 inches in diameter. The largest stone ever measured in the United States fell at Potter, Nebraska, on July 6, 1928. It was almost 5½ inches in diameter. The heaviest single hailstone found in the United States fell in Michigan during the summer of 1956. It weighed over 5 pounds!

Hail is a question mark in storm penetration. It can be found inside the storm cell or it may be encountered several miles from the thunderhead. Since hail is capable of inflicting serious damage to aircraft, the pilot must be alert for it as no perfect forecasting method has been evolved.

PENETRATION

When the pilot receives a storm forecast, he should determine his relative position to the area and decide upon alternate route or altitude to attempt a bypass. If neither choice is possible, an attempt might be made to fly parallel to the area then, with a "least time-distance" factor in view, to cross the front at its most advantageous point.

He should, of course, judge his own fitness against the possible severity of the forecast storm, particularly if he is inexperienced in storm-flying. Certainly fatigue will deprive him of maximum performance in attempting a penetration. He should not allow a case of overconfidence to dim the reality of his ability.

When the pilot has determined the stage of storm development, he should ease back on power and enter the area in the dissipation stage, thereby avoiding the maximum turbulence and weather elements.

In actually "flying the storm," he should determine the freezing level and avoid it. By so doing he will avoid not only maximum turbulence but also the equally serious threat of icing. He should also sacrifice his ETA to a reduced speed in the storm area. (For the correct penetration speed, consult the Flight Operating Instructions in the appropriate AF technical order or Army technical manual for the craft being flown.) Reduced speed should be maintained in turbulence.

The preferred level for a low penetration of the storm cell is in the vicinity of 6,000 feet.

A set course is advisable, as meandering both increases the duration of "storm-flying" and adds stress to the aircraft. However, if hail is encountered or turbulence is excessive, it may be prudent to make a 120° change of course for a few minutes, then a return to the original heading.

Do NOT use the autopilot. It is a constant altitude device that will place the craft in a dive to compensate for updraft, and will climb in a downdraft. In a dive, excessive airspeed is a danger; and in climbing to compensate for a downdraft, the airspeed may approach a stall. Try to maintain a level attitude.

As a general rule, avoid all dark areas of the cell and at night avoid those areas of heavy lightning, particularly the areas of cloud-to-ground lightning.

The altimeter should be closely watched and known power setting maintained to lessen the stresses upon the aircraft. The known power settings for different altitudes are recommended since the airspeed indicator is unreliable in vertical drafts and heavy rain. Consult the dash-1 handbook for your particular aircraft.

A bail-out is accepted procedure only as a last report. A free-falling pilot, without maneuverability and protection, descends in the face of many dangers, including a collapsed parachute, a chute carried upwards in the storm, hail, or lightning.

Flying men will encounter storms. For many pilots, it is a matter of course—a natural phenomenon associated with the atmosphere — their means of free passage. Their ability to understand and to cope with the elements in a storm is measured by their manner and safe degree of penetration.

VTOL or Just STOL?

Ken S. Coward

OF PRIMARY CONCERN to both Army and contractor planning for Army aircraft is the importance of the true vertical takeoff and landing capability as opposed to the "short" takeoff and landing. Some confusion in this assessment is justified; some is not. Further technical development is required to answer some questions; others can and should be answered now.

HOW IMPORTANT IS VTOL?

Just how important is it to have true VTOL capability? This fundamental and urgent question is being asked constantly. Pressure is brought to bear by people outside the VTOL field to the effect that this true VTOL capability is really not too important—that there is always a field nearby large enough to land a conventional or STOL fixed wing airplane.

One may present cost charts, speed data, complex analysis, etc., to show that VTOL is vital, but the primary indication of the importance of VTOL is the fact that about four-fifths of the Army's aircraft inventory, in terms of dollars, consists of VTOL aircraft—the helicopters. This is in spite of the fact that the **cost** involved is much higher per ton-mile (in dollars, fuel, manpower, etc.) for the helicopter than for the fixed wing aircraft.

We have confidence in the ability of the Army to place its funds where they are most needed. The emphasis on helicopters as opposed to fixed wing aircraft is an indication of the Army's need for VTOL (not necessarily helicopters) as opposed to operation requiring a certain length of level, smooth, hard ground with good **approaches.** This terrific emphasis which has **already** been placed on the true vertical takeoff and landing capability is the best possible indication of the Army's need to operate "straight up."

HOW SHORT IS "SHORT"?

When we speak of a short takeoff and landing, just how short do we mean and, most important, what penalties are involved? There have been many interpretations of the word "short." At one time it meant 500 feet over a 50-foot obstacle. This definition held until the hard, cold fact appeared that this is really asking too much of the existing development. The latest observation aircraft, for example, requires considerably greater distance, particularly in landing, than this 500-foot shining star. And 500 feet of what—of ditches, rocks, stumps, gullies, mud, brush? Or 500 feet of level, smooth, hard ground clear of trees and hills at either end?

We speak of "unprepared fields"; yet, those of us who have made forced landings in truly

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unprepared fields, in areas representative of a battle area, realize that the chances of doing so in anything but a light plane are almost sure to result in airplane damage, to say nothing of gray hair. Let us examine just what is involved in this STOL operation. It can be shown that in a highly powered STOL airplane the landing distance, rather than the takeoff distance, is critical.

LANDING SPEED

The speed at which the airplane touches down is all-important; this dictates the distance required to stop, and this speed limits the roughness of the ground which can be tolerated in the landing roll. It has been shown that wing loading tends to increase with aircraft size in a fairly well established manner—the larger the aircraft size, the higher the wing loading. As the wing loading increases, so does the landing touchdown speed.

As we install large flaps, BLC, or use some other device such as flaps and power with sufficient drag to facilitate a reasonable glide angle with power (called "Powered STOL" in this paper), the speed further decreases (figure 1). The data shown is for a family of airplanes wherein low wing loading is stressed in the original design.

Suppose we are considering a light transport having a gross weight of 30,000 lbs. If we do nothing but use Fowler flaps, the touchdown speed is about 75 mph. If we use BLC, the speed decreases to about 55 mph for the best BLC we know how to build for any reasonable weight penalty. If we now install a lot of power (practically enough power, incidentally, to land vertically) and unique flaps, we may decrease this speed to about 40 mph. Let us say that we do not wish to consider the last step, because if we go to this extreme we might as well go all the way to true VTOL because the power, control features, etc., would be required just as much as for VTOL.

Now, suppose we use BLC and settle for the 55 mph landing speed. The big question arises—just how many "unprepared" fields are there where you can roll at 55 mph? When driving an automobile down the road at 55 mph, just how many fields alongside the road would permit driving your car at 55 mph? Very few, if any. That is why the hard-top highway came into being, and that is why the smooth surface runways at our airports were built. The fact remains that, latest tire developments notwithstanding, operation at any kind of reasonable STOL speed will require **smooth** and **hard** surfaces—a far cry from the "unprepared" field.

LANDING DISTANCE

The landing ground roll versus airplane gross weight is shown in figure 2. It should be emphasized that this is ground roll only, and not distance over the 50-foot obstacle. Again, for the 30,000-lb BLC airplane considered above, the landing ground roll is about 350 feet. Just how many smooth and hard fields 50 feet longer than a football field are there in a combat situation—fields having clear approaches into the prevailing wind and over friendly ground? How often can our pilots touch down on the very end of this strip with zero error? To honestly answer these questions is to admit that operation of any STOL aircraft falls far short of the

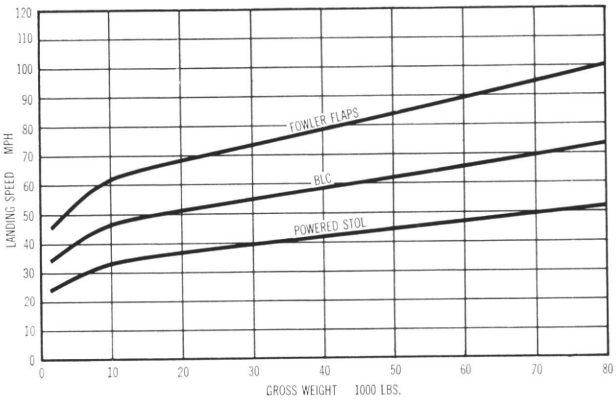


FIG. 1

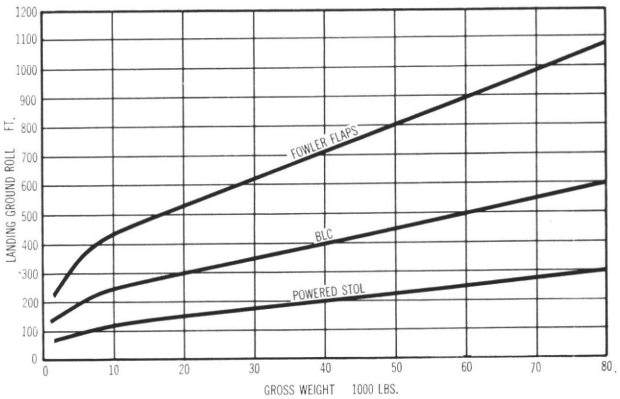


FIG. 2

requirement for operating into and out of truly restricted areas.

When the "short" takeoff and landing problem is studied in detail, it becomes increasingly clear that there really isn't such a thing as a truly short field capability unless we install the power and the control which is needed for true vertical operation.

The remark is heard, "If we back off a little bit from the true VTOL capability and allow a little run, there is a tremendous advantage." There is no such thing as backing off "a little bit"; one jumps from the true VTOL capability to the 500 feet over the 50-foot obstacle, with associated high speed rolling along the ground, without any intermediate stage. Because of the high descent velocities and short pilot reaction time required in this STOL operation, the landing is more of a controlled crash than a conventional landing.

COST OF VTOL

One hears repeatedly about the "tremendous cost of VTOL." Just what are those costs? Unpublished studies indicate that the increase in direct operating cost of a true VTOL fixed wing type over a STOL type having a 500 feet over the 50-foot obstacle capability is about 20 percent. The increase in cost over the purely conventional airplane is about 50 percent. These are far more moderate cost increases than the "tremendous cost of VTOL" which its proponents indicate. The direct operating cost includes first cost and the associated cost of the extra power, propeller interconnection, etc. It is interesting to note that the predominate cost is the cost of the fuel.

WHY FIXED WING VTOL?

The question, "Why do we want fixed wing VTOL aircraft when the helicopter will do the job?" is often asked. The answer lies in an examination of the time, fuel, and cost involved in transporting people and things. The dollars per ton-mile, the ton-mile per pound of fuel, and the dollars per ton-mile per hour data all indicate a considerable improvement in using the fixed wing VTOL aircraft.

True, the determination of detail figures cannot be made until the technological capability of these new aircraft can be determined by further development and operational tests; but enough is known at present to indicate that considerable improvement over the helicopter for all but the very short stage lengths is certain.

In the new Army film "Flying Soldiers," the fixed wing aircraft (Otters) are shown bringing troops to an assembly area, where the airplane must land and discharge the troops. The troops then board helicopters and are landed at the forward area. This requires a landing area at the assembly point which has enough space for not only landing the fixed wing aircraft, but also for permitting the aircraft to taxi out of the way to a parking area. This assembly space also must be large enough to accommodate the waiting helicopters and permit them to take off. Under ideal conditions, when the helicopters are aware of the exact time of arrival of the airplanes, such an operation is only moderately time-consuming. In a battle situation, however, this operation can become very confused and time-consuming.

Now, if these fixed wing aircraft, which were needed because of the limited range of the helicopter, could make a vertical landing directly at the battle area, the intermediate helicopter step would be eliminated. This would save time in this tactical situation — time which might spell the difference between failure and success in a critical situation. The helicopters would be released for use in areas better suited to their characteristics. This would result in a reduced requirement for helicopters and a subsequent reduction in the dollar inventory. The effectiveness would be increased at this lower cost because the ton-mile per hour, ton-mile per pound of fuel, and cost per ton-mile would all be benefited.

MISSION FULFILLMENT

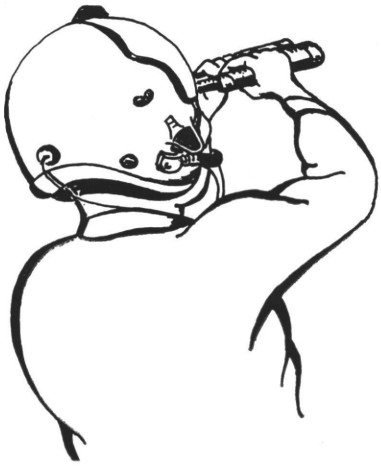
It is believed that the Army really doesn't care what form their VTOL aircraft takes, that mission fulfillment commensurate with operational feasibility is all important. If the answer lies in a fixed wing VTOL type which is capable of operating advantageously and economically over both the conventional fixed wing aircraft and the helicopter, then this is what the Army will buy. It is to these ends that many in industry are working and expect to be ultimately successful.

When the true VTOL capability of fixed-wing aircraft becomes an operational reality, there will no longer arise the question, "VTOL or just STOL?" The Army aircraft inventory will reflect the answer as it does today. VTOL aircraft will exist in strength, and these VTOL aircraft will have capabilities only dreamed of today.

Looking Ahead

Colonel Robert H. Schulz, Inf

IN THIS DAY of rapid technological changes, equipment obsolescence, and doctrinal changes which result in a shift of traditional roles and missions, an attempt to look ahead and predict what the status of a particular function will be for the next ten years can prove a precarious undertaking. For such predictions to have validity, it is necessary to establish several basic assumptions so that a common point of departure is at least recognized.



1. The Army must be prepared to fight in a general nuclear war, in a limited war where nuclear weapons might not be used, or in a situation where nuclear weapons might be limited in size and employment.

2. Roles and missions of the services will continue to change. Responsibilities will be redefined, but the basic functions of the services will remain established along the traditional lines of ground combat, sea power, and air power.

3. Army organic aviation will continue to expand. Its present functions will not be absorbed by the Air Force, nor will the Army establish a separate "Army Air Corps."

Behind the cloud of technological developments, the basic problems of ground combat mobility, communications, firepower, and logistical support remain much the same as they have for past generations. If ground combat is to remain a part of warfare in the future, there is little to indicate that these problems will be altered materially in spite of the fact that the manner in which they will be executed will undergo radical changes.

