ARMY AVIATION DIGEST

ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA

SEPTEMBER 1956 VOLUME 2 NUMBER 9

ARMY AVIATION SCHOOL

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ARMY AVIATION
DIGEST

VOLUME 2 SEPTEMBER, 1956 NUMBER 9

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COVER: The Great Profile, John Barrymore, always protested appearing on the stage or in a motion picture scene with children and pets. He charged them with scene-stealing. And so it is with the star-studded performances at any National Air Show, when the Army Demonstration Team's square dancers bow on stage. Laurels are hugged tighter because even old and seasoned airmen stop and stare. The square dancers have surprised and delighted thousands in the past and will continue to demonstrate the versatility of the helicopter in this unique manner. The current team is composed of Warrant Officers V. D. Shug, F. O. Bell, E. G. Bourne, H. C. Conyers and H. E. Gilliland, all of Department of Rotary Wing Training, The Army Aviation School, Ft. Rucker, Alabama.

This copy is not for sale. It is intended for more than one reader.

PLEASE READ IT AND PASS IT ALONG

EDITOR-IN-CHIEF

Captain Richard W. Kohlbrand

EDITOR

William E. Vance

The printing of this publication has been approved by the Director of the Bureau of the Budget, 15 March 1956.

The ARMY AVIATION DIGEST is an official publication of the Department of the Army published monthly under the supervision of the Commandant, Army Aviation School. The mission of the 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, ARMY AVIATION DIGEST, Army Aviation School, Fort Rucker, Alabama.

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THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*
Commanding General, The 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

A Personal Note to the Industry

MANY MAKERS OF AIRCRAFT and allied equipment come to the Army Aviation Center and make presentations on what they are doing under present programs as well as research and development. In general, the vigorous interest shown by industry in Army aviation is very encouraging. Much of the information presented to us is both classified and proprietary, and no specific mention will be made here of any presentation. The following are general remarks concerning personal impressions which have grown out of hearing the briefings.

The industry appears to be somewhat puzzled about what the Army's requirements are. This is not surprising because, in fact, the Army is not quite certain about the machines it requires to do the job which it must do. Even more perplexing is what the requirement will be five or ten years from now. The situation is a variant of the chicken and the egg argument. Does the machine come first or does the idea come first?

One thing is quite obvious. The Army's present aircraft were conceived of, designed and purchased with a fairly limited application in view. The basic designs are from five to ten years or more old. Five or ten years ago the Army was thinking almost solely in terms of limited use of Army aircraft. Some of that thinking persists today, but advanced thinking appears to be changing.

It is especially noteworthy that the large STOL/VTOL airplane is receiving much attention. This is excellent for the limited field of

its use, which is as a transport aircraft for personnel or cargo. The logistic and personnel function will always be there, but it is by no means an exclusive field.

This column does not speak for the Department of the Army: it is only the writer's opinion as of this moment. If I were directing an industry's research and development efforts, I would give serious consideration to the following:

Light weight command and reconnaissance helicopters which are air transportable, i.e., a flying jeep to replace the jeep.

A family of cranes designed to fold up and be loaded in transport aircraft, with various associated pods. There is no guidance as to size, therefore why not take the Army's present vehicle sizes as an indication? ¾ ton, 1½ ton, 2½ ton.

Some cost figures should be calculated. How many 2½ ton cranes would be required to replace 2½ ton trucks in an infantry regiment or a division?

The field of light weight weapon platforms with STOL/VTOL characteristics is largely overlooked.

The Army may or may not have stated a requirement for the foregoing. To wait for a stated requirement would be a little like it would be for the automobile industry to wait for the public to ask for automatic transmissions. Three to five years from now, if such machines were available, what would the requirement be? The company which is prepared at the proper time is very likely to be in a favorable position, while a company which waits for a requirement to be stated may find itself five years behind when money is put upon the barrel head.

NIGHT VISION

Lieutenant Colonel Rollie M. Harrison, MC

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

VISION IS THE MOST IMPORTANT single sense used in flying. When normal, it enables the pilot to estimate distances, altitude, terrain features, wind direction and to some extent, speed of flight. Visual perception under poor visibility conditions may cause misinterpretations, and errors. Absence of contrast, brilliance, color and perspective may cause improper estimates of size, distance and altitude. This misinformation may influence flight control to the extent that an accident results. Night flying presents some important differences from daytime flights, particularly as concerns vision.

For explanatory purposes, the structure and functioning of the eye may be compared with those of an ordinary box camera. The outer white coat of the eye may be considered as the camera case or box. This "case" has a dark brown tissue lining, comparable to the black lining of the camera, which prevents the entrance of aberrant light rays and eliminates blurring of the image.

At the front of the eye is the visible colored portion, the iris, containing an adjustable structure, the pupil, which corresponds to the diaphragm of the camera. In the presence of bright light the pupil contracts automatically to exclude the entrance of excess light rays, and conversely, expands in dim light to admit as much light as possible to the sensory portion of the eye.

The Retina

In addition, the eye has a lens which like that of the camera, brings the rays of light to focus on the inner back wall of the eye. This area, called the retina, is the sensory or receptor portion of the eye and corresponds to the sensitive film in the camera. The lens is

automatically thinned and elongated, or drawn together and thickened as is required to accommodate for far and near objects in order to produce a clear image on the retina.

All parts of the retina are not alike in their reaction to light. There is a small centrally located area which provides acute vision and color discrimination. This is the focal spot area and takes care of our direct line of vision. It is supplied with sensory receptors called "cones" and is used for reading, color perception and differentiation of details. This so called area of central vision functions only in illumination of daylight or greater intensity. (1/1,000 foot candle is the minimal stimulus that give perception; bright moonlight is equal to about 2/100 foot candles, so with illumination slightly below this level there is no central vision.)

The entire peripheral area of the retina is supplied with a different kind of sensory receptors which are called "rods." These, although capable of less acute visual perception and poor color determination, do function under conditions of low illumination (1/1,000,000 candle power or more) and provide vision on a dark starlit night. They also provide us with "corner-of-the-eye" vision.

Blind Spot

Because of the "blind spot" (central cone area) when attempting to see things in dim light *do not look directly at objects to be seen.* One must look slightly above, below, or to one side of the object, from 5 to 15 degrees using a roving or scanning gaze. This requires considerable practice, it can be done on the ground and should be practiced conscientiously until proficiency is acquired. In night operations do not stare fixedly at lights. To do so may produce a false impression of movement of the light which is known as auto-

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Lt. Col. Rollie M. Harrison, *who was Flight Surgeon for ARMAV, Ft. Sill, Oklahoma from 1950 to 1955, is stationed with the 31st Surgical Hospital, USAREUR. He received his B.S. from the University of Illinois in 1929 and his M.D. from Northwestern University College of Medicine in 1935. He is a graduate of the AF School of Aviation Medicine and completed the course in tropical medicine at the Army Medical Center.*

He is a member of the AMA, Chicago Med. Society, Illinois State Med. Society, Aero Med. Association, Association of Military Surgeons, AF Association, Airline Med. Examiners Association, and Masonic Bodies.—The Editor

kinetic motion or autokinesis. A stationary light may appear to move sidewise when it is actually going straight ahead. The possible undesirable results of such misinterpretations are quite obvious.

Objects are visible at night only by contrast with their surroundings, (either darker or lighter). Contrasts are reduced by fog, dirty or scratched windshields and goggles. For night operations these should be scrupulously clean and it should also be remembered that reflections of lights from instruments on goggles or windshields reduce visual acuity. Night vision cannot pick up small objects or details. An airplane can be seen from about 1,000 feet at night, if seen from above, below, or the side. It may best be seen against the sky or white clouds.

Adapting Vision to Darkness

Before one can see objects at night it is necessary that the eyes become dark adapted, or adjusted for maximum efficiency in low illumination. A common example of this is the experience of walking into a darkened theater where at first one is unable to see anything, but after a short interval the aisles and rows of seats gradually become visible. The central or cone area of the retina requires about eight minutes for maximal adaptation but does not provide night vision. About 30 minutes is required for maximal adjustment of the peripheral or "rod" area.

Both types of sensory receptors contain photochemical substances. In the rods it is called "visual purple" or "rhodopsin," in the cones, "visual purple" or "iodopsin." These chemical substances are broken down or bleached by bright light and may be rebuilt in darkness. Visual purple, the chemical substance contained in the rods, is unaffected by dark red light. This makes it possible for one to become dark adapted by covering the eyes with dark red goggles. Thus he may read, play cards or converse in a lighted room during the time required for the process of adaptation.

