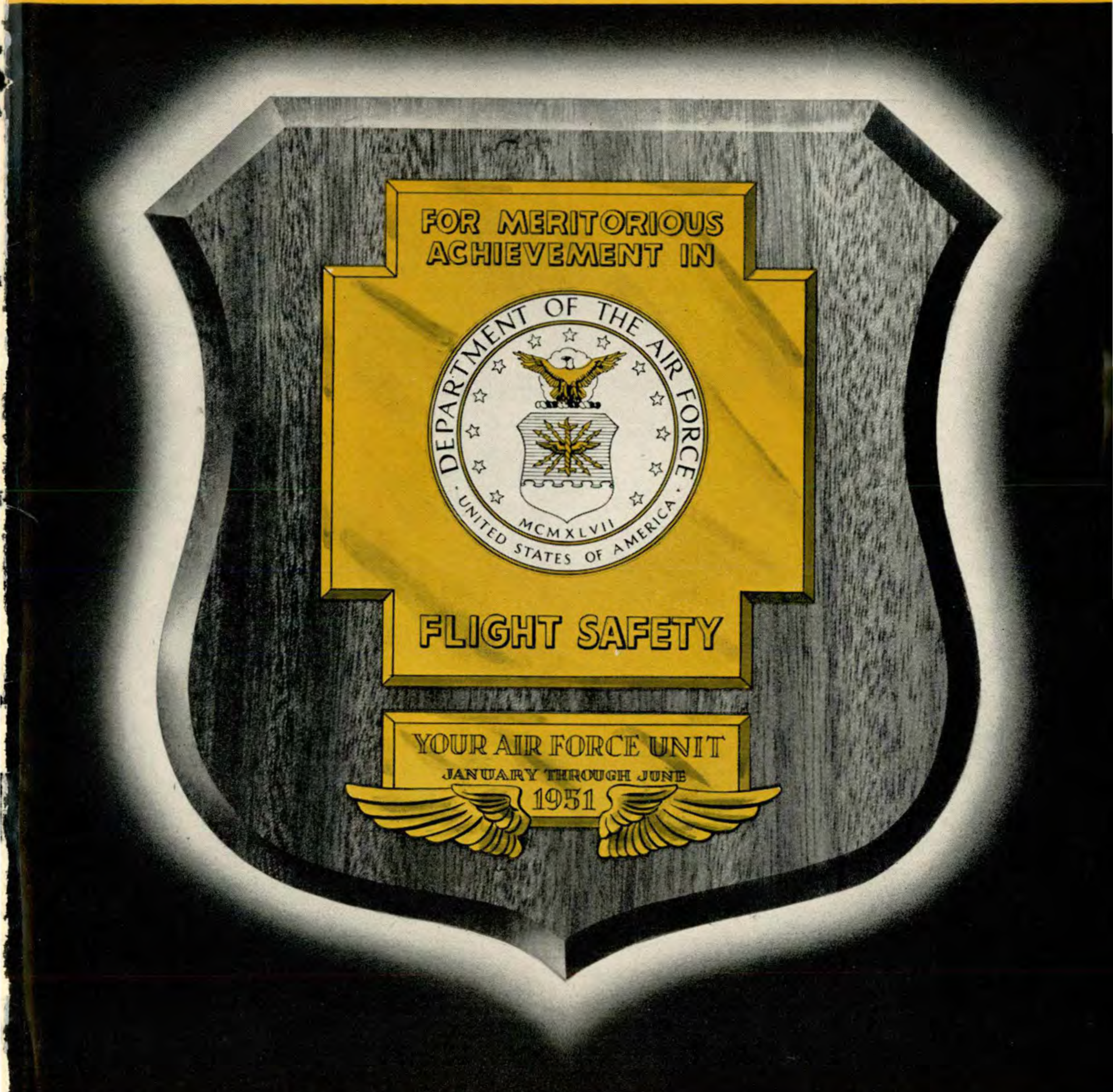
Flying Safety

HEADQUARTERS UNITED STATES AIR FORCE • RESTRICTED

JANUARY, 1951



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from PENNANTS *to* PLAQUES

Replacing the former temporary Flying Safety pennant awards, new, permanent plaque awards will be ready for presentations early in 1951 to provide outstanding recognition for those USAF, Air Force Reserve and Air National Guard organizations which establish meritorious flight safety records and show commendable efforts in eliminating aircraft accidents.

An added incentive in the USAF Flying Safety Program, the new award as shown on the cover, is a brass and mahogany plaque that is symbolic of flight safety and is engraved with the name of the winning base and the inclusive dates of the period for which the award is given. An organization winning an award becomes the permanent possessor of one of the plaques which may be displayed in the operations section of the receiving base for the greatest degree of safety publicity for that organization.

Since the prevention of aircraft accidents requires continuing efforts on the part of all Air Force personnel, an organization achieving a low accident rate reflects great credit upon itself and upon the Air Force as a whole, and is deserving of commendation for its accomplishment.

RESPONSIBILITY FOR ADMINISTRATION

Statistical computations of accident rates and appropriate listings of eligible organizations will be made by the Directorate of Flight Safety Research, Office of the Inspector General, USAF, Headquarters, USAF. Awards will be furnished by the Directorate of Flight Safety Research and forwarded by Headquarters USAF to the appropriate major air command and to the Air National Guard Bureau which will in turn notify the organization concerned by a suitable letter of commendation or by presentation ceremonies.

BASIS FOR AWARD

The basic organization considered will be the wing base.

Awards will be made semi-annually to Air Force organizations, Air National Guard organizations, and Air Force Reserves organizations having the lowest over-all adjusted accident rates. A minimum of 20 plaques will be awarded during each period. Organizations located in active theaters of combat operations, Air Force organizations flying less than 6,000 hours, Air National Guard and Air Force Reserve organizations flying less than 1,500 hours during the six-months period will not be considered. The award periods will extend from 1 January to 30 June and from 1 July to 31 December, inclusive.

In addition to the semi-annual awards provided for, the Flight Safety plaque may be presented also for exceptionally meritorious flight safety contributions or achievements when determined by the Directorate of Flight Safety Research to be warranted.

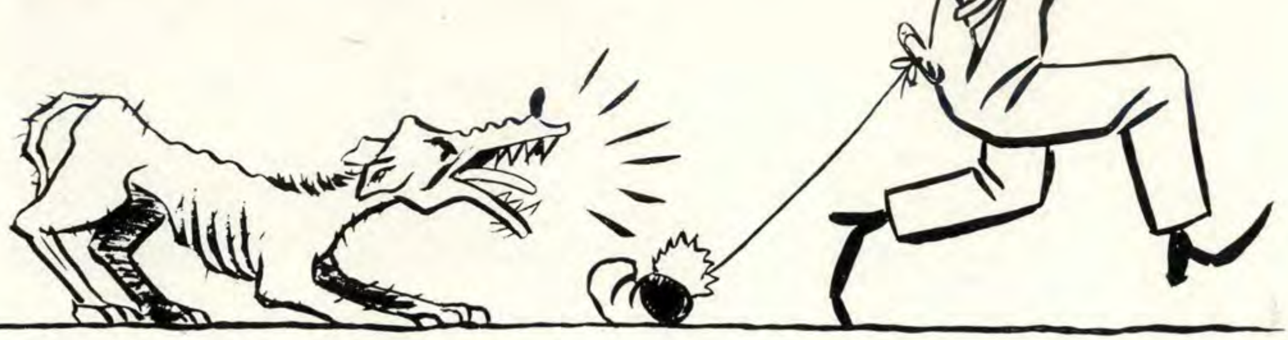
DETERMINING RATES

The rate adjusting procedure for Air Force awards is as follows:

- The over-all Air Force aircraft accident rate (exclusive of Air National Guard and Air Force Reserve) will be determined.
- The Air Force accident rate for each aircraft model will be determined.
- The over-all rate will be divided by each model rate to arrive at an adjusting value for each accident in which the aircraft model is involved.
- The number of accidents for each specific model charged to each organization will be multiplied by the adjusted value for that model to arrive at the adjusted number of accidents by model for that organization. The total number of adjusted accidents can then be determined for each organization.
- The hours flown by each organization will then be used to arrive at the organization's adjusted accident rate.

For Air National Guard and Air Force Reserve awards, the rate adjusting procedure will be the same, except that Air National Guard and Air Force Reserve accidents, flying time, and accident rates will be used in the computations.

WHAT IS PILOT ERROR?



There, in capital letters, in black and white, you have a pair of fighting words. They're always good for an argument if not a fist-slinging party, and if you don't believe it try them out on the next hangar-flying session you stumble into.

What is pilot error? There are probably as many different interpretations of the term as there are pilots in the Air Force. To one, pilot error as an accident cause factor may apply only in an acknowledged "bonehead" trick, such as forgetting to lower the landing gear before landing. Few will dispute that pilot error applies in such a case.

Yet to another pilot, the finding of pilot error as an accident cause may go much further—perhaps to include flying with cockpit lights turned too low. Or maybe not being aware of the latest approved procedure for preventing a groundloop. One accident board submitted a finding of pilot error when a pilot of an F-51 made a two-point landing on a wet sod field and the plane nosed forward sufficiently for the propeller to strike the ground. The reason given for this finding was the fact that the landing SOP for the pilot's group called for a three-point landing.

The truth is that the interpretation of pilot error depends upon who is using the term. However, the meaning of a word should depend upon the interpretation given it by the listener or the reader. This discussion is an attempt to reconcile the conflict. It is an attempt to establish an understanding by all concerned of just what pilot error means—at least insofar as it is used as a label in the Air Force flight safety program. And, you are assured, the definition is an arbitrary one devised to meet the needs of the program. If your definition disagrees, don't throw it out—but recognize this one as the one that governs for the flying safety program.

It is necessary to have some means or standard by which it is possible to classify the factors which cause accidents. Without a classification system, it would be impossible to determine what factors cause accidents and the frequency with which they occur. It would then be virtually impossible to conduct an adequate accident prevention program.

One of the great problems in establishing an objective classification system is that of eliminating the personal opinion and emotional attitude of the analyst. In short, the object is to record and interpret facts. Judgment of a pilot's proficiency or assessment of liability is for boards of officers. Bearing in mind that no set of instructions or definitions can cover all conceivable combinations and variations of circumstances, a scale of perfection has been chosen as a standard of measurement. Against this scale, any act which contributes to an accident can be arbitrarily recorded as a fact; the pilot either did or did not act in a manner which would have avoided the accident.

This classification of acts and conditions is not related to any board action or determination of line of duty or pecuniary liability. This is precluded by regulations. The compilation of the frequencies of errors as determined by this classification system permits a numerical statement regarding how frequently pilots have committed unsafe acts. These facts are gathered in mass numbers, and *never by the names of the men* who commited them. The use of these facts enables Air Force organizations to seek constant improvement in efficiency of operations, training and maintenance and also provides a basis for engineering research towards better aircraft design.

Thus, for the purposes of the accident prevention program, a pilot is in error whenever he acts in any but the perfect manner. This policy is necessitated by the requirement that personal opinion be eliminated from accident analyses in order to obtain a set of valid statistics for the determination of accident trends.

Before all the howls and groans begin, let's ask and answer one more question. "Does this standard of perfection as a basis for pilot error in any way reflect on the individual pilot?" And the answer is a big, resounding "NO!"

As stated before, statistics obtained from using the perfection standard are coded *without reference to names*. They are just figures to be used to profit from the mistakes and experiences of others.

How is this standard used in the "repeater pilot" program—the system which requires that a pilot involved in three major pilot-error accidents in a five-year period be evaluated? The answer is that the standard of perfection is not applied in the repeater program. The classification of pilot error used for this program is based on the same criteria as are used in local board proceedings, i.e., comparison of the pilots' actions and decisions against the reasonable performance which can be expected of a pilot with equivalent rating and experience. And an evaluation board cannot use statistics based on the perfection standard or the analyst's opinion as evidence of a pilot's present lack of proficiency or judgment.