GROUND SOLDIER NEEDED

Sir John Slessor, a prominent airman, recognizes the continuing need for the ground soldier. In **Strategy for the West** he said, "the greatest need in Korea was, and will be again in other small wars, for tough, self-reliant infantrymen, who can endure climatic hardships . . . dig like badgers and shoot like King's prizewinners and eat

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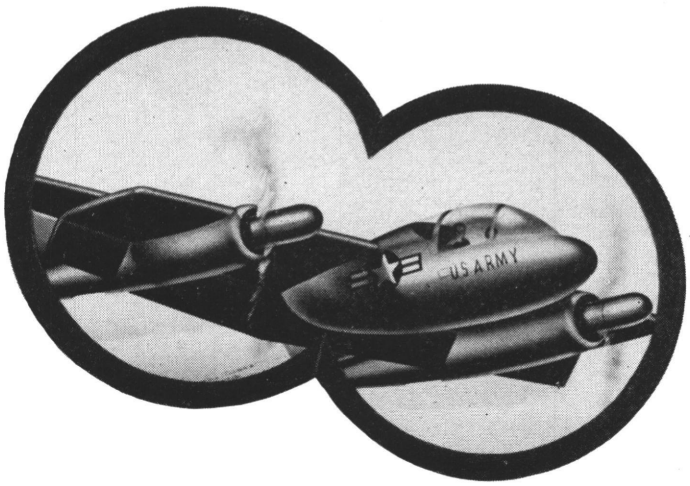
Colonel Schulz is the Director of Instruction, USAAVNS, Fort Rucker, Ala. He is qualified in both rotary and fixed wing aircraft.

like their enemies when they have to."

In coping with these requirements organic aviation can contribute a great deal. For some, aviation in itself can solve many of the problems, while in others it will have only a secondary role. For example, in providing battlefield mobility there are unlimited possibilities. Organic aviation can provide a degree of mobility that the Army in the past never dreamed possible. On the other hand, electronics will continue to be the main vehicle in the field of communications, with aviation helping to make the electronic devices more effective by providing aerial platforms for communication relays, radar, and telecasting the battle area.



MOBILITY REQUIRED

Maj General H. H. Howze, former Director of Army Aviation, has put it this way: "If the Army is ever to overcome these obstacles and obtain the mobility differential that the dispersed formations of the future will require, it frequently will have to take to the air. In taking to the air, however, it must do so in extension of ground combat. Army Aviation must never lose sight of the basic principles of ground combat, that fire and movement in contact with the enemy have always been essential to the defeat of ground forces . . . In other words, the Army should go no higher and faster than is necessary to remove the blocks imposed by terrain; and this may be no more than a few feet above it."

The type of organization for the ground field forces must not remain static. It would be folly to assume that the present Pentomic organization is the final or the best answer to proper organization. Changes, modifications, and complete alterations must come as field experiences and tests demonstrate the need for such changes. At the same time, Army Aviation must never lose sight of its principal role: that it exists only because it can serve the ground unit commander better than some other type of aviation support.

Aviation support under the present Pentomic concept has already brought a cry from the artillerymen that the historic mission of division aviation to adjust the fire of organic artillery units from an elevated and maneuverable platform is reduced in effectiveness under TO&E in the Division Aviation Company.

ORGANIC EQUIPMENT

Except for aircraft assigned to the primary missions of cargo lift, unit lift, and casualty evacuation, the bulk of the 5,400 active aircraft in the Army inventory will remain assigned to the units which have need of them. When Army aircraft are no longer responsive to the immediate needs of the using combat commander, then the system will have evolved into something other than organic Army Aviation — more likely, an "Army Air Corps."

FUTURE AIRCRAFT

What types of equipment will Army Aviation demand in the future? In the immediate years ahead, all types of present conventional aircraft will be replaced by improved models. Army Aviation's real future lies in the development of completely new types of aircraft—often called unconventional only because they are not flying today.

In approaching the problem of procurement of new aircraft, the Army is guided by four principles: The first is to obtain satisfactory maintenance requirements in the forward combat areas by the procurement of simplified aircraft. Second, aircraft must have short take-off and landing capabilities. Third, aircraft must have the ability to take off and land on rough, unprepared fields. Fourth, all aircraft must possess a high degree of all-

Aviation needs as typified by this Lockheed concept of STOL aircraft

weather capability. Such aircraft will need better instrumentation, lighter and simpler navigational and air traffic control systems.

Among the excellent aircraft that will be added to the Army's inventory in the next few months is the **Mohawk.** This STOL observation plane symbolizes the high performance and versatility being built into the Army's new aircraft. It is powered by two 1,000 hp Lycoming turboprop engines; its maximum speed is 275 knots at 5,000 feet. Takeoff over a 50-foot obstacle may be accomplished from a 600-foot strip at a gross weight of 10,400 pounds. External loads of 3,000 pounds can be carried.

Another aircraft to be added to the Army's inventory shortly is the **Caribou,** a workhorse airplane capable of many and varied missions. Its rugged characteristics and dependable P&W R2000 engines make the hauling of payloads up to 3½ tons in and out of restricted areas a comparatively simple chore. It has already been christened the "3½-ton airborne truck" by the U. S. Army. The Caribou will have a passenger capacity of 28 combat troops, and will cruise at 183 mph with an ultimate range of 1,350 miles.

In the rotary wing field, the new Iroquois shows great promise with its 825 hp gas turbine engine. It has a cargo capacity of 142 cubic feet plus four additional passengers. The Iroquois will carry an 800-lb payload of personnel, equipment, or supplies a distance of 200 NM at 100 knots speed.

During the next ten years there will be a marked change in Army aircraft. In the first place, the number of helicopters in the Army inventory will decrease. Even when a simplified helicopter is developed, it

will still have inherent weaknesses such as low-lift capabilities and low speeds.

R/W SIMPLICITY NEEDED

When fixed wing aircraft development breaches the gap to true vertical takeoff and landing capabilities, helicopters will become less important. However, there will be a continuing but limited need for helicopters. The goal in helicopter design is for simplicity and ease of maintenance. It is within industrial design capacity to product a small, rugged, cheaper, low maintenance, helicopter in the near future.

In the unconventional design area, the field appears to be limited only by the availability of funds and the ingenuity of American research and industry. New powerplants, such as the gas turbine engine which is just now entering the light aircraft and rotary wing fields, opens a whole new area of better performance with lower maintenance costs. A "flying crane" with a 12-ton lift capability should be ready for testing within the next few years. This device promises tremendous utilization in the logistic and missile field in forward areas.

Along this line, a feasibility study has been made evaluating a variety of systems using 2-6 helicopters to lift a single load which exceeds the weight capability of one helicopter. The H-21 and H-34 helicopters were used for this study.

AERIAL JEEP

An aerial jeep, using the ducted fan or deflected slip stream principle, has been test flown. Flying platforms are already a reality and only await perfection to be ready for field use. All of these new devices offer many opportunities for field use by the ground commander.

As ultra modern as the Army's new aircraft may appear, they must always remain tied to the needs of the ground commander. They must be responsive to his control, be simple to operate and maintain in the forward combat zone, and above all be a real tool to help the commander successfully accomplish his mission.

INTERSERVICE RELATIONSHIPS

As has already been observed, the roles, missions, and functions of the services are undergoing continuous changes. The scope of this article does not include missiles, close support, nor strategic airlift problems. But these three areas have such an impact upon the future of Army Aviation that a few observations, as they directly relate to interservice relationships, must be made. Today, the Army is authorized to use a missile with a range in excess of 200 miles; yesterday the range was restricted to 200 miles. No one knows what the range might be for tomorrow's battlefield. But any forward extension draws Army Aviation along with it.

Missiles also reduce the need for tactical air support by the Air Force. This was considered by the President in the 1958 budget when he proposed: ". . . the gradual elimination of strategic fighter wings, which are no longer considered necessary and a reduction in the number of Air Force tactical wings." A continued increase in the reliance on missiles with a corresponding reduction in the need for tactical air support calls for either a reassignment of service functions or new interservice agreements and understanding.

A brief look at the strategic airlift problem shows that this has always been a matter of funds and not a question of who should do it. The Army ground commander should be no more interested in controlling long-range heavy aircraft than he should want to control naval lift vessels. The Army's position should be that of assuring

Aerial jeep increases versatility and mobility

that enough airlift is available to provide the mobility that the Army needs.

A real problem that faces Army Aviation, and directly involves the Air Force, is control of the air space over the battle zone. When one considers all the artillery, rockets, missiles, plus some 3,000 Army aircraft in the field army's area, it is a tremendous problem. Add the Air Force's interest in air space control, and the problem becomes knotty. This problem can only be solved at the interservice level, but the basic perplexity has not yet been faced.

ARMY NEEDS . . .

The Army is the first to admit that it does not need nor want a separate air branch or arm. But the Army believes that it has shown over a period of 16 years that it does need aircraft tailored to meet the needs of the Army and organized to provide efficient, responsive support. Duplication is an easy charge to level at any service, but to be realistic one must look at the functions performed, rather than at the fact that two items of hardware in different services might be identical. Limitations that are imposed on Army Aviation in the future must be practical and guided by the needs and usage of the ground fighting units.

The Air Force doctrine that air power is indivisible has recently recognized that such air power need not all reside in one service. The objective of the U. S. Armed Forces is to defend our country, and, should war be forced upon us, to win that war by the proper utilization of the tools available. Air power is one of those tools; the use of the air and the vehicles that move through the air must be available for use by the services in the manner needed to successfully accomplish their stated missions.

Again, Sir John Slessor stated that, "the air is indivisible and the only principle that makes sense is that the man who fights in the air should be an airman, the man who fights at sea a sailor, and the man who fights on land a soldier. And, I repeat, the only exception to that rule should be when its application is organizationally impractical or operationally inefficient."

In the course of the development of modern fighting machines, the facts have indicated that certain missions can be more efficiently performed by aviation which is coordinated with the ground unit and is readily accessible to the ground commander.

In **The Air University Quarterly Review**, Winter, 1957-58 issue, Brig Gen S. F. Giffin lays a firm foundation for realistic interservice relationships with respect to the use of the air by stating: "Perhaps it is heresy to concede that U. S. air power resides elsewhere than in the Air Force. It may be even more heretical to concede that any wisdom lies in such a division of air power, which in some mystic sense is often regarded as organizationally indivisible. Nevertheless, as we must maintain surface forces, and as surface forces must, for the accomplishment of their own missions, possess indigenous resources capable of contributing to air power, it is proper that they be given those resources. The actual problem rests in determining how much they should be given—but the problem in preparing for war has always been one of determining priorities and allocating deficits."

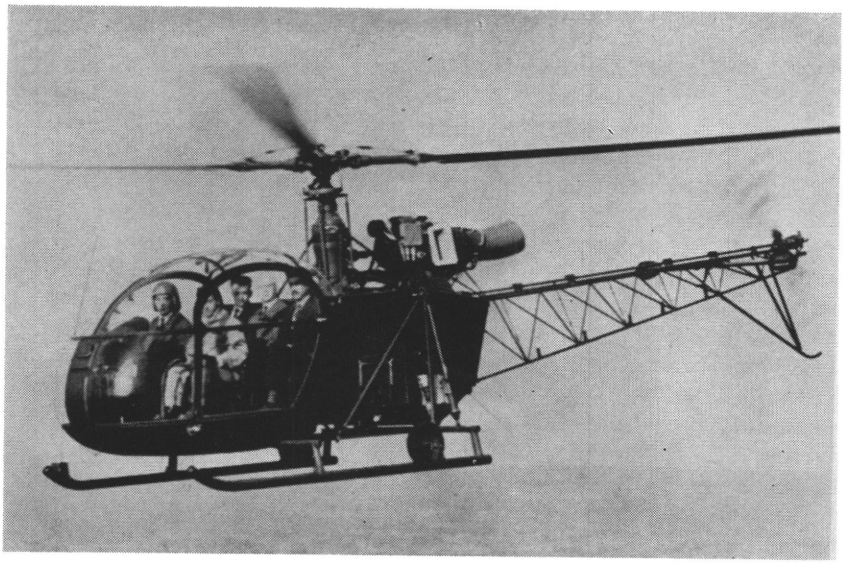
Army Aviation asks only for the opportunity, unhampered by artificial restrictions, to be able to continue to develop so as to better assist the ground commander to win the ground battle. On that it stakes its continued success for the future.

Attention: Aviation Officers Everywhere

All Army Aviation staff officers are requested to get out the word to aviation units asking if they have met any of their Army Aviation missions in a special or different way. If so, write it up. Don't worry about finished style, since the staff of the DIGEST is willing to supply required editing. Send it with suitable photographs and illustrations. Now that the magazine has expanded, we need your articles from the field to help accomplish our mission of presenting material of an operational or functional nature which will prove valuable to other units faced with the same problems.

French Turbine Powered Helicopters

Major Hilaire Bethouart



The Alouette seats five, including the pilot

FRANCE IS THE only country in the world presently mass producing turbine-powered helicopters, the famous "Djinn" and "Alouette" from the Sud-Aviation firm. And for the first time these helicopters have been used in combat operations, in Algeria by the French Army and Air Force.

A BRIEF HISTORY

Prior to 1934 Sud-Aviation, then known as Liore' et Olivier Company, had already devoted part of its resources to research in the field of rotary wing aircraft. The preliminary developmental work on the new jet helicopter was begun during World War II. In November 1946 the first jet helicopter, "Ariel I," was shown at the Paris Air Show.

Meanwhile, through merger of two major societies of aircraft construction, Sud-Aviation became the sixth largest aeronautical firm in the world, and the first in Europe.

Years of experimental work, carried out systematically with a whole range of rotorcraft, went into development of the double-seater Djinn, SO1221, which made its maiden flight in January 1953 and went into mass production in 1954. In March 1957, it climbed to a world altitude record of 27,860 feet.

The five-seater Alouette II, SE3130, made its maiden flight in March 1955. On June 13, 1958, in France, an Alouette won 6 international helicopter records, two of which are:

(1) The world altitude record for helicopters of all categories and for category B helicopters: 36,350 feet in 35 minutes.

(2) The world altitude record for category C helicopters weighing between 2,200 and 3,860 pounds: 31,450 feet with two persons on board.

This was the first time in aeronautical history that a helicopter has flown in the stratosphere.

THE ALOUETTE II

Alouette II was the first turbine-driven rotary wing aircraft in the world. A light 5-seat helicopter with a maximum gross weight of 3,300 lbs., it is a single rotor machine with an antitorque rotor. It is powered by a single-shaft TURBOMECA - ARTOUSTE II turbine which drives the main rotor and the antitorque rotor mechanically.

