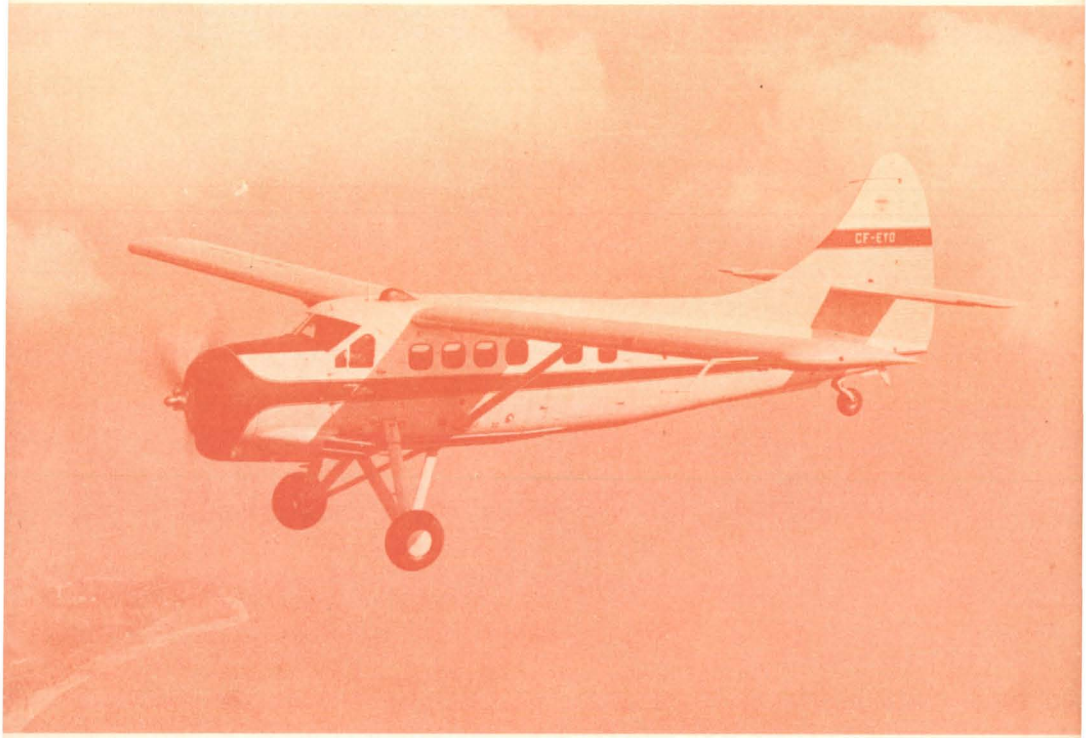
ARMY AVIATION DIGEST



ARMY AVIATION SCHOOL

CAMP RUCKER, ALABAMA

APRIL 1955 VOLUME 1 NUMBER 3

ARMY AVIATION SCHOOL

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ARMY AVIATION
DIGEST

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COVER: The "Otter" is the big brother to Army Aviation's fixed-wing L-20 "Beaver" also made by de Havilland. It carries a 2700 pound cargo or passenger pay load and cruises at 138 miles per hour but can be slowed to 40 miles per hour.

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

PLEASE READ IT AND PASS IT ALONG

ARMY AVIATION OFFICERS NEEDED

The fastest expanding field in the military services needs officers:

(1) Who are ambitious.
(2) Who are superior mentally and physically.
(3) Who recognize the need for Army aviation.
(4) Who realize the potentialities of airplanes and helicopters.

Expansion of the Army aviation flight training program provides unlimited opportunity for those officers who can meet the prerequisites and qualifications for flight training which are set forth in AR 605–96, dated 29 September 1954, and DA Circular No. 42, 1954. Flight training courses for commissioned officers not designated Army aviators consists of:

Army Primary Flight Training Course

This course is of 17 weeks duration and consists of primary training in fixed wing aircraft at Gary Air Force Base, San Marcos, Texas. Officers of all branches which are authorized Army aviation, except the Medical Service Corps, may attend this course.

Army Aviation Tactics Course

All officers who complete the Army Primary Flight Training Course attend this course immediately following graduation from primary training. This course consists of 12 weeks tactical training in fixed wing aircraft at Camp Rucker, Alabama. Upon successful completion of the course officers are designated Army Aviators.

Army Cargo Helicopter Pilot Training

This course, which may be attended by officers of the Medical Service Corps only, is given at the Army Aviation School, Camp Rucker, Alabama. It consists of 22 weeks primary and advanced training as helicopter pilots.

If you are qualified, you can be
"ABOVE THE BEST"

THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*

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

The Command Element In Flying Safety

HEADQUARTERS

1 April 1955

SUBJECT: AIRCRAFT ACCIDENTS

TO: ALL RATED PERSONNEL

The practice of having aircraft accidents in this organization will cease immediately.

BY COMMAND OF — — —

The safety people do not think very highly of the approach represented by the foregoing order. However, there is something to be said on the side of the traditional military treatment.

Aircraft (or any other) accidents happen when there is simultaneous occurrence of numerous contributing factors. If the contributing factors are removed, there will be no accident. It is the function of command supervision to isolate unsafe customs, habits, and practices and eliminate them before they join other factors to produce the resulting accident.

If aircraft maintenance is satisfactory (is it?); if the unit aviation officer checks the flying qualifications of aviation personnel (does he?); if hazards are removed from the airfield (have they been?); if aviators are assigned to missions in accordance with their ability and experience (are they?); if flight descipline is enforced by the unit aviation officer (is it?) then; the unit commander will have taken at least the

elementary steps towards a flying safety program.

Here is an example: An aviator entered a practice autorotation. He executed a running landing. A heavy rut which he had not seen caught the skid, and the helicopter overturned. The damage was extensive. Here are some of the contributing factors:

1. No area had been marked out, prepared, and designated as the autorotation practice area.

2. The pilot in this case had not practiced autorotations for "several months."

3. The helicopter was loaded with an aft CG loading, which may have caused the pilot some concern while he was attempting to establish a level attitude.

Good supervision would have removed these contributing factors. Autorotations are fairly critical under the best of conditions, and they should only be practiced when conditions are ideal. The unit aviation officer should supervise the flying habits of his aviators. If an aviator is rusty in his techniques, he should be checked out by a qualified instructor pilot. If helicopter pilots become careless about CG positions, they are building up trouble for the future.

Therefore, common sense and ordinary supervision can reduce the likelihood of an accident. The Command Element consists of recognizing the unsafe acts or conditions while there is time. Fortunately, accident experience figures are on the commander's side. They say that for every accident there have been many exposures in which an accident might just as well have happened but did not. In industrial situations as many as 350 exposures have been counted before the accident. The problem is simply to recognize what is unsafe beforehand rather than in hindsight.

This, military commanders are experienced with. While perhaps an order not to have accidents may seem far-fetched, if the result is a reduction of hazards, then the order will make sense.

This is the first in a series of columns which will be written by Brigadier General Carl I. Hutton, Commandant of the Army Aviation School, for the ARMY AVIATION DIGEST. General Hutton is a graduate of the United States Military Academy and the National War College. He is a qualified fixed and rotary wing Army Aviator—The Editor.

PILOT'S PHYSICAL FITNESS

Lieutenant Colonel Rollie M. Harrison, *Medical Corps*

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.

Flying is a type of occupation that generally requires little vigorous muscular activity. Although this is true, it is also true that in pilots a constant state of readiness is required in antagonistic or opposite muscle groups. This is necessary to produce the delicately coordinated stick and rudder movements which are key factors for the accuracy and precision that are so important in flying, and which are dependent upon well coordinated responses in the muscles of upper and lower extremities. Although no great amount of muscular activity is expended in flying our modern aircraft, nevertheless, flying does produce fatigue in the personnel who operate them. Susceptibility and reaction to, as well as ability to recover from, this fatigue is influenced markedly by the individual pilot's state of physical fitness.