So we see there are actually two valid standards for determining pilot error. Both are in use in the Air Force flying safety program and each serves a purpose. The first standard, perfection, is used only for purposes of records and statistics. It can harm no one—it can serve the Air Force to advantage in pointing the way to more effective accident prevention measures. The second standard, the reasonable performance expected, can hurt only those whose pilot proficiency and ability do not come up to what is expected of the average pilot. It is the yardstick by which a pilot's fellows judge his abilities as a pilot. It is the standard by which his proficiency is determined when an evaluation board meets.

A pilot who is found to be in error according to the standard of perfection is not necessarily an unsafe pilot. Mr. Saul Wallen, acting as neutral member on a board of adjustment during an airline dispute, stated, "An unsafe pilot is either one whose record over a period of time shows a progressive failure or inability to maintain his mastery of flying techniques or exercise sound judgment; or who at a given time commits acts that violate such important basic tenets of aviation safety as to clearly demonstrate that he lacks the judgment to continue to be a pilot." He further stated that a pilot

"... but once you get on to it, it practically flies itself."

who merely failed to observe some one of the many regulations governing flying should not necessarily be called unsafe.

Mr. Jerome Lederer, a leader in the civil aviation safety program, had this to say with regard to regulations: "Since enforcement of rules cannot eliminate the accident caused by human error, planes must be engineered and pilots must be educated to minimize the chance of human error. The pilot must be prompted to maintain flying skill and technical knowledge commensurate with his particular brand of flying."

This brings up another pilot error angle. How much

does faulty aircraft design contribute to pilot error accidents? Needless to say, the exact amount cannot be computed. However, it is undoubtedly a major contributor in many cases. Examples? Yes, there are many. The one which has probably contributed most to accidents is placement of gear and flap controls so that they may be mistaken for each other.

Disparity in placement of controls on the throttle quadrant cannot make for natural and easy operation. When one twin-engine plane has the throttles on the extreme left of the quadrant and another has the prop control so located, a pilot who flies both airplanes must really be on his toes. If he has an accident as a result of this arrangement, can pilot error justly be found as the cause? Perhaps it can to the extent that other pilots fly the same planes without accident. But the conflicting designs of the planes definitely constitute an accident potential. They induce pilot error.

This matter of poor safety design of aircraft is receiving a lot of attention these days. To prevent incorporation of design features which are obviously against the interests of safety, the Air Force has recently included representatives of the Directorate of Flight Safety Research on 689 and mock-up boards for new aircraft. Major General Victor E. Bertrandias, Deputy Inspector General for Technical Inspection and Flight Safety Research, monitors the program closely and has this to say about it, "In the past, engineers and scientists have designated airplanes to meet given sets of military characteristics without considering the abilities of the humans who must fly them. This was never a suitable situation. Now that we contemplate flight at extreme altitudes and once undreamed of speeds where split second timing and action must be considered routine, the situation is no longer acceptable. We must consider not only the mission when we build new airplanes, but also the human pilot who is to accomplish that mission."

In other words, everything possible to prevent design features which induce pilot error must, is, and will be done. However, in some cases, economy demands that we go on living with the design errors of the past which show up in our airplanes of today.

Meanwhile, psychologists and other medical personnel continue their search for an explanation of what it is about the pilot himself which permits and even forces him to push the wrong button, pull the wrong handle, or kick the wrong rudder. Their problem is less concrete than that of the design engineer.

What do all these words mean to the pilot? They mean that when he fights against the term "pilot error," he is fighting only himself. When pilot error is judged against the standard of an admittedly non-existent perfect pilot, it affects Air Force pilots only in that data is obtained upon which to base a more sound and beneficial crusade against aircraft accidents. When pilot error is judged by the standard of what might reasonably be expected of a proficient pilot, it is to the best interests of the pilot's health and professional pride that he not be found on the wrong side of the ledger.

In any case the Air Force is trying to help overcome the human weaknesses which produce pilot error accidents. It is trying from both the mechanical and the human angles. Pilots can help themselvse by maintaining flying skill and technical knowledge. This business of flying is one which requires constant attention and practice just for survival. Lack of skill, knowledge, attention or practice is dangerous. But the pilot who stays on the right side of the ledger, as far as these things are concerned, has little to fear from the bugaboo of pilot error.

STANDARDIZATION

MISTAKES ARE MERELY SAFEST BASE

By 1st Lt DALE BALL

Since the Air Force has been taken out of the "Hell's Angels" category and put on a business basis, flying safety and the responsibility of the individual in making it safe has been stressed more and more heavily. Finding underlying *causes* has become more important than giving military funerals to crash casualties. This has led to the establishment of certain flying rules and practices which result in unpleasant, messy, and often fatal consequences when violated.

The culmination of these preventive measures may be seen in the record of an Air Force Base which has proved itself to be the safest USAF base in the entire world.

Since April, 1947, Mather Air Force Base, California, has established a remarkable flying safety record in the United States Air Force. Through 41 months of continuous flying in all types of conditions, Mather's record has been marred by only two accidents. Neither of these resulted in death or injury to personnel, and damage to the aircraft was repaired locally, in both cases.

During this period of nearly three and one-half years, Mather's aircraft logged a total of 152,929 flying hours, covering 30,585,800 air miles. This averages in the neighborhood of 22,000 air miles per DAY.

Fair weather flying does not account for this record. Mather's missions are flown in all sorts of weather and conditions, and include regular cross-country and over-water flights. Ground Controlled Approach landings are common. Since January of this year, 32 actual weather GCA landings were completed successfully.

What is the reason for this remarkable record? Mather's aircraft, which include B-25's, C-47's and C-54's, are no different than the same type planes used throughout the Air Force. Its missions are like those of any other base, some routine, others hazardous. The pilots are not imbued with super powers. There is no secret formula.

The "secret" is very simple. It is *Standardization.* Virtually every department on the base feels its personal responsibility to Mather's record, and flying safety depends on all of these men rather than on just one group of individuals. No matter how skillful a pilot may be, he can do nothing in the face of mechanical failure, or operational malfunction; he is dependent on the control tower, the weather section or the GCA operator. On the other hand, none of these sections can insure a mission against human error.

It is for this reason that the coordinated standardization of set procedures by each department is so vital to safety. By establishing unvarying standards for base operations, control tower, form 5 section, weather section, GCA, and the various maintenance sections, and by coordinating these functions, human error can be reduced to a minimum. This minimum is further re-

= SAFETY PLUS

EMORIES AT MATHER
THE USAF

d Sgt JOHN SPADE

duced by an extensive system of cross-check inspections to which Mather's aircraft are subjected. In addition to section and squadron inspections, every aircraft on the base is subjected to an intensive check every month by a base inspection team.

Ultimately, however, it lies with the pilot to take the aircraft off, fly the mission, return, and land safely. In order to eliminate human error in the cockpit, a standardized pilot checkout system has been devised for *all* Mather pilots, and they must satisfactorily complete this before they are allowed to fly. It encompasses flight regulations, emergency procedures and all allied aspects of flying.

Let us take, for example, the procedure followed in a theoretically perfect mission, flown by a theoretically perfect pilot. Let us follow the mission from the time it is scheduled until it has landed safely upon completion of the flight.

At 0700 on the morning of the flight, the aircraft is given a complete preflight inspection by the crew chief. This includes a special anti-sabotage check. When it is found that the plane and its equipment are operating perfectly, the aircraft is cleared to fly.

At 0800, pilot briefing is held. This usually lasts from 30 to 45 minutes and includes such factors as weather and seasonal hazards likely to be encountered, route briefing, and any special procedures necessary for the safety of that specific mission.

The pilot then joins his crew at the airplane, where he checks them out on emergency procedures, location of fire extinguishers and escape hatches, proper fit of parachutes, and special procedures, if any. He follows this with a visual inspection of the aircraft.

Now they are ready to start. But first, the pilot must use the before-starting checklist to be sure that all instrument and control settings are correct. He starts the engines. Then, of course, he taxis out to takeoff position . . . after he has consulted the before-taxi checklist. He checks his emergency brakes and hydraulic system, then prepares to take off . . . by checking the before-takeoff checklist.

Our careful pilot then takes off, using, in this instance, a hooded instrument takeoff. It's lucky for him and for his crew that he has spent so many hours practicing these techniques in the Link trainer. The plane is safely airborne by 0900 hours.

During the mission the pilot gives accurate position reports, as required. This is usually about every half hour. This is survival sense—if he crashes, or is forced to land, his plane can be located almost immediately. The mission is flown within close flight limitations which restrict airspeed to within a two- or three-mile variation and altitude variation to within 50 feet.

Landing and braking to a stop, our cautious throttle-jockey turns off the runway onto the taxi strip, where he consults . . . yes, that's right, an after-landing checklist. After taxiing to the parking area, he stops his engines. And then? Why, an after-stopping-engines checklist, of course. Mission accomplished, our Careful Pilot goes off with the feeling of satisfaction that he will be able to fly again.

Special recognition for an outstanding Flying Safety record was given Mather Air Force Base during the Flight Safety Foundation's Annual Seminar, held in Denver, Colorado, 31 October 1950. The award, in the form of a bronze plaque, was presented by Brigadier General Charles H. Caldwell, Commanding General, Lowry Air Force Base, representing Major General Robert W. Harper, Commanding General of the Training Command.

Brigadier General Carl B. McDaniel, who commanded Mather Air Force Base during the three and one-half year period, flew to Denver from his new command at Randolph Air Force Base, San Antonio, Texas, to receive the award.

General McDaniel, in turn, presented the plaque and citation to Mather Air Force Base's representative, Lt. Colonel David N. Kellogg, commander of the Maintenance and Supply Group. A large share of the credit for the record was given to the M&S Group as the people who kept the aircraft in the air.

get on the ATTITUDE BALL

By Capt. David F. McCallister
142nd Fighter Interceptor Squadron
Delaware Air National Guard

Of all the instruments ever placed in a fighter, I believe the J-3 and J-4 attitude gyros have caused more criticism than all others combined. This article is derived from actual flying experience, Tech Orders and information the Sperry Company forwarded to me.*

It has been realized the J-3 and J-4 attitude gyros are not the perfect answer to the problem of providing attitude flight instruments, but until their replacement with the new J-8 gyro is completed, it is essential that each pilot flying a plane still equipped with the J-3 or J-4 become proficient in their use.

Fighter pilots have found it difficult to adjust themselves to the "reverse presentation" offered by the J-3 and J-4 attitude gyros and this can be readily understood because the fighter pilots have been trained on the old type gyro horizon and have formed certain brain patterns and habits which are difficult to change. In transition from the gyro horizon to the attitude gyro, a fighter pilot will have to fly 15 or 20 hours of instruments before he can grasp the reverse presentation.

If a pilot will visualize the sphere of the J-3 as being a stationary object about which his aircraft is pitching and rolling, the transition time to attitude flying will be minimized. The difficulty first encountered is in establishing a basic reference on the instrument sphere which can be used in conjunction with the miniature airplane (loading indicator adjustment). On the old type gyro horizon, the horizon bar was the basic reference, but on the J-3 and J-4 attitude gyros, there isn't a horizon bar. The equator line which separates the black portion of the sphere from the white portion is the natural horizon in relation to the earth, but it is not to be confused with the horizon bar of a gyro horizon.