This gas turbine has the following ratings: maximum per-

Major Hilaire Bethouart is the French liaison officer at the United States Army Aviation School, Fort Rucker, Alabama.

missible power, 360 hp; maximum continuous power, 320 hp.

A normal turbine speed of 34,000 rpm is maintained constant by means of a speed governer.

The Alouette II possesses the following military characteristics:

Empty weight	**1,874 lbs**
Useful load	**1,426 lbs**
Maximum gross weight	**3,300 lbs**
Maximum speed with full load	**95 kt**
Cruising speed with full load	**92 kt**
Range	**348 miles**
Endurance	**3 hr 15 min**
Maximum takeoff altitude with a gross wt of	**3,300 lbs**
Standard atmosphere	**8,200 ft**
Tropical atmosphere	**2,950 ft**

The military applications can be as follows: commando transport or parachuting; flying command post; reconnaissance, observation, liaison missions; artillery control; mobile repair unit for mechanized forces; escort for ships; antisubmarine surveillance; attack of armor with guided missiles "SS-10" and "SS-11"; police action in rebel country; propaganda (leaflets, loudspeaker); supply; detection of atomic radiations.

In 1957 the "Alouette" made a demonstration tour in the USA with very complete test flights, confirming two outstanding characteristics: its high useful load, and the easy control of its turbine.

The U. S. Air Force Test Center at Edwards, Calif., reported: "The turbo-propulsive installation of this machine is the most perfect which this test center has yet tried out." Moreover, at a temperature of +44.6° F. at the summit (approximately +97° F. at sea level), the "Alouette" was the first helicopter to land on Mount Evans (14,270 feet) with two people on board. The time required for maintenance of the machines (periodic overhauls included) was 50 minutes per flight hour.

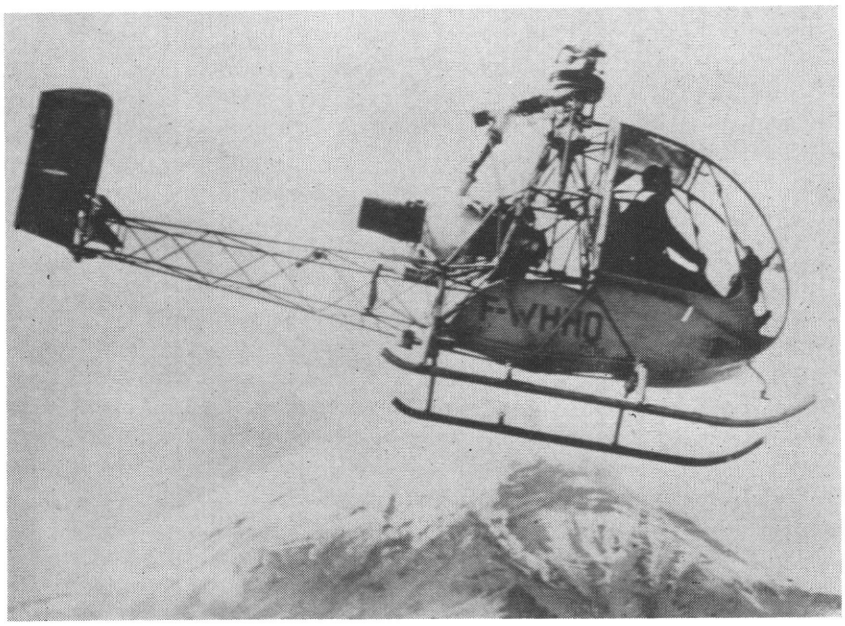
In January 1958 the Civil Aeronautics Administration granted the first airworthiness certificate for a foreign rotary wing aircraft to the Alouette. Republic Aviation Corporation has received the license for producing the Alouette in the USA. Recently it delivered its first aircraft to the Aetna Helicopter Corp., Etna, Calif., who will inaugurate the first jet helicopter commercial service in the United States.

Djinn and Alouette are used very intensely in Algeria operations, first mainly in a liaison, reconnaissance, and evacuation role, the second for flying command post and commando actions. Their ability to fly easily in very hot weather and in high mountainous regions, the rapidity of takeoffs and ease of handling make them an invaluable means of transportation in combat. Maintenance requires only about one hour per one hour of flight, and their useful load is always higher than that of conventional helicopters of the same engine power.

Long distance transport of both helicopters is common practice in the air freighter NORD-2501 (counterpart of the US C-119).

Further developments and new types of turbine-powered helicopters are now under study.

The Djinn III prototype has recently been completed. It is an improved version of the air-



The Alouette made the world's first helicopter flight into the stratosphere

craft which is now being produced on the assembly lines of "Sud Aviation." Keeping the same qualities of simpleness and sturdiness of the Djinn II, it will be roomier, faster, and will climb higher.

The "Gouverneur" is a handsome and comfortable military and civil liaison helicopter, developed from the Alouette II, with a cruising speed of 110 knots. The next development will be the Alouette III, which is now under construction. When completed it will be able to carry seven people comfortably, with a speed and economy never before attained.

The latest production of the helicopter division of Sud Aviation is the S. E. 3200, a heavy tri-turbine cargo which will be able to carry 4,000 pounds payload for a range of 200 nautical miles, or 5,000 pounds for 100 NM. The S. E. 3200 is currently undergoing flight tests.

This brief study has amply stressed the originality and high efficiency of the French Djinn and Alouette. These qualities are most important in increasing the civilian and military capacities of France and the many nations of the Free World. It is interesting, as a conclusion, to show here an example of true and efficient "community of brains": Republic Aviation Corporation of the United States is licensed to manufacture the Djinn and Alouette. Sud-Aviation of France has acquired the license for constructing and repairing the S-55 (H-19) and S-58 (H-34) helicopters. This is a new link between the USA and France, firm friends and allies since the Revolutionary War. It is also a warrant and an asset for the strong future of this cornerstone of French and American policy, the North Atlantic Treaty Organization.

THE DJINN

The Djinn, a simple and sturdy design, was developed to make widely available a helicopter at a reasonable price, by applying new principles, particularly that of jet propulsion. The system adopted consists of a free-oscillating, two-blade rotor driven by the blade-tip ejection of compressed air supplied by a "PA - Louste" generator.

The rotor of the Djinn operates on the principle of a rotary lawn sprinkler. The driving force, instead of water, is compressed air, and the powerplant is a gas turbine mounted in the fuselage. The compressed air is taken up at the outlet of the turbine compressor, which is extremely large. The air is then conducted through a pipeline to the hub, where it is distributed to the blades by a revolving airtight seal. This "free hub principle" eliminates the need for an antitorque propeller.

With conventional helicopters, however, the antitorque propeller is used also as a rudder. Directional control in the Djinn is effected by means of a rudder located within the turbine exhaust blast, which remains effective even when the relative wind is low or even nil, and provides excellent maneuverability at all times.

The weight and performance of the military model of the Djinn are:

Weight empty	**794 lbs**
Maximum takeoff weight	**1,764 lbs**
Useful load	**970 lbs**
Maximum speed with full load	**70 kt**
Cruising speed with full load	**54 kt**
Average fuel consumption	**25 U.S. gal/hour**
Maximum range, standard tank	**112 st. miles**

(Continued on page 36)

Armed with the SS-10, the Alouette can knock out a tank

U.S.S.R. Small Aircraft

SMALL AIRCRAFT play a large part in the day-to-day aeronautical life of the USSR, even if their performances are not the kind to make headlines. That most versatile of Russian designers, Alexander Yakovlev, has produced a number of these aircraft in addition to his achievements with single- and twin-jet fighters and helicopters.

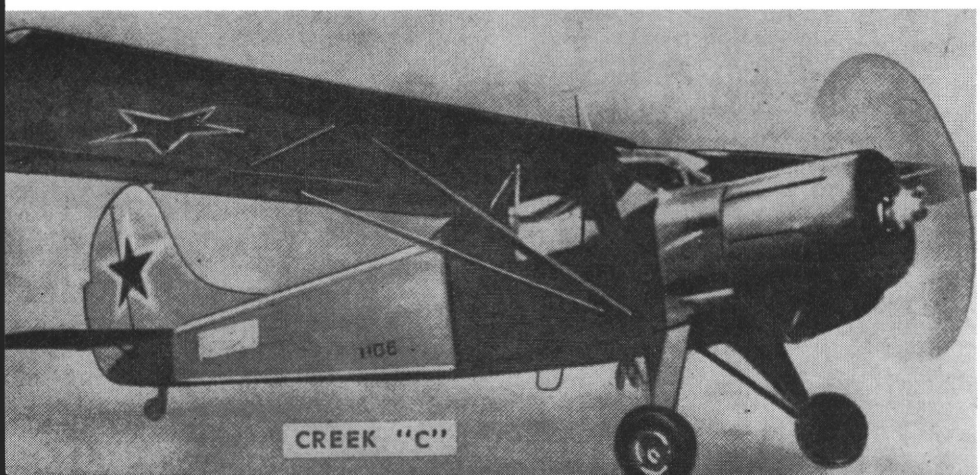
Yakovlev established his reputation—outside his own country, that is—during the Second World War, when he gave Russia the Yak-1, -3, -7, and -9 single-engined fighters. Each of these was a progressive development of the one before, and the wings and tail assembly remained, in shape at least, basically the same throughout. The shape of these units continues in the radial-engined Yak-11 ("MOOSE"), an uncommonly clean-looking trainer. It has been said that the Moose is probably the most widely used two-seat basic training aircraft in the world, next to the North American Texas or Harvard. The Moose is much the same size as the Harvard, not quite so wide a wing span (31 ft), and with a more powerful (700 hp) engine. In its time it has established several records officially ratified by the F.A.I., including three closed-circuit records and one for distance in a straight line. Nowadays it serves with the air forces of the satellite countries and Egypt.

Another Yakovlev primary trainer, the two-seat Yak-18 ("MAX"), bears a later military designation but has about it several features suggestive of an earlier design than the Moose: strut-braced tailplane, semi-retracted main under-carriage and a 5-cylinder radial engine with individual cylinder head cowlings. The first public appearance of the Max was at a Polish international trade fair in early 1948, and it too is in widespread use throughout the satellites, as well as with the air forces of Austria and Egypt. It is also used extensively by civil flying clubs. The standard version has a tailwheel-type under-carriage but a variant with a tricycle arrangement has been reported. The standard Max has a wing span of 35 feet and is 27 feet long. Like its stable companion it also has set up several F.A.I. records.

In 1944, Yakovlev initiated the design of a high-wing light aircraft, the Yak-12 (now known as "CREEK-A"). Like the Max, this type also had the "helmet" type of individual head engine cowling. It was succeeded by the Yak-12R ("CREEK B") which had an overall cowling, and later by the current production version, the Yak-12M ("CREEK-C") which has an extended fuselage and a redesigned fin and rudder with dorsal extension. The Creek in its several forms, which has been in series production since 1947, has been used as ambulance, air observation post, club aircraft, and sailplane tug as well as for military liaison, agricultural and forestry patrol duties, and fully justifies one paper's description of it as "Russia's leading light". It is a typical four-seat cabin aircraft of its class and has a span of 39 feet with a length (Creek-C) of 30 feet; top speed is about 125 mph.

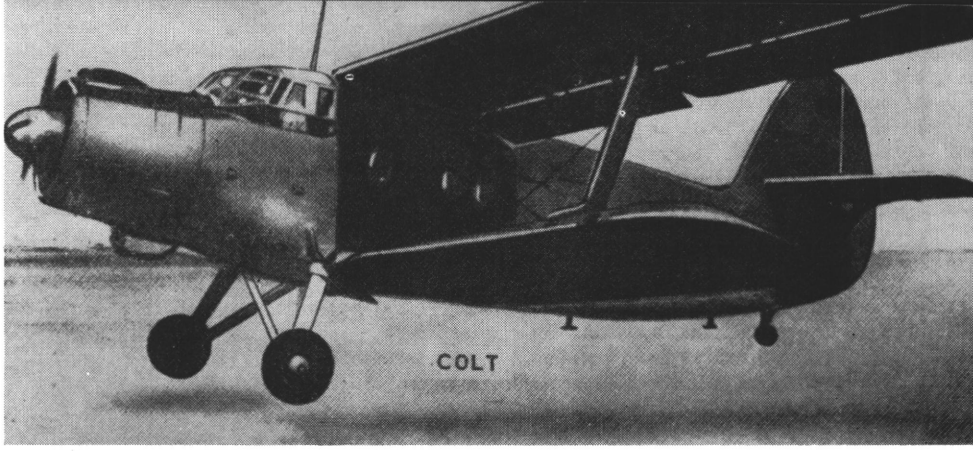
Another Russian designer who dabbles in "small fry" is Oleg Antonov, whose best-known venture in this field to date is the AN-2 ("COLT") a

Creek "C"—Russia's prime example in airplanes of this category

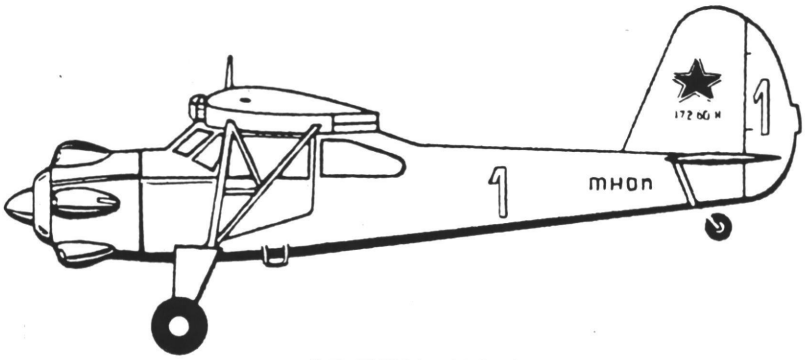


This article first appeared in the January 1958 issue of the Air Ministry Joint Services Recognition Journal.

