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

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

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NG: State AG.

USAR: None.

For explanation of abbreviations used, see SR 320-50-1.

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DIGEST

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COVER

The new shoulder sleeve insignia of the U. S. Army Aviation School is based on a prize-winning design submitted by Lt. Frederick Whiting, Assistant Training Officer, Program of Instruction Division, Office of the Director of Instruction. The emblem features a black winged torch inflamed and detailed in yellow on a black bordered orange shield two inches wide. Orange and black are the school colors. The aviation training mission is denoted by the connected wings and flaming torch. The wings symbolize flight, which is taught at the school, and the flaming torch is symbolic of the learning accomplished at the school.

Straight and Level

TO: Editor-in-Chief

General Hutton attests to the weakness of unit training programs in "The Commandant's Column," U. S. ARMY AVIATION DIGEST, December, 1956. He submitted a situation and requirement for a provisional aviation company training program. A solution to the requirement was published in the January, 1957 issue. However, the solution was not a panacea for unit training.

A training program for an aviation company must not only provide flight training for Army aviators, but it must provide training for enlisted men as well. In number, enlisted personnel exceed officer personnel, two to one, in the newly organized combat aviation companies.

Training for enlisted personnel is needed in the realms of aircraft maintenance, communications, automotive maintenance, as well as mandatory subjects specified in current Army regulations. . . .

All units should have a well planned aviation safety program. Accidents should be discussed when they occur. . . .

At all times unit morale must be maintained. Competition between sections or flights must be promoted. . . . Aviators need not only comply with regulations for flight minimums, but must also be familiar with maintenance problems. They should pioneer new ideas in tactical flying. Aviators should be cognizant that they are engaged in post-graduate flying. Basic fundamentals, learned in school, are to be integrated into routine flying.

In the Combat Aviation Company, 3d Infantry Division, Fort Benning, Ga., under the command of Major John B. Stockton, a need was realized for a progressive training program. A training program for the period of December, 1956 through March, 1957 was inaugurated.

An article on this master training program will be submitted to the DIGEST for publishing, after it has withstood the "acid test" application in the field. Anyone with new ideas or problems concerning unit aviation training please contact:

DONALD R. BAUSLER,
1/Lt, Arty,
Combat Aviation Co., 3d Inf Div.
Fort Benning, Georgia

"A Solution to the Provisional Aviation Company Training Program" in the January, 1957, issue was not intended to be a panacea for the ills of a unit training program. Rather it was offered as one solution to this problem with the hope that it would serve as a thought provoker for Army Aviators everywhere and might stimulate them to write their own version of such a training program. Although the enlisted personnel of the provisional division aviation company are not included in this article, everyone realizes that proper training procedures for enlisted specialists and NCOs must be included in any final program. Lt. Bausler's projected article on his unit's training program should provide further help to others faced with similar problems.

—The Editor

Letters to the Editor are welcomed by the U. S. ARMY AVIATION DIGEST. To appear in this column they must be signed.—The Editor

THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*
Commanding General, United States Army Aviation Center

The views expressed in this article are the author's and are not necessarily those of the Department of the Army.—The Editor

CLEAR FOR TAKE-OFF

THIS IS THE LAST of The Commandant's Columns under the present authorship. The task of preparing them was undertaken when the editor was desperate for material and would publish almost anything which came to his desk. Although material is still urgently needed, the Columns have served their original purpose.

The two year period represented has been very fruitful for the Army Aviation program. Without in any way depreciating the magnificent combat performance of the Artillery Air OP's in World War II and the Korean conflict, it is quite probable that the success of helicopters in Korea marked the real turning point in Army Aviation. The Air OP is a specialized (though tremendously effective) airplane, but the helicopter has proved to be of universal application. Its whole nature is uniquely suited to the Army's requirement for the degree of mobility which masters all types of terrain.

No types of vehicles except those which move in the air can possibly provide universal mobility over water, mountains, forests, jungles, swamps, and mud. All other types of vehicles must depend primarily upon roads for rapid movement. These are elementary facts which can hardly be denied. They indicate very clearly that those situations which require a high degree of mobility can be solved only by flying machines.

Of course there are problems involved, as can be heard any time this subject is broached. There are problems of training, maintenance, organization, education, tactics, armament, and reliability. It is important, however, that the problems be recognized as incidental to the *solution* of the mobility requirement, and that they not be confused with the basic requirement itself. No matter how complex the machines, if they alone can provide the mobility, then they are an inevitable requirement.

The functions papers which set forth the policies for Army Aviation seem broad enough to allow a great deal of room for the further employment of aircraft in the development of the Army's land warfare capabilities. Not only is the immediate field clear, but there are also indications that the policy positions are not inflexible.

You might say the flight plan has been filed, the preflight completed, the run-up finished, and the tower has said, "CLEAR FOR TAKEOFF."

So, build up the RPM and pull in pitch.

Supply Management Problems in Aircraft Logistics

Brigadier General William B. Bunker, *USA*
Transportation Supply and Maintenance Command

THE TRANSPORTATION SUPPLY AND MAINTENANCE Command in St. Louis is assigned the responsibility for exercising the Chief of Transportation's operational requirement to furnish logistical support to the Army aviation program. In fulfilling this responsibility, it is frequently necessary to try to reconcile the special problems of aircraft with normal Army procedures.

Somehow in the aviation business, everything tends to become unique and special. Part of the initial friction between the Army and its fliers back in the Billy Mitchell days arose from the penchant that the aviators had for insisting on special considerations and their many reasons for feeling that they had to deviate from most of the old, time-hallowed Army customs and procedures.

Generally, those outside of the flying fraternity tended to regard this accent on the special nature of birdmen and their machines as over-emphasized and unnecessary. We in St. Louis are not blind to the problems and the future of aviation and aviators. There are many specific problems in the aviation business not found in other Army operations which have to be considered if we are to handle this mission successfully.

Today, we are witnessing an increase of what might be termed a "second growth" aviation in the Army, and we seem to be making strong efforts in all aspects of the program to prove that our aviation is no different than any of the other functions of the Army nor aircraft any different than any of our other equipment.

Accent is on conformity and standardization with traditional Army policies and procedures, and little effort is being made by the Army, both within and outside of the flying organizations, to accent the peculiarities of the aviation business. Our high command has repeatedly emphasized that we have no de-

sire nor necessity to re-establish a separate Army Air Corps to handle our increased aviation program but can fit it into our existing structures.

In the logistic side of the business, too, the accent has been on conformity. Army Regulations designed for the mass problems of Ordnance and Quartermaster logistics are being applied directly and without exception to the problems of aircraft.

In general, it is necessary for the aircraft to become a commonplace piece of Army equipment if it is in fact to perform as an integral part of all Army operations as is so enthusiastically forecast by our leaders. Army Regulations and Army procedures are generally completely applicable to the problems of aircraft and aviation operations and we, in the Transportation Corps at least, have repeatedly taken the position that there was little necessity for special procedures and policies to handle aviation and aircraft problems.

As a matter of fact, we find some of the limited special treatment now accorded aviation matters tends to interfere with an orderly and effective handling of the problems. We in the Transportation Corps generally find ourselves pleading to have aircraft problems handled in the normal technical service procedures.

However, there are areas in which the aircraft, and hence, aircraft logistics, are decidedly and necessarily different from the logistics of other pieces of Army equipment. It is not necessary to establish a special set of regulations, a special technical service or special code of operations for the aircraft business.

On the other hand, it is essential that everyone in the supply management business understand that there are certain essential differences between aircraft and the normal pieces of

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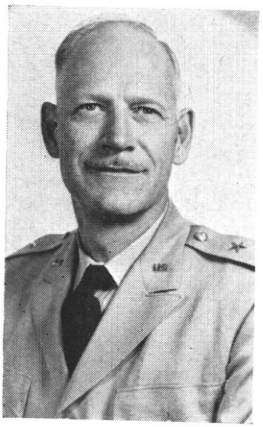

General William B. Bunker, Commander of the Transportation Supply and Maintenance Command, St. Louis, Mo., was commissioned in the Cavalry after graduation from the U. S. Military Academy in 1934. He received his Master of Science degree in engineering from Massachusetts Institute of Technology in 1937.

In 1950, he was assigned to investigate the application of the helicopter to Army transportation and convinced the Army of the value of an immediate and large scale expansion of this activity. He is a past national president of the American Helicopter Society.

This article is a condensed version of a recent address to a graduating class of the Army Supply Management Course, Ft. Lee, Va. Views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor

Army equipment and that these differences must be recognized and must be accounted for in establishing policies and procedures for logistics management.

Basic Differences

These differences between aircraft and other pieces of Army equipment arise primarily from three general factors. First is the difference between the military design and engineering responsibility for aircraft as opposed to that which is normal for other pieces of Army equipment.

Next is the difference between the aircraft industry and the industries on which we rely to produce most of our other equipment. The third is the exaggerated difference in emphasis in aircraft on such factors as weight, speed, strength and performance which result in a tremendous difference in price for aircraft quality items versus similar items used in other fields of activity.

Design Responsibility

To discuss these problems in the order in which outlined, let us first take up the question of responsibility for design. Generally, Army equipment falls into two broad categories.

First are those items of purely military application which are designed by our technical services in their Research and Development organizations or by contract with professional design organizations and are then constructed by private industry following the detailed plans and specifications furnished by the military.

Secondly are those items of more or less standard commercial design which, with or without modification, are usually procured from the normal manufacturers of similar civil items.