Many of our pilots have reached or passed the third decade of life, and too frequently have become so occupied with other duties that the thought of any program of physical training has long since been relegated to the limbo of forgotten things. Not only does this situation exist among our rated pilots, but it has influenced thinking and planning with respect to the training of Army pilots. Although highly necessary, no time has been provided in the curriculum for the inclusion of regularly scheduled and supervised physical training of our student pilots due to the press of cramming a plethora of subjects into too short a period of time.

The benefits derived from physical training are numerous. The attainment of good physical condition by correct and adequate exercise is very important. It is reasonable that the pilot who is in good physical trim will suffer less fatigue from a comparable amount and type of flying than

the man who is in poor physical condition. Exercise of an organism produces growth and strength, disuse results in atrophy and weakness. The goals of exercise are the development of a strong and vigorous body with efficient circulatory, respiratory, and excretory systems to provide energy for activity, and to remove its waste products efficiently. Muscle tone throughout the body benefits from regular training and the desirable effects are reflected in greater resistance to, and more rapid recovery from fatigue, improved coordination and reaction time, better digestion and absorption of ingested foods, as well as improved bowel elimination. Planning, judgement, and even visual acuity may be favorably affected by a high degree of physical fitness.

Body functions generally are improved. Circulation of the blood supplies nutriment and oxygen to produce energy and rebuild tissues throughout the body, and to remove the waste products that are produced by this metabolism. Physical training develops the muscular power of the heart along with the other muscles of the body. It has been determined that the heart of the trained man pumps more blood per minute with fewer strokes than does the heart of an untrained individual. In the trained man there is a rapid return to normal of the heart rate after exercise, while in the untrained person a considerably longer time is necessary for the return to a normal state. Thus with training, the circulatory system becomes more efficient, with an increased oxygen and nutrient transport, a reduced heart rate and a more stable blood pressure that is less subject to marked fluctuations of degree, and an overall beneficial effect upon the whole organism.

Lt. Col. Rollie M. Harrison, who was Flight Surgeon for ARMAV, Ft. Sill, Okla., from 1950 to 1955, is enroute to Europe. He received his BS from the University of Ill. in 1929 and his MD 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, Ill. State Med. Society, Aero Med. Association, Association of Military Surgeons, AF Association, Airline Med. Examiners Association, and Masonic Bodies.—The Editor.

Respiratory efficiency is also favorably affected. Physical training brings about well defined changes in the respiratory system and its functioning. Chest expansion increases, depth of breathing is increased, and the rate of respiration is slowed. This has been proved by controlled tests in which trained men were shown to have breathed less air but to have absorbed a greater amount of its oxygen and also to have eliminated a greater quantity of carbon dioxide in expired air than did the untrained man. According to Bergin, "The athletic, average weight, physically fit person has a markedly higher altitude tolerance than the overweight or otherwise inferior individual, and a remarkable increase in altitude tolerance can be observed as a result of the institution of regular physical training exercise and an attempt to raise the general standards of physical fitness in a selected series of cases." He also suggests a lower state of physical fitness as a possible contributing factor in air sickness.

In addition to the beneficial effects already mentioned, exercise provides an outlet for the tensions and worries that build up in the daily activities of flying, particularly as concerns the student pilot or the operational flyer. McFarland says, "For men engaged in airline piloting, exercise relieves emotional tension and improves general well being far out of proportion to the actual amount of exertion involved."

Physical fitness is not entirely dependent upon exercise, although as previously indicated this is a very important factor. Of equal importance are the individual habits. Excesses of any nature are most undesirable. Overeating, excessive smoking, and the intemperate use of alcohol can be considered only as insults to the circulatory, respiratory, and digestive systems and when continued over a period of years, invariably exact a toll in the form of impaired physical fitness and decreased efficiency.

Indiscreet eating habits are prominent on the list of causes for decreased physical fitness. The average adult person whose occupation requires only moderate physical activity undoubtedly consumes an excessive amount of food. This is apt to be true especially of persons in sedentary types of occupation. The amount of food required to maintain a normal state of nourishment and to provide adequate energy for the usual activity of flying is probably less than is consumed by the average pilot. Individual variations in ability

to utilize food do exist, but in many persons overeating results in building up body fat and the creation of a weight problem which has many undesirable features. Statistics point to a rather direct relationship between dietary excesses and obesity, or overweight, and the incidence of hypertensive heart disease, gall bladder disease, diabetes mellitus, and gout.

The consumption of alcoholic beverages has no place in the maintenance of physical fitness. It must be remembered that alcohol is an irritant and a toxic substance with no food value although it is a source of energy. McFarland sums it up in this manner, "Although the oxidation of alcohol provides some energy for the body (about 7 calories per gram), it differs markedly from ordinary foods in several ways: (1) It can only be burned immediately and cannot enter into the building or repair of tissues or be stored for future use as a fuel. (2) It is not utilized more rapidly when the supply is increased. (3) No accessory food factors, such as vitamins, are present. (4) Alcohol has definite druglike actions and toxic properties not possessed by foods. (5) Severe organic and mental ailments may result if alcohol is taken in large quantities for a long period of time."

Many persons feel that a drink of whiskey or a cocktail gives them a lift when tired or depressed. It is true that a few drinks may produce a temporary feeling of improved well being, but by the same token, when the temporary effects have been dissipated the resultant let-down is apt to be greater than the reaction that prompted the drinking originally. Not only is this true but if the habit is developed, the amount of alcohol required to produce the desired effect will become greater, the subsequent depression will increase, and in a susceptible individual varying degrees of alcoholism may ensue, with a general and progressive loss of efficiency.

Sleep and rest must not be ignored in any discussion of physical fitness as they are most important in maintaining efficiency. During sleep the various body processes are slowed down and balances are restored in the internal environment. Particularly important are the adverse effects of inadequate sleep upon the higher centers of the central nervous system as manifested by increased irritability and impaired memory. Susceptibility to hypoxia or tolerance for altitude are progressively lowered by loss of sleep. Adequate rest and sleep are essential for the (*Continued on page 40*)

BATTLEFIELD ILLUMINATION

Captain John B. Kusewitt, Jr., *Artillery*

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.

As darkness engulfed the battlefield, personnel of the First Battalion, which was established on the most critical terrain in the division sector, were somewhat on edge. The enemy had steadily increased his forces opposite the First during the last few days. The First Battalion Commander was concerned and the coming of night made him more so. The enemy had often taken advantage of the cover of darkness to initiate offensive actions in the past. However, defensive plans were complete; subordinate commanders had been informed; and the only thing to do was wait.

Upon the hill, Lt. Smith, a forward observer, stuffed his hands in his field jacket pockets, and gave an involuntary shudder from the chill air. "It's going to be a long night," he thought, "too damn bad we don't have some moonlight to see by."

The attack started suddenly. Enemy artillery erupted with a roar and the explosions of incoming shells shook the ground. But almost as suddenly as it started, the artillery ceased and rifle fire spattered through the darkness. Where are they? How many? It was obvious that an attack had begun and Lt. Smith got on the radio fast! Division artillery was alerted for final protective fires in case they were needed. In the meantime, light was needed with which to aim small arms fire and adjust artillery. Lt. Smith got approval from battalion headquarters for the use of aerial flares. He twirled his radio dial to the division aviation frequency and called an L–20 aircraft which was cruising in the division area on air alert. It was loaded with flares. Within minutes it arrived over the First Battalion area and the pilot signalled a crew member to release the first flare. As the flare burst into white light, a 2500 yard diameter area on the ground beneath it

became visible. After release of the first flare, the aircraft began flying a racetrack pattern while the forward observer on the ground rapidly estimated drift and commanded, "East 200, South 400." Three minutes later, the next flare was released. Subsequent commands from the observer brought the illumination to the desired area with the proper burning height. Thereafter, the aircraft continued to provide continuous illumination for approximately an hour and a half while the forward observer shifted the illumination as required by changes in the ground situation.