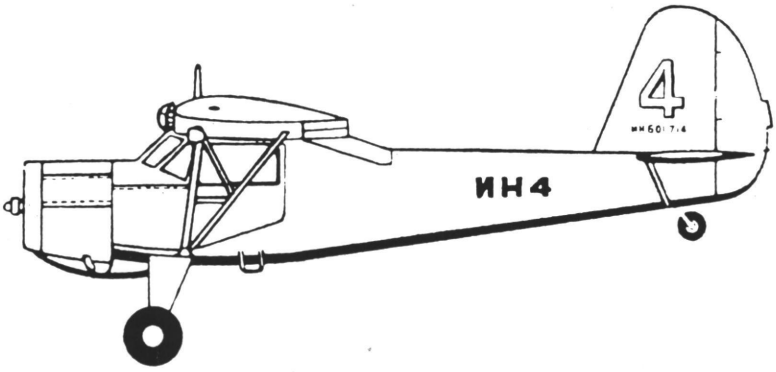
design which earned him a Stalin Prize. The Colt is the only biplane of modern design in wide military and civil use today, and it too has been used in a wide diversity of roles. Its prime military purpose is that of paratroop trainer, though use has been made of it as a V.I.P. transport and for liaison. A number are employed by Aeroflot for communications and cargo work as well as for agricultural duties and aerial survey. With a crew of two, the Colt accommodates 8 to 12 passengers or 12 to 13 paratroops. In addition to the standard Colt there are two variants which have important recognition differences. These are the AN-2V which has twin floats in place of the wheeled undercarriage, and the AN-2ZA, a special adaptation for high - altitude meteorological work which has an extra "glass-house" type cockpit built into the leading edge of the fin, presumably for observation purposes. An indication of the remarkable capabilities of this ugly but efficient jet-age anachronism is its setting up, in June 1954, of an official world altitude record for its class of 36,903 feet. The Colt has a wing span of 54 feet and is 34 feet long.



The Colt—only biplane of modern design in wide military and civil use today



CREEK "A"

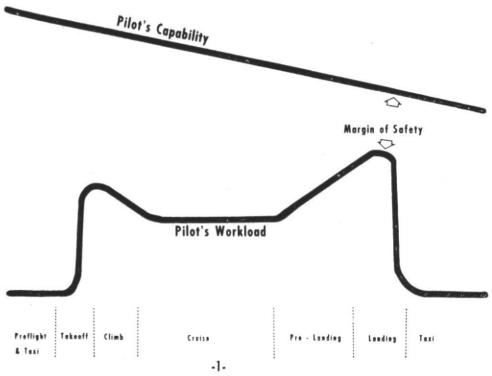


CREEK "B"

The latest Antonov design, the AN-14 Pehelka (which means "Little Bee") is a twin-engined high-wing design with twin fins and rudders and a top speed of about 125 mph. Designed to carry freight, mail, stretcher cases and similar loads, the Pehelka has about it very much the appearance of a dwarf-size edition of the British Beverley.

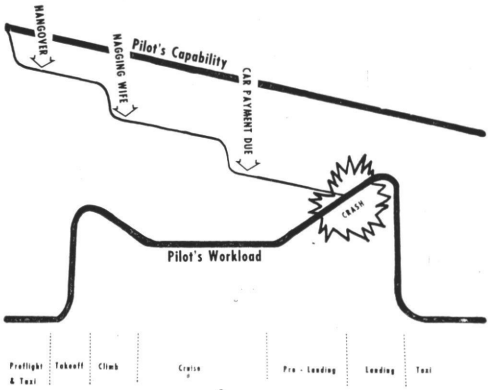
Richard E. Stockwell says in SOVIET AIR POWER: Russia has six air forces of which the Army Air Force (Volennye Vozdushyne Sily Sovetskoi Armii) is the largest. This Army Air Force probably accounts for 70 percent of the operational military aircraft in Russia and includes about 685,000 personnel whose mission is support of the ground forces. To ensure close coordination between air and ground forces, VVS-SA liaison officers are attached to ground force commands to assist with radio communications. The VVS-SA includes fighter-bombers (Flora), light bombers (Beagle and Beast), and a host of outdated types left over from World War II for close support as well as a short-range bomber force for interdiction.

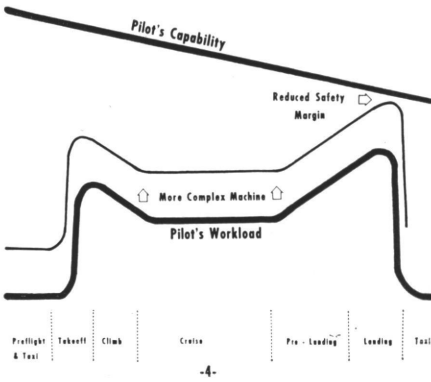
AN AVIATOR'S ABILITY to cope with any flying situation varies with the workload caused by each phase of flight. Aviation induces stresses and strains involved in few other occupations. Flying demands constant vigilance and alertness; it imposes situations which leave small margin for error. The following diagrams graphically illustrate the varying margins of safety between an aviator's capability and the workload imposed during all phases of flight.



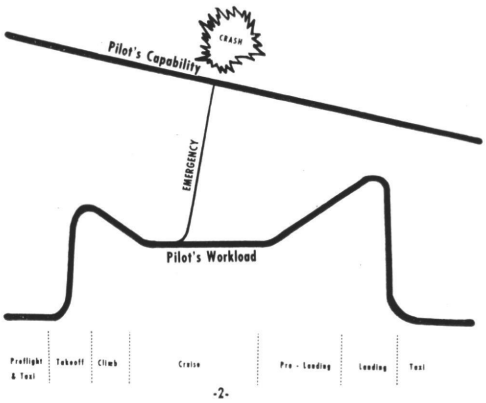
An aviator's capability is at the highest peak at the beginning of the flight. From there it assumes a constantly diminishing slope because of monotony, temperature, noise, hunger, and other fatigue factors. His capability is at the lowest point toward and during the termination of the flight.

An aviator's workload is not a constant factor, varying with each phase of flight.





Present-day demands for increased speed, maneuverability, and variety of missions for military aircraft result in more complex machines. More complex machines increase the aviator's workload. With no increase in pilot capability, the margin of safety is reduced.



An inflight emergency can increase an aviator's workload to a point that exceeds his capability. When this occurs, an accident is usually the result.

Flying places aviators in a totally unnatural environment. It requires concentration to maintain a level of capability that will exceed the workload. Personal problems — hangovers, nagging wives, overdue car payment — taken into the air can reduce an aviator's capability below the workload. When this occurs, accidents sometimes happen.

Aviator

Wo

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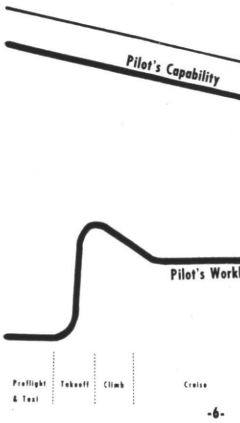

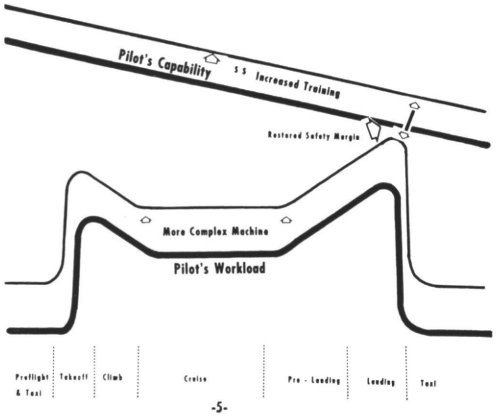

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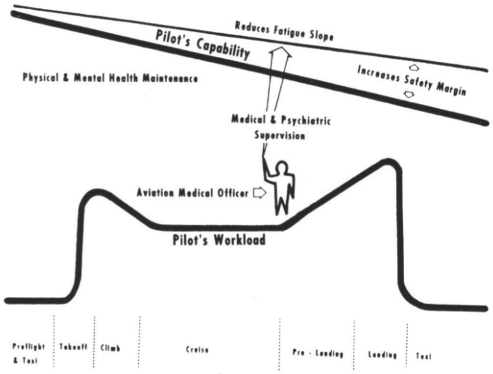
Increased workload and reduction in safety margin, caused by more complex aircraft, impose greater responsibilities for aviation training and supervision. The lost safety margin can only be restored through more thorough and comprehensive training to increase aviator capability.



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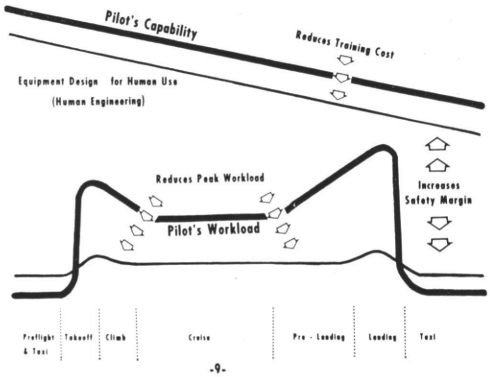
Aviator capability, greatly influenced by fatigue factors, can be improved through adequate physical and mental health maintenance. Responsibility for this improvement rests with aviation commanders and flight surgeons.

Capability vs Workload

Human engineering in the design of new aircraft and improvement of present-day aircraft can play a large part in reducing aviator workloads. Simplicity in design and ease of operation are the aims in this field. This can also serve to reduce training costs while increasing the safety margin.



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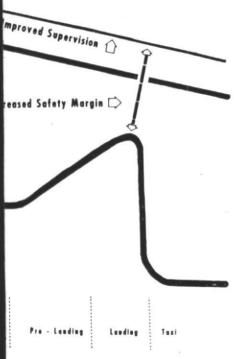
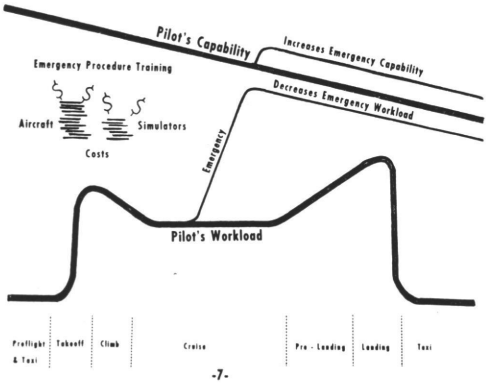
Research and development projects, designed to improve pilot environment, eliminate noise, and improve data presentation are important factors in equipment designed for human use. Success in these projects will increase capability, reduce workload and increase the safety margin. In this direction can be found greater capability for the man-machine combinations which make up Army Aviation.

ability can only be proved supervision





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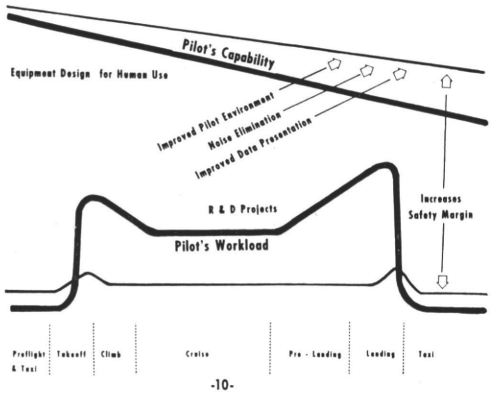
Ability to successfully cope with inflight emergencies is attained through emergency procedure training. This training serves to decrease the emergency workload and increase emergency capability. The cost of this training can be reduced by flight simulators.



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Army Aviation SCAMP

Brigadier General William B. Bunker, USA

THE PROPER BASIC philosophy and procedure for the performance of higher level maintenance of aircraft is a subject of considerable discussion and difference of opinion. The systems used in the military services and in commercial life vary considerably, depending upon the basic maintenance philosophy adopted by the organization. Each aircraft user has endeavored to establish a system which most economically meets the operational requirements of his aircraft and his fundamental maintenance pattern.

BASIC CONCEPTS

The Army, in its intimate association with the Air Force, has in the past six years operated under three basic maintenance concepts: the Depot Inspection and Repair (DIR) program, the Inspect and Repair as Necessary (IRAN) program, and the Standard Configuration and Modernization Program (SCAMP). Each of these programs in its lifetime underwent considerable modification in an effort to improve the level of customer satisfaction.

During the period 1949 to 1952, Army aircraft, at that time primarily the small observation fixed-wing types, were given depot overhaul under the DIR program. In this program, the aircraft was brought into an Air Force depot or contractor site and all the scheduled time-compliance maintenance operations were performed. The program's objective was to return to the user an aircraft in as near-to-new as possible condition and to ensure that no additional maintenance operations would be required when the aircraft was returned to its user.

Such an operation is quite normal in commercial practice where the maintenance facility is controlled by the owning organization and rather few aircraft involved. However, when contractors are used for large fleets of aircraft such as those maintained by the military, it was quite normal for contractors to change engines and components which still had a high proportion of their useful life remaining, and to perform other maintenance operations purely because they were chronologically indicated as necessary.

Many in Air Force maintenance management felt that this program was somewhat expensive and resulted in over-maintenance of the aircraft. However, there were many who felt that proper flexibility in the contractual document and careful judgment by the maintenance technicians at the contract site could easily have avoided such duplication or unnecessary work.

In 1952, the Air Force went to the IRAN concept of maintenance. Under this concept, the contractor determines what specific items need maintenance work and performs only that required maintenance. If a component is functioning correctly, it is not changed even though it will have to be replaced in a few more operating hours. During the past six years, this concept has been considerably modified, primarily by fiscal limitations. As a consequence, today there is a general tendency in the IRAN program to perform only that maintenance for which funds have been allocated without regard to whether such maintenance is necessary or not.

FUNDS CRITICAL

In FY 55, when maintenance money was quite critical in the Air Force, Army users often received their aircraft from IRAN with a long list of additional maintenance operations to be performed at the field maintenance level. Contractors prepared the lists to demonstrate to the user that the primary reason for not performing those operations was the contractual limitations of the IRAN specifications. In general, an austerity program in this type of operation tends to restrict the basic IRAN contract purely to the disassembly and reassembly of the aircraft and painting operations.

At the start of the past fiscal year the Army became responsible for depot level maintenance of its own aircraft in an effort to overcome the difficulties previously experienced in both the DIR and the IRAN

(SCAMP — Standard Configuration and Modernization Program)

programs. Additionally, certain operational peculiarities of Army aircraft were recognized and allowed for. Actually, our program, Standard Configuration and Modernization of Army aircraft, was designed first to bring the aircraft into a high degree of maintenance effectivity, to eliminate accrued deficiencies or discrepancies occasioned by unsatisfactory lower levels of maintenance, and to ensure the standardization program of Army aircraft to reduce the number of minor variations in aircraft supported from the spare parts system.

Brigadier General William B. Bunker, USA, commands the U. S. Army Transportation Supply and Maintenance Command in St. Louis. During World War II he was Deputy to the Assistant Chief of Transportation and in 1948 was in charge of terminal operations in the Berlin Airlift. He is recognized as a realistic advocate of the military use of the helicopter.