Dark adaptation is an individual process in each eye. It is slow to develop in the dark and is quickly lost in the presence of light. An instant of exposure to bright light will completely neutralize dark adaptation and a period of 30 minutes will be required for it to be regained. The pilot should be so familiar with the location of equipment and controls that no lights are necessary for making adjustments in flight. Memorizing routes will eliminate the necessity of consulting maps frequently during flight. If it becomes necessary to

use lights, use as little as possible for as short a time as practicable. Use a red light for illumination whenever possible and look at luminous dials no longer than required to obtain desired readings. If exposed to light, especially a searchlight beam, closing one eye will maintain its dark adaptation.

Exposure to bright sunlight during the day decreases night vision efficiency, therefore it is recommended that protective sun glasses be worn during such exposure prior to night time operations.

Hypoxia

Stresses of hypoxia (oxygen lack), fatigue, increasing age, smoking and drugs adversely affect vision. The effects of such stresses are increased under conditions of low illumination to the extent that small stresses which are relatively unimportant in the daytime may become destructive forces at night. Transition from IFR to VFR conditions and vice versa, may be a critical period.

Hypoxia and decompression produce most of the visual difficulties encountered at altitude. The latter is generally not a problem to Army pilots since they normally do not fly high enough to produce symptoms on descent. Hypoxia causes a constriction of the pupils making vision very difficult under conditions of low illumination.

There is a gradual decrease in night vision, from 5% at 4,000 feet to 40% at 16,000 feet when such altitudes are flown without the use of supplementary oxygen. Above 10,000 feet there is also said to be a decrease in the ability to focus the eyes, producing an increased possibility of double vision.

Fatigue

Fatigue reduces night vision as well as affecting other visual functions. Since the greatest demands on night vision are made at the end of a night flight when fatigue is the greatest, it is important on long flights to space the rest periods so as to lessen or minimize fatigue at the time of landing.

Age and Night Vision

Increased age has an adverse effect on night vision. It has been observed that night vision is less efficient in persons over 40 years of age than in younger age groups. It is true also that a high degree of

daytime visual acuity does not necessarily insure good night vision. True "night blindness" in the author's experience occurs very infrequently. Over a period of years and in the performance of several thousand physical examinations for military flying, but two or three such cases were noted.

Effects of Smoking

The effect of smoking and drugs on visual functions cannot be overlooked in a discussion of this kind. Excessive smoking impairs vision through the action of nicotine which causes a constriction of the blood vessels and produces a decreased flow of blood to the eyes. Carbon monoxide absorption has also been shown to decrease night vision efficiency. Heavy cigarette smoking may produce 5 to 8 percent carbon monoxide saturation of hemoglobin in the blood of an average person. Three percent saturation has been shown to impair night vision.

Carbon monoxide (CO) is one of the products of incomplete combustion of any organic substance including tobacco. From 1 to 2.5% of the total cigarette smoke volume is carbon monoxide. (Cigar smoke may contain 5 to 8% CO.) Rapid smoking causes less complete combustion of the tobacco and produces more carbon monoxide. Increased moisture and firmer packing produce a similar effect. CO is absorbed into the blood stream only if inhaled into the lungs. The smoke from an average cigarette is said to contain 20 to 25 cc of carbon monoxide, about 50% of which is absorbed (10-15 cc) if smoke is inhaled into the lungs.

Hemoglobin (Hb) is the oxygen carrying element in the blood and accomplishes its function by rapidly combining with oxygen (O_2) in the lungs and carrying it to the body tissues where it is readily released to play its part in providing heat and energy for the body.

The total gas combining hemoglobin of the average individual is about 100 cc. Thus one cigarette may saturate 1 to 1.5% of hemoglobin with carbon monoxide. If an individual smokes 20 to 30 cigarettes per day, 4 to 8% of his available hemoglobin may be saturated with carbon monoxide. This of course reduces the oxygen carrying capacity of the blood in proportion to the amount in which the CO is absorbed. (At body temperature, CO and hemoglobin combine over two hundred times more readily than do hemoglobin and oxygen.)

Carbon monoxide forms a relatively stable compound with the hemoglobin of blood and is eliminated very slowly. *It is recommended that pilots avoid smoking for at least 45 minutes before making night landings,* since the light sensitivity of the eyes is adversely affected by as little as 3% level of CO-Hb. The observation has also been made that a carbon monoxide saturation of 10% has a rather marked effect on altitude tolerance tending to lower the ceiling about 4,000 feet. In other words, a true altitude of 12,000 feet under such conditions would be equal to 16,000 feet physiologically.

Use of Drugs

All drugs are considered to be no asset to night vision and it is recommended that pilots do not fly when taking medication. Alcohol is included in this category and should be avoided before or during flight.

Diet and Vitamins

An adequate amount of Vitamin A is necessary for normal night vision and is usually provided in the average diet. Sources of this vitamin are such foods as: green vegetables, carrots, spinach, fruits, butter, cheese, eggs, and liver. Treatment of night vision deficiency by administration of Vitamin A is effective only when the condition is due to a lack of this substance.

Conclusion

1. The most important single sense used in flying is vision. Night vision differs considerably from day vision and it is essential that pilots know these differences in order that they may participate in night operations most effectively and safely.

2. The most common visual factor causing aircraft accidents is poor visibility during landing. Dirty canopies and windshields have been responsible for many landing accidents.

3. Night vision is very sensitive to hypoxia. At 10,000 feet, without supplementary oxygen, night vision is decreased by 20%. Excessive smoking and indulgence in alcohol have an adverse effect on visual functions and are to be avoided.

4. Accommodation of "far" to "near" vision and adapting to

(Continued on page 22)

It was estimated in 1955, that aircraft accidents cost the Army over $5 million, which is a big chunk of the Army's appropriated fund. We are doing something about it and even more can be accomplished by intelligent use of our—

ARMY AIRCRAFT ACCIDENT REPORTS

Major Ollie B. Richie, *Corps of Engineers*
Director, Army Aviation Safety Board

MAXIMUM ARMY AVIATION SAFETY has not been reached, but we do have the means, accident reports, through which we can greatly decrease Army aviation hazards. Army aviation is not as safe as it could be due largely to misunderstanding, on the part of investigating officers, of Army Aviation Accident Reports.

Army-wide corrective action, and accident prevention measures, are based on statistics compiled from accident reports. If the accident report does not present a true picture, neither will the statistics.

Reviewing accident reports over the past 12 months, as director of the Army Aviation Safety Board, I have found that approximately 60 percent reflect misunderstanding, concealment of facts, and misrepresentation of the facts by accident investigation boards. This large percentage indicates a lack of understanding of the report's purpose.

A common misconception by accident investigators, and pilots, is that the board should view the accident in the light of punitive action to be taken against the persons involved. Such consideration is definitely not within the board's scope. If the pilot involved in the accident violated regulations, or the accident resulted from some other professional dereliction, it is the commander's responsibility, not the board's, to take disciplinary action. Further, the accident entry on DA Form 759 (Individual Flight Record Form) is a *statistical* and not *damaging* recording. *IT CANNOT BE USED* as evidence under the Universal Code of Military Justice.

Concealing Facts

Fear of reprimand and possible loss of flying status undoubtedly prompts the concealing of facts. Supervisors, as well as pilots, are equally at fault in this category. In some cases the accident boards purposely omitted certain facts from their reports because of loyalty to their superiors or fellow pilots. Also, facts are withheld in order to narrow the scope of the investigation. This might be compared to a surgeon who opens a patient and sees so many things that might be wrong, he hastily sews the hapless individual up again and says "We'll just give him a little aspirin and hope he recovers." Surgeons just don't operate in that manner and neither should investigating officers.

Misrepresentation

While in the process of climbing out of the wreckage, many pilots have their minds busily engaged in producing an exonerating explanation as to why they did not switch gas tanks or apply carburetor heat. A report containing a narrative designed to excuse the act will distort the accident statistical picture. An alibi replaces fact, and our safety program suffers.

Report Procedure

What is an accident report? Who compiles it? To whom is it sent? What is done with it?