Fictitious? Yes, but it serves well to illustrate the mission of Army aviation in battlefield illumination. Missions of this type were flown in the latter stages of the Korean War, primarily by the 7th Infantry Division. In a recent letter to a former member of his command, Major General Arthur G. Trudeau, then 7th Division Commander, stated in part:

"The greatest value of my aviation section in night operations was in providing light over the battlefield when most needed. By the use of the L–20 in particular, we were able to pack 40 flares and maintain light over the point under attack for more than an hour and a half. By then spelling the L–20 by an L–19 with fewer flares while the former reloaded, we were able to keep light continuously over any particular section of the battlefield. . . Any L–20, being on the alert when darkness fell, could reach any point being attacked in any section within minutes . . ."

There was only one L–20 aircraft assigned to each division in Korea at the time of which General Trudeau writes; therefore, it was necessary to relieve the L–20 with an L–19.

Unfortunately, wide use of Army aviation in battlefield illumination during the Korean War was not possible due to

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—The Editor.

the critical shortage of aircraft flares. Enough was done, however, to demonstrate the importance of the battlefield illumination mission of Army aviation. The mission of Army aviation in battlefield illumination was prescribed in 1952 with the publication of Department of The Army TC 30. This training circular is the basis for current doctrine on the subject.

Illuminants

The object of battlefield illumination is to provide friendly forces with sufficient light to assist them in the conduct of ground operations at night, and, when possible, to deny the enemy the use of the illumination. There are many means of battlefield illumination available to the commander, each possessing somewhat different capabilities. They include pyrotechnics such as tripflares, mortar and artillery illuminating shells, and aircraft flares as well as searchlights. The use of high intensity pyrotechnics in battlefield illumination provides sufficient light for aimed fire of ground weapons, adjustment of indirect fire by ground observers, surveillance under conditions approximating daylight, movement of troops and vehicles, minefield operations, evacuation of casualties, resupply, and providing direction to ground elements. Such illuminants can also be used to silhouette and harass the enemy and discourage infiltration, not to mention incident increase in morale and confidence of friendly troops. However, high intensity pyrotechnic illuminants have the disadvantage over searchlight illumination in that their use temporarily destroys the night vision of friendly troops, complicates the supply problem when used in large amounts, and creates a hazard from falling parts if activated within friendly lines.

The use of aircraft flares for battlefield illumination have certain advantages over pyrotechnic illumination by other means, such as artillery or mortar shells. Aircraft flares provide very high intensities, slow rates of descent, and long burning times. An aircraft flare will burn over three times as long as a comparable artillery illuminating shell, resulting in considerable economy. Aircraft flares are less subject to malfunction than are artillery illuminating shells. Furthermore, their use permits all ground weapons to be employed

in firing lethal shells.

Army aircraft are particularly well suited to the mission of battlefield illumination. They are immediately available to the commander, thus enabling illumination to be furnished with a minimum of delay. Flare-loaded aircraft can be employed on a ground alert status or, when conditions require it, they may be employed on an air alert status and fly continuous cover for front lines to deliver on-call illumination.

Another significant advantage accrued by using Army aircraft for battlefield illumination is the better accuracy and control of illumination achieved as compared with high performance aircraft. This accuracy and control result from the reliability and flexibility of air-ground communications, the terrain familiarity of the aircrews, and the relatively low operational speeds and altitudes of the aircraft.

The L-20 (Beaver) is the most suitable Army aircraft for battlefield illumination. The rear two sets of seats are removed and flares are stacked longitudinally behind the pilot and copilot seats. The flares are dispensed by hand through the camera port located in the aft position of the cabin floor. The L-20 not only permits carrying much larger loads than the L-19, but also has the advantage of permitting fuze setting while in flight. This results in better control of flare activation altitudes than that which is obtained when flares are mounted on bomb racks as with the L-19.

All battlefield illumination must be coordinated so as to prevent the possible exposure of adjacent friendly elements. Overall coordination and control is normally exercised by the interested division and the procedures established in the SOP. Effective ground control must be exercised with respect to illumination aircraft in order to achieve accuracy of delivery, and to effect prompt changes in location of the illumination as required by changes in the ground tactical situation.

Ground control is effected through the artillery liaison officer for Army aircraft and may be visual or radar. In visual control, the ground observer adjusts the release point and height of burst to obtain the desired illumination. Thereafter, the aircrew uses the light of preceding flares to drop successive flares. If sufficient orientation for the aircrew is not available through recognition of terrain features for dropping the initial flare, illuminating (*Continued on page 22*)

AIRCREW EFFICIENCY UP

Captain Weyman S. Carver, *Artillery*

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.

The efficiency of Army aircrews can be greatly increased by unit training programs and the cultivation of individual initiative.

In accomplishing the mission of artillery adjustment, one of the major missions of Army aviation, an aircrew frequently controls the firepower of several battalions of artillery.

Army aircrews furnished a large portion of the intelligence information pertaining to enemy activity during the Korean War. They were called on to act as radio relay stations, provide battlefield illumination at night, provide close support aerial photography, and establish wire communications over difficult terrain. Army pilots often flew regimental, division, corps, and Army commanders on aerial reconnaissance of the combat area so that they might better formulate battle strategy.

Yet, during the Korean War, unit training programs for newly assigned pilots and observers which would prepare them for these responsibilities were almost non-existent; and display of individual initiative by Army aircrewmen was the exception rather than the rule.

Most unit commanders do not realize that aircrewmen, in addition to being confronted by the same problems which concern personnel assigned to ground duty, have additional problems which are peculiar to flying personnel. These problems are psychological and physiological as well as technical and have a direct bearing on the efficiency of the crews.

The very environment, space, in which aircrews must live in order to perform their missions is alien. Man is born with physical senses which enable him to live comfortably while on the ground. He has no difficulty in telling up from down, in knowing whether he is going fast or slow, or in knowing whether he is leaning to the right or to the left while he is

on the ground. However, in an aircraft flying through space, he is in an environment in which his senses are no longer as dependable as they were on the ground. This situation is due to the unusual forces which are exerted upon his body and the absence of nearby objects with which to establish relative movement. Initially, due to the strangeness of this new environment and the unusual forces, an individual may experience fear.

Fear

Ignorance causes fear, and fear in turn prevents the aircrewman from concentrating on the mission which he has been assigned. Thus, the efficiency of the aircrew is affected. A potential aircrewman must be made airwise if he is to properly perform his duties. His questions concerning flight must be answered. In addition to academic training, he must be given the actual experience of flight before he is assigned duties to perform. He must become familiar with the operation of his weapon, which is the aircraft and its equipment.

An aircraft is an unstable platform which can move in all directions, up, down, sideways, or turn completely over. The aircrewman must be capable of orienting himself and performing his mission regardless of the position of his aircraft. He must become so accustomed to the unusual positions, the roll and pitch of the aircraft, the physical sensations of flight, and the sounds caused by the wind and the engine of his ship that he has no apprehensive feelings, is not uncomfortable, and can devote his full attention to the accomplishment of his mission. Academic training on the ground, and the actual experience of flying in an aircraft familiarizes the potential aircrewman with flight, dispels his fears, instills confidence, and thus enables him to live in the environment of space as he has in the past lived on the ground.

The Army pilot, upon assignment to a unit having organic aviation, is air–wise. He no longer must concentrate on the problems of flight itself. He has experienced flight, learned the mechanics of his weapon, and is ready for training in the specific mission which he is to perform. On the other hand, the potential aerial observer, upon reporting to a unit for flight duty, is neither air–wise nor trained in the use of his weapon. He must learn the technical problems of aerial

observation and adapt himself, through training and experience, psychologically and physiologically to his new environment, space.

Under the present organization and operation of Army aviation, the unit to which these aircrewmen are assigned must provide the required training.

The unit training programs for the pilot and observer should be established so as to provide the best instruction for the number of personnel to be trained. In most units, this will mean an informal presentation of instructional material since there is often only one man to be trained. Obviously, if there is only one man to be trained or if a qualified instructor can be assigned to each student, the formal lecture type presentation of material is unnecessary. Individual instruction is desirable. However, the fact that informal, individual instruction can be provided does not eliminate the necessity for the unit having an organized training program. The details, such as the length of time to be devoted to each subject, training aids to be used, and the manner in which the material is to be presented are dependent upon the unit commander and his particular problems.