MODIFIED DIR

Basically, the maintenance portion of the SCAMP program is a modified DIR operation in which all time-compliance operations are performed, with certain limitations on the residual life of components to ensure that they are not replaced when only 15 or 20% of this service life has accumulated.

The second objective is to install all product improvement and modification kits which have been approved and procured prior to this time and not installed on the aircraft on the assumption that it was more economical to install these at the time that the aircraft was disassembled in the hands of a competent depot maintenance contractor.

Finally, we seek to restore the aircraft to its scheduled level of depreciation, as it had probably fallen below this level due to accumulated maintenance deficiencies.

This program was carefully designed to match the existing operational conditions of Army aircraft. It recognized that many modifications were necessary particularly in Army helicopters, to achieve the objectives of the product improvement program and to standardize, from a spare parts point of view, on one model the various series of our aircraft insofar as economically practicable. A high degree of maintenance competency on the part of the maintenance contractor ensured that at least once every three years the aircraft were placed in the hands of organizations competent to detect and correct the deficiencies which might have accumulated in three years of maintenance in the field installations of the Army, which have been traditionally undermanned, underequipped, and underfunded.

CONTRACTOR SUPPLY

One additional element of the SCAMP program important in analyzing this problem is that the SCAMP contractor would be expected to supply, either by manufacturing himself or procuring from other sources, any components or parts not normally stocked in the Army's supply system.

Since the Department of Defense had directed the Army not to establish its own facilities for the performance of these higher level maintenance operations, it was felt desirable, insofar as was practicable, to eliminate from the Army's supply system any parts which were solely procured for supply to various contractors. Most competent fifth echelon contractors should be able to manufacture or procure the necessary parts in ample time to meet their delivery schedules.

CURRENT SITUATION

During the first year of the SCAMP program certain basic difficulties arose. In the first place, the performance specifications made available to us were IRAN-type specifications and required considerable modification to carry forward the SCAMP and other Army concepts. Problems arose with the contractors concerning the exact scope of the work expected of them and the amount of work they were expected to cover under the basic terms of the contract, as opposed to "over and above" operations. Nonavailability of basic parts information, the dispersed locations, shortages of many tech order compliance kits which had been lost by the users, and other problems inhibited smooth performance.

The program was started quite late in the fiscal year due to the necessity to await the allocation of funds, difficulty and mistakes in securing our first contractors, and many other similar problems. At the same time, the single year nature of our funds required us to place a large number of air-

craft in the hands of the contractors at one time to ensure that the work could be performed with the available FY 58 funds.

Consequently, there were many slippages in delivery of aircraft back to the owning organizations and a considerable amount of customer dissatisfaction over the period which aircraft were held out of service at the SCAMP site. Customer dissatisfaction was aggravated by the failure of the contractor under the IRAN-type specifications to perform many lower level maintenance operations, which required the user to place the aircraft in his shop for further work just after they had returned from the contractor. On the other side, however, some 520 Army aircraft were passed through the SCAMP cycle at an average cost of about $5,000, and the general level of maintenance of Army aircraft was unquestionably raised.

Based on the experience of the first year's operation, every effort was made to initiate the FY 59 program in a more orderly fashion. Complete SCAMP-type specifications were prepared for each of the standard aircraft in our fleet and provisions established for maintaining these specifications in a current condition.

INVITATIONS ISSUED

Invitations for bids were sent out to qualified bidders early in the fiscal year, and determined efforts were made to award the contracts during the first quarter of the fiscal year. Due to a decision to eliminate the requirement for a performance bond, these requests for proposals had to be withdrawn and this objective was not accomplished. It is expected, however, that the contracts will be awarded in the second quarter of the fiscal year if sufficient funds are available.

In an effort to avoid accumulation of aircraft at the contractor's site, the new scheduling calls for immediate delivery of one aircraft to each contractor in order that he may properly plan his production workload and arrange the delivery of contractor-furnished parts to support the program. This, together with more experience as to the range and types of items to be required from a contractor and a better control over the supply of parts from the Army supply system to the contractor, where they are available, should eliminate the major sources of delays.

PROGRAM SUPPORTED

We have contacted the recipients of aircraft SCAMPed under the first year's contract and our contractors, through visits and correspondence. Manufacturers and other services were queried in an effort to determine those areas in which our operations could be improved to increase customer satisfaction. In general, all customers concur in the necessity and desirability of this program. If the major difficulties experienced in the first year are eliminated, it should result in a satisfactory program.

The major point of dissatisfaction raised, however, is the IRAN concept of returning aircraft with many necessary maintenance operations unperformed. Field commanders and users alike express the opinion that an aircraft held out of service for 30 days, and for which an expensive ferry flight to and from the contractor's site has been assimilated, should be returned to the user capable of operating for a considerable period without additional local maintenance.

During Fiscal Year 58, 3.2 million dollars were expended for SCAMP, an additional $400,000 for crash damage, and ¼-million dollars for modification of Army Aircraft under the Depot Repair Program. This figure is contrasted with the original estimate of 7.6 million dollars for this program, based on Air Force experiences and estimates. During the fiscal year, approximately 70 percent of the aircraft scheduled for SCAMP were passed through this program, which indicates that the midyear revision of the program to approximately $5,000,000 for SCAMP and crash damage was probably reasonably realistic.

Our original Fiscal Year 59 estimate for SCAMP and modifications was 12.5 million dollars, which was reduced to 5.25 million for SCAMP and no allowance for modifications of aircraft. After further reductions, our present program stands at only 4.2 million dollars.

While none of this money has been obligated to date, we must continually readjust our basic SCAMP program downward in order to absorb within this figure expensive modification programs. As a consequence, we have considerable confusion in aligning with our prospective contractors as to the quantities of aircraft under this program.

FUTURE PROGRAM

In considering the proper program for the performance of fifth echelon maintenance, certain definite peculiarities of Army aircraft should be considered.

The echelon of maintenance to be performed on Army equipment is specified in the maintenance allocation chart developed in coordination with the Transportation Corps, the using arms and services, CONARC, and the Army Maintenance Board. It is interesting to note that, other than components which are returned for fifth echelon time compliance maintenance, most aircraft show very few uniquely fifth echelon maintenance functions performed except to repair damage to the airframe from accidents or mishandling. It should also be recognized that most maintenance operations on aircraft are of the preventive maintenance category; that is, inspections are conducted at periodic intervals to ensure that the elements and parts will continue to function satisfactorily for an ensuing period of operation, or to remove parts which have been subjected to incipient fatigue damage.

ECHELONS OF MAINTENANCE

Normally, aircraft maintenance is echeloned chronologically to subject it to these and more precise diagnostic-type equipment. Under these circumstances, most maintenance operations are conducted at all five echelons of maintenance with varying degrees of care and fineness.

If a policy were established which eliminated from fifth echelon maintenance any functions which could be performed either before or after that operation at a lower level of maintenance, practically no maintenance except repair of damaged elements would be conducted. However, to determine whether such damage had been experienced would require extensive disassembly of the aircraft for inspection. Under these circumstances, considering also the chronological echelonment of maintenance inspections, it is logical and economical to perform at the SCAMP site all maintenance which has become due or will shortly become due on the aircraft without regard to where such maintenance appears on the maintenance allocation chart.

Considering the cost of a hundred or more aircraft in the hands of maintenance contractors, coupled with the cost of delivery of these aircraft to and from the maintenance site, it does not appear logical to defer or omit operations which will lead to the grounding of the aircraft on its return to the using activity. In view of the production line nature of their operation and their more highly skilled personnel, it is reasonable to assume that maintenance operations of any echelon performed by a maintenance contractor will be at least as economical as the performance of these same operations by a military or civilian operated maintenance shop at an Army post, camp, or station.

CHANGES LIMITED

Engineering Change Proposals, approved by the Department of the Army Engineering Change Proposal Board on Army aircraft, are primarily confined to those required to eliminate unsafe conditions of the aircraft or, as a result of the product improvement program, to decrease the total operating and maintenance costs.

In general, these approved changes result in the procurement of kits which are installed to accomplish these changes. Under previous policies, these kits were distributed to the location of the aircraft, but for a variety of reasons they have seldom been installed in more than 30 or 40 percent of the cases. Failure to install these kits results in confusion in the spare parts system and an inability to establish standard spare parts supply programs to support military operational plans. In view of their impact on the modernization and standardization program, ECP incorporation at the time of the SCAMP contract is desirable and economical.

CONCLUSION

Sufficient funds must be contained in the Depot Repair and Modernization Program to ensure the completion of this program, since continual failure to bring aircraft to a standard results in dissipation of other maintenance and supply funds. While programs have been established for the installation of new kits through the use of the fourth echelon shops at the general depots, this program cannot be completed for several years due to accumulated backlog and the time required to build up their facilities and skills.

Frequently multiple changes can more economically be accomplished at the time of SCAMP in programs requiring the installation simultaneously of several ECPs, such as involved in the automatic stabilization equipment, troop seats, battery relocation, and other changes currently programmed for the H-34 helicopter.

It is our feeling that the Army has, in the SCAMP program, developed a logical and economical method of keeping its aircraft in the best possible condition.

Memo from Flight Surgeon

- **COCKPIT DAZE**
- **MY BUDDY**

WHAT CAUSES an aircraft accident, when both the aircraft and the pilot appear to be in perfect working order? Even more important, what can be done about it?

Sometimes the reason is—and it can be a dangerous one—fascination. It might be called other names: cockpit hypnosis, fixation, or even asleep-at-the-switch. There are two important factors involved in fascination.

COCKPIT DAZE

You may have been looking at the wrong instrument at the wrong time. You may have taken a reading from the radio compass indicator instead of from the slaved gyro. You may have had your head in the cockpit when you should have been scanning the horizon.

The second factor—and just as important—is that of looking at the right object but taking the wrong action or no action at all. Such a case might be an improper or inadequate instrument cross-check. It might be just plain daydreaming. We are sometimes so intent on doing a bangup job that we find ourselves concentrating on many things at the same time. Occasionally, we leave out the very thing necessary for perfection or safety. We might find ourselves flying a perfect heading and rate of descent on a GCA, but our airspeed has fallen off and . . . here comes the crash crew!

Why does fascination, or fixation, or cockpit hypnosis take place? To operate efficiently we must be able to focus our attention where it is needed and when it is needed. We must take in all the sights and use only those that are necessary to accomplish the job we're doing. What causes a pilot to become hypnotized by a particular instrument, target, or light? Why do we become "stare crazy"?

As we look around, it's natural to take in first the sights that catch the eye: colors, contrast, movement, or simply those things which are the least difficult to distinguish.

Many sights compete for our attention at the same time. Which one should we pick? As we gain experience, we learn to select those which will do us the most good at the time, depending on what we're trying to do. It's certain we can never use all that nature puts in our way. Only through training and experience can we become proficient in using those resources properly. To tie it up neatly, we've got to pay attention to what we're doing! It's as simple as that.

Aviators who fly around in a daze are looking for trouble; unfortunately, other people sometimes get hurt.

Daydreaming uses up precious moments which should be devoted to something more important. A long delay in cross-checking instruments can result in disorientation, such as getting off course, altitude, airspeed, or attitude. Failure to scan the skies frequently might result in a mid-air collision. That second or two devoted to fascination robs us of a second or two which we could use for decisions or reaction time.

The drone of the engine or a monotonous radio signal tends to hypnotize us, particularly on long, straight-and-level flights. Mentally, we get sluggish; things happen so slowly we are unable to operate properly. The interest lags when we're not busy doing things. This is the cause of many automobile accidents on long, straight stretches of highway. That's when drivers fall asleep at the wheel and crash head-on into an oncoming car.

At night, flashing or rotating lights might sidetrack our senses. Can we afford to have our attention diverted while on final approach for landing?

Now that we know what the problem is, how are we going to solve it? Records show it to be more evident among the very inexperienced pilots. The answer then must lie in training and in the development of good flying habits. Are you building the right habits?

Attentiveness is something that has to be learned. Try explaining nuclear fission to a 4-year old and you'll notice he loses interest immediately because it means nothing to him. As we fly more and more, we learn that our time must be divided, so much inside the cockpit and so much looking out.

But let us not become overconfident. Let's not let experience go to our head. The minute we do this, we relax and become a perfect target for hypnosis or fixation. The natural reaction is to duck when you're a target for something unpleasant or dangerous. There is no way to duck this problem. You have to lick it. To quote some overused but still up-to-date advice: STAY AWAKE AND STAY ALIVE.

MY BUDDY

So you think the flight surgeon is an ogre, out to get your flight skins? If that's how you regard this man of mercy, put your fears to rest. It will help to read this account of the dedicated work that goes into keeping our aviators flying.

A 36-year-old pilot had been flying jets for 2½ years. He was getting about 350 hours per year in an all-weather CF-100 squadron. During his entire time in jet aircraft, he suffered from a persistent illusion that his aircraft was flying in a left bank when on instruments. Shortly before he came under scrutiny of the flight surgeon his anxiety had increased, despite his frequent use of the autopilot. At times he felt he could no longer stand the emotional strain to which he was subjected when flying under instrument conditions. He asked to be removed from jet flying, stating he could not make another trip in a CF-100 aircraft.

The pilot was grounded for a complete examination and study of all aspects of his case. A thorough physical examination revealed that, although his physical state was basically satisfactory, his muscular tone was very poor. He consumed an excess of alcoholic beverages at frequent intervals, although not daily. He was a heavy smoker. It appeared he had serious marital problems, although he was unwilling to discuss them.

A medical review board was convened with the commanding officer of the station, the officer commanding the squadron, and the senior flight surgeon. After a careful review of the case, they decided to attempt to salvage this pilot and to test a proposed 4-week spacial orientation and indoctrination. The program was coordinated by the senior medical officer and consisted of these points:

A course of physical training for 2 hours per day, with testing to measure progress at the beginning, the middle, and the end.

A daily brisk walk of 4-5 miles.

Abstinence from alcohol.

Supervised high protein diet.

Reduction in smoking.

Six hours of lectures and discussion with the flight surgeon to give the candidate a thorough knowledge of vestibular physiology, and ability to analyze the common causes of spacial disorientation.

Discussion by the senior medical officer of the entire problem with the candidate's wife in order to obtain her understanding and cooperation.

A 20-minute daily program of active vestibular training during the last 2 weeks of the course. (The trampoline which would have been ideal for this purpose, had not yet arrived; so tumbling was substituted.) The candidate's head was rotated rapidly and frequently through every possible maneuver to induce disorientation and to gradually increase resistance to the development of disorientation.