In the first category of items, our own engineers, frequently among the best in the particular field concerned, carefully design and develop items of equipment and prepare the necessary detailed specifications and drawings to meet our military characteristics or other general statement of operating requirements. These are generally those items of limited civil use and market like weapons, uniforms and tactical vehicles.

In the second category are found the vast majority of military support items ranging from Medical Corps aspirin to Quartermaster warehouse trucks. While, from time to time, commercial industry or individuals have developed certain weapons and special items of equipment which they have then tried to sell to the Army, in general military equipment has been designed by engineers in our employ.

Usually we are pretty unenthusiastic about the man who brings in an unsolicited idea for a new tank or gun; we have too often found that he is unaware of our basic operational requirements.

In the aircraft field, however, this is not true. The Military services generally do not have the competence nor the personnel to design a complex aircraft system such as a B-52, an F9F Navy Fighter or an Army H-13 or L-19 aircraft. These aircraft are the products of long periods of development, research and de-

tailed engineering on the part of the large engineering staffs of various manufacturers.

For example, the Aircraft Industries Association tells us that the B-52 contains four million man-hours of engineering effort on the part of the manufacturer; the H-13 probably represents several hundred thousand man-hours of effort on the part of the engineers employed by the manufacturer. While we usually supply a statement of our requirements and require that the manufacturer follow a handbook giving detailed standards to be met in the design of various components of military aircraft and, additionally, spend many hours in a meticulous review of details of design on the part of the manufacturer, it is highly debatable that we in anywise add anything to the technical assemblage that goes to make a complete aircraft.

While we assume the responsibility for the satisfactory design of an Army aircraft, it is in the final analysis, the manufacturers' airplane and we have merely decided that the assemblage which they have designed is as nearly satisfactory for our purpose as we can expect to get.

In the Army today the fact that our aircraft are the products of industry can be illustrated by reviewing our present so-called standards:

Our observation airplane was completely designed and built by a manufacturer and submitted for evaluation.

Our utility airplane is a commercial bush pilot's plane of a Canadian manufacturer.

Our command airplane is a private or business light twin engine aircraft built for commercial market and accepted after an evaluation by our CONARC Board.

Both of our reconnaissance helicopters were built for commercial sale, extensively modified to meet our informal comments and formal change notices.

Our utility helicopter was likewise a commercial venture.

Our light cargo helicopter was designed for Air Force arctic rescue work.

Our medium cargo helicopter was designed for use in Marine assault missions (the only function at least approximating our expected use). Our new utility helicopter, the XH-40, which we will start getting next year, is the first production machine to be built to our requirements. Even this aircraft, however, is a manufacturer's design which we have merely monitored.

This dependence on the manufacturers' design has certain important ramifications elsewhere in the logistics picture; if we are not competent to design the aircraft, certainly we are likewise not competent to fully evaluate the effect of a change or modification on the successful functioning of the whole machine.

We are pretty much at the mercy of the contractor in determining the desirability or necessity for a change in this or that component to meet an operating problem or eliminate a deficiency. We are not particularly able to apply the broad principles of maintenance engineering which requires that supply and maintenance technicians participate freely in the development stage of a piece of equip-

ment to insure the incorporation of ease of maintenance concepts into the design.

Similarly, we are not particularly able to implement programs of standardization. If, for example, we desire that the manufacturer use the same aircraft engine in the H-23 as we do in the H-13, our purpose is fully defeated the minute his engineers say that the H-23 will not work satisfactorily with precisely the same engine.

We in the Army have another difficulty in this area since we are not authorized to contract directly with the aircraft manufacturers for our equipment. Our helicopters and planes are secured by placing our requirements on the Air Force or the Navy, therefore, the military representatives in the plants are from the procuring service.

As a result we have an even harder time insuring that our ideas and desires are reflected in the day-to-day engineering that goes into our aircraft. Since we use Air Force and Navy contract documents we have a difficult time incorporating design features which meet our particular problems.

About the only way we can accomplish many of the sound objectives of supply economy and logistics management such as standardization, interchangeability, etc., as well as ease of maintenance concepts and other programs into the engineering design of Army aircraft, is to ask the manufacturers to do their best to bear these projects in mind during the development of their aircraft.

To expect that we in the military can directly influence the designer in the application of these principles without the technical competence to undertake the design ourself, is indeed misleading.

The current approach to this problem in the Air Force is to adopt the "weapons system management" theory. Under this concept, a prime manufacturer is given full responsibility to develop and produce a complete aircraft including all the engines, electronics, instruments, accessories, etc., which have heretofore normally been developed and supplied by the Air Force. Thus, they have tended to contract the engineering aspects of supply management responsibilities, especially those like standardization, ease of maintenance and such which have to be implemented on a day-to-day basis in design and production to the manufacturer.

Aircraft Industry Huge

The second area of peculiarity between aircraft and other items of military equipment lies in the position of the industry itself. In the last couple of years, the aircraft industry has assumed the position of the largest industry in America. Together with its supporting industries, manufacturing its accessories, power plants and electronics, the aircraft industry today employs as many people as there are in the whole Army. The giants of this industry far exceed the industrial giants in the automotive and other industries.

Although the aircraft industry, in numbers of workers or in dollar volume of output, exceeds that of any other endeavor, measured in number of end items

produced, the production remains rather small. Certainly there is no other industry producing end items with a unit price of six or seven million dollars.

The major point of difference between the aircraft industry and other manufacturing enterprises, however, lies in the fact that this industry is completely dependent on those items which it produces for the Government. While, obviously, our whole military production program relies on the productive capacity of the shipbuilding, automotive, locomotive and other heavy industry of the country, all of these industries have a broad base of commercial production on which they have been established.

The aircraft industry, on the other hand, produces some 70 or 80 per cent of its output directly for the United States Government and its commercial sales amount to practically a sideline business. Further, most of the industrial facilities engaged in the production of aircraft are in major proportion, owned by the Government. Even those factories which have been put up by private capital are equipped with tools and other facilities supplied by the Government.

The annual sales of an aircraft company represent many times the value of private capital invested in the business; the aircraft industry generally produces something over four to ten times its net worth per year compared to one third or less in normal production enterprises.

The result of the fact that the aircraft industry is in effect a socialized operation is manyfold. In the first place, it becomes, to some degree at least, the responsibility of the Government to keep the factories running or to determine whether any particular factory shall continue in production or be shut down.

A decision to buy from one manufacturer as against another is largely influenced by the backlog of Government work distributed between the two manufacturers and some effort must be made to balance the workload if the production base is to be maintained. When this Government ownership and responsibility for the plant is coupled with the fact that it is generally accepted that the total aircraft productive capacity of the country is far less than that which would be required under mobilization conditions, the necessity for distributing the work among the various manufacturers becomes apparent.

Our stake in the present industry has a restrictive influence on new designers and producers, too. If, for example, we decide that one or another manufacturer has a more promising design for a new cargo helicopter than our current producers, we would still be reluctant to change contractors. The aircraft industry being what it is, this decision would probably have to be implemented by closing down current producers—Government financed plants—and creating a new Government facility for the new contractor. Therefore, except in times of expanding procurement like that of six years ago, we seldom see new producers entering into the aircraft business.

There are many areas in which proper recognition of this

aspect of the aviation logistics picture is required. One of these is in scheduling replacement aircraft. Generally, we tend in the Army to buy our full requirement of a new design and then to wait a considerable period of time before buying a replacement. In the aircraft business, it is much sounder to place in procurement a limited quantity of each generation of aircraft in spite of the effect which this has on the parts management problems. Since getting a new design of aircraft into the production stage requires approximately five years, some program whereby the producer of an aircraft is also assigned responsibility for the design of its replacement should be encouraged.

All of these things mitigate against competition and normal procurement practices and necessitate some sort of managed sole source operation. The degree to which we seek to retreat behind an impersonal competitive attitude towards the industry directly affects our ability to maintain an adequate production complex.

This aspect of the aviation business is also tied into the first point mentioned since if our aircraft are in fact designed by the manufacturers it is essential that the producers be kept in business in order to insure the continuity of the developing team. If we stop ordering a manufacturer's current production machine and allow the factory to close we cannot expect that their engineering office will produce a satisfactory 1960 model helicopter when we need it. Similarly, if we decide to produce one manufacturer's types in other manufacturer's facilities we will correspondingly reduce the breadth of our engineering base.

As a consequence of this aspect of the aviation business the procurement of aircraft tends to become more of a joint military-industry partnership than does the procurement of other military equipment. We are quite concerned that our manufacturers are developing new and improved products to sell us, and that they do not increase to a size we cannot support or decrease to the point of uneconomical production. We are as thoroughly enmeshed in the day-to-day problem of management as is their own board of directors.

Weight Important

The third major area of difference lies in the nature of the equipment itself. Fundamentally, these differences arise from the fact that since the aircraft must defy the laws of gravity, weight becomes an all controlling factor. While we have, as a standard element of Army military characteristics, the requirement that our equipment should be as lightweight as possible and of late have placed increasing emphasis on this characteristic, generally these weight-reduction programs have been conspicuous by their lack of progress.

In the aviation field, however, weight is an all controlling factor. Every pound of extra weight in the aircraft is directly responsible for one pound less of useful load which the aircraft can carry to accomplish its mission. It is also further influenced by the so-called "growth factor" by which one extra pound placed, for example, in an engine or

transmission results in an eight or nine pound increase in the over-all empty weight of the aircraft itself by the time the extra supporting members, extra power and fuel, etc., are placed in the aircraft, to keep its performance constant.