The *pitch pointer* located on the right side of the sphere can be considered as a very short horizon bar, since it gives the same indication as the horizon bars found on the gyro horizons. When back pressure is applied, the pitch pointer goes down and when forward pressure is applied, the pitch pointer goes up. Due to the shortness of the pitch pointer it cannot be used as a horizon bar, but it is an aid when determining pitch attitude. The pitch pointer limitations are 10 degrees up and down from the equator line and the miniature airplane travel is limited to plus or minus six degrees from the neutral position. Consequently, a pilot must learn the various miniature airplane settings at different speeds in order to use the equator line as a basic reference. This is especially true in the F-84 at low speeds.

In the F-84 at speeds below 220 mph with the miniature airplane set in the full *up* position, the gyro will indicate a climb in level flight. This can be quite confusing when making instrument takeoffs, or instrument landings during periods of low visibility. To counter this false indication, lowering 20 degrees of flaps will

**Each pilot should acquaint himself with the principles of the operation of the attitude flight instruments discussed here by reading appropriate Tech Orders. This article, like other information appearing in Flying Safety Magazine is for the purpose of stimulating interest in Flight Safety problems. Such information is not to be construed as authority to change existing technical orders, rules or regulations.*

change the aircraft's attitude and thereby allow the pilot to gain correct readings from the attitude gyro.

With the old type gyro horizon whenever "horizon turn error" (gyro remaining slightly tilted after a turn is completed) was encountered, a pilot would automatically assume the gyro was not operating properly. Pilots using the J-3 attitude gyro encounter turn error every time they make a turn.

This is because in offering an unlimited presentation it was necessary to sacrifice a slight bit of turn indication accuracy to attain the ultimate in pitch and roll presentation. If a J-3 gyro erects within eight to 13 minutes, a pilot can be assured the gyro will operate properly and within the prescribed limits of horizon turn error. The horizon turn error in the J-3, J-4, A-1 and A-2 gyros is caused by acceleration forces (G's) reacting on the gyro and the erecting mechanism. The turn error is corrected after each turn by an erection mechanism attached to the bottom of the gyro case. There is no rule of thumb which can be used to determine the amount of turn error which will be experienced in a turn, but it can be said that the amount of turn error increases with an increase in degree of bank, an increase in airspeed, and an increase in G-forces. To minimize turn error, restrict the degree of bank, fly at lower airspeeds, and fly smoothly to avoid G-forces.

Another point in reference to turn error is the cyclical manner in which it occurs. The amount of turn error increases up to and including the 180-degree portion of a turn and then begins to decrease proportionately and cancels out completely after the completion of a 360-degree turn. Recent tests have disclosed a 30-degree bank (approximately one needle width) flown at 300 mph IAS will result in little if any turn error if a pilot will fly smoothly and avoid G-forces. At 180 mph IAS, a 30-degree bank will approximate a double needle width three-degree per second turn. Using 180 mph IAS for GCA and radio range letdowns will enable the average fighter pilot to fly his F-80, F-84 and F-86 in the same manner as he flew the F-51, F-47 or T-6. Avoiding quick entries into and out of turns will result in a minimum of turn error at low and high speed.

The degree of pitch error (nose up and nose down error) occurring in turns is another factor of which the jet pilot must be cognizant. The degree of pitch error following a turn is hardly discernible to the average pilot, yet it is prevalent and must be anticipated to effect a level flight attitude following completion of a turn. Under 500 mph TAS pitch error varies from a maximum of three degrees nose down (150 mph) to a minimum of .7 degrees nose down at 200 mph. Again there is no rule of thumb which can be used, but a pilot can assume that there will be a nose down error and counter the error with a slight back stick pressure after completion of a turn. Cross checking the attitude gyro against the rate of climb indicator will enable a pilot to counter the pitch error. A thorough understanding of the gyro's operation will give a pilot confidence in the instrument which some day may save his life.


Jump

The parachute demands skill and knowledge from the man who uses it. Since your first jump will not be for practice, you must know how to use your parachute before you leave the ground

IT MIGHT well be the most important decision of your life, in fact it might mean your life—this decision to abandon aircraft. There is a false sense of security about staying with the aircraft and often a crew will elect to ride with a disabled airplane to certain death. The most hollow-sounding phrase at the crash scene is the question, "Why Didn't They Bail Out?"

Accidents known to all of us call attention to the importance of all pilots recognizing their responsibility as the airplane commander for the safety of all passengers. Records of the Directorate of Flight Safety Research indicate that injuries from jumping at too low an altitude and injuries from striking aircraft structures are the primary causes for *fatalities* in parachute jumps. With this fact in mind, it is necessary for pilots to consider that the decision for attempting parachute jumps must be made quickly and decisively during emergency conditions. In all emergencies requiring bailout, a certain time lapse is necessary for jettisoning canopies or escape hatches, moving crew or passengers to the jump spot, and accomplishing the clearances from the aircraft of all people before the aircraft is below a safe altitude. In a recent accident the pilot delayed his decision until the passengers jump was accomplished below 600 feet. This resulted in the death of three of the five persons involved. The other two persons were injured on contacting the ground while their bodies were oscillating from the opening shock.

Because this safety device is so often carried, but so seldom used, many personnel who travel by air are prone to accept anything that is passed to them in the way of a parachute, without even a preliminary check of its fit or condition. Regulations state that parachutes should be repacked every 60 days and should be inspected every 10 days, and that such periods of repack and inspection must be duly noted and proper entries made.

It has been observed too many times on transport airplanes that the parachutes are tossed to the back of the cabin, with bags, coats, thermos bottles, sandwiches and other odds and ends placed on top of them. Emergency conditions arise suddenly. The application of G forces and entanglements with complex aircraft structures is to be expected, thus it is imperative that these hazards which increase the odds against a successful parachute jump be eliminated prior to takeoff. Radial G forces, such as in a tight turn or spin, can prohibit a person from moving to an escape hatch. It is too late to attempt to find a parachute after an airplane departs from straight and level. It is our conviction that the man who fails to *wear* his parachute at all possible times in combat aircraft, invites disaster. The airplane commander cannot afford to leave emergency procedures to chance.

LEARN AND LIVE

From the first of January, 1946, through the 31st of December, 1949, personnel in the USAF attempted 1,054 emergency parachute escapes; 10.2 per cent of these jumps resulted in death and 32.6 per cent resulted in an injury, and only 52.2 per cent of these 1,054 men succeeded in making their emergency escape without injury.

The two greatest cause factors of the deaths were: being struck by the aircraft and jumping too low. These two hazards accounted for 53.3 per cent of all the deaths.

As an illustration of the necessity for knowledge of how to use a parachute, your attention is invited to the causes of the injuries which did not result in death to the parachutists. In the four years from 1946 through 1949, approximately 60 per cent of all the major injuries received from parachute jumps were attributed to poor technique in landing. These injured men, prior to their emergency escape, may have been like other men who think that to make a parachute jump, all you have to do is get clear and pull the ripcord, and from that point on, everything is in the bag.

There are five questions which each aircraft commander should have the answers for:

- Does everyone in the airplane have a parachute?
- Does it fit properly?
- Does the individual know what the emergency signal is?
- Does he know where the emergency release handle for his exit is—so well that he can find it in the dark?
- Does he know how to clear the exit quickly?

If the aircraft commander believes these points to be sound, he will carefully brief all passengers and crewmembers before takeoff.

Each aircraft has its own bailout SOP and it is the pilot's responsibility to *know* this procedure and to indoctrinate his crew thoroughly with normal and alternate escape routes. The skill and knowledge gained before you leave the ground is a lot more dependable than a rabbit's foot or Lady Luck, as the B-29 stories on the next page will affirm. Read the incidents and then, before going on to the discussion of bailout procedures, ask yourself:

"How well am I prepared to meet similar emergencies?"

"What would I have done, differently?"

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Paratroopers sustain fewer injuries in jumps than do Air Force personnel. If you know in advance how to absorb the shock of landing you will avoid bruises and broken bones.

Jump

THE BAILOUT—While on a night round-robin flight, the flight engineer of a B-29 reported that the number one engine was on fire. All attempts made to check the flames were unsuccessful and the pilot decided that a bailout would be necessary. Instructions were issued to all crewmembers to prepare for bailout. The flight engineer operated his emergency cabin pressure release to reduce the cabin air pressure. The normal method of opening the bomb-bay doors failed; however, the doors opened when the emergency bomb-bay door release was actuated. The nosewheel was extended by the flight engineer.

Approximately three minutes after giving the "prepare for bailout" instructions, the pilot issued the "bail out" command. The flight engineer was the first to leave through the nosewheel well; he was followed by the extra pilot, the bombardier, the second navigator, and the first navigator, in that order. The radio operator departed through the forward bomb bay. The co-pilot then called to the rear of the aircraft by interphone and asked if everyone was out. After receiving no reply from the rear of the aircraft, the co-pilot left the bomber through the nosewheel well.

The pilot also successfully abandoned the aircraft after broadcasting on the radio to the effect that the plane was being abandoned. As he was leaving the aircraft, the pilot noticed that it was descending at the rate of 1500 feet per minute in a slight bank to the left. The B-29 crashed at a very steep angle with four crewmembers still aboard.

The crewmembers who were fatally injured all had their parachutes on. The position of the radar navigator's body indicates that he never left his compartment. The bodies of the three remaining crewmembers were thrown free from the aircraft and therefore their positions prior to impact could not be determined.

THE BAILOUT—When a fire became uncontrollable in the number two engine, the crew of a B-29 was ordered to bail out while over water. The "abandon ship" order was given at approximately 4,000 feet altitude and was accomplished without mishap. Of the crewmembers, nine jumped with dinghies and four without. The pilot of the B-29 was in constant contact with an Air Rescue B-17 orbiting near his position prior to the time the B-29 was abandoned.

Less than 25 minutes after the bailout, a boat was dropped to the survivors and 30 minutes later a second boat was dropped into the water. Two hours after the emergency, the entire crew was in the boats and both boats were together. A map was then dropped to the crew giving them their exact location and a course to the nearest land, some 80 miles away. The engine on one of the boats failed and it was decided to tie together and put out a sea anchor for the night. They were rescued the following morning by a destroyer.

A period of nearly four minutes elapsed from the time the trouble was first discovered and the signal to bail out was given, yet four of the crew left the aircraft without their dinghies . . . This crew did not make use of all personal equipment and only the presence of the other aircraft made it possible for the entire crew to be rescued.

BAILOUT PROCEDURE

The autopilot should be set up ready for use at all times during flight so that in the event of an emergency, the pilot may immediately engage the automatic controls.

In planes with crew or passengers in the rear of the aircraft, one person should be designated "jump master," and be instructed to stand by on interphone at all times. He should acknowledge all instructions given by the pilot or co-pilot, and if time permits, advise the pilot when everyone else in the aft compartment and tail has jumped. This system avoids confusion, insures that someone is on the interphone in each compartment at all times, and in case of failure of the alarm bell, allows the transmittal of bailout orders to the crewmembers and passengers in the rear of the aircraft.

At the first sign of an emergency, the crew should be alerted.

When any emergency develops to a point that the airplane commander feels it *might* be necessary to abandon the aircraft, the commander will order the crew to "prepare to bail out." In general practice this is followed by three short rings on the alarm bell, at which time the crew will make all preparations for abandoning the airplane. It is wise to let the crew know the plane's altitude so they can plan a delayed jump or quick opening.

When the commander gives the "bailout" order over the interphone, it will be followed by one long sustaining ring on the alarm bell at which time the crew will abandon the airplane, following escape routes as shown in bailout charts for the particular aircraft. You and every member of your crew should know these routes.