Common Training

Much of the training required is common to both pilot and observer. The commander, taking into consideration his unit's particular problems, should instruct all newly assigned personnel on the unit's mission, its organization, communications, and safety.

The organization of Army aviation sections differs in practice with the particular problems involved. Some sections consist of only two aircraft and their crews while other sections are of a centralized type in which aircraft and crews from several battalions or regiments have been concentrated in order to provide better aerial support and reduce administrative problems. The organization, command channels, and administration of the unit must be explained to the newly assigned personnel. A map study should be conducted and followed by an actual flight over the area during which prominent landmarks, other units' locations, and danger areas are pointed out.

The orientation on communications should include in-

struction on the particular type radios being used in the unit's aircraft followed by a tour of the communications installations in the local area. Familiarizing aircrewmen with the problems of personnel operating these installations increases cooperation, improves communications, and increases over-all efficiency.

A good safety program is not an accident. Aircrewmen should be thoroughly briefed on the unit's ground and flight safety programs. This training should stress aircraft accident prevention, aircraft crash firefighting, and especially subjects in which the aircrewmen have a very personal interest, such as the procedure for bailing out of the type aircraft which they are to fly, location and use of the fire extinguisher and first aid equipment in the aircraft, care of parachutes, use of survival kits if used locally, recommended methods of ditching aircraft and use of emergency life rafts, if applicable, and emergency procedures in event of forced landing. The mechanical perfection of modern aircraft precludes most of these emergencies but the exigencies of combat flying cannot be overlooked. In order to instill confidence in aircrewmen, and in the event of an emergency to have them prepared with an action plan, the unit commander should evolve such plans and instruct his personnel in their execution. This does not constitute an alarmist attitude but assures the changing of an incident from an emergency to a standard operational procedure. It results in the saving of life and equipment and an increased efficiency of aircrews through their increased confidence in their abilities.

Pilot Training

The training program for the pilot is, due to his prior experience, much less complex than the one required for potential observers. In addition to his education on the above common subjects, the new pilot requires specific training regarding his duties and the equipment which he will be using. Prior to being assigned flight duties, he should receive a checkout in the type aircraft which he is to fly while assigned to the unit. If the pilot is not thoroughly familiar with the aircraft and its equipment, he cannot devote his full attention to the performance of his mission.

The manner in which missions are accomplished will differ not only with the type missions but with equipment

available, local objectives, terrain, weather, and other factors. A particular unit's primary mission might be that of providing aerial photography and, due to the type camera equipment available, a specific flight altitude above the ground might be required in order to provide a desired scale. The new pilot has probably flown photographic missions, either in training or in other units, but he must be made aware of the unit's special problems. Another example in which local problems must be considered is the aerial patrol reconnaissance mission. It is often only a thrill ride for a patrol leader due to the pilot's lack of training. There is a difference of opinion on the altitude above the ground at which an aerial patrol reconnaissance should be flown. Obviously, there is an optimum altitude under given conditions at which to fly and there should be a methodical procedure for the performance of such a mission. Again, local problems, terrain, weather, and experience of personnel to be flown will dictate the procedure to be established.

In the event that there is weather phenomena which is peculiar to the area, such as cyclones, unusual turbulence, intense thunderstorm activity, or low visibility conditions, the unit commander should be certain that the new pilot is thoroughly briefed concerning it.

Observer Training

Duties of aerial observers differ with the missions assigned. Some observers are concerned only with the adjustment of artillery fire, some the adjustment of mortar fire, some are concerned primarily with the collection of intelligence information, and some, such as the patrol leader mentioned above, are concerned with a one–time flight during which they will observe the proposed route of a patrol, the movement of a convoy, the location of a bivouac area, or the effect of camouflage. For the purpose of this discussion, observers may be divided into the two categories of permanent and temporary observers. Those whose primary duty is aerial observation are permanent observers and those concerned with a one–time aerial observation are temporary observers.

Most observers, upon reporting to the air unit for the first time, will have had no experience in aerial observation and their knowledge of aircraft will be very limited. Thus,

they are faced with the technical problems of observation and the psychological and physiological problems which they will encounter in becoming air-wise in their new environment, space. Before sending the potential observers on missions, the air officer must provide them with as much training as time permits to help overcome these problems. Naturally, when a temporary observer comes down for his first flight, there is not sufficient time to train him properly for the performance of his duties but he can be briefed.

Temporary Observer

In order to alleviate the natural fear most people experience on their first flight and to educate him as much as possible concerning aerial observation, the briefing of the temporary observer by the pilot who is to fly the mission should include the following:

1. A map orientation in which the route to be flown, the objective, and surrounding terrain features are pointed out.
2. Use of field glasses.
3. Fitting of a parachute, its use, and bail out procedures.
4. Operation of the safety belt and shoulder straps.
5. Brief description of an aircraft, its controls, and why it flies.
6. Physical sensations which will be experienced, that is, effect of centrifugal forces on the body and the clogging of the ears caused by constriction in the passages between the throat and the inner ear. The means of relieving this clogging by holding the nose and forcing air into the nasal and throat passages should be explained.

Obviously, this briefing must be tailored to fit the individual situation. A thorough briefing results in a better performance of the mission.

Permanent Observer

Training of the permanent observer should also include the above but it should be much more extensive than the short briefing type training given to the temporary observer. The permanent observer is coming to the air section to stay, to be a part of an aircrew, and he must become an expert. First, he must learn his weapon and become accustomed to

his new environment of space.

That which is commonplace and obvious to members of the air section who have considerable flight experience represents the unknown to the new observers. Few of them have any knowledge of the theory of flight, how the pilot controls the aircraft, or the effect weather has on flight. Many of them are amazed when they discover for the first time that the aircraft will not fall from the sky in a fatal spin if the engine quits or is shut off by the pilot. Ludicrous? Remember that their education concerning flight has been confined largely to the headlines which they read in newspapers.

A training program must be established in which the new observer is educated so that he, like the pilot, becomes air-wise. It would be ideal if the observer could be given the training which is received by the pilot, but this is not practical or possible. However, the observer can be given a thorough familiarization course of several hours instruction which includes a study of the construction of the aircraft, fundamentals of flight, reading of aerial charts and aerial photographs, use of equipment in the aircraft, and emergency procedures. The course of instruction should consist largely of demonstrations and practical exercises.

A must in the training of the observer is a series of orientation flights. The first flights should be devoted to familiarizing the observer with the experience of flight, including the feel and operation of the aircraft controls, and in general, to putting him at ease in the air. As he becomes accustomed to flying, he should be taught recognition of objects from the vertical viewpoint, use of field glasses in flight, radio procedure, and the use of his aerial charts and photographs.

Once he has become air-wise and mastered his weapon, the aircraft and its equipment, his training for the particular mission which he is to perform may be initiated. The extent of this training is largely dependent upon the individual observer's past experience and his ability to learn. For example, if he is to be taught the adjustment of artillery fire from an aerial observation post, he will have much less difficulty if he is already familiar with the fundamentals of adjustment of fire from a ground O. P.

Since there is no other training available for aerial observers in the Army, the unit must provide all the training

which is required. This can be done only by the establishment of an organized observer training program by the unit commander in which the above areas are covered in detail.

Individual Initiative

Individual initiative, due largely to the isolation of aircrewmen, must be cultivated to the extent that they will have an intense personal desire to accomplish their missions in a superior manner.

Pilots and aerial observers do not have the companionship which their fellow soldiers enjoy on the ground. Once the aircraft leaves the ground, they rise into a world of their own consisting of the aircraft and its occupants. There is no one with them to lead and give orders. They, as a team, are their own leaders and they must give and execute their own orders. In combat, it is often exceptionally difficult to determine whether a crew succeeded or failed during a mission behind enemy lines, and if it did fail, it is almost impossible to determine where the fault lay.