The direct result of this importance of weight in aircraft is the fact that aircraft components are customarily designed to a very narrow margin of safety. Where a safety factor of six, or a six-fold excess of allowable stress over that imposed, is normal in civil engineering and a factor of four or so is normal in mechanical engineering, aeronautical engineering customarily reduces their safety factors as close as possible to unity.

When this problem is further aggravated by the fact that many of the more complex stresses in aircraft structures and particularly in helicopters are not well known, the frequent occurrence of unforeseen failures of various components, particularly in new designs, is not surprising.

In a further effort to reduce weight, elaborate and sophisticated means of metal working and shop practices such as heat-treating, shot-peening, cold-working, etc., are used on what might be considered very minor components. This is what makes a quarter-inch aircraft quality bolt cost $1.50 while the same size bolt used in a truck or tank can be procured for ten or twelve cents.

It leads to the requirement for special wrenches and tools to work in the restricted accesses and close quarters customary in aircraft; it leads to the use of expensive materials in order to further reduce the weight of the structures. The combination of these results makes aircraft components inordinately expensive.

A 200 horsepower engine which would cost in the order of $200 or $300 for a tank or a truck will customarily cost several thousand dollars for an aircraft and we can seriously consider the investment of $30,000-$40,000 to achieve the same 200 horsepower with still less weight by the use of a gas turbine. The high cost of components results in the necessity in our supply management operations for even more stringent control on their use and distribution.

This aspect of aircraft design leads to very close tolerances and fits and the requirement for skilled mechanics to perform operations which, in comparable maintenance operations on other pieces of equipment, would require only average skill. Our pleas for highly skilled mechanics to properly maintain our aviation equipment do not entirely represent an over-concern for our own problems but the fact that the mechanics must be sympathetic with the high precision which the designing engineers expect to be maintained in their aircraft.

Although modern automotive engine design specifies the torque of the cylinder head bolts, a reasonable approximation of this requirement by a normal backyard mechanic is sufficient to insure that the engine will operate successfully and safely. A similar degree of carelessness in torquing the bolts on an aircraft engine could well result in an

unforeseen failure.

While all of us have been able, from time to time, to overhaul the rear-end of a truck in the field using normal soldier mechanics, to endeavor to overhaul the transmission of a helicopter, which employs roughly the same mechanical principles, without special care to run Zyglo and Magnaflux inspections of all the components and to reassemble under ideal conditions of cleanliness and care, can only result in a loss of a $9,000 or $10,000 assembly, and perhaps the entire aircraft.

In our research and development effort and in our production engineering, every effort is made to impress upon the aircraft manufacturers the necessity for designing their equipment as ruggedly as possible and to stress the ease of maintenance characteristics essential for military equipment.

It is very easy to design a helicopter transmission that will last almost indefinitely but which no known rotor system can lift off the ground. Our objectives in these areas must always be tempered by the fact that we can only afford so much reliability and ruggedness and still achieve a machine which will fly.

A delicate compromise exists between the strength which we would like to see in our components in order to insure maximum usability in the Army and at the same time, secure a reasonable amount of performance for the money invested.

Our biggest problem remains in this area since, due to the infancy of helicopter design and, indeed, aeronautics as a whole, it is extraordinarily difficult to balance out what is the ideal proportion of weight to devote to the various components of a flying machine.

Aircraft Differ

There are many other detailed differences between aircraft and other items of equipment as far as their design and resultant logistic support requirements are concerned. Among these are the fact that aircraft components are normally removed before difficulties in operation are experienced on the basis of engineering analysis of their expected trouble-free life.

For example, the engine on an L-19 observation aircraft, if operating successfully, is removed after 1,000 hours of use and sent to an overhaul facility. Similarly, the transmission on an H-19 helicopter is removed after 450 hours and replaced by a new or rebuilt transmission. These changes, known as "time change components" are made in order to insure that the aircraft is safe to operate for its full mission and to obviate failures in flight. These time allowances are established at the original design stage by the aircraft manufacturer's engineers assisted by engineers from the Air Force or the Navy.

Based on experience gained in the tests of new aircraft, these times are gradually extended as it becomes apparent that, within the scheduled time, no difficulties are encountered. Thus, the time service life of certain aircraft engines has been known to gradually improve until they were authorized for operation for over 2,000 hours. Unfortunately, in order to extend these

times, it is necessary to have complete information on how successfully the components are reaching their currently scheduled time, an extraordinarily difficult program to implement in our widely dispersed aircraft fleet.

These time change components are very expensive and we must have a liberal supply of them in order to have them overhauled and reconditioned independently of the airframe. We buy as many as 100 per cent extra transmissions for our cargo helicopters or even 50 per cent extra engines for a light airplane. This would compare with a requirement for less than one per cent spare engines in a truck procurement program.

Parts Needs Vary

Most other aircraft parts are required on an extremely random basis and the fact that we have issued a part is no criteria that we will ever require such a part again nor, contrariwise, is the fact that we have not issued the part any true criteria that we will not require it. This is due to the fact that the vast majority of the line items comprising an aircraft are subject to random failures due to mishandling of the aircraft, mistakes or accidents by ground crews and mechanics, random failures due to fatigue or other unknown stress accumulations and similar unpatterned demands.

As an example, in an evaluation of the parts required to support an entire wing of B-47s, it was discovered that well over 4,000 items were required but once in a "wing-year" of flight time. Nevertheless, the unavailability of any one of these parts would have resulted in the grounding of these expensive pieces of equipment. Similarly, there is no regular pattern of demand which can be constructed on the basis of past requirements.

The Army supply system as a whole is based on an assumption that if we required ten parts in 180 days, we would require five in 90 days or 20 in a year and that the stock level can be computed on the basis of a linear equation. Experience seems to indicate that this pattern does not hold for the vast majority of line items making up aircraft support. We must determine not only the average monthly demand but the maximum, minimum and median onetime demand and use sophisticated probability computations in order to determine appropriate stock levels.

Components Change

Another problem of aircraft logistics arises from the rapidly changing components that go to make up an aircraft. While we have long standardized on the L-19 as the observation aircraft of the Army, and to all intents and purposes have but one aircraft to support, when we get down to the spare parts level, we discover that the L-19 is actually made up of some 4,000-5,000 stocked line items and 15,000-20,000 items which are not stocked, and that all of these items are rapidly changing either to secure a slightly higher degree of performance, to reduce still further the empty weight, to correct a deficiency which has

developed in operating experience or some other reason.

Consequently we are constantly engaged in evaluating the effectiveness of the parts in our supply system to determine whether they are usable on current aircraft and similar property management aspects of this problem. Frequently we have found that we have had to void for obsolescence as much as 30 per cent of the items procured to support a new aircraft. Before it is concluded that the way to stop this is to fire all the engineers in the aircraft factories, we must take recognition of the fact that if an aircraft is not allowed to improve, it can then be only made useful by retrogression and that the result of any freeze of design of the detailed components could result only in the procurement of unsatisfactory and obsolete equipment.

The only progress in the development of newer aircraft has been through experience gained in building and operating earlier designs. We have arrived at the DC7 by way of its six predecessors and it could not have started as a full grown man without going through all these growing pains. More directly, our current H-13H is the result of our experience and mistakes on the H-13B, C, D and G and other models.

Particularly in the helicopter field, which we must remember is still only some 15 or 20 years old, it is vitally necessary that changes of this type, however difficult to manage in the parts business, be encouraged rather than discouraged if we are to develop successive generations of increasingly more satisfactory and economical aircraft to fulfill our mission.

Leadtime a Problem

Another major problem area in aircraft logistics lies in the extended leadtime that is required to secure an aircraft or a major component. The design and production time of a new aircraft runs between four and six years. In a "standardized" aircraft, this time is reduced to the order of two or two and one half years but still remains far in excess of that for most other Army equipment. In view of the fact that each increment of aircraft to our system, even of a type already in use, results in a necessity to increase our stock of spare engines, transmissions, propellers or rotor blades, etc., it is necessary that we introduce into the system at the same time an added increment of these components.

Frequently, too, these components are of a new and improved design to go with the new model aircraft. Thus, our current procurement of the H-13, for example, is the H-13H which represents the seventh major model change in this aircraft since we started buying them about 10 years ago.

These new requirements for special parts and the assemblages required for time compliance changes are normally secured at a provisioning conference. This provisioning conference, held at the manufacturer's plant, consists of a group of people from the Transportation Supply and Maintenance Command, the using units in the field and the manufacturer who go

over the aircraft, drawing by drawing (some 30,000 - 40,000 drawings being required for a normal Army aircraft) to determine how many of the parts will be in our supply system and if any parts currently on hand can be used. Based on these determinations and the programmed flying hours, we determine the quantities of each part to be procured to support the aircraft as it is introduced into the system.

This sounds like an orderly procedure until we realize that it is normally held some six months after the contract is signed for the aircraft and consequently a year to a year and a half before it is ever flyable and therefore purely on the basis of the engineers' best estimates on how the things are going to work out.

As if this were not enough, frequently after the design conference, the engineers at the manufacturer's establishment decide that the particular engine, transmission or what have you, under discussion, is not the best for the new aircraft and therefore they desire to design another one. This may have a drastic effect not only on what we buy but how many we will require to support our new aircraft. It is this process that frequently results in having to cancel and get rid of parts which were never applicable to any aircraft that was actually produced.

At the same time we cannot take the obvious solution that we will not procure any aircraft or parts until a firm decision has been made as to what aircraft or parts will be most acceptable and then freeze our production design. This information is only obtainable by actual use of the aircraft and discovering its deficiencies. In a "trial and error" system, which this business often is, we are committed to do the trials and make the errors in order to progress.