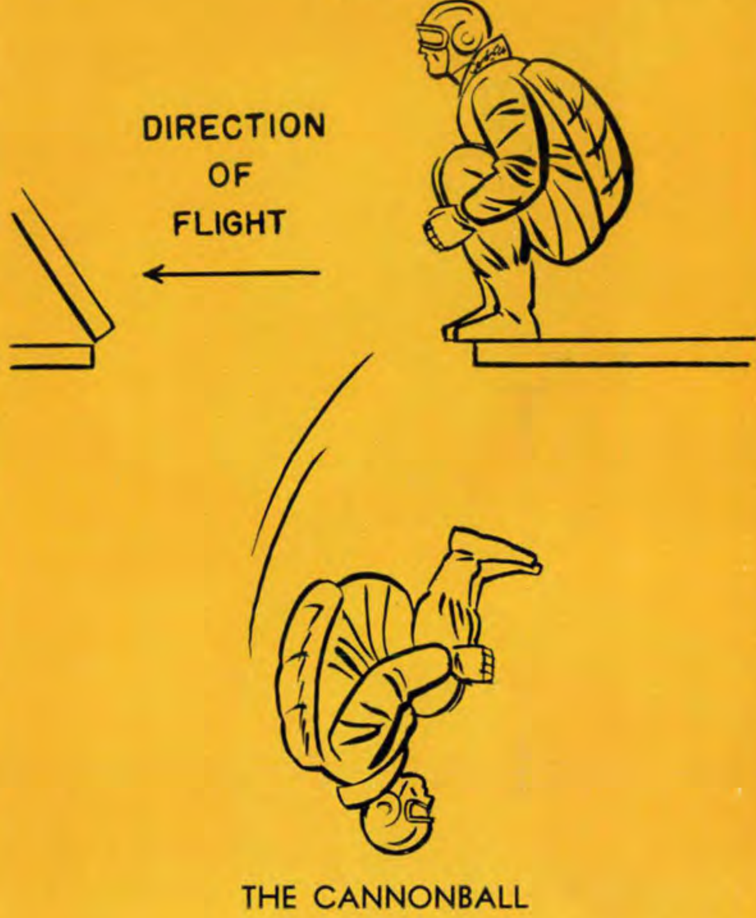
To avoid injury when jumping from belly or side hatches, it is usually best procedure to leave head first. If the hatch is so arranged, face forward and squat to the rear of the hatch. Then roll out with your knees tucked under your chin. This is the "cannonball."

When jumping from narrow side doors, crouch slightly, hold both sides of the door—then propel yourself out with both arms and legs.

When jumping from wide side doors, especially at any speed above 130 to 150 mph, leave from the rear edge. Use your arms, if possible, to help speed your exit. Dive forward and down.

If exit doors are fairly close to tail surfaces, radomes, etc., curl into a "cannonball" as soon as you leave. This reduces body drag. While you will fall no faster for the first few seconds, your forward speed will drop off more slowly. Thus for a given distance aft of the door, you will be farther below the airplane "cannonballed" than if you stayed erect.

Keep your eyes open.



THE CANNONBALL

COUNTING

Clear the airplane before using the ripcord. A delay of five to ten seconds is recommended if you have enough altitude. Never pull the ripcord without absolute minimum of one second of delay. Jumpers find that counting "one-one thousand, two-one thousand, etc.," gives fairly accurate delay times. It's a tragedy to get clear of the cockpit only to have your chute get tangled with the plane.

Jump

BODY POSITION

Don't be in a lather to pull the handle. First, get your body set for opening the parachute.

1. Tuck Your Chin Down On Your Chest so you can see the ripcord handle. Don't get your head upright. Rubber-necking at this point is not recommended. When your parachute canopy opens, it comes out *fast*. You shouldn't put your head in a position where a riser or a connector link or a pilot parachute can argue about the right-of-way.

2. Cross Your Hands On Your Chest. Keep them there until you're ready to pull the ripcord handle.

The preferred body position should be assumed a few seconds after bailout and held until the parachute opens. Don't wave your arms and legs like a homesick octopus. It will make you spin very rapidly. While spinning won't really hurt you, it can make altitude hard to judge.

Whether you bail out manually or through an escape tunnel, or with an ejection seat, remember to assume proper body position before pulling the ripcord.

If you jump with a chest parachute, body position is slightly different:

a. Turn your head until you're looking straight out over either shoulder, to avoid shroud line burns.

b. Cross your hands across your body *below* the pack until ready to pull the ripcord handle. Thus arms won't retard the opening.

3. Pulling the Ripcord—Opening a parachute is simple.

If you have a *seat or back parachute,* grasp the ripcord handle with your right hand. Hook the thumb of your left hand in the handle.

On seat and back parachutes, there is slack in the ripcord system. So, with both hands, pull the ripcord handle away from your body *hard* and *fast,* to the length of your arms. Try to pull the ripcord cable free of the housing.

If you have a *chest parachute,* hold the bottom of the pack with your left hand. Grasp the ripcord handle with your right hand.

On chest parachutes, pull the ripcord handle with a hard, fast yank. Use follow through, and pull the handle completely free of the pack.

4. Put Your Feet Together And Hold Them There. It's easiest if you bend at the waist, as though you were sitting stiff-legged in a chair. The reason for this position is simple. Your pilot chute and canopy don't know the air between your legs from the rest of the atmosphere.

Summary of Jump Procedures

- Bail out according to instructions for your particular aircraft.
- "Cannonball" for two or three seconds if you have to pass close to any part of the aircraft.
- Assume proper body position.
- Delay five to ten seconds after exit, if possible . . . and a minimum of one second under ANY circumstances, no matter how low you are.
- Pull the ripcord FAST and HARD.

After safely leaving the airplane, the next phase is the free fall which can be somewhat governed by keeping the body stretched full length, with a slight bend at the waist, feet and legs together. Open the chute before entering a cloud layer if the ground is obstructed from view. Likewise in making a night jump, the ripcord should be pulled early because judgment of altitude is difficult.

After your chute is fully opened, uneven escape of air will usually cause an oscillation. This leads to your weight swinging under the parachute canopy, pendulum fashion. This oscillating, if allowed to continue, can prove dangerous upon landing, so you should correct it. Use extreme caution in attempting to correct oscillation below 500 feet. This is a good method: With your chute fully opened, there are four risers extending above your head. Place your right hand well up on the front riser and your left hand on the left rear riser. Pull down slowly and hold. After approximately 30 seconds, release, very slowly. Do this several times if altitude will permit and oscillation should be negligible.

Maneuvering the chute can help avoid dangerous ground objects. This is done by slipping the chute. In order to slip forward, you reach well up on the two front risers and pull down as far as possible. This causes the air to spill out the rear of the canopy and the direction of your travel will be forward. To slip to your right, pull the right forward riser with your left hand and the right rear riser with your right hand. To slip to the rear you pull down on the two rear risers. To slip to the left you pull down on the left rear riser with your left hand and left front riser.

Experienced jumpers say it will be difficult for you to judge when or how much to slip on your first jump. As this loss of air by spilling causes a faster rate of descent, leading to broken bones, don't attempt a slip unless it is absolutely necessary.

The landing phase of a jump can mean the difference between walking away, if it is performed correctly, or being carried to the medics. It is in landing that the most non-fatal injuries occur.

The most desirable landing, of course, is an open field, but one doesn't always have a choice, consequently, emphasis will be placed on the type of terrain landing most likely encountered.

Open Terrain—By the time you are 100 feet from the ground, all preparations to land should have been completed. The correct position of the body should be as follows: Feet and legs together; head and eyes up—looking out to your front and not at the ground because a person has a tendency to pick up his feet just before he lands, causing serious injury to legs or back. At this time your hands should be grasping all four risers. When you land, your knees should be slightly bent. Try to land on the balls of your feet and then go into your parachute landing fall which is illustrated in the photo sequence.

LANDING TECHNIQUE

Don't watch the ground directly below. In descending, keep your head up, look around.

This is the position to assume if you land in a backward drift.

On impact, notice the jackknifed knees. Here, the landing roll is being started . . .

The correct landing roll technique shown in this FLYING SAFETY series of action pictures, is done by M/Sgt. Tom Odom, who heads the physical training program and teaches the parachute course at SAC's Survival School at Camp Carson. All of Tom's jumps notwithstanding, he has yet to report any injuries to his tongue.

From left to right is shown the correct position of the body, legs and feet in landing in open country. From the slightly jackknifed position the knees are bent sideways to roll on the calf, thigh, side, and back, with the legs kept together and brought up sharply over the head and to the side to complete the roll. Don't land stiff-legged—watch your drift direction.

Jump

Tree Landing

When you are over a wooded area and you find it not advisable to slip your parachute to miss a tree or a group of trees, do the following:

Be ready to land by the time you are 50 feet above the trees. Forget your risers. Cross your arms in front of your face. Keep feet and knees firmly together, but don't cross your legs, or you might break them on a limb. Don't be in a hurry to get down, after you stop. More men have been hurt trying to climb down than in actually jumping. If you can, wait for rescue. If you can't, you have hundreds of feet of suspension lines to use as a rope to let yourself down. Use your knife to cut some of the suspension lines, tie them to the tree and let yourself down.

Overwater Bailout

To bail out over water rather than ditch is a decision to be made by the airplane commander in view of the existing circumstances — the ditching characteristics of the plane, for example. Bailout is not recommended over a possible ditching unless visual contact is made with adequate surface help. If no rescue vessels are in the vicinity, bailout from bombers and transports should be used only as a last resort because of the extreme difficulty of getting the crew together in the water. The large life rafts offer more elaborate survival and signaling equipment than do one-man rafts. Fighter pilots have all their survival equipment attached to their chute, and a bailout is preferred to ditching.

In any but the warmest seas, a man will survive only a few hours if kept afloat by means of a life vest alone. The wearing of an exposure suit will increase this time considerably, but it still cannot compare with the time of survival possible in a life raft. In icy seas, an unprotected man will survive only a few minutes.

If overwater bailout is required or decided upon, the following *procedure* is *recommended.*

If surface help is available, head the airplane in a direction to allow the crew to drift into the course and just ahead of the rescue vessel.

On command "prepare for bailout," or when verbally ordered by the commander or copilot, the crew will don exposure suits if available, then life vest and parachute harness. Be certain the air in the exposure suit is not trapped below the waist band. Make sure the individual one-man raft is snapped onto the parachute harness. The crew-members should check each other to see that all equipment is in place.

The man or men assigned should stand by to release the life rafts. If time permits, the rafts should be released and then the aircraft should circle twice over the rafts, bailing out half of the crew over the rafts on each pass.

It is advisable to bail out as close together as possible so that it will not be so difficult to assemble the crew in the water.

The best altitude for overwater bailout of a crew is about 2,000 feet. By so doing you tend to keep the crew together. Low airspeed also aids in the bailout procedure. As the airplane commander prepares to abandon the aircraft, he should engage the autopilot.

Water Landing

With Class I Harness—While you have several hundred feet, push the sling under your buttocks with your thumbs. Then loosen the chest strap by pushing a lift web toward the fitting with one hand. Unsnap the chest strap. Then lift your legs, one at a time, and unsnap the leg straps. Cross your arms over your chest. When your feet touch water, *but not before,* arch your back and throw both arms over your head. The harness will slip off. Then inflate your life preserver and swim upwind, away from the canopy.

With Class II Harness—Pull the safety clip and turn the quick release box button to Unlocked, at about 1000 feet. When your feet touch water, hit the button hard with a clenched fist. Arch your back and throw your arms over your head. If the wet leg straps don't want to unthread around the main sling, help them along.

With Class III Harness—At 1000 feet, loosen the quick-fit chest strap. Then unsnap it. Loosen both leg straps. Unsnap them if you want to; it doesn't matter. Then put your right hand on the right canopy release, and your left hand on the left release. *When your feet touch water,* operate both releases quickly. The canopy will drift away.

Landing at Night

In making a parachute landing at night, use the same method for a day landing in open terrain. If it is light enough for you to see objects on the ground, naturally you will check your oscillation, and slip to miss dangerous objects. If, however, it is too dark for you to see, keep your feet together, knees slightly bent, and hands well up on the risers. Hold this position, and as soon as your feet touch the ground, go into your parachute landing fall.