The majority of the Army aircrewmen's missions in combat are accomplished with the enemy as the only witness. Fire missions are initiated and intelligence reports are based on what the aircrewmen report seeing. If they do not know what to look for or do not get close enough to the enemy to see properly, their reports may be erroneous. In the tumult and constant change of combat, it is impossible to accurately critique a particular mission without basing the critique on the aircrew's report. It is true, in the missions of aerial photography and illumination of the battlefield which are performed over enemy territory, that concrete evidence is available with which to critique the missions. These have been the exceptions rather than the rule. In the final analysis, the most important single factor determining whether or not the aircrew accomplishes its mission is the desire of the individuals to do so.

The desire to accomplish their mission regardless of the difficulties or hazards encountered may be instilled and maintained in the individuals by the unit commander through indirect action.

A high esprit de corps must be established in the unit. Esprit de corps among Army aircrew personnel is usually

notable by its absence. The performance of their duties isolates them from the companionship of other ground troops which results in their not having the sense of belonging to an organization that other troops have. This is usually true whether the air section is a centralized type or whether it consists of two pilots and two observers assigned to a battalion. The ground unit commander often does not have time to take a personal interest in the air section's training, operation, and accomplishments. This apparent lack of interest results in a disinterested attitude on the part of the flying personnel.

Obviously, the solution to this problem is for personnel of the air unit to be included in the activities of personnel assigned to ground duties. Representatives from the unit should be included in staff conferences of the parent ground unit. The air section should be frequently inspected by higher commanders. These inspections provide concrete evidence that the parent command is interested in the unit and assures that the unit will maintain a high state of preparedness.

Personnel desire rigid policies and firmness in the operation of the unit. The unit air officer must provide them with leadership which will give them this desired firmness. The air officer must require high standards of physical appearance and dress. External neatness tends to instill internal desire to maintain the neatness and builds pride in the individual and the unit.

Awards

Naturally, the most important means of cultivating initiative in personnel is to provide concrete evidence of the accomplishments of individuals or of teams. This creates competitive spirit. It may be done by maintaining a chart which shows flight time and missions accomplished or by providing awards such as a three-day pass for outstanding achievement, commendation letters, or even decorations where warranted. Awards should not be given for minor accomplishments or as bribery for the performance of assigned duties, but in recognition of the effort expended by the individual beyond the call of duty in accomplishing his mission. The individual should feel that he has received a just reward for overcoming unusual difficulties which he en-

countered in his mission. This type award is extremely important where, as in the case of aircrewmen, individual initiative often means the difference between success or failure of a mission.

Conclusion

The above suggestions for increasing aircrew efficiency are general in nature. It is not possible to prescribe specific rules which, when applied, would assure an increase in aircrew efficiency in every unit. There are too many local factors to be considered. Each commander must, under the above general outline, evolve specific procedures applicable to his particular unit. He alone can determine the precise training required in his unit and the means of providing it.

But to increase aircrew efficiency, he must provide a definite training program for his pilots and observers and cultivate the initiative of the individual.

(*BATTLEFIELD ILLUMINATION continued from page 12*) or white phosphorous orientating rounds may be fired to identify the initial drop point to the aircrew. Radar control may be used in bad weather to vector the aircraft to the release point. Radar vectoring may be accomplished by the artillery countermortar radar section with the MPQ-10 radar. The technique for vectoring while using this radar is beyond the scope of this article; however, The Artillery School at Fort Sill, Oklahoma, is preparing procedures for this operation. In general, the procedures used are similar to GCA operations. Direct communications must be established between the aircraft and the ground control agency. Even when radar is used, a visual ground observer should be used to adjust or monitor the release point.

There are two points to remember in dropping flares. The initial drop should always be aimed beyond the area to be illuminated and the subsequent flares should be adjusted after wind drift has been determined. Otherwise, wind effects might result in unfavorable illumination of friendly elements by the initial flare.

Battlefield illumination has been an Army aviation mission for several years and it is an important mission which requires extensive training. Is your outfit prepared to fulfill this mission?

ARMY WEATHER SERVICE

Private First Class Ralph Schoenstein

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.

In an outstanding example of interservice cooperation, the United States Army and the United States Air Force in the Far East have pooled men and equipment in an operation which will help keep Army aircraft flying. Four weather stations in Japan, constructed by the Army Signal Corps and manned by officers and airmen of the Air Force, are today disseminating information vital to the maintenance of Army aviation.

The Army Signal Corps recognized the need for a more comprehensive weather service to the Army but lacked the trained meteorologists to operate the required weather stations. Because of this shortage of technicians, Brigadier General Albert F. Cassevant, the Army Signal Officer in the Far East Command, negotiated with the Far East Air Forces to supply personnel to operate these units.

The First Weather Wing of FEAF immediately cooperated by supplying the meteorologists who manned the weather stations which were supplied with Signal Corps communication equipment, radios, facsimile machines, and teletypewriters.

Weather forecasting stations at Zama, Sendai, and Otsu, with an additional observation station at Chofu, are now furnishing weather service exclusively to Army units. Although the customer receiving most of this service is Army aviation, there is also a big demand for weather service by non-aviation units. For example, although all of these stations are located on air strips, Transportation and Engineer units also receive and utilize information from them. The Engineers would not want to pour cement on the day of a frost; Transportation would not want to be caught moving a large shipment of cargo on the day (*Continued on page 27*)

FIRE AND SODA

William R. Gaines

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.

Many of you married men remember when your new bride cooked her first large meal, and, after eating it, you felt your life was saved by a teaspoonful of baking soda. Or perhaps you remember the morning after a party when you got up with burning pains in your stomach, reached for the bicarbonate of soda (baking soda), put out the fire, and felt that again your life had been saved.

Bicarbonate of soda is also one of the best extinguishing agents known for use in combating gasoline, oil, and electrical fires. It is really possible for a dose of soda to save a life.

During the last five years there has been considerable research in the use of dry chemical extinguishers in combating hydro–carbon and electrical fires. Fortunately, electrical fires are extremely rare in most types of Army aircraft, such as the L–19, H–13, and H–23. The gasoline–type fire is, for all practical purposes, the only type which we who are concerned with Army aircraft have to combat.

To date, carbon dioxide and foam have been the principal extinguishing agents used in fighting aircraft fires. These two agents combat fire by cutting off the oxygen supply, that is, they smother the fire as you would if you threw a blanket over it. Of the two agents, carbon dioxide, under ideal conditions and with sufficient quantity, provides the most rapid extinguishment of a fire. However, in strong wind conditions, the efficiency of carbon dioxide is greatly reduced since it is a gas and dissipates in the air. The second agent, foam, may be pre–mixed or may be placed on the fire by use of a pickup nozzle which proportions the foam to the water. The foam, upon application, forms a thick blanket over the fire, thus cutting off the oxygen supply. Large quantities of foam may be produced, pre–mixed, in equipment such as

Type O–10 and Type O–11 aircraft crash fire fighting vehicles.

The Navy Department recently completed a study in which it used a dry chemical, bicarbonate of soda, as an extinguishing agent. The Navy personnel discovered that the dry chemical is much more effective than carbon dioxide on a pound–for–pound basis. The reason it has not been completely adopted by the Navy is due to the fact that it leaves a fine powder residue which may clog carburetors and small orifices.

In Army aviation crash fires, our primary purpose is to save life by immediate extinguishment of the fire. The dry chemical, soda, compared to carbon dioxide, provides a much faster extinguishment. The ability of the dry chemical units to rapidly extinguish oil and gasoline fires has been effectively demonstrated in their use against pit and pan fires. On a day with ten to fifteen miles–per–hour winds, against a 3x3 foot pan fire of burning gasoline, one 4–pound dry chemical unit extinguished it within ten seconds, whereas three 5–pound carbon dioxide units failed to extinguish the blaze. Dry chemicals will also extinguish spill type fires, such as those which occur when a wing tank is ruptured. Carbon dioxide will not extinguish this type blaze. Another advantage of the dry powder extinguisher is that immediately upon its release, a shield of powder which cuts off the intense heat is formed, permitting the user to approach much closer to the blaze from which point he can more effectively direct the extinguishment. When the sodium bicarbonate is placed on the fire, it begins burning at 165° Fahrenheit, thus producing large quantities of carbon dioxide which blankets the fire, cuts off the oxygen, and causes extinguishment.