As a consequence of this problem, we have several hundred million dollars worth of parts on order for a year and a half or two years at a time without any knowledge as to whether the parts will, in fact, be usable on our equipment and precisely at what rate they will be required.

Good Supply Management

The Army's system of supply management is a good one. Our procedures of supply control and stock management reduce to the minimum the chances for mistakes and inadvertent errors. Our endeavor in the management of aircraft spares is to apply these principles and policies to the maximum. The general policies of maintenance and ease of maintenance required for complex mechanical equipment in the modern Army are likewise sound and we will endeavor to do our best to apply these to the aviation field. It is apparent to all of us that our ability to exploit all the new devices being made available to our modern Army is entirely dependent on our being able to maintain them in the field. As far as procurement is concerned, most procurement regulations reflect the basic policy of our country that Government business is the people's business, that everyone has an equal opportunity to share in it and that the function of the

Government contracting agency is to secure a satisfactory product for the least expense without necessarily seeking either the best or the most logical solution which might be available in the commercial world. These principles, too, we seek, the best we know how, to apply to the aviation field.

In this discussion of some of the peculiarities of the aviation business, attention has been called to the fact that the aircraft and its industry are in many respects peculiar; that our relationship with our manufacturers is considerably different than our relationship with our other contractors; and that the requirements of the aircraft, itself, are in many respects quite different from those of normal Army equipment. Our function is to integrate the best aspects of Army logistics, the requirements of the law and the management principles of the Department of the Army, into the idiosyncrasies of the aviation business. This is a difficult and, at times, frustrating job but offers an increasing and intensive challenge to the imagination.

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Memo from Flight Surgeon

ARE you about to have an upper rear molar removed? Don't fly afterwards — at least, not without discussing it with your dental surgeon.

The Armed Forces Medical Journal tells about a serviceman who recently had two molars extracted. As is fairly common, some of the jaw bone around the socket of his molars was removed, and he was told not to blow his nose or sneeze afterwards. He complied. Trouble is, no one told him not to fly. About a week later, he did just that and quickly wound up in oral surgery with a ruptured sinus lining. Here is what happened:

The cavity in the skull, just above the jaw on either side, is a sinus (the maxillary sinus, to be technical). It is lined with a membrane and is almost completely supported by bone except that it communicates with the nose cavity via a tiny opening. When the serviceman got off the ground, the pressure of the air around him began to lessen, or to put it another way, a given quantity of air at sea level will expand as its altitude increases. Trapped air cannot expand, but it will try. If it finds a weak spot, a blow out follows.

In the above case, the expanding air of the sinus should have leaked off into the nose cavity. It did not because that opening was blocked temporarily, (a common occurrence that might be caused by a simple cold, for example). It could not escape through the supporting bone except at the spot above the extracted teeth where the bone had been removed. Only a thin patch of membrane remained at this point. It "blew" and thus the trip to surgery.

FATIGUE can be fatal. Either cockpit fatigue or the fatigue that results from too little sleep can deprive a pilot of the alertness needed to handle each incident that might occur during the flight.

The former, not so well known, is nevertheless a true

The views expressed in this article are not necessarily those of the Department of the Army or of the U. S. Army Aviation School. — The Editor

fatigue that produces changes in body chemistry just like regular fatigue. Its chief cause is a cramp or immovable position. Aids in avoiding it are enough sleep, plenty of fluids and no heavy meal before flying time. In the air, the chief defense against it is forced exercise; that is, flexing the muscles, moving the feet and in general, moving about as much as possible within the confines of the cockpit.

The Army pilot spends long hours in the cockpit with little rest. He must remain aware of this danger.

ARE you accident prone? Perhaps not. But, like the rest of us you are certain that this person exists—the individual who might have an accident at any moment. Unfortunately, no one has been able to single him out. Each attempt to find him scientifically ends inconclusively.

And now, to really confound us, a further study suggests that the pilots best qualified in training tend to have the most accidents later. It concludes that the findings support this hypothesis: " . . . those pilots who have a greater number of aircraft accidents than expected on the basis of exposure risk tend to be younger, better adjusted to their jobs and status, and more skillful than pilots who have fewer accidents."* What next?

The scientists are careful to point out that accident proneness may exist, but that the criteria used for seeking it may be wrong. Or, perhaps, the criteria for training success is not the same as the criteria for operational success.

RECENTLY, an aero-medical specialist, one Dr. H. Strughold, formerly of the Luftwaffe, made the supreme sacrifice. On behalf of scientific accuracy and aviation, he injected his posterior with a large quantity of novocaine to determine once and for all whether it were really true that we fly by the seat of our pants.

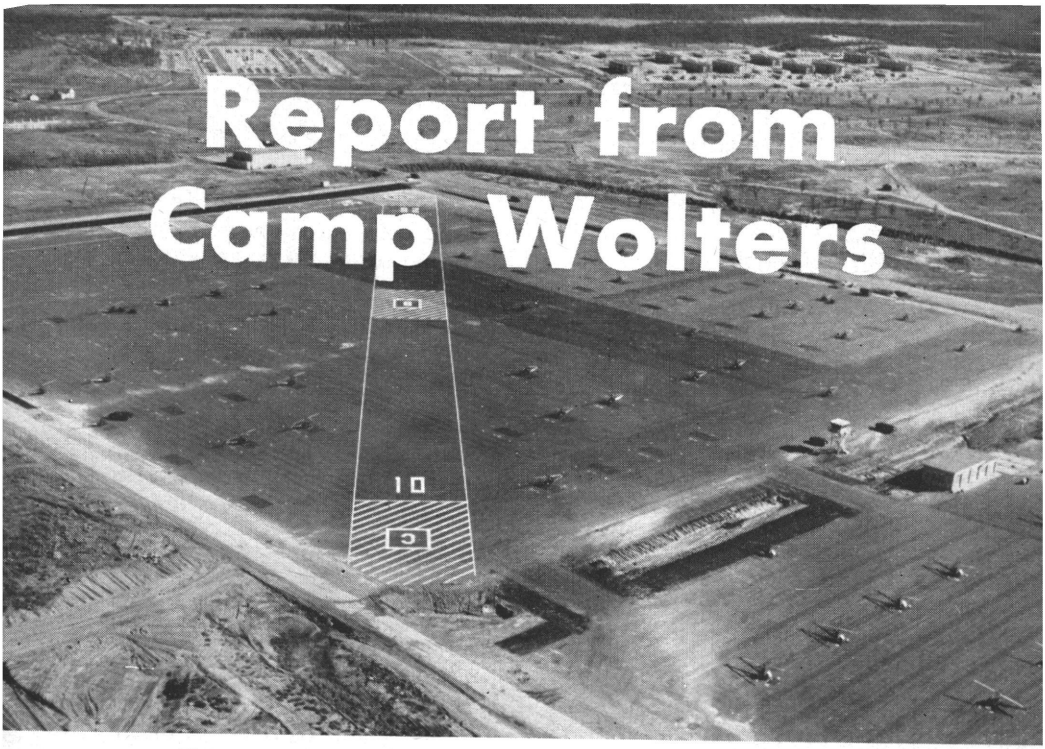
The experience left him shaken, but convinced.

Once the numbness took over, he boarded a plane and the pilot took off to perform various aerobatics. Now, Dr. Strughold is no flight novice; he has spent many hours aloft. Despite this, he reports that without the nerve impulses from his seat, the effect on him was profound. He grew sick, afraid, and completely disoriented.

Thus, an old saying, half believed, half deprecated, is now supported by the results of scientific experiment.

**Trites, D. K., Kubala, A. L., Sells, S. B.: Aircraft Accidents vs. Characteristics of Pilots. The Journal of Aviation Medicine, Dec., 55.*

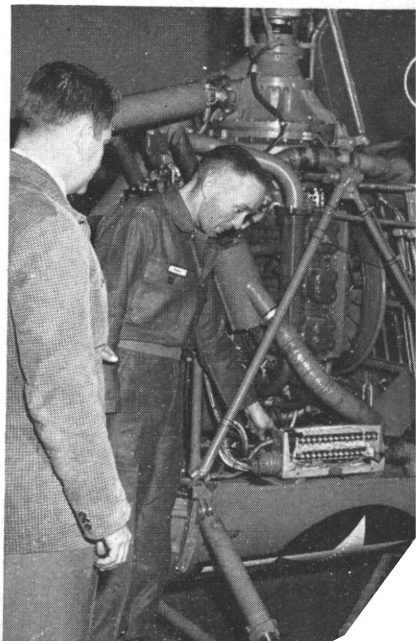
Report from Camp Wolters



H-23 reconnaissance helicopters, used in flight instruction, are kept at the main heliport which is equipped with a control tower, marked runways and lighting facilities. Converting the Air Force Base to an Army post required long months of hard work by three heavy construction engineer battalions, members of the 931st Engineer Group.

One of the 60 civilian instructors, employees of Southern Airways, checks the pre-starting procedure with his students. Most of the officers assigned to the school are helicopter pilots who give periodic checks to the students as well as the contract instructors to assure adequate progress of training and standardization.

Warrant Officer Candidate Jose
the first man to solo at Camp Wolte
important part of helicopter mainte
low students. By the end of June, t
fully operational with all flight tr
ciated ground school instruction
ployees of Southern Air



With the initial graduation set to take lace in May, classes at the U. S. Army Pri- ary Helicopter School, located at Camp Wol- ers, Texas, are swinging into high gear. A otal of five classes, each beginning with ap- roximately 75 students, will be in residence ith a new class beginning each month. Four f these groups will be studying various hases of flight training while the fifth class ill be engaged in preflight training.