Major Ollie B. Richie *is the Director of the Army Aviation Safety Board, Ft. Rucker, Ala. He is a senior pilot with over 2,500 hours flying time, is instrument rated, and qualified in both rotary- and fixed-wing aircraft.*

He entered the Army in 1939 as a private, worked his way through the ranks to sergeant, and then to OCS in 1943. During WW II, he was an Infantry Unit Commander in Trinidad, B.W.I. After the war he applied for Army Aviation Pilot Training and graduated an Army Aviator in 1947. Prior to the Korean War, Major Richie was assigned to the 30th Engineer Base Topographic Bn flying in Alaska during the summer months and in the mountain ranges of Southern California during the winter months.

In the Korean War, Major Richie flew for the 25th Inf. Div., and later became the executive officer of the 8th Army Flight Detachment. He returned to the Army Aviation School in 1954, and subsequently was assigned to his present position.—The Editor

The Accident Report (DA Form 285) is a printed form designed for listing pertinent information about an Army aircraft accident. The Army Aircraft Accident Investigation Board, or investigating officer, fills out the form with the information gathered during the accident investigation. It is forwarded through the major command to the Commandant of the Army Aviation School.

The Army Aviation Safety Board, established for the purpose of study and statistical correlation of reports, prepares the review for the Commandant's approval. Upon approval, one copy of this review, or accident brief, is sent to G1, DA to be filed in the working 201 file of the pilot or individual involved. The other copy is retained and attached to the original accident report and placed in the permanent files of the Safety Board.

Purpose

It is through the statistical picture, compiled from all Army aircraft accident reports, that the Aviation Safety Board can plot the factors currently producing accident trends. This information forms the basis for corrective action in the improvement of training, aircraft design, and flight procedures. Therefore the person or persons writing the report must keep foremost in mind that the accident report serves a three-fold purpose. One, it is the means of recording the findings of the investigation. Two, it will be used by the major command in its analysis of accident trends. Three, it is finally analyzed by the Army Aviation Safety Board. With inaccurate reports, the Army Aviation Safety Board and the major command cannot plot the real statistics. This may result in unnecessary restrictions being placed on Army flying or misdirected corrective action. We could compare the report of accident to medicine, in that it is sometimes hard to swallow, but it will eventually cure the patient.

Mission of the Board

The accident investigation board is like a photographer who is assigned the mission of taking one small picture that is to be used in the makeup of a large panoramic view. How well his contribution will fit into the overall picture depends a great deal on his understanding of the mission and his technique.

The accident investigation board's sole purpose is to determine the primary cause and contributing factors in the accident and to

recommend effective corrective action. This information is recorded on DA Form 285.

Investigation Procedure

Consideration of all possible flaws which *could have made* the accident inevitable should be the theme of the investigation.

Approach the investigation objectively and not with the thought in mind of who will take the "rap" for this one. As an investigator, you know nothing until all the facts have been gathered. Unfortunately, there is no Army publication pertaining to the technique of aircraft accident investigation at the present time; however, the Department of Publications and Non-Resident Instruction at the Army Aviation School is researching material to compile a DA manual on techniques and procedures of aircraft accident investigation. Until this publication is available, outside literature on the subject may be used as references. The Manual of Aircraft Accident Investigation, published by the International Civil Aviation Organization, is one of the more comprehensive manuals on the subject.

The investigators should use a blank DA Form 285 (Report of Accident) as a guide. A check list should be made of additional information required by regulations SR 385-10-40, C1, C2.

All members of the board should participate actively in the investigation and in the preparation of the report. This participation means physical action at the accident scene, digging up wreckage, interviewing witnesses, dismantling critical parts and the like. Also, the board members should be assigned different parts of the investigation, one to obtain the documented evidence of flight clearances, weather reports, pilots records, etc. A second member can be coordinating with experts, and/or specialists in analyzing matters beyond the capabilities of the board. A third should be obtaining survivors' accounts of the accident, history of the flight, and statements of any available witnesses.

The investigators should keep in mind that the first objective is gathering all information, no matter how remote, that could be connected in any way to the flight, or aircraft. When all the information is obtained, it can then be correlated and analyzed.

Analyzing information must be a careful process. Primarily the investigators must determine what was the foremost act, circumstances or conditions that set the stage for the accident. Next, the contributing causes should be determined. Then the investigators

are ready to compile the report, DA Form 285.

First, investigators must keep in mind the purpose for which the report will be used. Second, make certain that all the information considered is included or attached as annexes to the report for availability of consideration by the reviewing agencies. Do not leave out information which does not appear particularly relevant to the accident. For example, do not leave out the weather report because it was determined that it was not a factor in the accident. Include the weather report so that review agencies may decide for themselves.

DA Form 285

Section 1, Major Command and Reporting Unit; Section 2, Type of Accident; and Section 3, Personnel Involved, are self explanatory, and not too much difficulty has been noted in recording the information requested in them.

Section 4, Equipment or Property Involved. In addition to the requested information on the form, the aircraft's date of manufacture, its total hours, date of last overhaul, and similar data must be included. This information is required by SR 385-10-40, C1, Section 4, para. 1. In many cases it is omitted.

Section 4e, Damages. Many reports have been held up pending a precise accounting of damages. The exact amount is desired; however, do not delay the report awaiting an exact figure, but obtain the best available estimates from a reliable source (TAAM Co).

Narrative

Section 5 is one of the most abused sections in the accident report. It is the description of the accident in narrative form and provides completeness to the report and validity to the investigation board's analysis. Within the narration, the behavior of the aircraft, its power plant, and its controls, before and at the time of accident, should be included. This information is important as well as that concerning the efforts of the pilot, or any other person, to prevent the accident.

The most common fault of boards in connection with this item is to make statements in the narrative and not authenticate them, or elaborate on them anywhere else in the report. Poorly written narratives cause confusion.

The entire report should be carefully edited to insure that all

the essential facts are included and that the narrative is not written in such a slant that incorrect conclusions will be drawn.

In addition, Section 5 requires information on a continuation sheet. On many reports this is not complete or is missing altogether. SR 385-10-40, C1, para 10g, item 5 (a through l) specifies the information desired. This information is important to the overall Army statistical picture, so make certain it is complete.

Diagram

Section 6, Diagram of the Accident, provides space for a graphic description of the accident scene. This greatly aids in the accident analysis. The regulations require a diagram only if, in the opinion of the board, it will further disclose factors or conditions related to the accident. However, in the interest of the review agencies a diagram should be included. The regulations state that photographs are desirable; the investigation boards should construe this as mandatory. In many accidents a review cannot be analyzed accurately without the aid of photographs of the area, damaged aircraft parts, ground marks, and so forth.

Accident Analysis

Section 7, Accident Analysis, is extremely important. Block 7a is titled "Primary Unsafe Act" (and by whom). It is in determining the primary cause and contributing factors that most accident investigation boards make errors. For example, let us consider an accident reviewed in the January Gray Hair Department.

A pilot was dispatched on a mission under extremely unstable and marginal weather conditions. It was his first scheduled flight in the unit and second flight since graduating from pilot training 70 days previously. As he broke traffic, a ground fog moved in under him, then the tower announced that the field was closed. Eventually, the pilot found a hole and went down through it. The hole closed above him, and he found himself trapped in a valley. He attempted an emergency landing on a road but his wing tip struck a small tree and he crashed.

The investigation board called it pilot error. Higher headquarters corrected this situation in their review and placed the responsibility where it belonged, on supervisory personnel, (1)

(Continued on page 36)

EMPLOYMENT OF INTERCEPTOR AIRCRAFT IN AIR DEFENSE

Colonel John F. Sharp, *USAF*

THE OPERATION of the tactical aircraft of our command, other than administrative or proficiency flying, presents a problem unlike that of the other commands and services or commercial operations. While others operate normally on a point to point basis, our operations are of great urgency and are of limited duration and normally return to the base of take-off short on fuel.

To better appreciate the reason for our type of operation, I believe some background will help.

ADC's Mission

The mission directive to the Air Defense Command is simply stated, "*Defend the United States Against Air Attack.*" Note, it does not say where, when, how, under what weather conditions, or to what degree.

How do we go about defending the U. S.? The job has not been easy.