Collapsing the Chute

With a harness that is equipped with a quick release this is simple. You just let your chute go free. But, if you are unable to get out of your harness, you should, if at all possible, get to your feet and run to the lee (downwind) side of the canopy. This will spill the air from the canopy causing it to collapse. If the wind is blowing too hard to accomplish this, then roll over on your stomach and start pulling your bottom suspension lines in, towards you. This will cause the air to spill from your canopy and collapse.

Both of the parachute harnesses shown here are the familiar Class I.

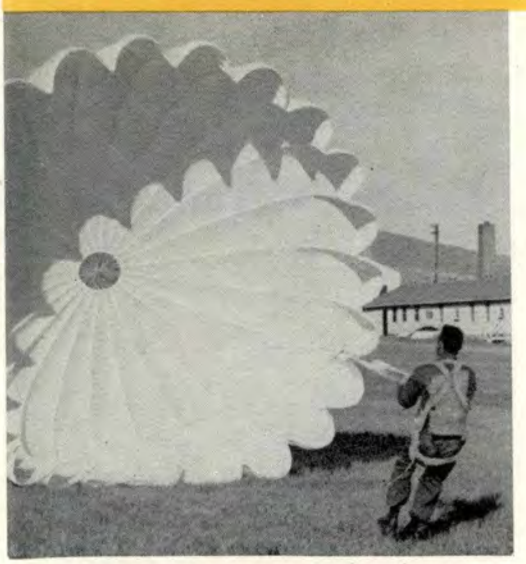
Demonstrated here is the later style Class II "quick release" harness.

The Class III harness is the latest, with pre-set aneroid chute opening.

Over water: harness unbuckled, arms crossed, sitting well back

When feet touch water, arch your back and throw arms up

As you enter the water it is easy to slide out of the harness



In collapsing a 'chute, gather in the risers in a run to the side.

Or pull in the bottom risers and spill the wind from the 'chute.

Here the 'chute canopy is collapsed in a stiff wind after a short run.

Jump

HI-SPEED - - HIGH ALTITUDE

The Matter of High Speed Jet Bailout Is Quite Different From Procedures Used in the WW II Fighter. The Use of Ejection Seats Has Changed the SOP

If the bailout procedure is reduced to simple steps on an aircraft not equipped with an ejection seat, it may be considered as involving four steps:

- Jettison, or open, canopy.
- Release safety belt.
- Get out of aircraft, and,
- Pull parachute ripcord.

On the other hand, with an ejection seat, the sequence of these four steps is:

- Jettison canopy.
- Leave aircraft (in this case, fire ejection seat).
- Open safety belt, kick free of seat, and,
- Pull parachute ripcord.

Thus it is seen that in the transition to ejection seats, the second and third steps in this procedure are reversed.

In view of the tendency for a man in time of emergency to revert to a well established habit pattern, the more thoroughly he is indocrinated in the conventional procedure, the stronger the tendency to revert to this procedure even though he had an aircraft with an ejection seat. It seems probable that this may be the explanation of the failure of an F-84 pilot to release the safety belt after ejection. This pilot did pull the ripcord while still strapped in the seat and sitting on the parachute, but it is probable that the low altitude did not allow time for him to realize his error and take corrective action.

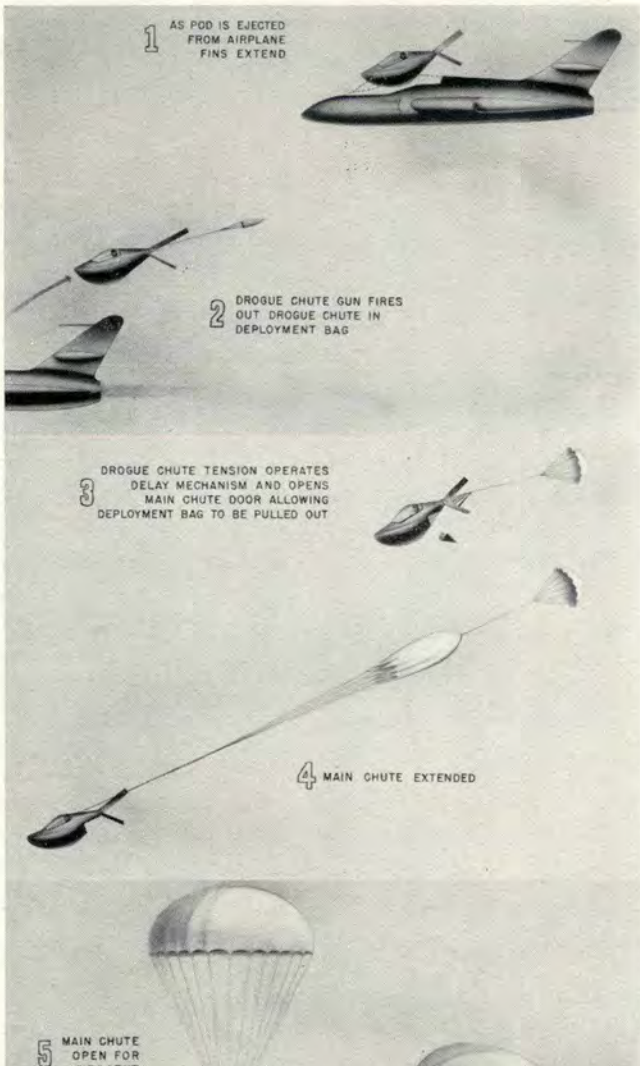
The main problems in high speed jumps are escape from the airplane and opening shock. The answer to the first problem is the ejection seat. The second is the free fall. Your body decelerates very quickly from high speeds. The drag of your body will slow you from 600 mph to 300 mph in two seconds, if you jump at 20,000 feet.

Actually, the most critical problem in high speed parachuting arises when the bailout altitude is low. Then the delay has to be cut to the minimum. The ejection seat helps eliminate this delay. This minimum varies with the airspeed of your aircraft at bailout.

The following rules are general, but they are safest:

Delay as long as possible. If you can delay five seconds or more, you will be at terminal velocity if you bail out below 5000 feet. If you can't delay very long, open the

A breakaway cockpit unit, equipped with a parachute to serve as an emergency escape vehicle for pilots of supersonic planes, has been developed by the Navy Bureau of Aeronautics. The "ejection cockpit capsule" is completely enclosed, and is pressurized and insulated. The capsule carries survival gear, emergency rations and radio to direct rescue operations.



parachute as late as you safely can. It takes about eight seconds to fall the first thousand feet after bailout. Even a two-second delay will reduce your speed considerably.

If you have plenty of altitude, don't be in a hurry to pull the handle. The farther you free fall, the better. Terminal vertical velocity does not increase with time of fall. It reduces, because you fall into denser air. At sea level, your terminal velocity is about 120 mph true. At 10,000 feet, terminal is about 140 mph true. Though it seems logical that opening shock should be lower when air density drops, it is not. Opening shock increases with altitude, and sharply.

The best way to avoid trouble in high altitude jumping is to free fall into warmer, denser air.

The best opening altitude is about 5000 feet above the surface. It gives you plenty of clearance, but brings you down to warmer air and a good oxygen level. It is also an easy altitude to judge. From 5000 feet in a free fall, the earth begins to look green, details can be seen, the horizon spreads rapidly, and the ground starts to rush up.

Jumping after ejection in a seat involves one additional problem—clearing the seat.

Since the seat is fairly light for the amount of drag it generates, it tends to slow down faster than you do, and to fall more slowly.

At any altitude, or any speed, you should:

Release the safety belt and shoulder harness and kick free of the seat as soon after ejection as possible.

Delay your parachute opening as long as possible after leaving the seat. This delay should be five to seven seconds at 5000 feet, or a free fall to 5000 feet from higher altitude.

If you follow the rules above, the seat will fall far wide of you, on a shorter and slower trajectory.

This new crash helmet will stay on a flier's head during high-speed bailouts, protecting him from concussion. When not in use, the visor can be pushed up out of the way.

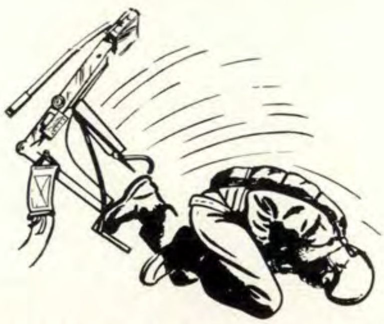
1

JETTISON CANOPY

2

LEAVE AIRCRAFT

3



UNFASTEN SAFETY BELT—
KICK AWAY FROM SEAT

4

PULL RIPCORD

Jump

NEW PARACHUTE FOR HI-SPEED BAILOUTS

The new automatic back-type parachute which has been accepted by the USAF for service use offers many advantages over the old types. It is comfortable to wear, easily adjusted to all sizes of aircrewmen, provides means for getting rid of the chute canopy quickly to prevent the chutist from being dragged across the ground or through the water, and enables bailouts to be made at high speed and altitude in comparative safety by pilots of high-performance fighters and by bomber crewmen.

One of the outstanding features of the new chute, according to engineers of the Equipment Laboratory, AMC, is its method of assembly. All of the components are fastened together by mechanical means. This eliminates all sewing when replacing worn parts, and enables the parachute to be taken apart or put together with a screw driver.

The parachute's F-1 release is designed to provide, automatically, time and altitude delays for safe high speed and/or high altitude jumping. In the air, all you have to remember is to pull the handle. The F-1 will do the rest. If you jump at altitude, it will give you free fall delay to a low altitude. If you jump at high speed at low altitude, it will give you time delay.

In practice, the automatic release works like this:

Before the pilot of a high-performance aircraft takes off, he sets the timer from 5 to 7 seconds, and the aneroid element for an altitude 5,000 feet higher than the highest point of the terrain over which he expects to fly. For example, if the highest point on the terrain is 7000 feet, he sets the release for 12,000 feet. Should it become necessary for him to bail out at 40,000 feet, his parachute will not open until he "free-falls' to the preset altitude of 12,000 feet.

This safety factor is important for several reasons. For one thing, at 40,000 feet the shock of the parachute opening is four times as great as it is at sea level. Also, if the chute opens at this altitude, the descent will take longer, and hypoxia (lack of oxygen) may prove fatal.

Canopy releases, one on each side of the harness at the shoulder, take the place of the quick-release box used on the old-type parachutes. Developed by the Navy, the new mechanisms have several advantages. Since they release only the chute canopy, the loss of personal gear attached to the harness is prevented. Moreover, they are not as bulky as the old box-type release.

The new canopy is the same as standard 28-foot canopies, except that the material is about 30 per cent lighter. The tearing strength of the canopy fabric has been increased 100 per cent by use of a special rip-stop weave. Alternating orange and white gores are provided for quick detection by rescue groups.