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The sodium bicarbonate in the dry chemical extinguishers is expelled from the extinguisher by either compressed carbon dioxide or compressed nitrogen. In hand–type extinguishers, up to 30–pound size, carbon dioxide is used as an expelling agent. In the larger, wheel–type extinguishers of 150 to 300–pound size, compressed nitrogen is used as an expelling agent. Use of the compressed nitrogen cylinders permits regulation of the pressure.

Manufacturers of dry chemical extinguishers have demonstrated nation–wide the effectiveness of bicarbonate of soda compared with carbon dioxide and foam. In most all cases where demonstrations have been given, the corporation concerned switched to dry chemical for use as its primary extinguishment agent. The majority of petroleum companies in the United States use the dry soda powder as an extinguishing agent around their transportation terminals. Piasecki, Lockheed, and other aircraft manufactuers are also using the dry powder in their flight line equipment. The Royal Canadian Air Force has furnished its air bases with large 1,000 and 4,000 pound dry powder units which are used when responding to a crash on the line. Foam and waterfog are maintained only as a back–up–type support.

The jeep mounted 350–pound dry powder unit and a foam truck make an excellent working combination on large airfields. A jeep thus equipped also provides ideal aircraft–crash–rescue equipment for small Army air sections where larger equipment is not justified. Jeeps are readily available since they are assigned to most all Army airfield operations offices, and the mounting of dry powder units is a minor expense considering the protection which is afforded. Further, these units are simple to operate and personnel can be trained easily and inexpensively. The units may be recharged by the local air section personnel. In units where nitrogen cylinders are used, the cylinders must be changed in order to recharge the unit. If spare cylinders are available, this can be done in a matter of minutes. Recharging of hand extinguishers requires approximately five minutes time. Further, the jeep has much greater mobility than the Type O–10 and O–11 equipment.

When a small fire occurs, such as a carburetor fire, naturally a small carbon dioxide hand extinguisher should be used. However, in any situation where a life may be en-

dangered or considerable property damage result due to slower extinguishment of the flames, a dry powder unit should be used.

In view of the superior extinguishing capabilities of the bicarbonate of soda which have been demonstrated, and due to the fact that most Army aircraft fires are of the oil or gasoline type, jeep–mounted 350–pound mobile units and hand extinguishers utilizing the dry chemical would provide much more effective and economical fire extinguishers than the foam and carbon dioxide types currently used.

(*ARMY WEATHER SERVICE continued from page 23*)
of a heavy snowfall or typhoon. Each of these four weather stations is manned by one weather forecasting officer and six enlisted airmen who take hourly weather observations which they transmit to all weather stations in Japan including civilian and Air Force stations. After receiving observations from other stations, the unit prepares its weather map from which the weather officer makes his forecast.

It is still true, as Mark Twain said, that everybody talks but does nothing about the weather; but, working side–by–side, the Army and Air Force in Japan are now talking about it more than ever. And, while the weather remains unchangeable, the constant talk about it is proving invaluable to a service once concerned only with the solid earth.

Army aviation units need personalized weather service by men who will analyze weather in terms of the unit's specialized operation. These four stations which are set up to serve the Army make more intensive analyses of weather in smaller areas because Army aircraft fly lower and make shorter trips than the planes of the Air Force. Fog on a mountain or low pressure in a valley would not be of interest to a B–36 flying from Tokyo to Hawaii; but this information would be of vital importance for the pilot of a two–engined Army passenger plane flying from Tokyo to Otsu, or the pilot of an Army helicopter making a hop from Tokyo to Zama.

The reconnaissance planes, passenger planes, and helicopters of the Army's aviation units must have custom–tailored weather service. With equipment supplied by the Signal Corps, the men of the United States Air Force are helping to keep airborne a small but essential department of a brother service.

H-13 FLIGHT RULES OF THUMB

Hans Weichsel, Jr.

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.

The following "rules of thumb" have been prepared for helicopter pilots in an effort to assist in predicting helicopter performance under any particular set of conditions. Some of these "rules of thumb" are applicable to all helicopters while others are applicable only to Bell Model 47. Unless otherwise noted, the following will be for Bell 47—200 Horsepower (H–13 C, D, E, HTL–3, –4, and –5, 47D1 and G).

Rule No. 1
Maximum Payload Increase

Frequently a pilot is called on to fly to an unfamiliar location to pick up a load and is too rushed to become involved in figuring loads under varying conditions. This was particularly true in Korea where pilots flew to the front, picked up the wounded, and flew them back to a MASH unit. If the pilot, prior to landing at his "pick–up destination," momentarily opened his throttle wide at 100 feet or less above the landing site level and noted his maximum available manifold pressure reading (in forward flight), he would then know approximately his maximum obtainable manifold pressure for take–off. Then, while hovering prior to landing, if the pilot reads his manifold pressure for the hover condition, that is height off the ground, wind, temperature, etc., the maximum additional payload can be determined as follows:

Take the difference between full throttle manifold pressure and manifold pressure required to hover. This excess manifold pres-

> sure in inches can be translated into increased weight—1 inch of manifold pressure equalling approximately 80 pounds weight.

For example: A pilot making an approach to a mountain top has a maximum manifold pressure of 27 inches, full throttle. On landing, he notes that he has to clear a 4 foot obstacle; consequently, he hovers 8 feet, or thereabouts, above the ground and notes it requires 24 inches to hover. The difference between 27 inches full throttle and 24 inches for hovering is 3 inches of manifold pressure which, when multiplied by 80 equals 240 pounds as the approximate maximum load he can add and still hover his desired height above the ground. Temperature, wind, altitude, fuel load, flight weight, helicopter empty weight, etc., are thus taken into account.

This rule of thumb was derived from flight test engineering data. The engine's power curves show 1 inch manifold pressure equals 6 horsepower. The helicopter's speed power polar indicates 1 horsepower lifts 13.5 lbs. at hovering. Thus, 1 inch HG equals 80 lbs. is a good rule of thumb.

A conservative estimate of the reduction in gross weight due to fuel consumed in cruising flight is 80 lbs. per hour.

Rule No. 2
Hovering Ceiling Increase

If, while hovering prior to climb out, the pilot determines the number of excess inches of manifold pressure available above that which is required to hover, he can determine at how much higher an altitude he can successfully hover by the following rule:

> Add 1000 feet to the take-off altitude for each excess inch of manifold pressure available, providing the winds at the destination are compar-

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> able to those at the take-off point and providing that the flight is made within the same air mass with no radical temperature changes.

For example: At his take-off point, a pilot finds he has 3 excess inches of manifold pressure available. Applying the rule above, he can hover successfully at an altitude 3000 feet higher than that of his take-off point, assuming the provisions of the rule are met. If he wished to go only 2000 feet higher, he could use the extra inch of excess manifold pressure to increase his payload by 80 pounds in accordance with Rule No. 1.

This rule makes use of the fact that up to 10,000 feet, the power required to hover the Model 47 remains practically constant, whereas the maximum available manifold pressure drops about one inch per thousand feet. Therefore, the ship can hover 1000 feet higher for each excess inch of manifold pressure available.

Rule No. 3
Effects Of Wind

What does the pilot do if the wind is substantially different from that at his take-off point? It can be shown that the effects of wind on possible performance can be allowed for as follows:

> Increase the hovering ceiling 100 feet or the payload 8 pounds for every mile an hour of wind present between 0 and 10 mph; and, increase the hovering ceiling 350 feet or the payload 28 pounds for every 1 mile an hour of wind present between 10 and 30 mph.

For example: If the pilot in the previous example (Rule No. 2) found no wind conditions at his destination whereas he had a 10 mph wind at take-off, his actual hovering ceiling would be 10 times 100 or 1000 feet lower than he had originally planned and therefore he should not attempt to hover at any point higher than 2000 feet above his take-off point.