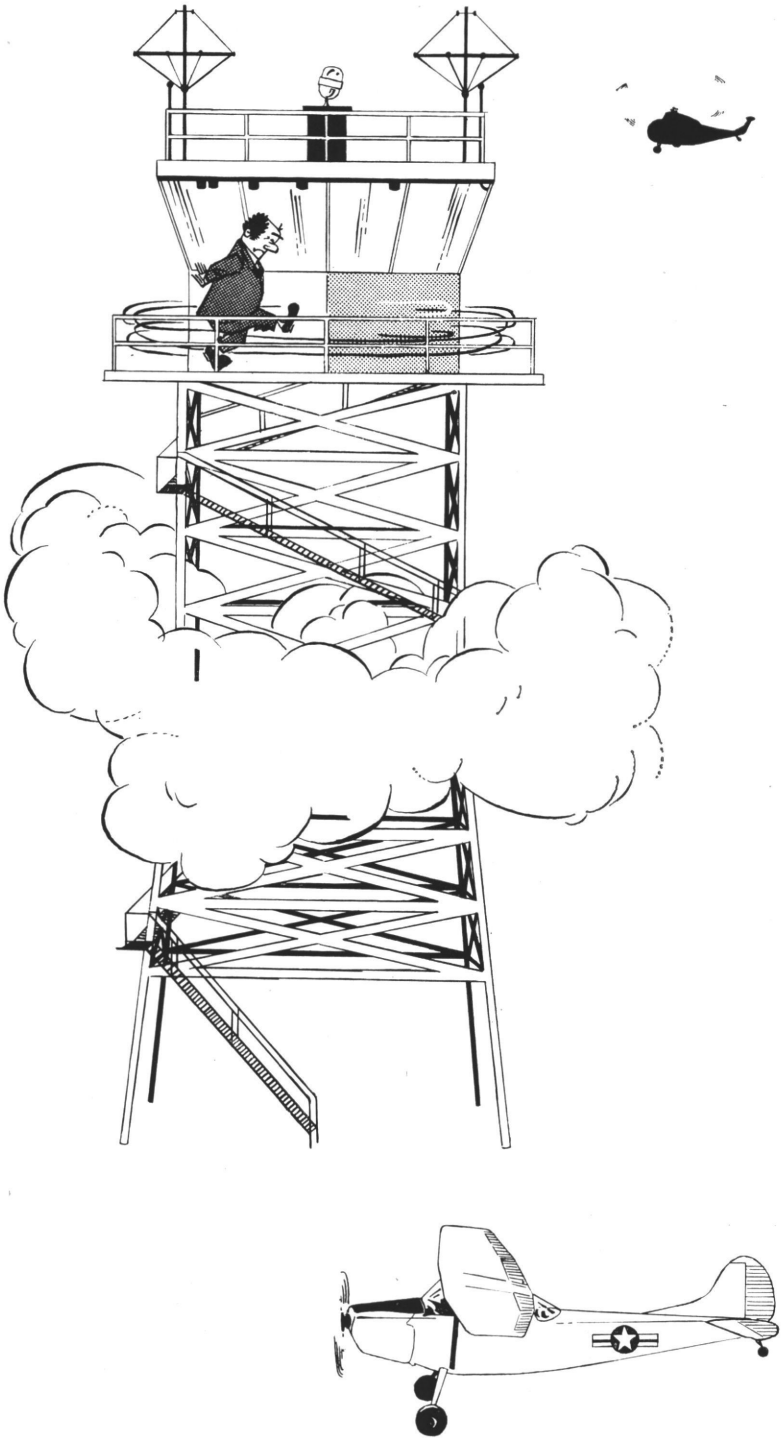
A daily program of flying in T-33 or CF-100 Mark III aircraft with another pilot in all-weather conditions, or flying the CF-100 Mark V under VFR conditions only.

Following the course another station medical review board was convened. The candidate's physical condition had improved 100 percent, from 17½ percent to 34.16 percent of the standard. His attitude towards jet flying was greatly changed and he was now anxious to continue jet flying.

It was decided that this candidate's disorientation was due to the reverse oculo-vestibular reflex phenomenon. His disorientation was probably caused by repeated turning of the eyes to examine clouds when flying under IFR conditions. This probably upset the central portion of the oculo-vestibular reflex, which, in turn, caused the illusion of flying in a left bank. A pair of "blinders" was constructed to prevent him from unconsciously looking to the left when flying in clouds.

Does this sound like an ogre trying to stop a man's flight pay? The resultant report read: "The result of these measures is that this officer is now flying regularly under all conditions."

FOR



CAGED IN glass prisons, control tower operators seldom come face-to-face with other aviation personnel. Because of this, they fall into an unheralded existence and rarely meet the aviators they aid until some quick-tempered birdman climbs the winding ladder to air his beef. Frequently, these beefs could be eliminated by a little effort on the part of pilots and other aviation personnel to understand the complex problems that face tower operators. Cooperation and coordination will effect safer and more efficient airfield control.

CHATTERBOXES

One frequently encountered and needless nightmare which develops stomach ulcers in the most iron-nerved tower operator is flooding available radio channels with unnecessary radio chatter. This yakkety-yak renders tower operator aid and control absolutely useless. It is not confined to the air around training fields, but can fre-

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

GOTTEN MAN

quently be heard around those airfields where only experienced pilots fly.

The causes are usually very simple: failure to tune receivers when switching channels; failure to keep volume adjusted to an audible level; a disconnected jack plug; full description of the terrain below or lengthy discussions of the night before that are given over intercom, but strangely are audible to all receivers within range; or, most frustrating, those who key their mikes before they engage their thinking motors (this frequently comes out as "ummm-----ah-----" and so on).

Then come the gripes: "I started calling 15 miles out! What's the matter with your receiver? You guys sleep all the time?"

This is a matter for radio discipline, mostly self-discipline. It can be cured only through courtesy, monitoring of channels before transmissions, and thought before verbal action.

THE BROAD VIEW

What you, as Army Aviators, see from your position isn't always an over-all view. Between the time you call for landing instructions and the time you enter traffic, situations around an airfield can alter drastically. Though you don't always see the other aircraft in the pattern, the tower operator usually has a good reason (your welfare) for asking you to leave traffic or take it around. Quick compliance, rather than an angry retort or a gripe about the guy who cut you out on base leg, will get you in faster and safer every time.

Waiting for clearance at the end of the runway, aviators often feel that **they** are really the forgotten men. Unfortunately, this is a condition which must be lived with for the present. Repeated calls to the tower will only delay your clearance rather than speed things up.

The day may not be far away when electronic equipment will replace the methods presently used to accomplish administrative work in Army towers. Until that day, however, patience and understanding will effect the fastest, most efficient operation.

HELP WANTED

So far, we have discussed those actions of other aviation personnel which hamper control tower operators. Now, let's put the shoe on the other foot. Vital and important though their role is for efficient aviation operations, very little is written about or heard from control tower operators. Certainly control tower operators are in one of the best positions to observe Army Aviation and note its shortcomings. Why then, don't we hear an occasional word from these forgotten members of the aviation family?

You needn't be a Shakespeare or a Hemingway to make an important contribution. When you observe any part of aviation that's not as it should be, or could be improved, it takes only a moment or so to jot your thoughts on any convenient scrap of paper. These can be typewritten, handwritten, or sent in smoke signals as long as they receive the attention they deserve.

May we submit that the U. S. ARMY AVIATION DIGEST is an excellent medium for airing your thoughts? Direct communication is authorized with the editor.

Cockpit remains of Beaver making low-level supply drop and a downwind turn

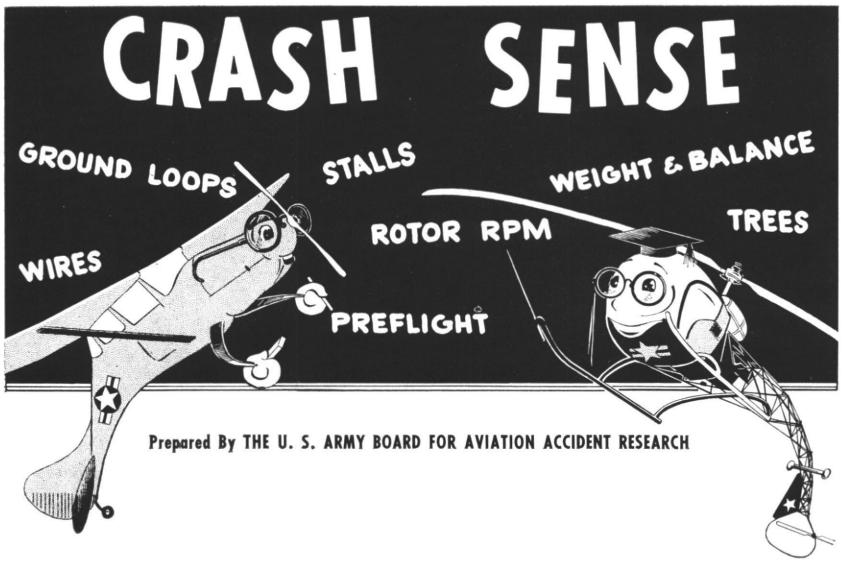
Scratch one Bird Dog due to apparent effect of speed going downwind

- **DOWNWIND TURNS**
- **TESTS**
- **ROTOR RPM**
- **FUEL**

GROUND PERSONNEL hastened to mark the area with white and red signal flags when they heard the Beaver approach. The pilot circled the campsite beside a river to determine the best approach route for a supply drop. He then lined up and began his drop runs. On the third drop, the aircraft got below the level of the trees, and the pilot had to follow the river to gain altitude.

During the fifth run, the Beaver came in low and the pilot attempted a steep turn to the left. The wings snapped level during the turn and the aircraft began to settle. Ground troops heard full power applied and the engine appeared to respond immediately. The right wing struck a treetop and was sheared off; the aircraft crashed through the trees and smashed into the riverbank, bursting into flames. The aircraft was demolished, and pilot, copilot, and three passengers received fatal injuries. At the time this pilot began the steep turn, the wind was directly on the Beaver's tail.

An instructor pilot, wishing to practice rear-seat flying,



took off with another pilot in the front seat. During the flight, the aircraft was observed executing basic maneuvers in the training area. Another pilot saw the Bird Dog circle a small pond at low altitude. The left wing dropped during a downwind turn. The aircraft straightened out momentarily, then crashed into the ground at the edge of the pond; it caught fire on impact. Rescuers were unable to remove either pilot.

Another Bird Dog pilot took off crosswind, passed over the camp, and began a climbing turn to the right. After 90° of turn, with the wind at its tail, the aircraft stalled. The pilot attempted a stall recovery, but noted that his flight path would take him dangerously near the camp and ground personnel and began a turn to the right over a river.

At this time, the pilot pulled 45° flaps. This aggravated the stall condition; the aircraft settled and struck right gear and wingtip on a sandbar. It bounced, continued forward for several feet, struck pilings with both wings and flipped over in 5 feet of water. The pilot sustained multiple contusions and abrasions.

Downwind groundspeed can fool you into believing you are wealthy with airspeed. It makes you steepen up your bank, confident that your apparent airspeed will see you through the turn. Remember the steep eights around pylons your instructor used to insist on practicing? Remember the rectangular patterns you were taught to fly? Inherent dangers involving downwind steep turns at low airspeed and low altitude are taught, practiced, retaught, practiced, taught again and practiced, yet . . .

TESTS?

The purpose of test flights is to put aircraft through their paces and determine whether they are safe for other aviators to use. In some instances, the aircraft passed their tests with flying colors, but the test pilots . . .

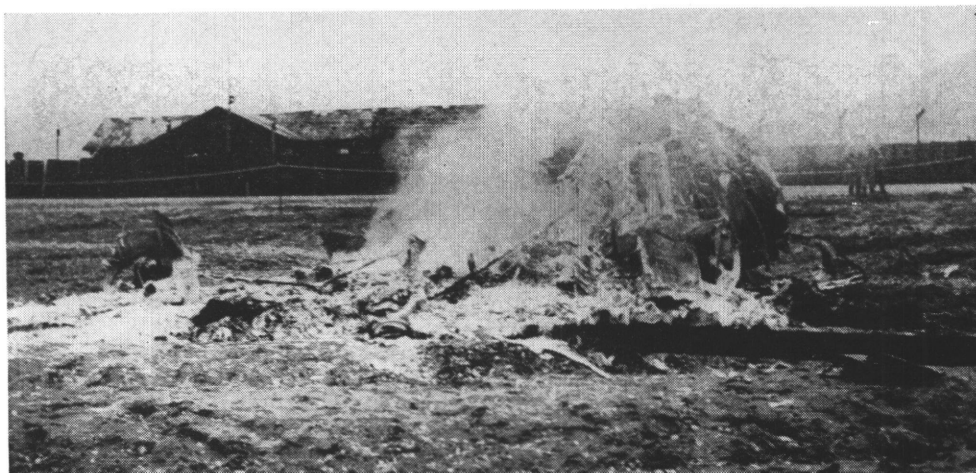
A Chickasaw test pilot flared steeply during a hover. The tail rotor blades struck the ground, shearing the tail rotor shaft and causing loss of directional control. The aircraft struck the ground, bounced back into the air, settled again and crashed.

A Bird Dog test pilot, flying from the rear seat, took off from the edge of the runway to avoid mud and slush. He completed maneuvers to test the engine and entered traffic to practice wheel landings. During the fourth touchdown, the aircraft struck several landing lights, damaging the right landing gear and cabin bulkhead.

WHY SEE THE FLIGHT SURGEON?

You drop in on a landing, spread the gear and damage the propeller. Why see the flight surgeon? You back the helicopter into some bushes and damage tail rotor blades. Why see the flight surgeon? You lose directional control and ground-

Steep flare while hovering



The Flight Surgeon could have told him

loop. Why see the flight surgeon?

The student pilot touched down for his fifth landing, released back pressure and the aircraft began to swerve to the right. This student pushed in left rudder, held it too long and the Bird Dog swerved to the left. Too late, he kicked in right rudder and brake. The momentum of the swerve caused the right wheel to break off, and the lower end of the landing gear dug into the runway. The aircraft flipped over and came to rest inverted. Other than injured pride, the student appeared unhurt. He was indignant at having to report to the flight surgeon.

One of the questions asked by the flight surgeon was, "How long had you been flying when the accident happened?" The answer was 2½ hours — not long for a rated aviator to fly without rest, but **very** long for a student with few hours.