First of all we were late getting started, but I am happy to report that tremendous progress has been made in the last four years. As we first began to receive the air defense radars, we placed them to cover the most likely enemy approach routes through our coastal and northern border areas and the atomic energy installations. Our limited day fighter force was placed accordingly. In order to evaluate the tracks detected by these radars, it was necessary to obtain information on flight movements within these areas of surveillance. The Administrator of CAA, having been delegated the responsibility to designate zones or areas for the security control of air traffic, through an amendment to the Civil Aeronautics Act of 1938, was requested to designate the necessary zones where identi-

fication was to be performed. As our detection and intercept capability increased, other nations' capabilities to launch an attack against the United States, both in numbers and better types of aircraft, also increased. In keeping abreast of these developments, adjustments have been made in the areas covered by the air defense identification zones (ADIZ).

Questions

The questions probably uppermost in your mind are, "Why are intercepts made?" "Who orders them?" "Why am I intercepted when I am obviously not in violation?"

We will take these one at a time. Intercepts are made in ADIZs when it is not possible to correlate the radar observed track with flight plan information available at the radar site. How about outside ADIZ? Remember our mission directive? It does not say *where* within the United States. Intercepts, or rather identification checks, are made outside ADIZs on occasions when the track, due to its observed actions, may create suspicion. These actions may be a combination of speed, altitude, maneuvers, and proximity to our turning toward a critical target. These identification checks are the exception rather than the rule. I call this outside of ADIZ identification, "identification checks," because, since no violation is involved, there is no reason to obtain the aircraft number as it may be identified by friendly aircraft configuration and markings. In such cases the interceptor pilot need not fly the standard intercept pattern but may observe from maximum visual range.

Who orders intercepts? The radar site, which we call an Air Defense Direction Center, having responsibility for identification in the particular sub-sector orders the intercept. The decision to order

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Colonel Sharp, *assistant to the vice commander for Flight Safety at Continental Air Defense Command headquarters, Ent Air Force Base, Colorado Springs, entered the service in 1939, and served 56 months overseas during World War II. In that period, he flew from Guadalcanal with the 69th and 70th Bombardment Groups.*

After the war, he held a series of staff and command assignments at several Air Force installations in the U. S. In 1949, he went to Okinawa as commanding officer of the Fourth Fighter Squadron. During the Korean War he flew a F82G-type night fighter in support of the UN effort in Korea.—The Editor

the intecept is not arbitrarily made. It is based on precise factors. An observed aircraft for which a flight plan is not on file or one which is outside the correlation tolerances in time and/or distance is declared an "unknown." The radar director is allowed two minutes to establish a track and one minute to classify as "friendly" or "unknown." Immediately following the classification of the track as unknown, appropriate air defense action is taken. This is normally the intercept of the aircraft in question. If, subsequent to ordering the scramble for intercept, the aircraft is identified as friendly, the fighter is ordered to discontinue and return to base.

A pilot may be intercepted or "looked at" when he is not in violation, for the following reasons:

1. He is outside an ADIZ but his track creates suspicion for the reasons I just mentioned.

2. He is in an ADIZ but due to communications lag or mishandling of the flight plan, information on the flight is not available to the radar site. Of an average of 125,000 flight plans the CAA passes to the radar sites each month on ADIZ operations, there are an average of about 25 to 30 intercepts due to the mishandling of flight plans. These errors are distributed among air carrier dispatch or communications personnel, CAA air traffic control and communications personnel, and military flight service centers. Considering the number of flights operating in ADIZs, this is not an unacceptable condition.

3. He is flying above 1,500 feet and/or flying in excess of 110 knots. He must file DVFR or IFR if exceeding either in an ADIZ, if not flying toward an open area.

Judging from complaints we have received from pilots from time to time, indicating resentment of intercept, our reasons for intercepting are not understood by the average pilot. The first thing that enters a pilot's mind upon being intercepted, when he knows he is legal, is "Why are those jet jockeys jumping me, I'm clean. They must be practicing on me." If you realize these two points, much will have been accomplished to eliminate resentment against intercepts:

First, it is no disgrace to be intercepted and does not always imply a violation.

Second, ADC interceptors are strictly forbidden to practice intercepts on civilian aircraft of any category. They are not even allowed to practice on military aircraft except in planned air defense

exercises, or at other times only with permission of the pilot to be intercepted.

We have also received reports of the interceptor flying too close to the intercepted aircraft. We do not profess to be entirely blameless. Our command regulations and supplemental directives prescribe a safe intercept procedure. In cases where alleged hazardous flying has been proved, we have taken stern disciplinary action and will continue to do so in the future, when necessary.

Considering the number of intercepts flown, there are relatively few complaints of too close flying. Even then, are all complaints really justified? What is too close? We have all known pilots who are aggravated if they see an aircraft anywhere near them. It is awfully difficult in investigating reports of close flying to say which of the two pilots is wrong in his estimate of the spacing between the two aircraft. Fighter pilot affidavits, which must be prepared after each intercept, frequently report hazardous situations created by the intercepted aircraft. Typical of these are:

1. Turning into the interceptor.
2. Dropping gear and flaps and causing the interceptor to overshoot and have to come back for re-positioning.
3. Turning powerful flashlights into the cockpit of the interceptor at night. This is particularly hazardous as the light striking the canopy as well as the pilot's eyes will momentarily blind him and force him to break-off.

If all pilots can be made to realize that the defense of the United States is everybody's business, and will cooperate during an intercept by holding steady to the course, speed and altitude, the possibility of collision will be lessened.

In 1952, after having received complaints from pilots that interceptors had approached too close, the Air Defense Command requested the CAA and CAB to consider a regulation, which could require larger numbers on the tail or side of civilian aircraft. Our position was that we had no desire to approach closer than absolutely necessary to obtain the aircraft registration number and that if it was believed we were approaching closer than pilots liked, the problem could be solved by larger numbers. The CAB, in replying to our recommendation, inquired as to why the wing numbers, which are of large size, could not be used rather than the tail numbers. Experienced interceptor pilots in the headquarters still held the belief that reading the tail numbers was the safest and most practical method but were willing to consider the problem further. A project was

therefore given to our Western Air Defense Force to conduct a series of tests of various intercept patterns. A C-47 type aircraft was painted with conventional civilian markings and numerous intercepts were performed using F-86, F-89, and F-94 interceptors. The report was quite lengthy. Briefly stated, it advocated the use of tail numbers for the following reasons:

1. Coming in from the rear and off to one side, the interceptor pilot is better able to trim his aircraft and coordinate his speed before moving in closer for reading the number. The interceptor is also in a better position to break-off if necessary. Our pilots are also proficient in formation flying, which makes this approach easy.
2. Reading the top wing number is difficult due to glare, angle of view, and rapid loss of view due to intercepted aircraft passing under wing of interceptor. He may also lose "pitch awareness" trying to look down and behind.
3. Reading bottom wing number is not practical because the interceptor pilot sees it upside down, necessity of passing under aircraft, possibility of dirt covering numbers and poor lighting. "Pitch awareness" and depth perception may be lost here also.

After receiving our final recommendation, the CAB about six months ago published a "notice of intended rule making," which would require a minimum size registration number on the tail or side of civil aircraft. Due to strong objections from civilian pilot organizations, the CAB has recently withdrawn the notice for further study, but has authorized the use of larger numbers on the fuselage sides on a voluntary basis.

The most difficult of our problems in the employment of interceptors are the scramble and recovery phases during IFR conditions. Within the framework of policies and responsibilities developed between the CAA and the Air Defense Command, local scramble and recovery procedures are developed for each fighter base. The problem is further complicated where we operate from a joint-use civil field. By much give and take between all interested parties, we have managed to get along. In recognition of the need for traffic control,

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This article was originally prepared as a news letter release to technical publications by Headquarters, Air Defense Command, Ent Air Force Base, Colorado Springs, Colorado. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

we do, in a number of areas, fly a considerable distance away from the unknown aircraft before we can take up a vector to the unknown. Ideally, we should proceed as directly as possible to the unknown, but we realize this is impossible in heavy traffic areas. Can you imagine ours and the CAA's problems in expediting active air defense operations out of a number of east and west coast bases when the airways radiate like spokes in a wheel?

In this day of nuclear weapons we in the Air Defense business are keenly aware of our great responsibility in defending the United States, and we solicit the understanding and cooperation of both military and civilian pilots.