This rule is based on the fact that the power required to hover is substantially reduced as the wind velocity is increased. The take-off weight calculator for the Model 47 indicates the following wind correction should be made: "Calculated weight may be corrected for wind by adding 15

pounds for each mph not to exceed 300 pounds."

This conservative correction is valid when used in conjunction with the calculator. It is not valid, however, when used as a general rule for determining the effect of both increases and decreases in wind velocity.

Rule No. 4
Effect Of Hovering Height

The height above the ground from which a successful take–off can be made varies widely because of adverse or advantageous terrain features. On level ground with no obstacles present, the minimum practical take–off clearance height has been determined by flight tests to be approximately 4 feet. The effect of varying hovering heights on performance can be estimated by the following rule:

> For each 6 inch decrease in skid height below 4 feet, add 300 feet to the hovering ceiling or 24 lbs. to the payload.
>
> For each 1 foot increase in skid height between 4 and 10 feet, subtract 300 feet from the hovering ceiling or 24 lbs. from the payload. (Ground effect is decreased rapidly above 10 feet).

For example: If terrain features forced a pilot to make a hovering take–off utilizing a skid height of 8 feet, he must reduce his payload 4 times 24 or 96 lbs. below that which he could carry if he could take off successfully from a 4–foot skid height.

This rule was derived by approximating flight test results of the reduction in power required to hover when operating close to the ground (in ground effect) as compared to that required out of ground effect.

Summary

Judicious use of these thumb rules by pilots flying the H–13 will allow fuller utilization of the ship and will give the pilot an insight to the effect of various factors on helicopter performances. However, pilots are cautioned that these thumb rules are approximate aids to them and are not licenses to exceed operating limitations nor are they substitutions for pilot experience and judgment.

INSTRUMENT FLIGHT HINTS

Nolen C. Howell

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.

Every trade has its tricks and instrument flying is no exception. Here are a few such tricks of basic instrument flying which have proven their merit.

Learn to relax while flying instruments. Practice relaxing. Occasionally remove all pressure from all controls and observe the tendency of the attitude instruments. If you have been flying with a poor trim setting, or have been holding an unrealized control pressure, it will immediately show up. Maintain proper trim and use a light touch on the controls.

Timed turns on partial panel require good technique. The computation must be accurate and the rate of turn must be three degrees per second or it must average three degrees per second. To get the timing accurate, start the time when pressure is applied to the controls in starting the turn. Keep the turn indicator deflected for a standard rate turn until the computed time has expired, then apply pressure to bring the turn indicator to the center index at the same rate it was deflected to start the turn.

It is impossible in rough air to keep the turn indicator deflected exactly correct for a standard rate turn, so it must be made to average out three degrees of turn per second. If more than a standard rate turn is indicated for a few seconds, then less than a standard rate turn must be indicated for about the same period of time. Do not hesitate to make a correction to average out a turn when the turn indicator is observed to be deflected incorrectly. Upon rolling out of a turn, maintain a fast cross check on the turn indicator. A common error at this point is to overconcentrate on the magnetic compass. Keep the turn indicator centered until the compass has settled down.

An improperly calibrated turn indicator adds to the difficulty of making an accurate timed turn. Suppose the

turn indicator reads fast. For example, a standard rate indication for two minutes turns the aircraft only 345 degrees rather than 360 degrees. This error must be allowed for by turning at an indicated rate greater than standard. However, the error is so slight that any correction made throughout a turn will be almost certain to cause the aircraft to overshoot the desired heading. Do not make the correction throughout the turn. Make an intelligent estimate of the time required to compensate for the fast turn indicator, and then correct only during that period of time, keeping the needle deflected at standard rate for the remainder of the turn.

Another method of allowing for an improperly calibrated turn indicator is to adjust the turning time. However, when holding or doing pattern work, it is desirable to make standard rate turns in order to facilitate timing. Check your ability to count seconds up to ten seconds. This will make small turns easier by eliminating the clock from your cross check.

Know the turning errors of the magnetic compass. In unaccelerated flight these errors fall into a set pattern which can provide useful information. The patterns of errors are completely disrupted when the angle of bank exceeds approximately twenty degrees, so in order to apply the following procedure, the aircraft must not be banked steeper than twenty degrees. It should be noted, however, that a bank steeper than twenty degrees will not be necessary to produce a standard rate turn, unless the true air speed exceeds 150 miles per hour. The magnetic compass lags approximately thirty degrees when turning near north headings and leads the turn the same amount near south headings. It is approximately correct in turns near headings of east and west.

Suppose you are performing a timed turn to the right from a heading of 060 degrees to a heading of 200 degrees, but for some reason you failed to get an accurate time check

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—The Editor.

at entry. This means you have no predetermined time for roll out. The desired heading can normally still be approximated by noting when the magnetic compass reads 210 degrees, at which instant the aircraft should be headed south. This means you have twenty more degrees to turn, or approximately seven seconds at standard rate. Start a seven second count at the 210 degrees indication and recover at the end of the count. To turn left from a heading of 080 degrees to a heading of 330 degrees using the same procedure, start a ten second count when the magnetic compass reads 030 degrees. By properly applying the known characteristics of the compass, any heading can be approximated. The lead and lag errors are a result of the latitude, so the allowance for these errors may have to be adjusted according to the locality. With decreasing latitude, the lead and lag become less. This method of turning to a compass heading is not recommended as a standard procedure. It comes under the classification of "nice to know information."

At times while flying instruments, it is a good procedure to know your reciprocal heading. Some pilots find the easiest method of computing a reciprocal heading is to add 200 degrees to the present heading and subtract twenty degrees from the sum, or if more convenient, subtract 200 degrees from the present heading and add twenty degrees to the difference. A perpendicular heading can likewise be quickly computed by applying 100 degrees and ten degrees in the same manner.

The vertical pointer of the flight indicator often confuses a beginning instrument student because it and the turn needle are on opposite sides of the zero index during a turn. Remember, the vertical pointer of the flight indicator remains vertical during banking maneuvers, whereas the turn needle measures the rate of rotation of the aircraft around its vertical axis. Since the aircraft, in banking maneuvers, rotates around the vertical pointer of the flight indicator with the pointer remaining vertical, it follows that this pointer must indicate the angle of bank of the aircraft, while the turn indicator is showing the rate of turn of the aircraft. If you observe the vertical pointer of the flight indicator to be to the right side of the zero index, the aircraft is banked to the left and the turn indicator will be deflected to the left. To return to level flight, apply right rudder and aileron pressure

as required. So perhaps it would be well to remember that the vertical pointer of the flight indicator can be returned to the zero index by applying control pressure in the same direction the pointer is removed from the zero index.

The direction to turn to a heading, especially if the required change is small, is another trouble maker for many basic instrument students. Turn to the right to increase the heading and to the left to decrease the heading. Using this rule for turns near north may require that a heading such as 005 degrees be considered as 365 degrees. Another plan used by many pilots is to visualize the aircraft rotating around a vertical axis running through the center of the directional indicator while the card remains stationary. The lubber line of the directional indicator can be pictured in the mind as being controlled by the rudder pedals. When the desired heading is visible in the window of the directional gyro or magnetic compass, it is easy to visualize the rudder moving the lubber line around to the desired number. This plan should not be construed to mean that the turn is actually accomplished by rudder alone. Take note of the fact that the directional gyro has an inverted triangle index for headings of 045 degrees and 315 degrees, but has no index for 135 degrees and 225 degrees. A roll out on northeast or northwest is made easier by the index, but no index is present to aid the pilot on a southeast or southwest roll out.

Learn to take care of first things first. High on the list of first things is maintaining the proper flight attitude at all times. To do this requires a constant cross check of the flight instruments. Many things can distract your attention and slow down the cross check. One such distraction is making a change in power settings. This distracting influence can be kept to a minimum by continuing the cross check of the flight instruments while the power change is initiated and checking the power instruments only after the correct power setting is approximated. A quick glance at the tachometer or manifold pressure will indicate any need for a further change. This same technique can be applied to setting a specific carburetor air temperature. Do not stare at the power instruments while making a power change.