Another Bird Dog pilot made a normal three-point landing. The aircraft rolled 50 feet and swerved to the left. The aviator was late applying rudder and brake to correct and failed to regain directional control. Unable to go around because of a parked Chickasaw, he slammed on full right brake and rudder and purposely ground-looped. The aircraft was damaged slightly and the pilot received no injuries. He reported to the flight surgeon, and it was found that he had flown more than 23 hours during a 3-day period. This was too much, even for an experienced pilot.

Far more serious was the case involving an overdue Beaver pilot. An all-out search was started, and the demolished aircraft was found with the aviator's body still inside. The wreckage pattern indicated that the aircraft had crashed in a power-on spiral at a high rate of speed. Pathological examination proved that the pilot had a 60 percent saturation of carbon monoxide. This, coupled with marginal weather and darkness, is believed to have caused vertigo which resulted in the crash.

If **you** are called on to visit the flight surgeon after an acci-

The pilot had a 60 percent saturation of carbon monoxide

dent, do it cheerfully. Your case may contribute another shred of evidence in an extremely worthwhile cause.

ROTOR RPM

The aviator and his passenger were on a reconnaissance flight in a Sioux equipped with litters. En route the pilot demonstrated typical helicopter approaches to his passenger. He made several hovering maneuvers in the vicinity of a small lake, then followed a winding road for a short distance. The pilot then turned downwind over the road at an altitude of 30-50 feet, at an airspeed of 45 mph, to demonstrate a tactical approach. The wind was 10 knots.

The pilot flared to reduce his airspeed and made a controlled descent down to 10-15 feet. At this point, the Sioux began to settle and vibrate. The aviator lost control. Continuing downwind, the Sioux drifted to the right in the direction of shrubs and small trees along the edge of the road. The pilot applied left aft cyclic and right rudder, and, as he settled closer to the ground, he added pitch. This corrective action proved fruitless and the tail rotor struck the ground. The helicopter rose momentarily, swung its tail to the left, settled to the ground and rolled to its side.

The passenger cut his hand on the shattered plexiglass as he escaped through the door and heard the sound of gasoline igniting. The pilot remained inside to cut off the switches, threw the fire extinguisher to his passenger, and then climbed out. Attempts to extinguish the flames were unsuccessful and the aircraft burned. The helicopter is a versatile machine, able to land and take off from almost anywhere, **providing rotor rpm is maintained.**

The helicopter can take off and land almost anywhere

FUEL BLINDNESS

Sleight of hand and legerdemain have proved that all things are not always as they appear to the eye. It doesn't take a magician, however, to remind an aviator of this, especially if he happens to be one of those pilots who has mistakenly assumed that the fuel flow stoppage of a draining fuel filter is a sign that the drain valve is closed. If he does . . .

The Beaver, on a routine passenger pick-up, was in the air 30 minutes when the pilot noticed the fuel pressure light on. He changed from the rear tank to the center tank and operated the wobble pump. Realizing the possibility of engine failure, he made a 180 for an airfield some distance back.

Suddenly, the engine temporarily cut out and then ran erratically. The pilot was afraid he would be unable to reach the field and he decided to turn toward a large abandoned airport. He found that a heavy forest lay between him and the airport and decided to land where he was rather than try to fly the crippled Beaver across the several miles of forest. He turned the fuel selector to all tanks, and a passenger operated the wobble pump.

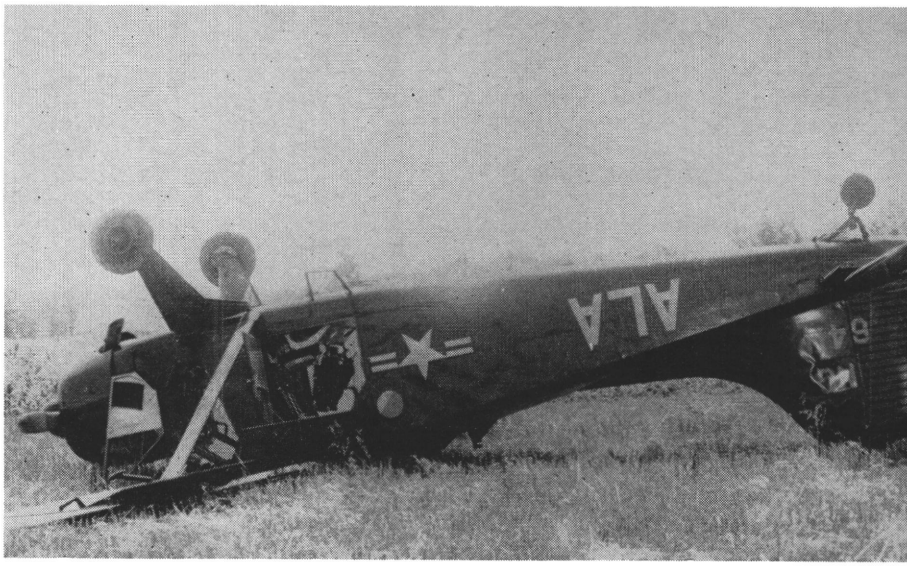
Many good fields were located in the area, and several weeks without rain minimized the possibility of deep mud. The pilot selected a recently mowed oat field and proceeded with an approach into the wind. Pulling 60° flaps, he started his final with the field well in front. The engine suddenly caught briefly, causing an increase in airspeed, and the aircraft floated almost the length of the field.

He finally set down in a three-point attitude but with excessive speed. Seeing a fence looming across his front, he then decided to ground-loop. The wheel dug into the soft ground as he began his turn, and the Beaver went over on its back. Neither of the occupants was injured, but the aircraft was damaged extensively. Investigation disclosed the main fuel delivery line filter drain had been left open.

On the L-20 (see DA Safety of Flight Message 386850), the drain valve of the delivery fuel strainer is a positive lock open

or closed type. With the fuel selecter in the off position and the delivery line strainer valve open, only fuel in the strainer will drain. As the strainer becomes empty, fuel flow stoppage has been misinterpreted as an indication that the valve is closed. With the delivery line valve in the open position, turning the fuel selecter to a full tank will result in fuel running out the delivery line strainer, causing fuel starvation.

Past tests indicate switching tanks and use of wobble pump after fuel starvation, with delivery line strainer valve open, will not give sufficient fuel pressure for continued engine operation.



A bent connecting bolt caused the failure that resulted in this crash

WATCH YOUR WEIGHT

Old Dobbin lets you know when he's overloaded by squatting in the traces and refusing to budge. Your aircraft won't react in the same fashion; however, from its action there will be little doubt in your mind that you should have made two trips instead of one.

The pilot watched his Sioux being loaded. As he entered, gross weight was in the neighborhood of 2,300 pounds. Density altitude was estimated to be 6,200 feet. The pilot brought the Sioux to a hover without any difficulty. In order to take advantage of the nearest dropoff, the pilot began a 180° hovering turn to the right. During the turn, a drop in rpm was experienced and the pilot attempted to land the Sioux back on the pad. All this time he was experiencing difficulty controlling the turn. During the landing attempt, a skid slipped off the landing platform. The aircraft dropped to the right, tail low.

As the Sioux continued turning to the right in a tail-low attitude, two loud reports were heard as the vertical fin struck a stump. The aviator applied forward cyclic in order to fly into a clear dropoff area where he could regain rpm and airspeed. The helicopter continued to turn at an increasing rate until it struck trees. Upon strik-

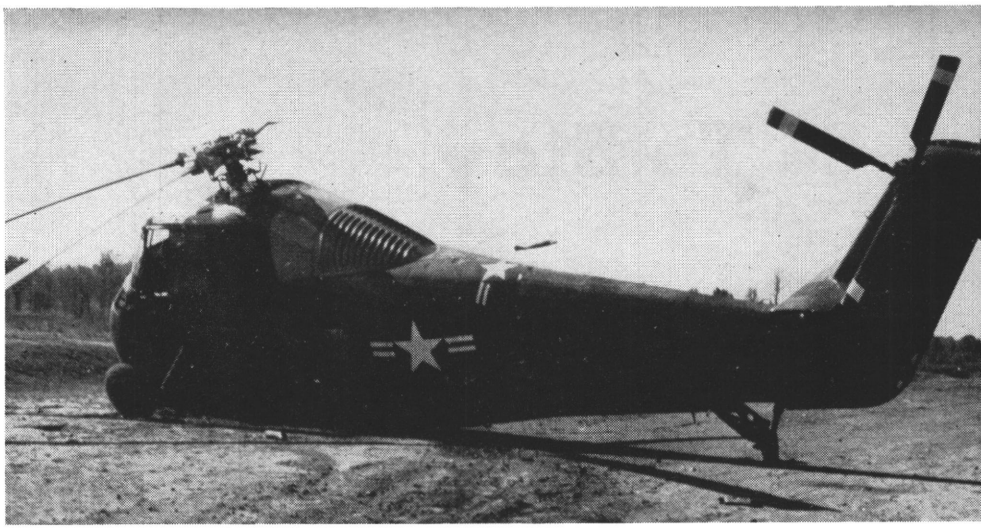
Overloads can make you weight conscious

DA Safety of Flight Message 386850 spelled it out

ing the trees, all control was lost, and the Sioux came to rest on its side, a total loss. Fortunately the pilot and passenger suffered only minor injuries.

Another Sioux was picked up and hovered to the takeoff position. It was near gross weight, and density altitude was 2,800 feet. The pilot turned the helicopter into the wind and proceeded toward the best takeoff path, which took him over a small lake. He noticed that rotor rpm was slightly low as he reached the edge of the lake. He reduced pitch and increased throttle, attempting to regain the lost rpm. This action failed to correct the loss, and the Sioux settled into the lake. The pilot used all his pitch to get as close as possible to shore, then rolled the Sioux over on its side upon second contact with the water. The pilot and passenger escaped without injury, but damage to the aircraft exceeded $16,000.

Unknown to the pilot, the Beaver was loaded beyond its allowable gross weight. As he reached an altitude of 75-100 feet, the aircraft pitched up. With full application of forward stick and down elevator trim, the Beaver returned to a normal climb attitude. As he advanced the throttle, however, the Beaver pitched up again. Retarding throttle, he announced he was going to make a forced landing, selected a landing site and began his approach. Touchdown was made in a three-point attitude. The aircraft rolled 330 feet and struck a ditch. It then bounced and struck another depression and finally nosed over and came to rest on its back.



Result of gross load and density altitude

Dobbin wasn't temperamental. He just darn well wasn't going to pull an overweight. Your aircraft isn't temperamental either, but it may get you off the ground with more than you should be carrying and balk at a critical time.

"FOR WANT OF . . ."

"For want of a nail, the shoe was lost; for want of a shoe, the horse was lost; for want of a horse, the battle was lost!"

The Choctaw pilot took off for a test flight after a periodic inspection. Also aboard were a copilot and crew chief. Following several maneuvers, the pilot made a 180° autorotation and landed. As the left gear touched the ground, the lower shock strut universal broke at the upper attaching point to the oleo strut and the aircraft lurched to the left and nosed forward. The wheel hub and arm immediately rotated 180° from the forward momentum of the aircraft, allowing the left front of the engine compartment to strike the ground, jamming the throttle control cable. With no power available, the pilot watched the aircraft again lean to the left and come to a stop with the left front of the engine compartment and fuselage resting on the ground. The main rotor blades lost centrifugal force, drooped, and struck the ground.

The accident investigation revealed a bent connecting bolt (Part No. NAS464-7A36) caused failure of the left universal (Part No. S-1625-50120-2) and prevented normal movement when the gear touched down during landing.

For want of a bolt, the wheel was lost; for want of a wheel, the helicopter was lost, for want of a helicopter, the battle was . . . ?

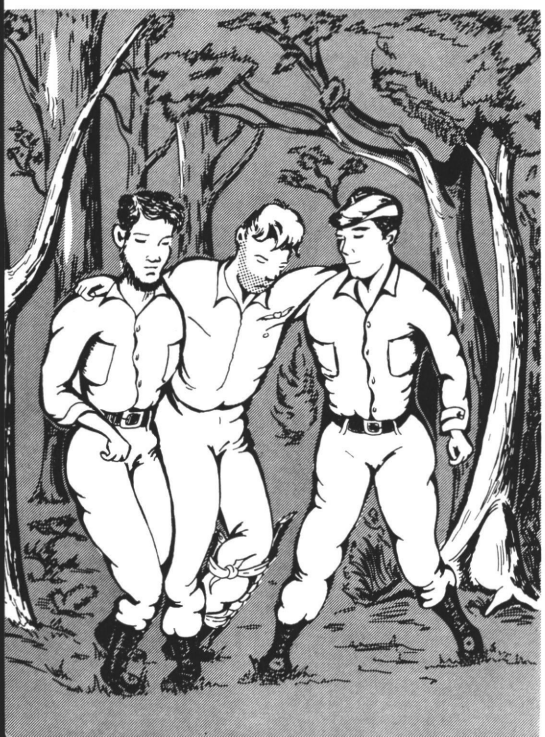
● *Number Two of a Series*

To Stay Or Not To Stay?...1

Fred M. Montgomery

TO STAY WITH a crashed aircraft or leave to seek help is a question not so easily answered that an AR can be issued to cover every situation. The aviator concerned in each forced landing or crash will have to judge whether or not to stay with the aircraft. The basic reason for remaining at the crash site is that wreckage is **usually** more readily detected from the air; therefore, rescue follows more promptly.

Training and practice under survival conditions will help the flier to chart his course of action. Thinking about what he would do in crash circumstances is helpful, too. Here's an example based on a situation in which the pilot had the chance to make his decision and fortunately elected the right one.



His unit occupied a field strip in western New York, and the aviator was practicing short strip landings and takeoffs. On an afternoon in late summer he returned to base operations, filed a flight plan, received approval, and took off in a Bird Dog on a round-robin cross-country flight that would carry him to points in eastern New York and back to base.

The flight down was uneventful. Visibility had been good on the trip, but at Albany some Beaver pilots mentioned that a stormy area existed on his route home. He shrugged off their warnings and at 2315 departed on his return trip. About 30 minutes after takeoff, he ran into squally weather with gusts of wind strong enough to buffet the craft around. He was over the southern portion of the Adirondack Mountains and flying high enough (5,800 feet) to clear the tallest peak in the state, Mount Marcy (elevation 5,344 feet).