The mission of the U. S. Army Primary Helicopter School is to provide preflight, pri- nary, and basic helicopter flight training for fficers and enlisted men in preparation for dvanced and tactical phases to be conducted t the U. S. Army Aviation School, Fort Rucker, Alabama. Enlisted men who are ac- cepted for the course are appointed as war- rant officers upon successful completion of his advanced training. Commissioned offi- cers of the Medical Service Corps attend this course and, from time to time, officers from foreign nations are also students.

Colonel John L. Inskeep, Commandant, U. S. Army Primary Helicopter School, Camp Wolters, Texas

R. Pinard, ints out an to his fel- ool will be and asso- t by em-

Students pick up maintenance hints in one of the seven classrooms which were completed when the first class arrived for preflight training in November, 1956. Work on these classrooms and other projects which included a large heliport, a maintenance shop area and one stage field started in June, 1956. Three more stage fields with access roads are scheduled to be completed this spring.

Effect of Clarification of Roles and Missions on Army Aviation

Colonel Frank G. Forrest, *Inf*

SECRETARY OF DEFENSE Charles E. Wilson announced rulings on 26 November 1956 to clarify roles and missions to improve the effectiveness of operation of the Department of Defense. One of the areas covered by these rulings is the use of aircraft by the Army.

In recent years organic aircraft have been a subject of increasing interest to the Army. Department of the Army made its position known on Army aircraft in a letter published by The Adjutant General, 4 April 1956, subject: "Army Position on Major Issues." In this letter, the Army stated that it required a family of organic fixed-wing aircraft and helicopters for:

1. Battle area surveillance, and adjustment of artillery missile fires.
2. Movement of troops and supplies in the combat zone.
3. Evacuation of wounded.
4. Command and control.

With the publication of the 26 November 1956 rules and missions paper, all these functions were confirmed by the Department of Defense. Specifically, the Department of Defense rulings provides for Army aircraft to carry out the following functions in the combat zone.

1. Observation, visual and photographic reconnaissance, fire adjustment, and topographical survey.
2. Airlift of Army personnel and material.
3. Aero-medical evacuation.
4. Command, liaison, and communications.

In matters affecting the use of aircraft by the U. S. Army, the combat zone is defined in the Department of Defense document as an area 100 miles forward of the general line of contact. It normally extends approximately 100 miles to the rear. In executing Army aviation functions, the Army will use fixed-wing aircraft, converti-

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Colonel Frank G. Forrest is Aviation Officer, Sixth U. S. Army. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of the U. S. Army Aviation School—The Editor

planes, or vertical/short takeoff and landing aircraft which have a weight empty of not more than 5,000 pounds, and helicopters of 20,000 pounds or less weight empty.

Exceptions to the weight limitations may be granted for specific aircraft. Already, Secretary Wilson has authorized the Army to procure five DH C-4 airplanes (twin-engine "Otter") for test and evaluation and to proceed with the development of an improved observation airplane. Airlift of troops and material is described as action to improve local mobility for small units and limited quantities of material on a scale not contemplated in joint airborne operations.

Further clarification of the function of Army aircraft is made in the 26 November 1956 rules and missions paper by a list of functions for which Army aviation will not be programmed. They are:

1. Strategic and tactical airlift (airborne operations).
2. Airlift from points outside the combat zone to points within.
3. Airlift, to include medical evacuation, from within the combat zone to points outside.
4. Aero-medical evacuation from an airhead where the airborne operation includes air-landed logistical support by the Air Force.
5. Tactical reconnaissance.
6. Interdiction of the battlefield.
7. Close combat air support.

The 26 November 1956 roles and missions paper contains specific rulings on missiles. One of these rulings has an affect on Army aviation and should be mentioned herein. This is the ruling which authorizes the Army to continue development of guided missiles or free rockets for close support in the area extending not more than 100 miles beyond the front lines. Of interest also is the provision for the Joint Chiefs of Staff to recommend to Secretary Wilson what tactical Air Force wings for Army support may be eliminated as a result of these decisions.

Army Aviation Functions

Within the functions and limitations contained in the 26 November 1956 roles and missions paper, what kind of Army aviation program is possible? In answering this question, it should be noted that nothing in the Department of Defense rulings limits the performance of Army aircraft within the combat zone as defined by the defense directive or the quantity of aircraft. However, performance is affected by the weight limitation, and the number of aircraft in the Army inventory can be limited by available funds.

The functions of Army aviation recommended by the Department of the Army and confirmed by the Department of Defense were determined in light of new concepts of conducting warfare brought about by atomic weapons and guided missiles. These two items provide vastly increased fire power at ranges much greater than conventional artillery weapons. As a result, wide dispersion on the battlefield will be required. This dispersion will be obtained by maintaining large intervals between combat groups of relatively small size.

This, in turn, creates a demand for a means of obtaining rapid mobility for the purpose of shifting these combat groups, quickly assembling two or more of them, or placing one or more groups in the enemy rear. Air mobility appears to be the only practical way to obtain rapid movement in an area of thousands of square miles. For the purpose of battlefield mobility, it is possible that each field army will be provided with an Army combat airlift capability of a certain size. The size will depend on the number of troops which are considered necessary to be lifted at any one time. The Department of Defense ruling states the Army airlift will be provided for movement of small units to improve local mobility.

Department of the Army Training Circular 1-7, 26 January 1956, describes how Army combat air transport units will be employed. They are assigned at field army level, and are used to move troops and supplies in connection with operations conducted by corps and divisions. Opportunities for air mobile tactics are particularly evident for such actions as exploiting the effects of an atomic strike in the enemy rear; seizing critical terrain features to aid attacking forces, especially fast moving armor; shifting troops; or moving reserves.

Supply by Air

Army aviation transport units may be used to resupply forces which are isolated, cut off, or surrounded, thereby enabling these forces to maintain their effectiveness. Being supplied entirely by air will permit certain types of armored forces great freedom of operation. In the conduct of operations of this type by Army aviation, extensive use of night and instrument flying will be required for purposes of security.

The possibilities and potentialities of battlefield air mobile tactics to influence the land battles are significant. As better aircraft are developed, the influence will become greater. By virtue of the reliance which will be placed on Army combat air transport units, they must be first line troops. A high degree of skill and determination will be necessary to carry out their mission. These troops will be an important element in the Army organization to come.

The recent Department of Defense rulings on roles and missions specifically provides for the Army to use aircraft for observation, reconnaissance, and fire adjustment. The importance of this function in connection with the employment of atomic weapons and guided missiles is difficult to exaggerate.

Successful employment of atomics and missiles depends on proper target acquisition. Acquiring targets at the ranges of Army weapons (100 miles forward of line of contact) will be very difficult. Its importance is obvious. Observation from aircraft appears to be the only practical method of accomplishing target acquisitions, especially at ranges over 10 - 15 miles.

It is quite possible, therefore, that the Army will make extensive use of piloted aircraft for target acquisition. These aircraft will be used to patrol designated areas and reconnoiter specific points. Observation will

be accomplished using visual, photographic, and electronic means.

Target Acquisition

Army aircraft which are used for target acquisition may be organized into sub-units of a larger unit, the mission of which is to conduct target acquisition using all types of equipment, or they may be formed into separate units with the mission of supporting divisions or corps. The latter method of operation may be necessary to provide flexibility, or to facilitate concentrating all aircraft in a particular area if required.

A combination of these two methods of employment may be employed in the field army area. At this time, the Army has a project at the Army Aviation School, Fort Rucker, Alabama, to determine the tactics for using these aircraft. Whatever is developed, air reconnaissance by Army aviation will be an extremely important function. The magnitude of this activity will be in direct proportion to the extent the Army employs missiles for close support.

Sky Cavalry

Whereas the 26 November 1956 roles and missions paper does not specifically mention sky cavalry, it is concluded that authority to develop and employ these units is granted therein. This conclusion is reached because the aviation functions of sky cavalry, namely visual and photographic reconnaissance, and airlift for combat troops are specifically provided for in the Department of Defense paper.

It is visualized that the sky cavalry concept will be developed in due time to the point where a major portion of future armored cavalry will consist of this type of unit. The growth of Army aviation in this area could be extensive.

In addition to transport and sky cavalry units, certain type units which perform all or the majority of the Army aviation functions are feasible under the Department of Defense rulings. Examples of these types of possible units are:

1. Division aviation company to provide observation and fire adjustment for division artillery, aerial photography, very limited quantity of air transport, medical evacuation, and command and control.
2. Aviation companies for corps artillery, primarily for observation and adjustment of fire.
3. Aviation companies for corps headquarters and corps troops, and Army headquarters and Army troops, primarily for command, control, and medical evacuation.

In summary, the scope of Army aviation organization permitted by Department of Defense may consist of combat airlift units, observation units, sky cavalry units, and the three types of units mentioned above. TOE aviation sections or teams may be provided for command and control in certain engineer and signal units, and for medical evacuation. The scope of aviation organization, if all these types of units are adopted, would be extensive.

Types of Aircraft

Any discussion of the effect

on Army aviation of the 26 November 1956 Department of Defense rulings should consider the types of aircraft permitted as well as the types of aviation organizations. Combat airlift units may use both helicopters and fixed-wing.

The weight limitation of 20,000 pounds empty is sufficient to enable the Army to procure troop transport helicopters as large as the state of the art today can justify. It appears that Secretary Wilson recognized the Army's need for fixed-wing airlift when he authorized procurement of the DH C-4 (DeHavilland twin-engine "Otter"), and stated that he is giving consideration to another project involving a plane in the development stage.