(NIGHT VISION *continued from page 10)*
various levels of illumination requires *time.*

5. *Aids to Night Vision:*
   - (a) Eat a well balanced diet.
   - (b) Become dark adapted before night flights. (30 min. red goggles).
   - (c) Avoid searchlights and bright cockpit lighting.
   - (d) Use roving gaze, look 4°-12° off center. (Practice this on the ground.)
   - (e) Insure clean windshields and glasses for night operations.
   - (f) Avoid bright sunlight before night flights. (Wear sun glasses.)
   - (g) Keep physically fit. This improves night vision as well other physiological processes.

BOOKS

For The Army Aviator

THE PAPERS OF WILBUR AND ORVILLE WRIGHT— *McFarland, Marvin W. (McGraw-Hill Book Co., 303 W. 42nd St., New York 36, N. Y., 1953.)*

Reviewed by Brigadier General Carl I. Hutton, *USA*
Commanding General, The Army Aviation Center

These two volumes contain the editor's selection from the papers of the Wright brothers in the Library of Congress. Insofar as one can judge without knowledge of the papers, the editorial job by Marvin W. McFarland is superb. In any event, the publication of these papers makes a fascinating addition to the relatively few good aviation books.

Prior to the Wrights' efforts, all inventors had fallen into a hidden trap. They had assumed that the major problem was to construct a flying machine. Maxim and Langley built machines which sustained themselves in the air—Maxim's weighed 8,000 pounds—but crashed upon the first flight. Lillienthal preceded the Wrights in successful gliding, but he was killed in a crash. The mystery appeared to be this: what error in design was being made?

In fact, the problem was entirely different and it is surprising now that it was not understood. Chanute came very close to the solution when he repeatedly counselled caution, but his later attitude shows he had also missed the point. If these pioneers had watched young birds learning to fly instead of concentrating upon the sleight-of-hand skills of adult birds in soaring flight, they might have learned that the major problem in the beginning was simply how to develop aeronautical skill and experience. In short, the inventor had to build up flying time in order to gain the necessary experience to fly the first airplane.

The Wrights solved this problem. The gentle hills at Kitty Hawk allowed them to conduct their glides at minimum altitudes. The winds contributed by reducing their ground speed. Consequently the numerous crashes which they experienced were not fatal. As their experience grew they were able to solve the many design difficulties through trial and error. This approach made the miracle of flight possible, and the successful flights which are shown in the photo-

graphs take on an emotional quality which they have never had (for the reviewer) before.

The unique nature of their discovery proved embarrassing when the Wright brothers attempted to deal with the various governments which were interested in their airplane for military purposes. Their flying knowledge was not patentable, and they had an extremely difficult time convincing all governments that they really had something for sale. These governments were being told by their own inventors that in a short time they would have airplanes of their own and that the foreign inventors were making exorbitant demands. It is probable that the exact knowledge of what it was they had to sell caused the Wrights to adopt their secretive methods. This in turn led to acrimoniousness which persists to this day.

All aviators will enjoy this book and profit a great deal from reading it.

The following book reviews were compiled by the ARMY AVIATION DIGEST *staff.*

DOCTORS IN THE SKY—*Benford, Robert J., M.D., Colonel, Medical Corps, U.S.A.F. (Charles C. Thomas, Publisher, Bannerstone House, 301-327 E. Lawrence Ave., Springfield, Illinois, 1955. $8.75)*

DOCTORS IN THE SKY is an *airborne saga* of organized aviation medicine. It contains nearly 400 pages of progress and achievements in aviation medicine. There are more than 50 photographs of leaders in this specialty and of memorable events from 1929 to 1954.

DOCTORS IN THE SKY is the story that members of the Association and flight surgeons have lived *in the air, on the flight line,* and *in the laboratory*. It contains a wealth of information about aviation never before assembled in one volume. You will find chapters on CAA and airline medicine, the 25th annual meeting, the struggle for specialty recognition, awards and traditions, and the Wives' Wing together with lists of officers and fellows, biographical sketches of the presidents and much more.

This narrative history of the Association tells how and why the society was founded, and traces its growth in 1929 from a small group of 35 physicians to the prominent international organization

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Views and opinions expressed in the above reviews are not necessarily those of the Department of the Army.—The Editor

it has become today. It is a fitting tribute to Dr. Louis H. Bauer, the founder and first president of the Aero Medical Association. The story covers the development of the Journal of Aviation Medicine, the establishment of the *Lyster, Longacre,* and *Tuttle Awards,* the rise of airline and civil aviation medicine, and the attainment of certification.

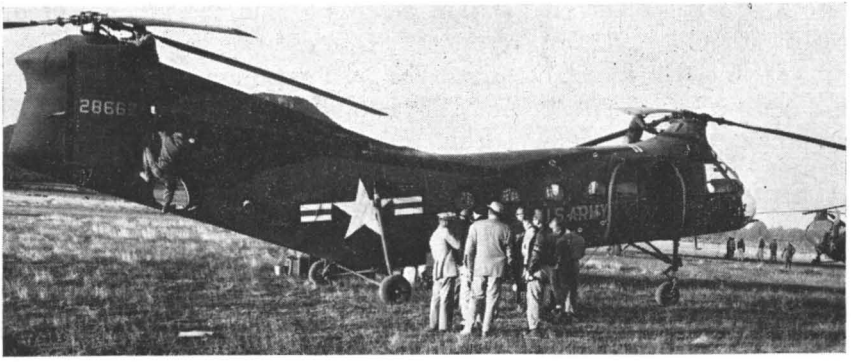
DOCTORS IN THE SKY describes the 25 annual meetings of the Aero Medical Association, the notable scientific presentations, and traces the achievements of the organization.

DEVELOPMENT OF THE GUIDED MISSILE — *Gatland, F.R.A.S., Kenneth W. (Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y., 1954. $4.75)*

This is the second edition of an important book which presents factually all the main information available on the contemporary development of guided weapons and rockets for military and peaceful purposes. The author, who is an aircraft design engineer and a founder-member of the British Interplanetary Society, describes the potentialities of the rocket as a weapon of offense or defense, as an instrument of research into the upper atmosphere and outer space, and eventually as a vehicle of interplanetary travel.

This edition has been completely revised and greatly enlarged, a number of useful features having been added. New chapters deal with problems of propulsion, research into rocket techniques and requirements, and post-war work on guided bombs. Of particular importance is the detailed survey of Russian potentialities for long-range rocket development. An appendix reveals some details of the telemetering equipment used in British missiles, and another appendix shows photographs, to scale, of over 40 notable rockets from various countries. The table of characteristics which was an important feature of the first edition has also been enlarged, and now provides data on 140 powered rockets from eight countries.

Air Chief Marshal Sir Alec Coryton, formerly Chief Executive (Guided Weapons), Ministry of Supply, has contributed a foreword to the book, and it is illustrated by over 100 photographs and drawings of exceptional interest. Everyone who wishes to understand the significance of the guided missile—both the dark threat it holds as a weapon of war and its bright promise of man's adventuring into space—should read Mr. Gatland's book.



OPERATION GRANITE MOUNTAIN

Late in the afternoon on Saturday, 30 June 1956, Major Jerome B. Feldt, Commanding Officer, 14th Army Aviation Company, received a call concerning an airliner disappearance. Shortly thereafter, components of his command went into action, effecting one of the most outstanding missions in the short history of Army aviation.

Two giant airliners had crashed together and fell in tangled heaps of wreckage into the depths of Arizona's Grand Canyon. The problem of ascertaining if life remained fell to the men of the 14th and to the 93d Transportation Company. Within a short time it was established that all were dead in the worst crash in commercial aviation history. Thereafter, a saga was enacted that will print indelibly on the minds of the witnesses and of the watching nation, the worth of Army aviation.

The job of removing the dead and recovering tell-tale pieces of wreckage that enabled the CAB to make valuable conclusions was one that the aviation companies discharged with efficiency and dispatch. They did their work in the pattern that Army aviation is shaping and they did it well. The complete story will appear in next month's ARMY AVIATION DIGEST under the title "Operation Granite Mountain."