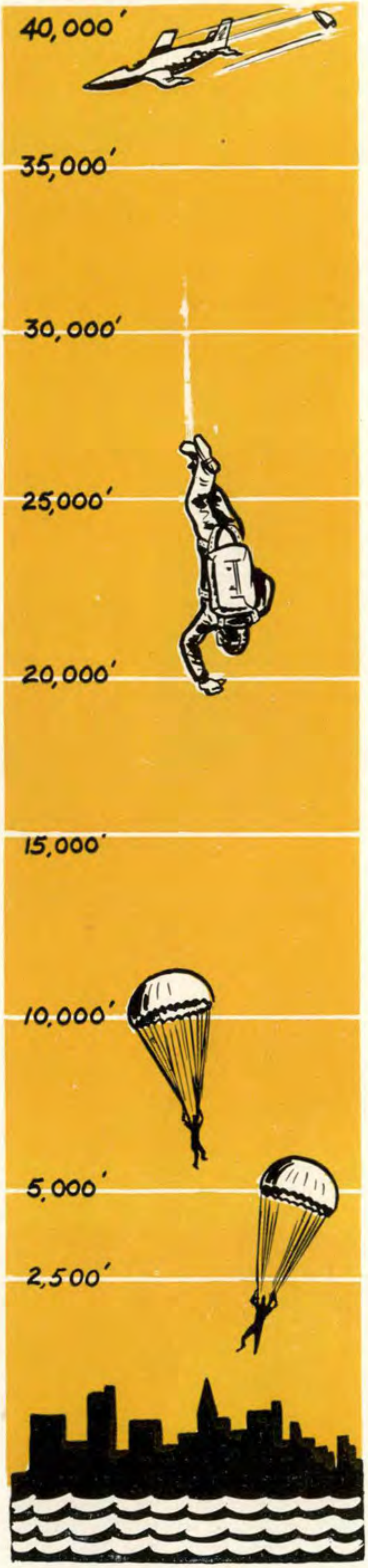
Injured, wounded, or unconscious crewmen can be dropped by using the F-1 if the emergency warrants. Tighten the harness, position the man near the hatch or door, pull the arming handle of his F-1, and get him out of the aircraft as quickly as possible.

The F-1 release does not interfere with the manual operation of the standard ripcord, since the D-ring may be pulled independently of the automatic release at any time. Night or day, undercasts or instrument weather, with or without oxygen, arm the F-1 as you bail out. Wait for the F-1 to open your parachute. Don't get rushed and don't over-ride the device. Until men are equipped with sensitive aneroids, the F-1 will have better altitude sense.

New parachute harness is easy to fit

F-1 provides time and altitude delay

Canopy can be released from harness



If you have an F-1 Automatic ripcord release you can bail out at this altitude with the assurance that your 'chute will open after a free fall to the altitude you have pre-set. If you eject at 600 mph at this altitude, you will decelerate to 400 mph in two seconds, 294 mph in five seconds.

If you have no automatic release or oxygen, try to reach 20,000 before bailout. Otherwise hold your breath and free fall as long as you can. Note that you will free fall from 40,000 to 10,000 feet in two minutes.

In a dire emergency, with no oxygen, you can remain conscious and free fall without an F-1 from this altitude after light exertion.

In an emergency you can remain conscious and free fall without oxygen or F-1 from this altitude after moderate physical exertion. Delay opening at high altitude in a thunderstorm—the updrafts may hold you above critical oxygen level.

Try to reach this altitude before night bailout if you have no F-1 and/or no oxygen. At 20,000 feet you will decelerate from 600 mph to less than 300 mph in two seconds, and to 198 mph in five seconds. Between 20,000 and 5,000 feet above surface, delay as follows:

In bright moonlight and good visibility to 5,000 feet.

In complete darkness—five seconds minimum manually.

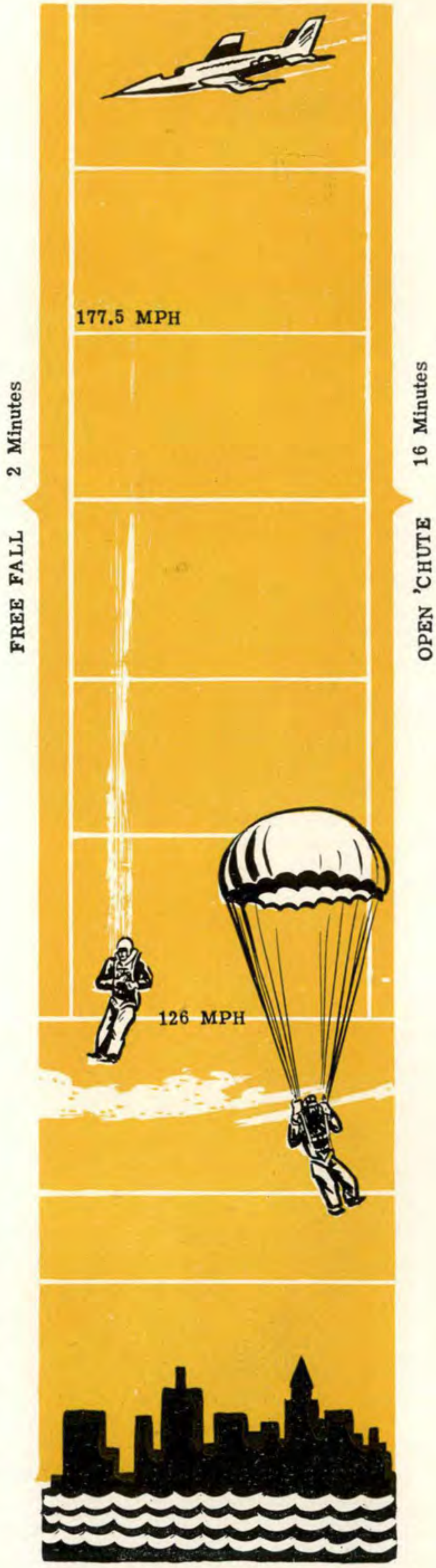
With an F-1 release, bright or dark, use the automatic delay.

Set your F-1 for 5,000 feet above the highest terrain on your flight path.

Delay at least five seconds below 5,000 feet above surface. If you are free falling into an undercast without an F-1, open parachute as you enter, unless you know ceiling height and ground elevation.

Prepare for landing as soon as your parachute opens. Make preparations for land (wind) or water as described in the text of this FLYING SAFETY Magazine feature. Depth perception at night is very poor. Don't wait.

Use caution slipping 'chute below this altitude. For water landings, wait until your feet are wet before releasing harness or canopy. Swim upwind.



AACS plane from Tinker AFB flys over a VHF/DF unit to check its accuracy. Such in-flight inspections are made every 90 days.

Ask For A Steer In Good Weather It Will Pay Off Later

By Colonel Anthony G. Hunter Commanding Officer, 1800th AACS Wing

Perfection, like Heaven, is something we cannot attain in this life. But it's important for those of us among the living to strive toward both those goals. A pilot who does not approach the former goal stands a good chance of achieving the latter ahead of schedule . . . providing he has set his course in that direction.

Because no one is perfect, Airways and Air Communications Service operates very-high-frequency direction finding equipment at many USAF bases. This equipment is sort of an insurance policy for pilots who, for one reason or another, aren't sure which way they should fly to reach an air base.

Unfortunately, some pilots hesitate to use VHF/DF equipment because fellow pilots might hear about it and accuse them of becoming lost. Actually, no pilot is "lost" until he has exhausted every facility at his command in his search for the answer he needs. Ability to analyze a situation and take the proper action is one of the marks of a good pilot.

It takes a fraction of a second to glance at a compass to determine what heading is being maintained. It takes a little more time to obtain a DF bearing to determine what compass heading should be followed to reach an airfield. The difference between determining the compass heading being flown and the compass heading that should be flown is merely a matter of a few second's time. Both the DF station and the compass are devices to aid the pilot in determining direction. There should be no more stigma attached to utilization of one direction-determining device than there is to using the other.

Actually, pilots should use VHF/DF in good weather as well as bad, just as pilots at many bases practice GCA runs in good weather to maintain proficiency they may later need when visibility conditions get poor. Frequent use of VHF/DF provides operators an opportunity to strive toward the elusive goal of perfection. The more practice assists they give pilots, the more efficiently they will be able to operate in time of actual emergency.

The value of this equipment in an emergency was demonstrated recently by VHF/DF operators of the Tinker AACS detachment. A B-45 high over central Kansas had its instruments knocked out by a violent

-insurance for PILOTS

electrical storm. Because of static caused by the storm, the pilot was unable to make himself heard at Forbes Air Force Base, Topeka, Kansas.

Operators at Tinker, outside the static area, picked up the calls for assistance and gave the pilot a series of "steers" to Tinker where the plane landed with almost empty fuel tanks. Had the operators been a step farther from perfection, perhaps their service would have taken a few moments longer, resulting in the jet bomber running out of fuel before reaching Tinker.

The best pilot in the world would have been in a spot at the controls of that B-45 bomber were it not for VHF/DF assistance. Certainly that pilot did not hang his head in shame because he had made use of VHF/DF! Another Tinker-bound pilot, however, found his lack of knowledge of VHF/DF somewhat embarrassing.

Bound from a base in Texas, this pilot called Tinker for a VHF/DF steer when visibility lowered. When he landed, he complained that the operators had steered him directly through a thunderstorm instead of around.

Asked how he expected VHF/DF men to know he was flying into a storm, the pilot replied, "They could have spotted the storm on their radar scopes."

Somehow the pilot had picked up the erroneous idea that radar is employed at VHF direction-finding sites. He walked out with a slightly red face when he was informed that VHF/DF was a radio device, not radar. Had he been cognizant of the limitations of this equipment, he would have circled the thunderstorm and requested additional steers toward the base.

A veteran transport pilot accused VHF/DF operators of not knowing how to use their equipment when they were unable to tell him his exact distance from their station, or inform him when he was directly over the field. Had he made occasional practice runs on VHF/DF, he would have known that a lone direction-finding station cannot pinpoint a plane's position, but exists solely to inform the pilot of the proper heading he should fly to reach the air base.

Ground navigational aids operated by AACS throughout the country and in many parts of the world outside the United States are there to provide assistance to pilots. They are operated by skilled AACS men who are striving for the unattainable goal of perfection. You can help them by making frequent use of these facilities, in good weather as well as in bad. In so doing, you will come closer to attaining perfection as a pilot.

The equipment is there to help you when you need help. It's sort of an insurance policy which has paid off many times to pilots. The premiums are low . . . just a little fair-weather practice now and then, but the dividends are high.

Have you paid your premium this month? If you haven't, you may be letting someone else down. This is a mutual company, and the experience you provide the AACS direction-finder operators goes into the pot that may pay off to a less experienced pilot some day. And . . . it's just possible that it might pay off to you!

Lists of VHF/DF stations and VHF channels for DF assistance are provided in current issues of T.O. 08-15-1 "Radio Facility Charts." Refer to "VHF/DF Stations, Air Force and Navy," in Table of Contents.

D/F operator T/Sgt Harold D. Talley, above, earned a "Well Done" in Flying Safety (June, 1950) for saving a plane. New type visual units in control towers, below, find a plane's direction quickly.

Safety and the CIVIL PILOT

The CAA Would Rather 'Educate And Counsel' Than 'Suspend and Revoke'

Sixty-six paragraphs of fine print in a recent issue of the CAA Journal, monthly publication of the Office of Aviation Information, tell as many separate living stories of civil pilot license suspensions and revocations, thus giving lawful emphasis to the fact that flying is for the birds and those who observe the rules of safe flying.

But the pilots responsible for these 66 violations are the "hot rods;" the show-off boys with the "look-Mabel-I'm-aflying" complex, and represent only a small fraction among the thousands of civil pilots in the United States. Civil Aeronautics Administration's "educate and counsel" program is aimed to prevent the buzzing and dare-devil tactics practiced by this "hot rod" group of pilots who give the large-economy-size headaches to the CAA Office of Aviation Safety and a black eye to aviation in general. Just take a look at a few of these suspensions by the CAA:

"Private pilot certificate of Joe Jerk, Grointz, Idaho, suspended for low flying, with a passenger, over a congested residential district."

"Private pilot certificate of Sam Sidewinder, Insult, California, suspended for buzzing a swimming pool and ball park."

"Commercial pilot certificate of Teemany Martoonis, White Lightning, Tennessee, revoked for piloting an aircraft while he was under the influence of intoxicating liquor."