The matter of fixed-wing aircraft is of particular importance because their ultimate potentialities are greater than the helicopter. In comparison with helicopters, the airplane has the advantage of costing less to procure and operate. For a given empty weight, an airplane will carry more tonnage further and faster than a helicopter.

The decided advantage of the helicopter at this time is its ability to rise and descend vertically. This advantage becomes less pronounced when it is realized that fixed-wing aircraft are being developed today with short field takeoff capabilities (STOL), and which eventually will have the ability to land and takeoff vertically.

As previously indicated, there is nothing in the Department of Defense rulings of 26 November 1956 which limits the performance of Army aircraft within the combat zone as defined. It is possible, therefore, that the Army will develop a new high-speed observation airplane.

This plane will be used for the traditional Army air observation role, but because of the increased distances involved and the necessity for instrument flight, this plane must have capabilities and characteristics which exceed those of the L-19 type observation airplane. It appears that operation of a high performance plane for observation can be justified by the Army on the basis that such action is necessary to carry out its mission in the area of terrain in which it will be providing missile support of field operations.

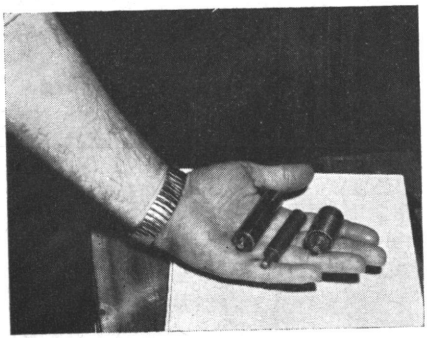
It is evident from the discussion herein that the 26 November 1956 Department of Defense ruling provides the Army with authority to proceed with a very substantial aviation program. In the future, as new developments in aircraft appear and increased uses of Army aviation become evident, further expansion will occur.

The 26 November 1956 Department of Defense document is one of the events in the parade of progress the Army has made in the field of organic aviation. The possibilities in the use of aircraft by the Army are extensive.

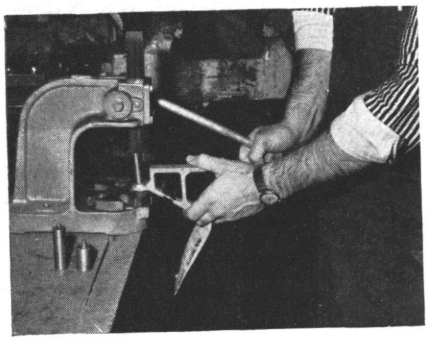
Army Aviation Maintenance Hints

BEGINNING WITH THIS ISSUE THE U. S. ARMY AVIATION DIGEST will publish, at regular intervals, a series of notes on maintenance hints. The information will be based upon maintenance and overhaul shortcuts developed at the U. S. Army Aviation School and by units in the field. The items used will concern such subjects as new maintenance or overhaul equipment available to field units, modification of special tools to make them more versatile, shortcuts to better maintenance, etc. Your suggestions, comments or contributions to this department will be appreciated.

These punchout tools were machined from brass bar to fit a number of bearings. Used for swivel link, hanger bearings, KP5A and many others, the tool will also help in inserting new bearings.



Bearing Press Tool

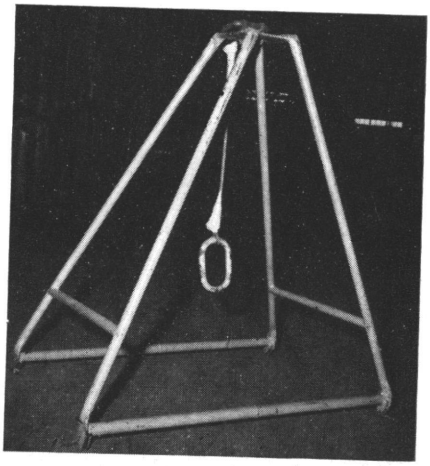


Instrument Change

During the service life of an aircraft and particularly when it is new in the field, the instrument markings are subject to change. Under the Army system of interchangeability, an L-19 instrument might be used in an H-13 or vice versa.

As limitations change, or the instrument is interchanged, the markings on the instrument should be changed also. The Flight Handbook (Dash One) is a source of correct instrument markings, so each time a revision or re-issue is received, check it for changes in instrument markings.

This jig for air-lifting an L-19 was drawn in the rough by Lt Col David Condon, former Deputy Chief of Staff for Maintenance, the U. S. Army Aviation Center. Maintenance personnel



Lifting Jig

then quickly spot welded the pipe. The entire job took less than two hours.

More damage is done to an aircraft such as the L-19 during salvage operations than usually happens in a forced landing. Much of this can be prevented by airlifting. This lifting jig is a direct result of the necessity for careful handling.

Dust and Aircraft Engines

Dirt is an engine's worst enemy, and because of continually existing dust conditions in various parts of the country, we cannot overemphasize the fact that good preventive maintenance will save money, time and unnecessary engine repair costs.

Recent investigation of engines by an aircraft company which were reported to have excessive wear or scored cylinders revealed accumulations of dust and sand in the intake pipes. Improper maintenance proved to be the primary cause of dust getting into the intake system of these engines.

To guard against accelerated engine wear when operating from dirt strips, or in time of high dust content in the air, the following precautions should be observed.

Only where these simple precautions are utilized for operating under dust conditions, can normal engine life be expected.

1. Avoid prolonged engine run-ups where dust is present. Where possible, the engine run-ups should be made over a clean, hard surface area.

2. Make certain that the engine intake system is sealed tight so that dust cannot leak into the air box behind the filter.

3. Remove, clean, and oil air filters daily. Filters which have all of the flock removed, or are damaged, should be replaced. At the same time the air scoop and ducts should be cleaned to remove any dirt that may have accumulated inside the induction system in the vicinity of the filter.

4. Change oil every 10 hours in the L-19 if extremely dusty, otherwise every 25 hours of operation.

5. The use of carburetor heat during ground operation should be avoid-

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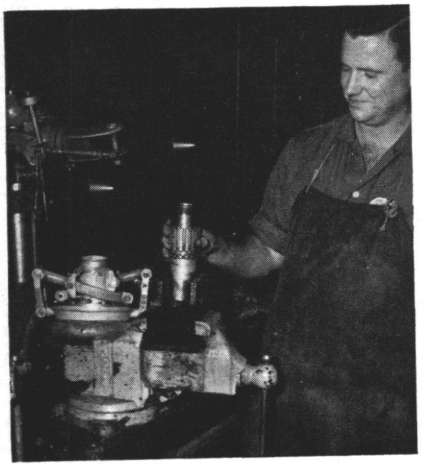
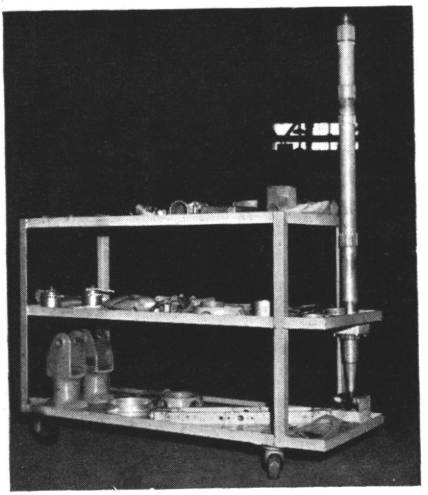
ed where possible since this supply of air is taken from an alternate source and is unfiltered. This is particularly important during engine run-ups, unless conducted over a clean, hard surface area.

Many special tools for maintaining or overhauling a helicopter can be made locally from parts which are no longer serviceable for use on the helicopter. Make use of an unserviceable mast drive flange (Part No. 47-620-524) by spot welding two iron bars so it can be held in a standard bench vise. This swash plate holding device was made by third echelon maintenance personnel at Field Maintenance, the U. S. Army Aviation Center.



Swash Plate Holding Device

Mr. E. A. Cutcheon, Field Maintenance Project Engineer, developed this teardown cart. It holds a quick change kit for main mast assembly of the H-13 and expedites these changes.



Teardown Cart

Plywood is inserted inside the channel iron to form the platform on which parts are placed for convenience and ease of disassembly or installations.

Pickups and Drops

Two Army doctors, Lt Col R. B. Austin and Capt H. H. Tyminski, recently graduated from the Naval School of Aviation Medicine at Pensacola, Fla. This was the first time in the history of the school that members of the U. S. Army were among the graduates.

Col Austin has been assigned to the U. S. Army Primary Helicopter School at Camp Wolters, Tex., and Capt Tyminski to U. S. Army Primary Fixed Wing School, San Marcos, Tex.

A self-contained electronic automatic navigator, Model 103, has been developed by Ryan Aeronautical Co., San Diego, for the U. S. Army Electronic Proving Ground, Arizona. Ryan is also in production on other automatic navigators and a helicopter hovering detector.

Hayden Aircraft (of California) is developing a modernized version of the old Ford tri-motor to be called the Stout Bushmaster. After 29 years of service, and in an age of high speed flight, more than 30 of the original 196 Ford tri-motors are still being flown commercially. Their use varies from scheduled airline passenger service in the Great Lakes region to jungle transport flying in South America.

Two years ago a group of aeronautical and mechanical engineers from a number of California aviation companies began work on the modification that allows a gross weight takeoff (14,500 lbs) distance of 1400 feet over a 50 foot obstacle. Range will be 850 miles at an average speed of 112 mph according to the manufacturer.