The Gray Hair Department

Unauthorized Modification L-19

UNAUTHORIZED MODIFICATION to an aircraft, no matter how minor, can cause a serious accident. For example, a block of wood, one

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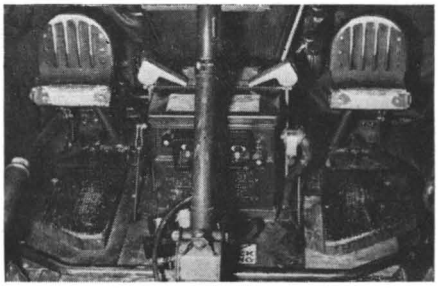
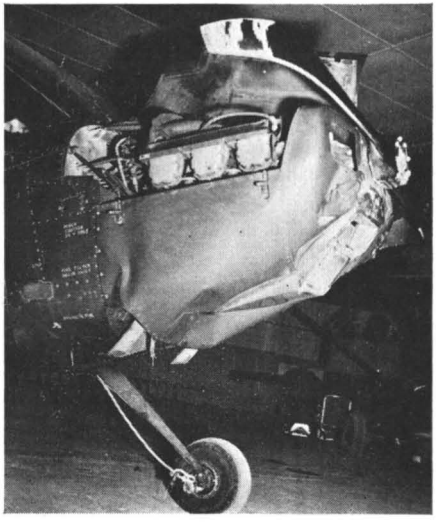
Major Roy W. Haney, *the very senior Army aviator pictured above, is the Executive Assistant to the Air Coordinating Committee, in the Office of the Assistant Secretary of the Army (Civil Military Affairs), the Pentagon, Washington, D. C. Major Haney's Army flying career began in 1943, shortly after graduating as a second lieutenant from Officers' Candidate School, Ft. Sill, Okla. He was a member of Army Liaison Pilots Class Number 24, and upon graduation was assigned as Group Air Officer of the 188th Field Artillery Group, Iron Mountain Desert Center, Calif. He was shipped to Europe with that unit in early 1944. In 1945 he was reassigned to the 3d Armored Division, also in Europe, as Division Air Officer.*

Upon his return to the states he was off active duty for two and one-half years, then returned to active duty in 1948 as the Assistant Chief of the Light Aviation Division, G-3, in Headquarters, Third Army. He returned to Europe in 1950 and was assigned to Headquarters, Seventh Army in Stuttgart, Germany, as the Assistant Army Aviation Officer for that Headquarters where he remained until receiving his present assignment in September of 1953.

Major Haney has over 3,600 hours flying time, is instrument rated, has a CAA instructors rating and is qualified in both rotary- and fixed-wing aircraft.—The Editor



Wooden blocks placed under the rudder pedals of an L-19 caused the damage pictured below.



inch high, placed on the floor of an L-19 as a heel rest, beneath each rudder pedal, caused this accident. The pilot made a normal three-point landing and applied braking action to shorten his landing roll, but the tail raised off the runway. He quickly tried to release brake pressure by sliding his heels back on the wooden blocks but in doing so, he still applied pressure to the brake pedals. Then, as the tail-high attitude increased, his body weight shifted forward, causing him to apply even more brake pressure. The propeller hit the ground 11 times before the nose cowling struck the runway surface and the aircraft slid 30 feet to a stop.

Primary Unsafe Act: "Excessive braking action by the pilot."

Unsafe Physical Condition: "The one inch wooden heel rests installed on the floor of the cabin, under and to the rear of the rudder controls."

Contributing Factors: "The size of the pilot's shoe, size 10E, combined with the block heel rests, made it difficult for the pilot to move the forward part of his feet from the brake pedal and the tail-high attitude coupled with the aircraft's deceleration which thrust the pilot's weight forward."

The Army Aviation Safety Board concurred with the above findings.

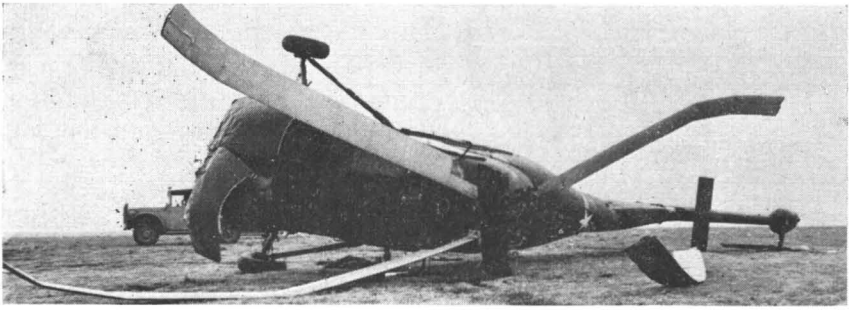
You Had It!

An H-34A pilot was receiving instructor standardization train-

ing. During this particular flying period, his instructor demonstrated a "roll on" landing with loads (the helicopter grossed 13,000 pounds), and the student practiced the next five. After the fifth touchdown, the IP told the pilot, over the intercom, that he was doing fine, and his last landing was very good. However, when the student noticed the instructor's hand on the cyclic stick (to depress the "mike" button), he assumed his instructor was taking over the controls, and relaxed his own control pressure. As the IP spoke he also applied a gradual braking action (brake controls were on the IP's side only) to slow the aircraft down; but, as far as he was concerned, the student still had control of the aircraft.

The helicopter started a side-to-side rolling motion, then passed through a depression in the ground which caused violent vibrations in the rotor system. These vibrations quickly developed into ground resonance.

The IP attempted to get the helicopter airborne again, but instead it angled to the left, continued in this direction for 50 yards, then pivoted up onto its nose, turned 180 degrees, and rolled over on its left side.



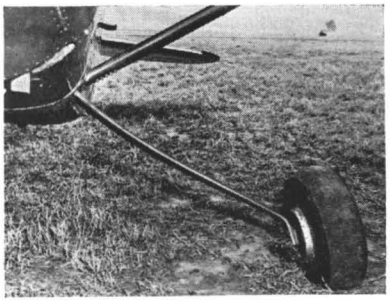
Who has control of the aircraft is one of the most important procedures that must be established between an instructor pilot and his student. The H-34 accident pictured above was caused by the *lack* of such a procedure.

Primary Unsafe Act: " . . . each pilot assumed the other had control of the aircraft."

Contributing Factors: "Rough terrain, a weak left brake, probable low rpm, and ground resonance."

The Army Aviation Safety Board concurred in the findings of the Investigation Board.

Stalling It In L-19



A pilot was flying his passenger back from a field exercise in an L-19. When coming in sight of the airfield he saw other L-19s practicing barrier landings, and he decided to join them as he also needed to accomplish his barrier practice requirements for the current period. He called the tower and received landing instructions, and the wind was reported blowing at 12 knots, gusting to 25 knots.

On final, the pilot had 45 degrees flaps and 65 mph airspeed. As he crossed over the barrier his airspeed dropped to 60 mph, the left wing also dropped, and full throttle was applied. Power could not save his stalling condition in time and his aircraft hit the ground hard, springing the left gear and bending the propeller tips.

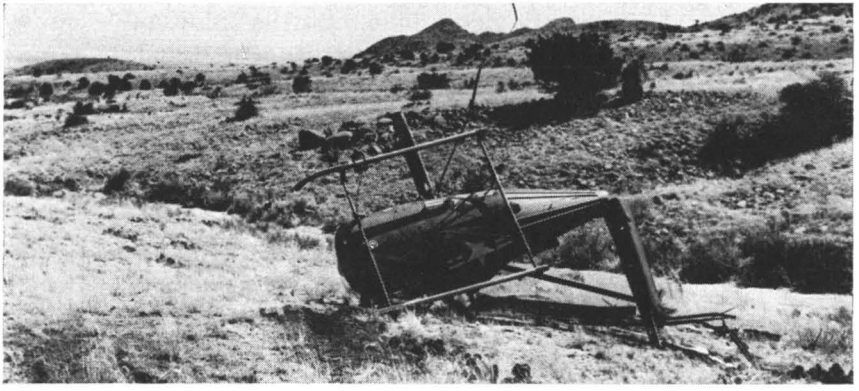
Primary Unsafe Act: "The pilot erred by letting his airspeed drop too low in the existing gusty surface wind conditions which resulted in a partial stall."

Contributing Factors: "The gusty surface wind conditions."

Action Taken to Prevent Further Similar Accidents: "(1) That all pilots with a low experience level will be checked out on barrier approaches by unit instructor pilots prior to practicing barrier landings solo. (2) The control officer will brief each pilot participating in barrier practice as to the minimum airspeeds for the approach, and varying airspeed according to prevailing wind conditions."

Comments of the Army Aviation Safety Board: "The Board concurred in the findings and recommendations of the Accident Investigating Board."