For 20 minutes or so, the Bird Dog plowed into the rain and wind. There was no appreciable loss of control until he suddenly experienced a violent updraft, then the "rollercoaster" feeling of a consequent downdraft. In a few seconds he dropped 1,000 feet. He applied full throttle and started to climb. The sound of the engine under this sudden strain and stress was a deafening and terrifying scream. But engine power was not enough to overcome the elements. The Bird Dog continued to drop . . . a lurch . . . a swing . . . still laboring against the wrath of the storm with the throttle wide open.

Just seconds before the crash, the pilot saw the treetops in the eerie glow of his navigational lights. There was nothing else he could do . . .

The aircraft crashed about 100 feet from the top of Little Moose Mountain and was completely destroyed by fire. The time was approximately 0005 hours. The pilot had been thrown clear but suffered a broken leg. However, he was able to drag himself far enough away from the crash for safety and for a while lay watching as fire consumed the aircraft.

Then the pain in his leg increased, and he knew he had to do something about it. The skin was not lacerated by the broken bone, so all he felt that he could do was ease the pain. This he did by moving about as little as possible while he made himself comfortable and warm in the folds of his parachute.

One hour after his ETA at base, operations reported to Flight Service that the aircraft was overdue, and a ramp check was made of all the aircraft in the vicinity. A search and rescue unit was alerted and dispatched at sunrise the following morning; however ,the pilot reported later that at no time did he hear or see any aircraft searching for him.

Although sunrise on this critical day for the pilot was at 0521 hours, he slept until about 1000 hours before he was awakened by the sounds of the forest around him. At his first stirring, excruciating pain shot through his leg and he almost lost consciousness. Realizing that he must do something for his leg soon, he looked around for material to use as a splint.

About 50 feet away his eyes fell upon some branches of a tree that had been cut down some time before. With his pocketknife he cut the lines from his parachute, ripped off some of the material, and slowly and painfully made his way toward the branches. It required more than an hour to travel the distance, but at last he reached them and found a piece about 18 inches long that would immobilize his broken leg. He wrapped the stick in the nylon and then tied it around his leg with the lines.

It required only a few minutes to bandage his leg, and gingerly he arose to see if he could walk more easily. Hardly! Even with the stick and the padding, his leg could not stand weight. The pain was bearable, however, if he dragged the broken limb behind him as he crawled on hands and one knee. In this manner he crawled back to his sleeping place and unfolded the rest of the parachute to aid the search-rescue unit in finding him. He used loose dirt and rocks to hold the edges down so that the wind would not blow the 'chute away. With this accomplished, he settled back to wait for the welcome drone of searching planes.

Just after the sun had reached its zenith, the pilot made his first attempt to find water and food. He had been so preoccupied with bandaging his leg and spreading the parachute that the pangs of thirst and hunger had not been keen enough to stop him. First, he looked for water. Even though it had stopped raining, he found a small puddle of water that had accumulated in a large rotted-out stump. It tasted sweet, and when he could get no more in his cupped hands, he used part of his cotton undershirt to soak up the rest. This he used to wash his face and neck. The water slackened his hunger, too, and he felt that he could wait a while longer before foraging for food.

That night he again used the dry folds of the parachute for bed and cover. The sun came up about 0522 hours on the second morning after the crash. He awoke hungry and thirsty. His first thought was to find water. He believed he might find some in a mountain brook or natural basin somewhere down the mountainside. His broken leg was extremely stiff and pain racked his body whenever he moved. He wondered why he had not seen or heard any rescue aircraft the day before. Nevertheless he spread the parachute again as a marker.

Taking a bearing on a tall spruce tree several hundred yards down the mountain, he started crawling over the rocky ground. The trip was made more difficult by heavy undergrowth of briars and vines. He avoided several small rises and took the easier route around them. Thirty minutes later he stopped to check his bearing on the tall spruce. Already his hands were bruised and bleeding slightly from the rocks and briars. His good knee was raw and painfully tender. It felt as if he had been crawling for hours!

As he ate some of the wild berries found along his route, his eyes kept searching for precious water. About 0700 he felt he could go no farther. He had reached his first goal, the tall spruce, but he was so tired! He sprawled beneath it, wondering if he were doing the right thing by leaving the aircraft. He dozed fitfully for several minutes. What was that strange new sound—water running over rocks? He cupped his hand to his ear trying to pinpoint the direction of the sound.

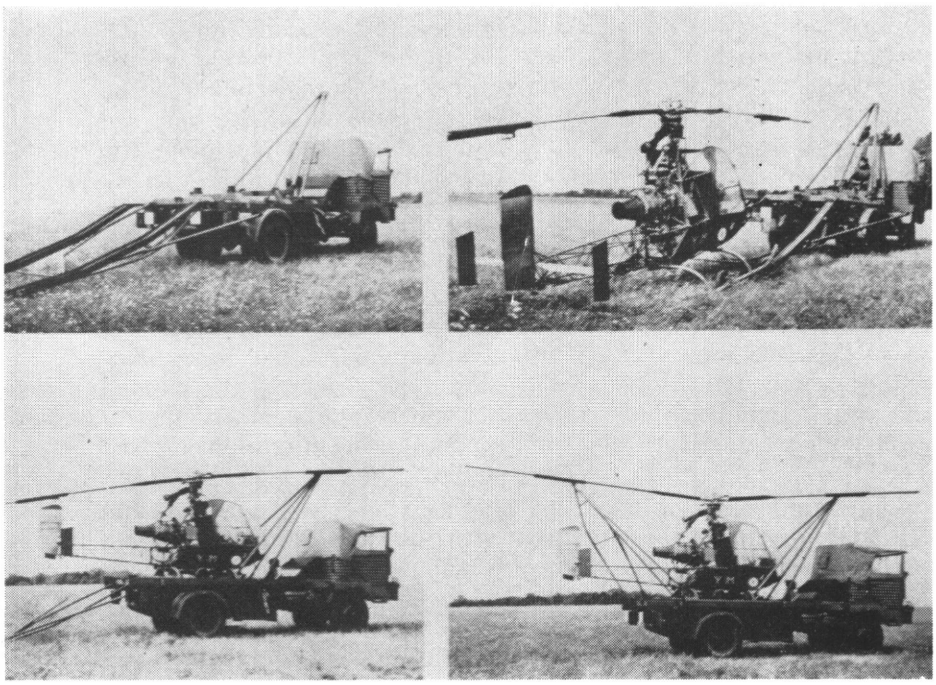
Yes, there it was again, and with it came another sound. But in a half-awake, half-asleep state the pilot was unable for some time to grasp fully the significance of the undulating, rasping sound that came to his ears. Then it dawned upon him! Somewhere close by, but unaware of his presence, was help. Thank his lucky stars! He didn't panic. He didn't waste his breath by yelling. But from

which direction were the life-saving sounds coming? He reached down, picked up some dry leaves and grass and, like a referee at a football game, tossed them into the air to get the wind direction. North. That's the direction. He started crawling toward the sound of the saw. At first, his leg pained him, but he brushed aside the aches and doggedly kept crawling . . . a hundred yards . . . five hundred yards . . . thank God it was downhill most of the way!

Finally, after some two hours he reached the lumber camp where two lumberjacks helped him into an automobile and sped with him to a hospital. There he was treated for exhaustion, and his broken leg was placed in a cast. At 1300 hours police called his base and reported his arrival and condition to his operations officer. Except for the broken leg and the cuts and bruises on hands and knee, his body showed little effects of the ordeal of 37 hours and 45 minutes.

The will to live is evident in this survivor's behavior. Disregarding the fact that he took off in marginal weather, his ability to size up his situation and act upon his presence of mind to get himself out of danger perhaps saved his life.

The fire destroyed everything except his parachute. This he used to good advantage as a sleeping bag and source of bandages. He didn't have a survival kit, only his bare hands and a pocket-knife. He believed that he could better his situation and did something about it. He improvised; he remained calm; and he had a strong will to live—strong enough to overcome intense pain as he crawled toward help. He could have elected to stay with his aircraft, but what assurance did he have that the air-rescue team (or the woodchoppers) would find him in time to save his life? Under these same circumstances what would you have done? To stay or not to stay with the downed aircraft is the question survivors have to answer. Would your answer be the correct one?



These scenes show the Djinn being loaded for transport

Maximum endurance, standard tank	**2 hr 15 min**

The conception of the Djinn offers many advantages as compared with conventional helicopters—simple, light, rugged and sturdy; low operating cost (through elimination of all mechanical transmission, organs and antitorque propeller); easy starting; easy piloting and safety.

Typical uses in the military field include liaison, observation and reconnaissance missions; transportation of wounded; supply; antitank fighting, when equipped with the French antitank missiles "SS-10" and "SS-11"; and pilot training.

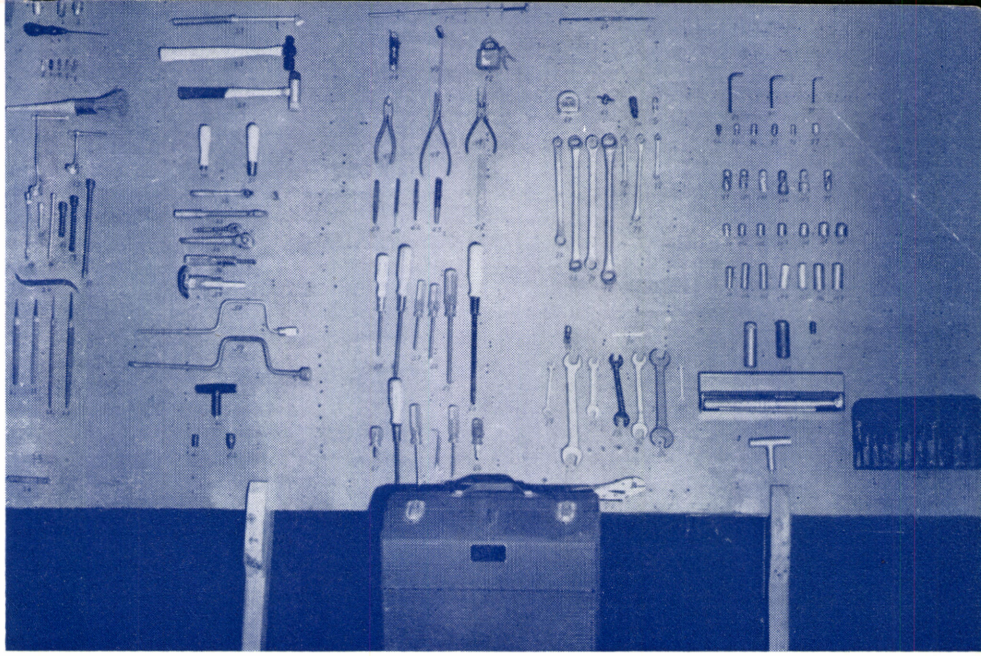
Particular mention must be made of several thousand flying hours accumulated under exceptional conditions of altitude and temperature — take-offs and landings effected at over 13,000 feet (Jungfrau peak in the Alps and Popocatepetl in Mexico), and flights made in tropical countries in Asia, Africa, and South America.

French Helicopters . . .

(Continued from page 15)

Maintenance Hints

Mechanic's Tool Box



Captain William R. Swift, Arty

THE GENERAL AIRCRAFT MECHANIC'S tool box is a very important item of issue to all of us in the flying profession. You will find this tool box in various shapes, sizes, and conditions. In it are supposed to be all the tools necessary for the aircraft mechanic to perform his preflight, postflight and periodic inspections.

Now let us take a look inside this mysterious tool box and see what we can find. Tools, yes, *but* the average aircraft mechanic has a little of the pack rat instinct in him, and invariably you will find not only his tools but also a few repair parts that he just forgot to turn in after finding he no longer needed them. But some other mechanic in your same unit probably needs these parts to put his aircraft back in a flyable condition.

We are not checking the tool box for hoarded supplies, however; we are looking at our mechanic's tools laid out in an approved manner so that inspection can be made quickly and easily. This inspection is necessary to discover how many tools are missing, how well they are taken care of, and/or how many misfit tools there are.

The inspector should look for more than just missing or rusty tools and dirty, oily tool boxes. In fact, pick up some of these pieces of equipment and look them over carefully. Check them to see if they are complete and in good serviceable condition, or whether the tool should be turned in to supply for replacement through FWT.

Captain Swift is Assistant Division Chief, Advanced Maintenance Division, Department of Maintenance, USAAVNS, Fort Rucker, Ala. He is dual qualified and has logged approximately 3500 hours flight time.

Here is a partial list of what to look for when you inspect the mechanic's general tool set, or any of the tool sets used in maintaining your aircraft.

1. Broken screw driver handles or blades.
2. Worn out files.
3. Hammers with irreparable heads or broken handles.
4. Wrenches with cracked, broken, or sprung jaws and sockets.
5. Worn out ratchet handles.
6. Spanner wrenches with defective hooks or pins.
7. Allen wrenches which are broken or filed to an off size.
8. Excessively worn or misaligned plier jaws.
9. Diagonal cutters (dikes) with broken or misaligned cutting surfaces.
10. Needle-nose pliers with worn or misaligned jaws.
11. Cross-point screw drivers with worn points.
12. Broken handles on any hand tools.
13. Broken or worn points on punches.
14. Broken, mushroomed, or misshaped heads on chisels.
15. Incomplete steel tapes.
16. Inaccurate feeler gauges.

Whenever you find tools that are defective, see that they are turned in immediately, regardless of how loud the cry of pain from the mechanic, because a broken, worn, or misaligned tool is worse than none at all. The prompt, judicious requisitioning of replacement tools will alleviate a good deal of the waiting for a replacement when the requirements are known and taken care of expeditiously.

Med Plans & Operations

"Freedom is man's most precious possession. It cannot create brains, ability, or talent, but only in the climate of freedom can man develop what is in him to the fullest extent. The freedom we cherish is not passive freedom from something—from want, or fear, or trouble, or injustice—but dynamic indivisible freedom for something—freedom to work out our own destiny according to the pattern of our own highest aspirations, the labor of our hands, the power of our own minds, and the strength of our own dedication."

Wilber M. Brucker
Secretary of the Army

America will observe her 10th Armed Forces Day this month with a gigantic display of power for peace. The U. S. Army Aviation Center, commanded by Brig Gen Ernest F. Easterbrook, will hold its annual open house 16 May, one of the highlights of the year in which community-military relations reach a satisfying high.

General Easterbrook has stressed time and again the part the individual soldier plays in forming the backbone of a new, modern, fast-moving Army. He has dedicated the School and the Center anew to support of the individual soldier.

The Army's growing mobility through Army Aviation is added to the contribution of the Navy, Air Force, Marine Corps, and Coast Guard in advancing the security of the free world.

Power For Peace