First delivery of an Army L-23D command transport was made early this year. The "D" seats six persons and carries complete instrumentation for all-weather flying. The L-23D has been beefed up with two 340 - horsepower supercharged Lycoming engines and a three bladed propeller to give it a top performance of 240 mph and a cruising speed of 228 mph. Service ceiling of the new model is 24,800 feet and it can take off and clear a 50-foot obstacle in less than 1,300 feet. Rate of

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Mention of any specific item in this department does not constitute indorsement or approval by the Department of the Army or the U. S. Army Aviation School.—The Editor

L-23D boasts top speed of 240 mph.

climb is 1,620 feet per minute.

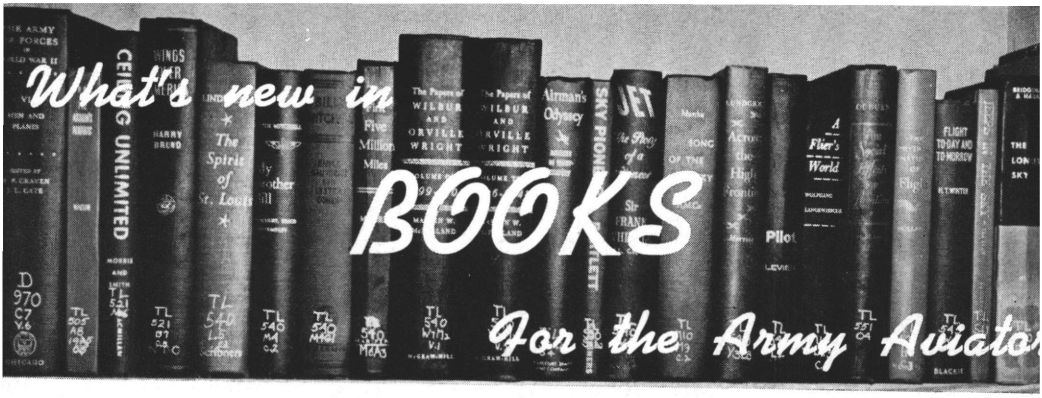
Capt. William R. Chaires, TC, took delivery on the first model of a $2,800,000 production contract.

The Royal Canadian Air Force has announced that four de Havilland Otters will operate with the United Nations Emergency Forces in Egypt. These aircraft will work out of ABU SUWEIR near the Suez Canal and will be used for reconnaissance, short-range communications and general supplying among UN ground units.

A small, simple, lightweight device has been developed for tracking helicopter rotor blades in flight. During flight evaluation, pilots who had never operated it before brought rotors that had been set as much as six inches out of track in track within seconds at speeds up to 60 knots. The device can also be used while the helicopter is being run up on the ground. At least one aircraft company will produce an automatic tracking device to insure constant in track operation.

An Army order for 84 H-13H helicopters and spare parts on a fixed-price type contract valued at more than $3 million has been received by the manufacturer.

The order is in addition to previous contracts, under which the Army had ordered a total of 105 H-13Hs for use as liaison and training aircraft.



THE FLYING YEARS—Lt. Colonel Lou Reichers (Henry Holt and Co., Inc., 383 Madison Avenue, New York 17, N. Y. ($5.00)

Reviewed by Walter V. Clark Technical Advisor and Writer, The United States Army Aviation School

In *The Flying Years,* Lou Reichers tells the story of his life and experiences in both military and civilian aviation. The book is well written and very interesting. Very colorfully, he tells of his inner feelings of fear and exasperation at the inadequacy of facilities that are so essential to long range navigation. He tells of astounding projects, in some of which he faced death. The necessity of planning, foresight and imagination are very well portrayed. The lack of cooperation on the part of dignitaries of foreign nations and the tact with which they had to be handled makes one wonder why the United States accepted Russia as an ally.

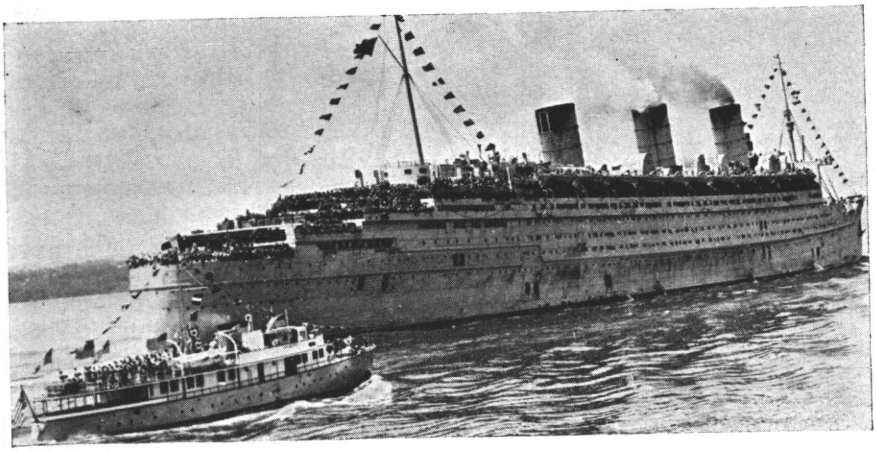
Lou Reichers, who was originally trained in the old PT-1, not only advanced with the Air Corps and Air Force but helped in many ways to make it what it is today. He set an endurance record of 313 hours under almost impossible conditions. He was the first to fly nonstop from Montreal to Havana. He tells of his flight in the "Miss Liberty" from Newark Airport to the point where he crashed, fifteen miles short of the Irish coast. He was pilot of the famous Oumansky-Harriman-Lend Lease Mission which brought him from Prestwick, Scotland, to Archangel and over the invading armies to Moscow—the longest nonstop flight to that date. He was commander of the Kit Project and the Newfoundland - Marrakech Survey and trouble-shooter for the Alaska-Siberia Project.

All these air adventures, and many others, Lou Reichers describes crisply and colorfully, with amazing recall and authenticity, and a rare ability to convey the professional flyer's attitude toward his work.

Book reviews appearing in this department do not necessarily reflect the opinions of the Department of the Army or of the U. S. Army Aviation School.—The Editor

THE TRANSPORTATION CORPS: MOVEMENTS, TRAINING, AND SUPPLY—Chester Wardlow (Office of the Chief of Military History, Department of the Army, Washington 25, D. C., 1956. $4.25).

In a great conflict fought on foreign soil, as Chester Wardlow points out in the newest volume of the series U. S. ARMY IN WORLD WAR II, victory depends on how many soldiers and how much materiel can be moved



"Queen Mary" arrives in New York with American troops—1945

to the oversea commands and on the timeliness of their arrival.

Not until months after the United States had entered World War II, however, did the War Department create a unified organization to take over the key role of transportation. A Chief of Transportation was appointed in March, 1942, and in the following July, the Transportation Corps came into official existence.

The volume makes clear that, in the face of the handicaps involved in setting up a new organization after the war had already begun and making it operate smoothly, the new Corps and its chief achieved an impressive record. Although there were minor transportation delays, some breakdowns in procedures, and some separation of troops and their organizational equipment — and the author scrupulously chronicles demerits along with merits—no interruptions in movements to the theaters adversely affected military operations.

It becomes apparent from this history that supplying the overseas theaters involved far more than the transportation of huge tonnages. The task was an intricate one of co-ordination and synchronization. The right proportion had to be maintained between troopship and cargo ship capacities. Care had to be taken to ship to the theaters the types of troops and the items of supply that they needed, and to deliver them when they were wanted and at ports where they could be accommodated.

To assemble and ship related supply items received from many different depots and factories required careful identification and sorting at the ports of embarkation. The great variety in weight and size of military supplies made it impossible to get well-balanced cargoes and efficient use of cargo space.

Recognizing these difficulties, the Chief of Transportation emphasized the necessity of assigning highly competent commanders and staffs to the ports.

The movement of troops and equipment within the United States is an integral part of the transportation story told in this volume. During the war the Army shipped 340,000,000 tons of freight by domestic carriers, and it provided transportation for more than 35,000,000 passengers traveling in organized groups as well as for many other passengers in unorganized travel. Since the bulk of this traffic moved by rail, the Transportation Corps had to work very closely with the railroads.

The Military Transportation Section of the Association of American Railroads was located in the Pentagon and functioned side by side with the Chief of Transportation's staff in working out efficient routings, conserving equipment, and maintaining schedules.

ANTHROPOMETRY AND HUMAN ENGINEERING — The Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization (Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y., 1955. $3.50)

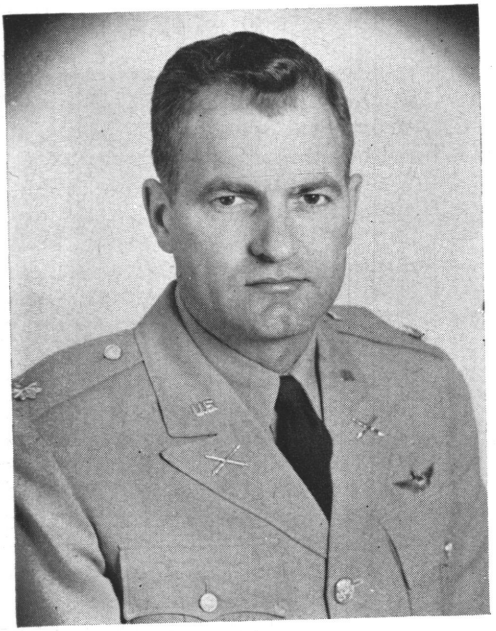
Reviewed by Dr. Arthur C. Poe Education Advisor, The United States Army Aviation School

This publication presents the reports given at the Symposium on Anthropometry, Human Engineering, and Related Subjects by members of the AGARD Aeromedical Panel on 3 and 4 May 1954 in Scheveningen, The Netherlands. All reports are well documented with pertinent references.