Or this lulu:

"Commercial pilot certificate of Enditall Quickly, Boothill, Texas, revoked for performing major and minor changes and repairs to an aircraft without being under the supervision of a certificated mechanic; returning the aircraft to service without having it inspected and approved; operating an aircraft that was in an unairworthy condition; operating an aircraft in the vicinity of an airport where air traffic control was in operation without maintaining contact with ATC; operating an aircraft in a reckless and careless manner, etc., etc."

The CAA is striving continually through the Office of Aviation Safety, to "educate and enlighten" civilian operators. As the watchdog over the security of all those who go into the "wild blue yonder" in civil aircraft of United States registry, the lawful finger of CAA rests anywhere from the passengers and crew of the newest and mightiest airliner to the hesitant student pilot puttering over the countryside in a rented plane.

While the duties, functions and responsibilities of the Office go far beyond the helpful-hint and pat-on-the-back routine, the theory prevails that if accidents can be prevented and bad flying practices eliminated *before* an aircraft piles up against a boundary fence, the health of civil aviation will remain at a higher level and lengthy and expensive investigations will not be necessary.

In carrying out its policy of "education," the Office of Aviation Safety employs various methods—from posters showing good and bad practices, to be displayed in hangars, flight schools, and other gathering points of pilots and potential pilots, and personal notes from the Administrator of Civil Aeronautics to all newly-licensed pilots, to the gathering of statistics on various types of accidents. These latter are given out to flying schools and airport managers who may be guided by the mistakes of others, and so concentrate their instructions and practice upon perfecting the types of maneuvers which, improperly executed, were responsible for the mishaps listed.

Also in the field of safety education, Office of Aviation Safety prepares and distributes, by the hundreds of thousands, pamphlets and other easily and quickly-read literature, emphasizing salient points, not only of flying, but of airplane maintenance and pre-flight checking. One of the most widely distributed series of such pamphlets is "Hangar Hints," a set of four-page leaflets variously entitled, "Preventive Maintenance," "Your

". . . inadvisability of dropping to 100 feet to wave at girl . . ."

Airplane and its 'Food'," "Checking the Landing Gear," and similar subjects.

The Office of Aviation Safety cooperates closely with state and local officials in the educational program, which has shown considerable growth during the past year. Meetings with the state and local officials have resulted in distribution of safety literature through these agencies, as well as through industry organizations.

Preparation of a large volume of safety information and other literature, as well as its distribution, has been undertaken by manufacturers and suppliers in many branches of the industry, always in cooperation with CAA, and when a private pilot taxis his plane to a gasoline stand for fuel he may be handed a leaflet on preventive maintenance, the necessity for using the proper grade and type of oil, or the inadvisability of dropping down to 100 feet to wave at his girl as she sun bathes in her back yard.

In the investigation and policing of Civil Air Regulations violations, the policy of education, or more properly "counsel," has a prominent place, although CAA agents have authority to use other means in the case of flagrant or repeated violations.

A violation of the CAR's may come to the agent's attention in a number of ways—through personal observation, through a report from state or local authorities or other CAA personnel, or through a complaint from the public (as of "buzzing" a residential or other congested area).

After an investigation to determine that there was in fact a violation, the agent may take one of several steps. If it was of minor nature and did not result in an accident, he may decide that it is not important enough to warrant a formal report. In this case, he discusses the violation with the person or organization involved, warning that a repetition will result in more stringent action. In such a case he merely prepares a memorandum on the violation and the action taken, and forwards it for the files. In giving the violator warning, the CAA agent may find an opportunity to give him a tip as to how to prevent such an occurrence in the future; or it may be that the particular CAR which was violated needs clarification in the mind of the violator.

If the violation warrants a formal report, the agent is instructed to continue his investigation; interview witnesses; assemble documents, flight records and other material pertinent to the case; interview the violator and prepare his formal report. Once filed, there are five different types of action which may be taken: (1) The case may be filed for record; (2) A reprimand may be issued; (3) A civil penalty may be imposed; (4) A suspension or revocation proceeding may be brought, or, (5) Criminal prosecution proceedings may be employed.

Reprimands are issued by the Regional CAA attorney or the general counsel in Washington, informing the violator that the incident will be made a matter of record which will be taken into consideration in any future case involving violation.

In the case of a civil penalty, the Civil Aeronautics Act of 1938 provides that a civil penalty not to exceed $1,000 may be imposed for each violation. If such a penalty is assessed, the violator is informed by letter, and he may offer a compromise in lieu of paying the "fine." The Administration is authorized to accept such a compromise if he deems the offer to be in line with the violation. However, should the violator decline to pay, civil suit may be brought to collect—in the case of scheduled air carrier violations by the Justice Department; in the case of private flyers, the matter will be referred to the United States Attorney in the district in which the violation occurred.

Meanwhile, the civil penalty becomes a lien against the aircraft in question if the violation was committed by the owner or person in command, and the regional Administrator may seize the aircraft without court proceedings, if the case warrants such action.

Proceedings to suspend or revoke airman certificates, airworthiness certificates, air carrier operating certificates, and other certificates, are brought before the Civil Aeronautics Board by CAA through filing of a complaint. CAB, as the "judicial" department of civil air regulations, rules on the complaint following further investigations, hearings, arguments and the other trappings of judicial procedure.

Criminal prosecution is resorted to only in extreme

"... airworthiness of aircraft is as important as any of CAA ops..."

". . . criminal prosecution is resorted to only in extreme cases . . ."

cases. Penalties are provided in the Civil Aeronautics Act for forgery of certificates, interference with air navigation facilities, wilful and knowing failure to file reports, and falsification of records. If evidence of these or other crimes detrimental to air safety or to the development of civil aeronautics come to the attention of an agent, he gives the facts to the regional attorney. Where necessary, investigation and prosecution is coordinated with the regional attorney, with the general counsel and the Department of Justice.

"... posters showing good and bad practices are displayed ..."

"... frequent checks of airworthiness must be made by CAA men ..."

But, beyond the educational aspects and the handling of violations, the Office of Aviation Safety has a broad field. The Washington office is organized into four divisions: The Aircraft Division, which deals with all the material aspects of aviation, including the important function of type certification, of prototypes and parts of aircraft, the original and continued airworthiness of aircraft and their registration; The Airman Division, which holds the responsibility for the original certification and continued competency of all types of airmen and the standards by which airmen are licensed; The Flight Operations Division, which has as its primary concern the actual use of aircraft in every form, and, finally, the Medical Division, which is charged with the medical standards for airmen, the design of aircraft from a medical standpoint concerning both crews and passengers.

Airworthiness of aircraft is as important as any of the phases of the operations of the Office of Aviation Safety. This applies not only to original airworthiness but the continued airworthiness so necessary to safe operation and public confidence in aircraft travel.

The job of checking aircraft begins when the proposed aircraft is on the drawing boards, and continues through the factory and until the aircraft is in the hands of its buyer. From that time on, frequent checks of airworthiness must be made by and with the owner, and certain standards met for continued operation.

Actually, with 100,000 civil aircraft registered, this job of airworthiness is far too big to be handled by the available number of CAA personnel, so, to get the job done, and done well, the CAA a few years ago initiated the effective system of designating qualified individuals in the industry and at airports to perform a large portion of the task, under close supervision of about 600 CAA agents. Under this system, the CAA now has almost 7,000 volunteers—engineers, pilots and mechanics—whose job is to check in the factory on aircraft as they are being constructed, to check airmen, to check airframes and engines on existing aircraft.

The performance of all aircraft and airmen when off the ground is the concern of another department of the Office of Aviation Safety—the Flight Operations Division. Until several years ago, most of the work of this division was centered around the operation of the scheduled air carriers, both within the country and wherever American Flag carriers operate. However, since 1946, the Flight Operations Division have had the responsibility of similar duties with regard to non-scheduled operations.

Naturally, if flying is to be safe, rules must be closely observed. Certain requirements must be met before airmen or aircraft, whichever the case may be, can take to the air. An embryo pilot must show competency before he is licensed, and an aircraft must be airworthy before it is flown.

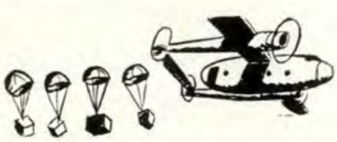
KEEPING CURRENT

Jet Sweat Glands—Sweat glands for rocket and jet engines, to keep them cool and make planes go faster, are being studied in engine research, and the method works somewhat like human sweating to get rid of excess heat. A liquid is forced through holes or pores in the metal surfaces of the engine, or through porous parts of the metal. The liquid then vaporizes on the hot metal surface, helping to cool it.

A major problem in rocket and jet engines is keeping surfaces cool enough so metals won't lose their shape and strength by heat. But hotter engines are wanted, for higher gas temperatures mean greater speed and greater fuel efficiency.

• • •

J-35 Overhaul Line—Overhaul of J-35 jet engines at Hamilton Air Force Base, saves an estimated $150,000 per month over previous plan of shipping all turbine jobs back to an Air Force depot for such work. In addition, average engine hours between overhaul has been boosted from 50 to 180; time formerly spent in crating, shipping, and uncrating engines is now spent keeping them in top flying condition. Other results: engine test stand built from salvage material; and best—and cheapest—exhaust deflector yet devised, a blast bucket of welded oil drums.



Monorail "Unloader"—Five tons of air cargo unloaded in seven seconds is now possible with Air Materiel Command developed monorail system installed in USAF cargo planes. Drop cargo is loaded in 20 five-hundred-pound packages, each topped with chute, and all swung from overhead rail on trolleys. Punching a salvo button opens cargo doors and starts the trolleys for the door where they automatically release their load and a static line opens the chute on each package as it clears the plane. Compared to previous one-drop-per-pass method, the new system permits one-pass unloading, results in all five tons of cargo landing in a 1500-foot strip.

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Traffic Warning — Western Air Line stewardesses announce at the completion of each flight: "Please drive carefully, or ask your driver to be careful, when you leave the Airport." Thus dramatizing the fact that travelers are seven times safer in airliners than on the highways.

Roger and Over—More than 4,000,000 radiotelephone contacts with pilots in flight were made by CAA aircraft communicators in the first eight months of 1950. This is an increase of 224 per cent over the same period for 1949. The increase in preflight briefs, the other major service given by CAA communicators to pilots flying the 60,000 miles of airways, was from 690,590 in the first eight months of 1949 to 1,225,253 in the 1950 period.

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New Home of ADC—Ent Air Force Base, Colorado Springs, Colorado, is the new home of Air Defense Command. ADC will be responsible for the defense of the Continental United States and will consist of The Eastern Air Defense Force, with headquarters at Stewart Air Force Base, Newburgh, New York, and Western Air Defense Force, with headquarters at Hamilton Air Force Base, San Rafael, California. Lt. General Ennis C. Whitehead will head the new command.

Navigation Tip—When a Chinese bomber became separated from the rest of the formation the pilot ordered the navigator to bail out and ask for the correct heading to the home base. He did so and signaled the pilot the desired direction. Several days later the navigator arrived on foot somewhat the worse for wear.

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Painting For Safety—Flight Safety Foundation reports that operating results from painting tops of fuselages has shown that not only does the white paint limit the increase in cabin temperature on a hot day, but it also provides much better visibility to reduce collision hazards when flying with a background of leaden skies.

Non-Stop Evacuation—Pacific Division MATS recently made the first non-stop medical air evacuation flight from Tokyo to Hickam AFB, a distance of 3,400 miles, in 13 hours and 20 minutes. The flight carried 68 persons, 54 of whom were combat wounded from Korean battlefields. The plane was a C-97A Stratofreighter from the 1500th Air Transport Group.

ARS Keeps Busy—ARS SA-16 in a race against time flew a round trip of nearly 2,000 miles to intercept and remove a seriously ill Merchant Marine seaman, recently. This was the longest mission in ARS history of its nature. The trip was made without incident until the plane landed in high waves on the Arabian Sea, where is was a touch-and-go for a few moments. The mission took approximately 12 hours . . . Hundreds of personnel have been rescued or evacuated since the outbreak of hostilities in Korea. Of these, many have been evacuated to rear areas by H-5 helicopters. Others have been picked up from behind the KoRed lines by H-5's, while numerous sea rescues have been made by SA-16's.