Overloaded
H-23B



The pilot involved in this accident report had crashed with the same H-23B helicopter seven weeks prior to this accident. His helicopter was rebuilt, and accompanied by the Hiller Technical Representative, he performed the test flight. During the test flight they found that the engine ran rough at 23 inches of manifold pressure and that the main rotor blades were slightly out of track. Upon completing the test flight, the "Tech Rep" recommended to the pilot and crew chief that a compression check be made on the engine and other tests accomplished as necessary in order to determine why the engine was not performing at peak efficiency at higher manifold pressure settings. Also, the "Tech Rep" reviewed a density altitude and gross weight chart with the pilot to determine operating limitations of the H-23B, carrying its mission load, and operating off the base field which is located 4,000 feet above sea level. The gross weight was 2,407 pounds.

The density altitude chart showed that at a gross weight of 2,407 pounds, operating from an altitude of 4,000 feet, the temperature would have to be 30 degrees F. to keep the helicopters above the marginal takeoff region. The temperature at this particular time of the year ran much higher, which put the gross weight above the maximum for takeoff.

Later, the pilot and crew chief found that, at a richer carburetor mixture setting, the engine ran smoothly at 23 inches; however, it still was not functioning as it should at higher manifold pressure settings. They concluded that the trouble was more with the mixture setting than anything else and decided that the compression check and other tests, that were recommended, were not immediately necessary.

Before takeoff, on the day of the accident, additional "classified" equipment was loaded aboard the helicopter, which increased the planned for gross weight of 2,407 pounds. The pilot flew the H-23 to a predetermined landing spot, located in rugged mountain terrain, and landed on the lee side of a mountain peak.

On takeoff he picked up to a two foot hover and began to move off slowly. Since the terrain, directly ahead, rose at a greater degree than his rate of climb, he had to turn either to the right or left. A turn to the right would be over gradually sloping terrain and in a direct cross wind. A turn to the left would be over gradually rising terrain and in a quartering tail wind. He executed a very steep turn smartly to the left and into a gully between two small ridges. His main rotor blades hit the ridge on his left, the left skid hit the ground and the helicopter bounced, rolling over on its right side and crashed to the ground. The pilot kicked himself free of the wreckage and climbed out. He suffered injury to two vertebrae in his neck.

Primary Unsafe Act: "That the pilot, fully aware of the adverse circumstances, freely elected to fly a marginally loaded helicopter into a dangerous set of conditions."

Unsafe Physical Condition: "(1) The helicopter was overloaded for safe operations through the range of temperatures and altitudes of the terrain. (2) The engine was not operating at peak efficiency."

Contributing Factors: "(1) The pilot made a steep left turn just after takeoff. (2) The pilot chose to fly in an uphill direction after takeoff. (3) Choosing a landing site on the lee side of the mountain and in an exceptionally rough terrain."

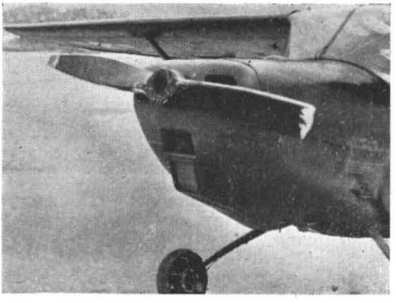
Recommended Further Action: "That the pilot be required to meet a flying evaluation board immediately after his release from the hospital in order to determine whether or not he should be retained on flying status."

Statement of Reviewing Official: "(1) Concur in the recommendations for evaluation board action. (2) That standards set forth by the manufacturers of aircraft for operating limitations in this

area strictly adhered to. (3) That operations within close proximity of the mountains be approved by the flight operations officer, or moved to better areas. (4) All flying personnel will be briefed on weather and other conditions by the flight operations officer immediately prior to takeoff."

Comments of the Army Aviation Safety Board: "This board concurs with the findings of the Aircraft Accident Investigation Board as stated above. Corrective action taken is considered adequate to insure against recurrence."

Message Drop?
L-19



"I was delivering a message to a Battalion S-3. The arrangements were that I would fly low over the S-3 office before landing at the airstrip so when I "revved" my engine it would be a signal to the personnel in the S-3 office to send transportation to the airstrip, to meet the flight, and pick up the message. After the first pass over the office, I decided to put the message in a message pouch, and drop it in front of the building (I had delivered messages, by message drop, to this office before). As I made my pass, I held the stick with my left hand and opened the right window to throw out the message. I looked down at the target and as I did, I turned the plane away from my intended flight path; when I looked up, there were two flag poles in front of me. I pulled back on the stick, experienced a high speed stall, my propeller hit the left flag pole breaking off the top four feet of it. After feeling the blow and terrific engine vibrations that followed I cut the engine and went in, "dead stick," on a frozen reservoir located behind the compound, landing safely on the ice. Apparent damage to the aircraft was a broken propeller tip, a three inch dent in the right wing strut, a cracked oil cooler support, and a half inch crack in a weld on the engine mount."

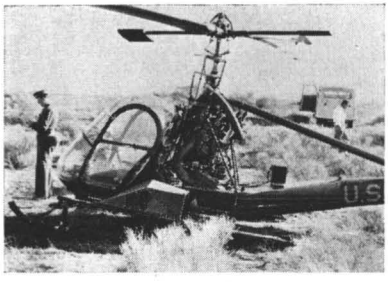
Primary Unsafe Act: "The pilot momentarily lost control of the aircraft while attempting to make a message drop solo."

Action Taken to Prevent Further Similar Accidents: "Recom-

mend that all units brief Army aviators of the hazards involved in making message drops when flying solo."

Comments of the Army Aviation Safety Board: " . . . Immediately after dropping the message,... the aircraft hit the flag pole,... resulting in damage to the propeller and other parts of the aircraft. The pilot immediately made a forced landing, without power, on the frozen ice of a nearby reservoir. The calm, quick decision and piloting technique displayed by the pilot in this emergency reflects highly upon him as a pilot. The initial error committed which resulted in the accident was 100 percent pilot error. Instruction presented at The Army Aviation School repeatedly emphasized that the responsibility for a safe flight takes precedence over accuracy while dropping messages."

Engine "Missing"
H-23B



A pilot was flying two passengers on an administrative mission in his litter-equipped H-23B helicopter. The helicopter was within the prescribed weight and balance loading limitations, with the ballast bar installed in its proper position on the tail boom.

After flying for approximately five minutes the engine started to run rough. The pilot immediately attempted to return to the airstrip but engine roughness became increasingly worse until normal rpm could no longer be maintained. The pilot put the helicopter into autorotation and the engine stopped. MAYDAY was transmitted over the radio and a forced landing spot selected.

The pilot reasoned that a running autorotation would be the best method of touchdown considering the load, terrain, and wind. He stated that rotor rpm was normal, indicating up to 340 rpm while autorotating. On the normal recovery the helicopter "fell-through" as pitch was applied and hit the ground on its right rear skid with such force that it bounced and floated for 18 feet, then the left skid hit the ground and the helicopter bounced for 9 more feet, next hitting the ground on the forward part of both skids in a tail high attitude, pitching forward until the main rotor blades struck the ground

and the helicopter fell back onto its skids. Pilot and passengers evacuated the wreckage without injury.

The Accident Investigation Board found no primary unsafe act on the pilot's part.

Unsafe Physical Condition: "(1) Eight spark plugs, in cylinders 1, 2, 5, and 6 were heavily fouled and leaded. (2) Water was found in the carburetor, gas tank, and fuel strainer. (3) A considerable amount of bronze filings were found in the oil filter."

Contributing Factors: "(1) Engine failure, caused by spark plugs fouling and contaminated fuel. (2) Aircraft was overloaded for operation in this type of terrain and weather which restricted its autorotative capabilities."

Action Taken to Prevent Further Similar Accidents: "(1) Fuel handling and aircraft servicing procedure revised to assure maximum protection against contamination of fuel. (2) Transport of more than one passenger, with or without litters installed in the H-23B helicopters within this command is now prohibited."

Recommended Further Action: "(1) Construction of, or arrangement for more satisfactory maintenance facilities be expedited. (2) Authorized refueling and servicing equipment not now available be furnished immediately. (3) Assignment of a Senior Helicopter Mechanic to the Air Section to supervise inexperienced personnel."

Comments of the Army Aviation Safety Board: "The Safety Board concurred in the findings of the Accident Investigation Board."