The discussion of Anthropometry considers the body measurements of aircraft pilots in connection with methods of determination of suitable dimensions for standard cockpits and the relation of different body builds and physiological fitness tests with success in flight performance.

The section on Human Engineering notes that "pilot error" causes most aircraft accidents. In order to eliminate "pilot error" caused by misinterpreting instruments which are difficult to read or poorly arranged, it discusses dial sizes, various dial presentations, and those instrument arrangements which are conducive to easiest perception by the pilot. The human factors in aircraft design and the adaption of the cockpit, including position of controls, shape of control handles, and direction of control movements are also presented with regard to ease of operation and avoidance of the common errors of using wrong controls. CDR George W. Hoover, USN, Bureau of Aeronautics, proposes that the instrument pilot be presented with direct answers to two questions: "What am I doing?" and "What should I be doing in order to accomplish my objective?" instead of piecemeal data and a computer to obtain the answers.

The Related Subjects discussion presents reports on statistical techniques for improving the validity and usefulness of aeromedical research data, and the progress of a study of those physiological and psychological changes which occur in a military pilot during his flight career.



The Gray Hair Department

AN AVIATOR WAS FLYING an L-19 on an extended ferry mission, delivering the airplane from a maintenance depot to its unit. During the first leg of the trip, the engine was intermittently rough. At the first scheduled refueling point, the engine was checked and maintenance personnel replaced five of the bottom spark plugs and added four quarts of oil. The oil consumption though high was within established limits.

On the two hour second leg of the flight, the engine was again rough with occasional backfiring. Again the left magneto showed a 200 rpm drop, and almost four quarts of oil had to be added.

Maintenance personnel replaced spark plugs, bench tested the carburetor, leaned the carburetor mixture, and replaced some of the intake seals. The run-up now showed a 50 rpm drop on the left "mag" and a 15 rpm drop on the right "mag."

The aviator decided to test fly the aircraft before continuing the ferry mission and was accompanied by a mechanic on the flight. He took off and circled the field,

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Lieutenant Colonel Thomas O. Morrow, the senior Army Aviator pictured above, is the Director, Department of Rotary Wing Training, the U. S. Army Aviation School, Ft. Rucker, Ala. His career as an Army Aviator began shortly after graduating from Artillery OCS at Ft. Sill, Okla., in 1942. He was assigned to Class No. 5 at Denton, Texas, for primary training and subsequently graduated from the Liaison Pilots Advanced Course at Ft. Sill.

He arrived in Italy in 1943 and was Division Aviation Officer of the 85th Infantry Division. He remained with the 85th until returning to the United States in 1945, when he was assigned as the Aviation Advisor for the New Jersey National Guard. After com-

Lost Composure and Overshot Forced Landing Area.

keeping within a safe gliding distance while he checked the engine acceleration, observed the engine instruments and listened for any unusual sound. Satisfied that the engine was running normally, he flew away from the airfield to continue the test flight. About six miles from the field, satisfied that engine operation was normal, the aviator throttled back and started a descent toward the airfield. At 1500 feet he applied throttle to level out, but the engine did not respond. He switched tanks, turned off carburetor heat and checked the mixture control in the full rich position. The engine continued to idle and did not respond to throttle.

By this time the pilot was becoming excited. He turned around in his seat and asked the mechanic where he thought they should try for a forced landing.

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pletion of his tour with the National Guard, Colonel Morrow attended the instrument flight training course and rotary wing training. He was the Aviation Officer for the United States Troops stationed in Trieste for the next two years.

Later he joined the 9th Infantry Division in Europe as the Division Aviation Officer and remained in this assignment until returning to the United States. He completed the Artillery Officers' Advanced Course prior to reporting to his present assignment. In his 15 years of flying, Colonel Morrow has logged approximately 3,000 hours of first pilot flying time, and is qualified in most Army fixed- and rotary-wing aircraft.—The Editor

They were over a populated area, but the aviator selected a sand bar along the right bank of a river for his landing area. He aimed the L-19 toward the sand bar and came in high and fast. He believed he was much faster than 70 mph, but could not remember how fast. As he crossed the downwind end of the intended landing area, high tension wires loomed in front of him. The landing gear hit the wires, shearing two of the six strands of ¼ inch copper cable.

The airplane overshot the intended touchdown point by more than 700 feet and was within 300 feet of a bridge which spanned the river perpendicular to its path. In order to avoid hitting the bridge, the pilot lowered the left wing in an attempt to hit the ground. However, before the wingtip struck the ground, the left landing gear hit and sheared off, the aircraft spun around 180 degrees and slid into three feet of water. Neither pilot nor mechanic was injured.

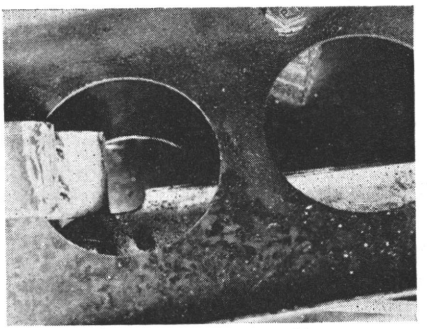
No doubt the aviator involved in this accident had had more than his share of anxiety with this airplane, and there is always a tendency to get excited during a forced landing, as many of us can witness. Excitement and anxiety usually manifest themselves in an excessively fast glide, as the pilot's instincts shy away from a possible stall. It is a tribute to the reliability of our present engines, that many aviators can expect to go throughout their flying careers without experiencing a failure in flight. When the failure comes, it shows up immediately whether the aviator has prepared himself mentally to cope with it.

The Gray Hair Department is prepared by the U. S. ARMY AVIATION DIGEST staff with information obtained from the files of the U. S. Army Aviation Safety Board. The views expressed in this department are not necessarily those of the Department of the Army or of the U. S. Army Aviation School.—The Editor.

AN UNUSUAL ACCIDENT

The day before the accident, the pilot had flown the same L-19 from the field maintenance company where a new tail-wheel channel had been installed. He was now taking off with a mechanic aboard and with the mechanic's tool chest and a five gallon can of oil in the luggage compartment.

The aviator states, "I applied throttle to about 2250 rpm, but as we accelerated down the runway the tail would not lift off the ground. I throttled back and braked the aircraft to a stop and taxied back to the takeoff end of the runway. I assumed the load in the luggage compartment was placed too far aft so we rearranged the position of



Foreign Object Wedged In Elevator Bellcrank

180 Degree Turn is Not Always a Safe Escape.

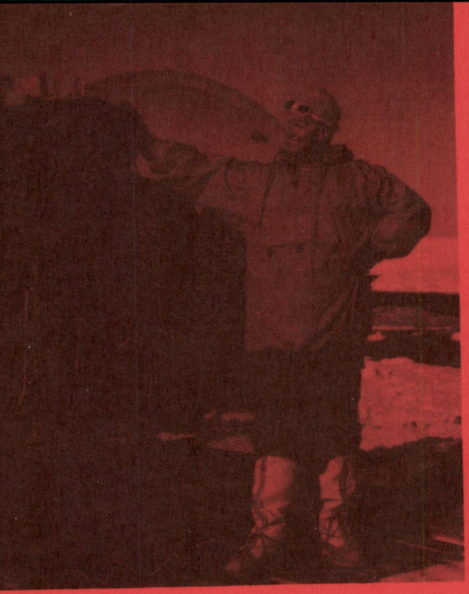
sity is apparent. It is not an ace-in-the-hole which will save the aviator's life after he has pushed far enough into the weather to see that it is necessary. The reason is simple when you think of it. By the laws of chance in 358 cases out of 360 the weather will be coming across the line of flight. If the aviator waits to make the turn until he is sure it is necessary, he has no assurance whatsoever that he will now find better weather behind him. The weather will certainly have changed along the route he has just come over.

The last escape route is up! Therefore, the first requirement for an aviator, before he pushes the weather at all, is instrument training and an instrument ticket. With these, he can afford to push farther into the weather to see if conditions are going to improve. If they do not, and the 180 degree turn looks dangerous, the last escape route remains open.

THAT FIRST STEP

An aviator was practicing wheel landings in an L-19. He aligned the aircraft on the final approach holding 80 mph airspeed. The round out was incomplete and the wheels struck the runway hard. The landing gear spread and the aircraft ballooned into the air, floated and touched down again. On second touchdown, the pilot instinctively applied forward stick to hold the airplane on the ground in a wheel landing attitude. The propeller struck the runway twice.

This specific accident has happened perhaps 100 times in the L-19 in the last five years. It apparently is hard for our aviators to believe how close the propeller tips are to the ground and how little forward pressure it takes.



ench Army Major C. Petitjean, above, stands side the H-13 which he used to ferry supplies r the French Polar Mission at Adelie Land, ntarctic. Following the supply visit, the xpedition, headed by M. Paul-Emile Victor, ttled down for the long Antarctic winter. t right, a curious penguin takes a closer ok at the H-13 used in the operation.

Major Petitjean also used the H-13 to reconnoiter paths to be used by the expedition's Weasels in order to detect crevasses and other hazards. Below, he makes one of the many trips flown during the two-month supply operation which ended in February, 1957. Back cover shows how the sling load is fastened to the bracket underneath the H-13 which features both an automatic and hand release.