The above techniques apply to most of the more common maneuvers which are known to cause difficulty in basic flying.

Grey Hare Says

Bull In The China Shop

We thought that we had seen everything in accidents until we came across this case which happened in Germany. A Private E–2 was serving as Charge of Quarters for the Air Section and about midnight he decided to get in a little taxi practice. He cranked up an L–19 and went travelling around the field but he misjudged the edge of the runway and his right wheel dropped into a ditch which was approximately eight inches deep. Private E–2 jammed on the brakes, causing the aircraft to stand on its nose. Minor damage was done to the propeller and the oil cooler.

If, at this point, he had left well enough alone, damage would have been approximately twenty dollars. Further, it would have been classified as an incident and not an accident, according to regulations. However, he decided that he

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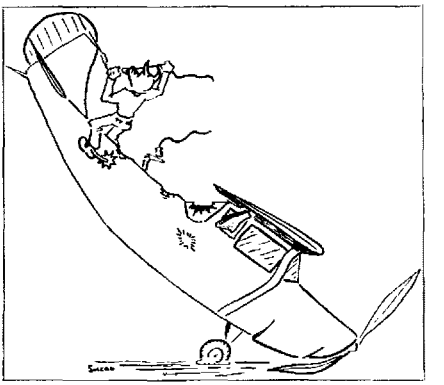
The Grey Hare Department is prepared monthly by the Camp Rucker, Alabama, Post Safety Director, Mr. William R. Gaines, with information obtained from the files of the world-wide aircraft accident safety review board. The views expressed are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor.



would climb up on the wing, out over the top of the rear pilot's compartment to the tail section, and force the tail to the ground. His first attempt to crawl on top of the wing was over the right flap which he found would not support his weight. It bent. No, he did not stop. Up the steps on the strut and fuselage he went. He grabbed hold of the free air temperature gauge and broke it off. With sheer determination he made it to the top of the wing where he tramped on the rear deck window and fell through it with one leg. Undeterred, he continued up the fuselage and broke off the low frequency antenna. When he eventually reached the tail section, he found that his weight was not sufficient to lower the tail to a three–point attitude.

One would think our Private E–2 would have stopped at this point. Not with his determination! He procured a three–quarter–ton truck and used it to drag the aircraft from the ditch and back to the tie–down area. Needless to say, when the next pilot went out to fly the aircraft, he found many deficiencies in performing his pre–flight check. Our E–2 failed to report any of his adventures in his night proficiency taxiing session.

Formation Fatalities

Six L–19's were putting on a formation flight demonstration at an altitude of 100 feet above a reviewing stand in Korea. The formation was divided into two groups of three planes, the second group was flying three seconds behind the first. The lead aircraft of the first group pulled up straight ahead, while the wing planes pulled up and to the right and left respectively. The second section followed the same pattern. The lead plane of the second section pulled up into the lead plane of No. 1 section. The lead plane of the second section fell off and spun to the ground where it immediately burst into flames. The pilot and the passenger were killed and approximately $12,000 damage was done to the aircraft.

In the subsequent accident investigation, it was found that the pilots participating in this demonstration had not held a rehearsal for the formation flying. Some of the pilots were flying in positions in which they had never flown.

The pilot of the lead plane in the second section failed to clear himself before pulling up into a steep climb. He had been instructed to make a pass in formation at 100 feet altitude and pull up. He did. I personally feel that there is major supervisory error in this case. Had the formation been rehearsed and sufficient caution exercised so as to keep an altitude separation between the two flights, this type of accident would have been highly improbable.

Formation flying is an art which has not, until recently, been included in the Program of Instruction at the Army Aviation School. Aviators have acquired the art in the field, and there is quite likely a wide range of skill developed among them. Supervisors should bear this in mind, and not push the formation requirements beyond the capabilities of the pilots.

The Aviation School has recognized that Army aviators are continually required to fly in formation to accomplish various kinds of missions. Formation flying has therefore been introduced into the curriculum.

Friendly Ack–Ack?

We recently received a report from a unit concerning two L–19's which were performing simulated strafing and flour–sack bombing of troops. The aircraft were making low passes at the infantry troops. The infantry soldiers, firing blank ammunition, were not to be outdone by the L–19 pilots. They placed cartridge cases inside the grenade launchers which were mounted on their rifles. As the planes came over, the soldiers fired at them. Upon completion of the mission it was found that one aircraft sustained four hits and the other two hits.

The mission resulted in $438.47 damage to the two L–19 aircraft. The infantry personnel, by firing projectiles, jeopardized the lives of the pilots as well as ground personnel. On the other hand, if the pilots had not flown their aircraft at extremely low altitudes, it is doubtful that they could have been hit by the cartridge cases.

When blank ammunition is being used by ground troops to fire at aircraft, very close supervision should be exercised by the ground unit commanders. Further, the unit air officer should thoroughly brief the ground unit commander concerning the hazards involved.

Lost

Recently an accident which cost $13,000 was reported. The pilot was making a night flight of approximately 135 miles. The accident report stated that the pilot received VFR weather clearance and that after take-off a rapid change in weather conditions caused the pilot to drift off course and lose his way. It further stated that when the pilot realized the weather had become worse, he made a 180° turn to return to his point of departure, but finding that the weather had closed behind him, he decided to continue to his original destination.

When past his ETA for his destination he tried to orient himself but due to the storm conditions, radio reception was very poor. After an unsuccessful attempt at orientation he sighted the lights of a small town. The state police and local townspeople arranged their car lights around a small athletic field. After several passes at the field, the pilot made a crash landing in which he completely demolished the aircraft. The accident investigation board interrogated witnesses at the scene who stated that "the pilot used caution and good judgment in landing the aircraft."

The accident investigation board listed the primary unsafe act as "rapid change in existing weather conditions after the pilot had taken off, causing him to drift off course and get lost." Contributing factors were listed as "radio failure probably due to weather conditions."

The investigating board took considerable leeway in blaming it entirely on the weather. The pilot made his first mistake by not personally checking the weather conditions over the route which he planned to fly. His second mistake was when he delayed making a 180° turn.

If weather conditions are marginal for VFR flight, the pilot should be very alert for lowering conditions and positive of his position at all times. If VFR conditions are good at time of take-off, and he receives a proper weather briefing,

the pilot on a flight of approximately one hour and fifteen minutes duration in an L–19 should encounter no difficulties.

The pilot's third mistake was in delaying his orientation until he was past his ETA.

An accident investigation board, as set up in regulations, consists of three individuals, two of whom are Army aviators currently on flight status. Its duty is to (1) investigate the accident, (2) determine the primary cause and contributing or underlying cause factors, if any, and (3) recommend action to prevent recurrence. In this case, it is felt that the accident investigation board failed to find the proper primary unsafe act which caused $13,000 worth of damage. In other words, board members, let's call a spade a spade.

(*PILOT'S PHYSICAL FITNESS continued from page 8*)
alertness, planning, and judgement that are required of the military pilot.

Physical fitness is a matter of great importance to the military pilot in that it connotes good health and has a direct bearing upon his general efficiency, term of useful utilization, and general well being throughout life.

Conclusions

1. Physical fitness is very important to the military pilot. It is only by the maintenance of good health that he is able to function well in his job.
2. Physical fitness depends upon a number of factors.
   a. Regular physical training.
   b. The development of good habits.
   c. Avoidance of excesses.
      (1) Overeating and obesity.
      (2) Alcohol and tobacco.
   d. Adequate rest.

References

1. *Bergin, Kenneth G., M. A., M. D., D. P. H., A. F. R., A. E. S., (Aviation Medicine)—(1949)*
2. *Armstrong, Harry G., M. D., F. A. C. P. (The Principles and Practice of Aviation Medicine, 3rd Ed. 1952)*
3. *McFarland, Ross A., Phd. (Human Factors in Air Transportation, 1st Ed. 1953)*

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