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

(ARMY AIRCRAFT ACCIDENT REPORTS *continued from page 16)*
for sending such an inexperienced pilot into a known marginal situation, and (2) for not giving him the proper indoctrination.

The investigation board apparently took the one act, on the part of the pilot involved, which contributed most directly to the accident into consideration in their analyzation. Thus, they confused the contributing factor of the pilot striking the tree with the primary cause.

The regulations generally describe the difference between the primary unsafe act and contributing factors. However, they are not specific and therefore open to interpretation. The words "the one act on the part of the Army person involved which contributed most directly to causing the accident," mislead many investigators (SR 385-10-40, para 10i).

Human Error

The primary cause should be more than a simple statement that there was an error. Very seldom will a pilot who has made a bad landing say, "I knew it was a bad approach but I tried to cram it in anyway to keep from going around." Information as to why an error was made is essential. Without it corrective action which should be taken cannot be properly determined.

The board is morally bound to report supervisory error. Although such a report may reflect a deficiency in the command which convened the board, the cause cannot be corrected unless the deficiency is disclosed. It is the proper disclosure of such supervisory error that is of prime importance in revising operational doctrine and SOP's in order to assure greater safety.

Keep in mind that the object of the investigation is to determine the *primary cause* and cause factors, not to discipline the responsible individuals.

Design Error

The board should also investigate for possible *design error*. It must endeavor to determine what dangerous characteristics were inherent in the airplane prior to action taken by the pilot. For instance, two pilots in two planes, flying cross-country for checkout of the lead plane pilot, ran into difficulty. The check pilot, flying wing, upon noticing the lead plane go through erratic maneuvers,

thought the pilot a victim of anoxia. He tried radio contact unsuccessfully and then followed the lead plane into a cloud layer and lost contact. Presumed to be a victim of vertigo, the check-pilot crashed. In the meantime the lead plane flew into the clear and, unable to contact his check-pilot, flew on to his destination. Later it was found that the erratic movement of the lead plane which led to disaster for the check-pilot was nothing more than its pilot's attempt to tune the next station on his ADF. This was a design error that indirectly caused a fatality.

If the controls or instruments are located in such a position that a pilot cannot look at them without dangerously diverting his attention from his instruments, a design error exists.

Maintenance Error

In connection with design error, we have maintenance error. If a replacement part can be installed a right way and a wrong way, someone, sometime, will install it the wrong way. Should an accident result because of improper installation of a part, then the primary cause would be maintenance error. Inspection error would be a contributing factor. Design error, maintenance and inspection error are more lethal than pilot error, for a pilot has an opportunity to recover from a moment of inattention, but no opportunity to recover from a maintenance error.

Unsafe Physical Condition

Section 7b, Unsafe Physical Condition, pertains to a mechanical failure, material failure, condition of runways, maintenance facilities, operation, or an act of God. It should also include accidents caused by the physical condition of the pilot. In brief, we could construe item 7b to mean almost any uncontrollable condition that caused the accident.

Contributing Factors

Section 7c, Contributing Factors. This item parallels the Primary Unsafe Act (item 7a), and in so many cases the two are confused with one another. Contributing factors are those conditions or acts of persons which aggravated the accident situation. They are those conditions or acts which might have helped prevent the acci-

dent, and over which control could properly have been maintained. However, there are exceptions. Weather could be a contributing factor although it cannot be controlled. Yet a decision can be made by a pilot whether to continue on or turn back.

Section 8

Section 8, Action Taken to Prevent Similar Accidents. Many accident boards eliminate the particular type mission, or restrict the flying area, as a solution. Thus, they assume the attitude that "if you do not fly you will not have flying accidents."

The objective of this section is to find a remedy or answer to prevent repetition of the accident. All the evidence must be taken into consideration, contributing factors, unsafe physical conditions (if any), and the primary cause, and recommendations made. Corrective action might be more training of the pilot involved, improvement of facilities, or an amendment to the flying SOP. Accident boards should not be too quick to take the easy way out by eliminating the maneuver, or restricting the area in which the accident occurred. Keep in mind that we are charged with the improvement of utilization of Army aviation and the increased safety of missions, not the elimination of hazards that can be overcome by training or closer supervision.

Section 8b

Section 8b, Recommended Further Action (and by whom), should include recommended action to be taken by higher authority. This may be action deemed necessary but action which cannot be taken at the level of the reporting agency. It should not be construed to mean disciplinary action.

Sections 9, 10, and 11

Section 9, Signature of the Board members, is self-explanatory.

Section 10, Statement of Reviewing Official, will constitute approval, or his comments will reflect the adequacy of the findings of the accident investigation board. He also can recommend action to be taken by higher headquarters. This individual does not have to be the commander who convened the board, or the commander accepting responsibility for the report. The commander may choose

any individual he considers qualified to comment on the board's findings. However, the commander should appoint the most *senior rated* Army aviator in his command as his aircraft accident reviewing official.

Section 11, Approved. This is the signature of the commander forwarding the report, and his signature indicates approval of the report.

Command action should be taken, by commanders, to see that immediate action recommended to prevent recurrence is enforced. In the event that the commander deems it necessary to take disciplinary action he should hold another investigation under the UCMJ, and conduct hearings and bring charges accordingly. The Accident Report Form 285 *SHOULD NOT BE USED* as evidence in disciplinary action.

Remember, the Army Aviation Safety Program is based on the accident report compiled in the units; they must be accurate; they must be understood. The report is the focal point of the accident prevention cycle, starting with an accident, followed by investigation, report, analyzation, conclusions, recommended corrective action, action taken, and finally, *elimination of another accident cause.*

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

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WELL DONE!

To Captains Claude E. Hargett and Ellis D. Hill, of Board 6, CONARC, Ft. Rucker, Alabama, in establishing three new world records for the H-34. Flying the Army helicopter over a course bordering a section of Connecticut shore, a new closed circuit record was set for 100, 500, and 1,000 kilometers. The old record had stood for a period of up to ten years.

Straight and Level

TO: Editor-in-Chief

Reference the editor's note of Army Aviation Digest, Vol. 2, Nr 6 in reference to the unwritten SOP on cold weather operation of the L-19, we have had several trains of thought which have not completely solved the problem; but will allow favorable operation of the L-19 engine. Three (3) Unsatisfactory Reports were submitted from this section on cold weather operation of the 0-470-11 Engine.

TCSMC replies indicated that the corrective actions taken were considered acceptable and advisable.

Corrective actions were as follows:

A plate was installed over the Cowl Cylinder Air Intake (inboard edge of opening), blocking off approximately one-third of the total intake area. This plate was mounted on the cowl by the use of Dzus Fasteners which permit immediate installation or removal. (Caution: The air intake plates should not be used in temperatures above 10° F.)

When operating the L-19 in temperatures down to —35° C. using the air intake plates, the cylinder head temperatures at cruise rpm (2,050) would normally indicate approximately 190° C. The throttle could be chopped and the engine would accept normal response to throttle application, without a great loss of cylinder head temperature except for extended letdowns in excess of 2 to 3 minutes.

TCSMC indicated another item that could be causing the difficulty as cited in the Unsatisfactory Report, is the age of the carburetor diaphragms. If the diaphragms are over-age they will be stiffer than normal and cause unsatisfactory metering of the fuel. No carburetor difficulty should be experienced at low temperatures since the material used in the present diaphragms will permit satisfactory carburetor operation down to —65° F. Unsatisfactory carburetors were replaced with rebuilt units (pickled for one year or less) which alleviated most of the unsatisfactory condition.

Further investigation by Field Maintenance revealed that the mounting flange on the Air Box Assy, part Nr 1ASC-0650111 was warped, which induced air between the flanges of the air box and carburetor, causing an interruption in the smooth flow of air into the carburetor.

TCSMC recommends that carburetor heat be used whenever ambient temperatures are below —10° F. in order to obtain smooth operation. Further references Par. 167 d of FM 20-100, and T.O. 00-60B-1, Section III, Par. 3-68, dated 10 February 1949.

CHARLES J. LEWIS
Captain, Infantry
USARAL

Letters of constructive criticism are welcomed by the ARMY AVIATION DIGEST. *To appear in this column they must be signed.—The Editor*

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NG: State AG (10)

USAR: None

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

ARMY AVIATION SCHOOL CREST

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