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Briefly Noted—NAA's New Navy Carrier Plane AJ-1 has outer wing panels that fold inboard and the rudder assembly folds onto the right surface of the stabilizer . . . The XC-120 Fairchild detachable fuselage packet has a folding ladder that weighs only 29 pounds. It is used by the crew to reach the flight deck when the fuselage is detached. The flight deck is 15 feet off the ground . . . Convair at Fort Worth is conducting high altitude tests, consisting of dropping bombs from heights of over 40,000 feet to secure data on the bombing system and the fall of the bombs. An electrical switch on the bomb release automatically starts several cameras which record the fall of the bomb until it reaches the ground. The distance of penetration into the ground is measured by technicians stationed on the ground. Data is also being gathered for bombardier aiming charts. A 10-Engine B-36D is being used for the tests.

SHARE YOUR IDEAS

FLYING SAFETY Magazine welcomes comments, criticisms and editorial contributions from all members of the United States Air Force. Readers can help the Magazine promote safe flight by offering information on procedures, equipment or training methods that have been effective in decreasing aircraft accidents. Also, whenever superior airmanship, piloting or maintenance saves an airplane or crew from disaster, we want to publish the story as a "Well Done." Address your comments to the Editor, FLYING SAFETY Magazine, Norton Air Force Base, San Bernardino, California.

CROSS FEED ★

FLYING SAFETY IDEA EXCHANGE

NEAR ACCIDENTS—

Here are two incidents which might have been fatal accidents. They were contributed in response to an appeal in the October issue of Flying Safety Magazine that all Air Force personnel report near accidents or unusual incidents which might have a relationship to aircraft accidents in which the cause cannot be determined.

OXYGEN EQUIPMENT—

The first one, concerning an F-86 pilot, was submitted by a flight surgeon:

This pilot's fighter plane was equipped with the usual A-14 regulator and he had an A-13A mask which he casually checked before takeoff. He noticed that the Form 1A showed the cabin pressurizer to be inoperative. Shortly after takeoff he checked the oxygen blinker and it was apparently functioning perfectly. After approximately 50 minutes of flight, of which 40 minutes had been at an altitude of over 20,000 feet, he noticed that the instrument panel was becoming increasingly difficult to read, and that everything seemed blurred. At approximately the same time he noticed a sensation of dizziness and realized that these were the early symptoms of hypoxia.

His first thought was to adjust his oxygen regulator but in his confused thinking he decided it would be less work and more quickly accomplished if he took other action, so he pulled back on the throttle and popped the speed brakes. At about that instant he lost consciousness. When he regained consciousness it was at an altitude of about 7,000 feet, with his airplane in a 20-degree dive. By the time he was fully re-oriented his indicated airspeed was 350 knots. He then changed the regulator to 100 per cent oxygen and headed for the Air Force Base.

The pilot feels that his thinking was confused and slow so that he had some difficulty in finding the field. He knows of making no errors in the landing approach other than that he made a much larger pattern than usual. The pilot had received his most recent re-indoctrination through a Physiology Training Unit in June, 1949, approximately 15 months prior to this incident.

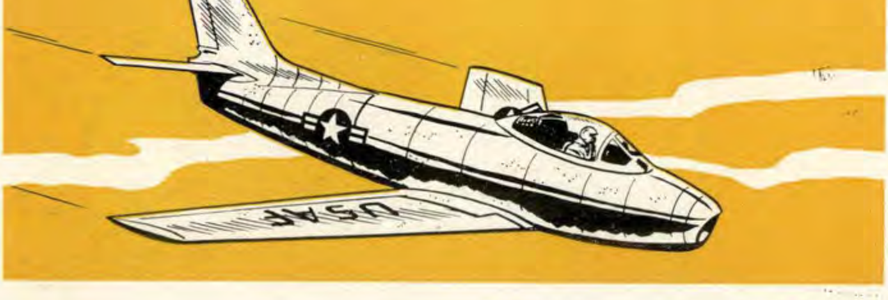
After he landed he felt that the defect which had resulted in hypoxia was due to defects in the oxygen system on the aircraft, but on the following day in checking over his equipment he discovered there was a slit on the posterior surface of his mask approximately two to three centimeters long at the lower tip of the mask where the metal bailout check valve insert is jointed into the soft rubber of the lowest portion of the mask. At the time of the incident, this pilot was the squadron personal equipment officer, so the A-13A mask was checked out to himself. In reconstructing the incident he found that he received enough oxygen when seated in the pilot's seat leaning forward as he would normally do to look at the oxygen blinker, but in leaning back in the usual pilot's posture, the slit in the mask allowed an uncontrolled mixture of cockpit air with the oxygen.

The moral of this near fatal accident which could easily have cost the USAF one pilot and one expensive aircraft is rather obvious. This officer as an individual failed to check properly and *thoroughly* his personal equipment prior to takeoff. As personal equipment officer, he had permitted improper personal equipment to be used in the squadron and only belatedly sought more vigorous action to obtain sufficient personal equipment so that each pilot could have his own oxygen mask, anti-G suit, flying helmet, and other personal equipment. Lack of a squadron flight surgeon to keep constant vigilance in personal equipment education was also a strong indirect consideration. Frequent indoctrination of all pilots whose normal duties require high altitude missions will help prevent incidents such as this near fatal accident.

COVERALLS TOO SHORT—

The second experience is reported by an F-51 pilot:

I was flying an F-51H, the day was clear, sunny, temperature about 70 degrees, the field elevation about 4,500 feet. I was flying wing on a



formation takeoff. The element leader took the runway and I lined up on his right wing with the prescribed nose and tail clearance. He gave the signal to go and we started to roll.

As I took my feet from the rudder pedals, where I had been holding the brakes, and let them slide down to the normal position, the left leg of my flying suit, which was much too small for me, caught on the fuel mixture control which is located just to the inside of the calf of the left leg. I did not think it necessary to abort the takeoff, instead I tried to free the flying suit, and at the same time kept on adding throttle to maintain formation. When the suit did not come loose immediately, I deliberately over-corrected to the right to keep from colliding with the flight leader, and started drifting slowly to the right. About the time the aircraft reached 70-80 mph it was too late to abort without taking a very great risk of a groundloop to the right, since I had practically no left rudder available. I was also well over to the right and nearly off the runway.

Just as the plane reached flying speed, I gave a kick which freed the leg, but also kicked the left rudder abruptly all the way in. The aircraft swerved to the left, and to avoid the collision that seemed impossible to avoid, I pulled the plane off the ground, passed directly over the flight leader, with about a foot to spare, then added full power and turned to the right.

The aircraft stalled about 400 feet in the air, and, since I was close to the edge of the field with no chance of making the runway, and the gear being retracted, I was lucky the plane did not strike the ground.

The flight was uneventful after that, and as my explanation of the incident satisfied everybody, nothing more came of it. The reason for the small flying suit is simple: I am 6 feet, 4 inches tall, and they had none to fit me.

Perhaps controls such as the one in this case should be relocated, and, very definitely, personal equipment in all sizes should be available at all times.

WHO'S RESPONSIBLE—

One man, carrying the lives of others in his hands, neglected a routine detail. He failed to replace and lock a filler cap on a fuel tank after refueling. Fuel streamed from the open cap into the hot engine accessory section, ignited, and blew out the access doors, buckled the fuselage and scorched the skin of the plane.

The two pilots? They were lucky. It happened at 120 mph—the aircraft still rolling on the takeoff run. They braked to a stop and abandoned the plane, unhurt. Ten seconds later might have been fatal.

Then you try to find who is responsible. Who serviced that tank? Everyone is a little hazy. Well, then, who is responsible for servicing that tank? Still hazy. "You see, the crew chief is away, and a couple of us were just trying to help out with those planes which were flying."

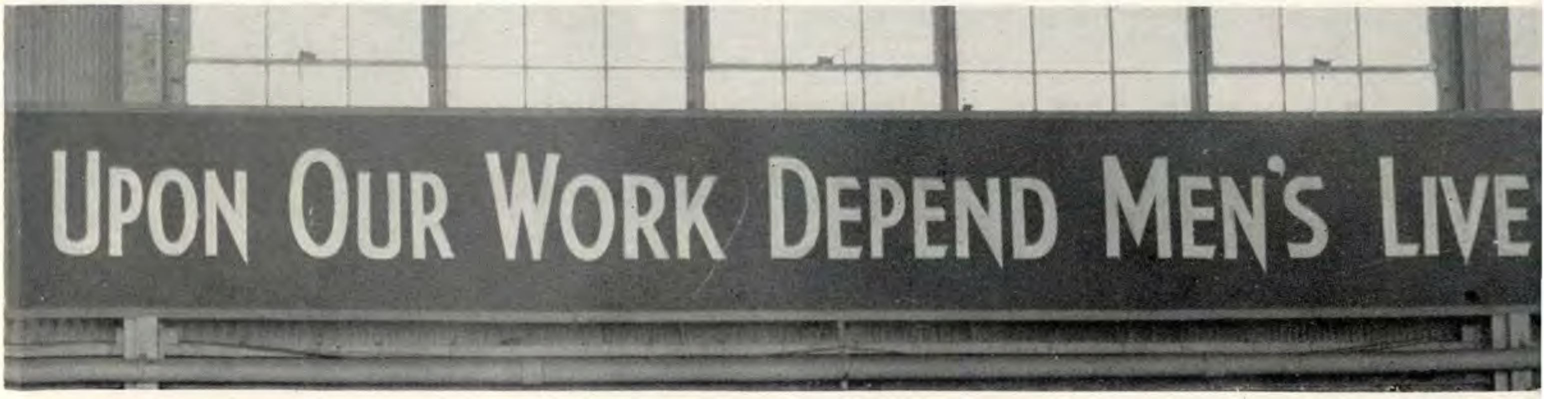
A non-commissioned officer must accept responsibility. He must be charged with the care of his assigned aircraft, and he must merit the trust of the crew.

Responsibility — each aircraft should have an individual responsible for its ground care—a specifically designated individual. "Today, Sergeant, you will take care of 623." The Sergeant knows who will replace the filler cap on 623.

On down the line — it pays to designate responsibilties. Who is in charge when the boss is away? Designate the next man to assume responsibilities. A fundamental principle of management . . . but it is important, for *upon our work depend men's lives.*

Such a slogan posted prominently in the shops and hangars can help as a reminder.

Capt. Martin A. Foster
Flying Safety Officer
Shaw Air Force Base



Flying Safety

RESTRICTED

DEPARTMENT OF THE AIR FORCE
THE INSPECTOR GENERAL, USAF

Major General Victor E. Bertrandias
Deputy Inspector General
For Technical Inspection and
Flight Safety Research

DIRECTORATE OF
FLIGHT SAFETY RESEARCH

Norton Air Force Base, California
Brigadier General O. F. Carlson, Director

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✓✓ DOUBLE reminder on ICE

KEEP ON YOUR TOES

✓ A proficient dancer's performance on ice is safe, smooth and spectacular—because she practices and knows her limitations on skates. A pilot's performance in flying an airplane through icing conditions can be just as spectacular—but not so safe and smooth if he is not prepared to meet ice and is not proficient in his winter flying.

✓ Clear, hard ice on the rink makes for fast, safe skating and good control; but it can make an airplane unsafe, sluggish and uncontrollable when too much of it forms on wings, control surfaces, propeller blades and induction systems. Be sure you know the icing limitations of the plane you are flying. Don't risk a crash by failing to brush snow and ice off your airplane before takeoff.

Learn and Live

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