Flying Safety

HEADQUARTERS UNITED STATES AIR FORCE • RESTRICTED

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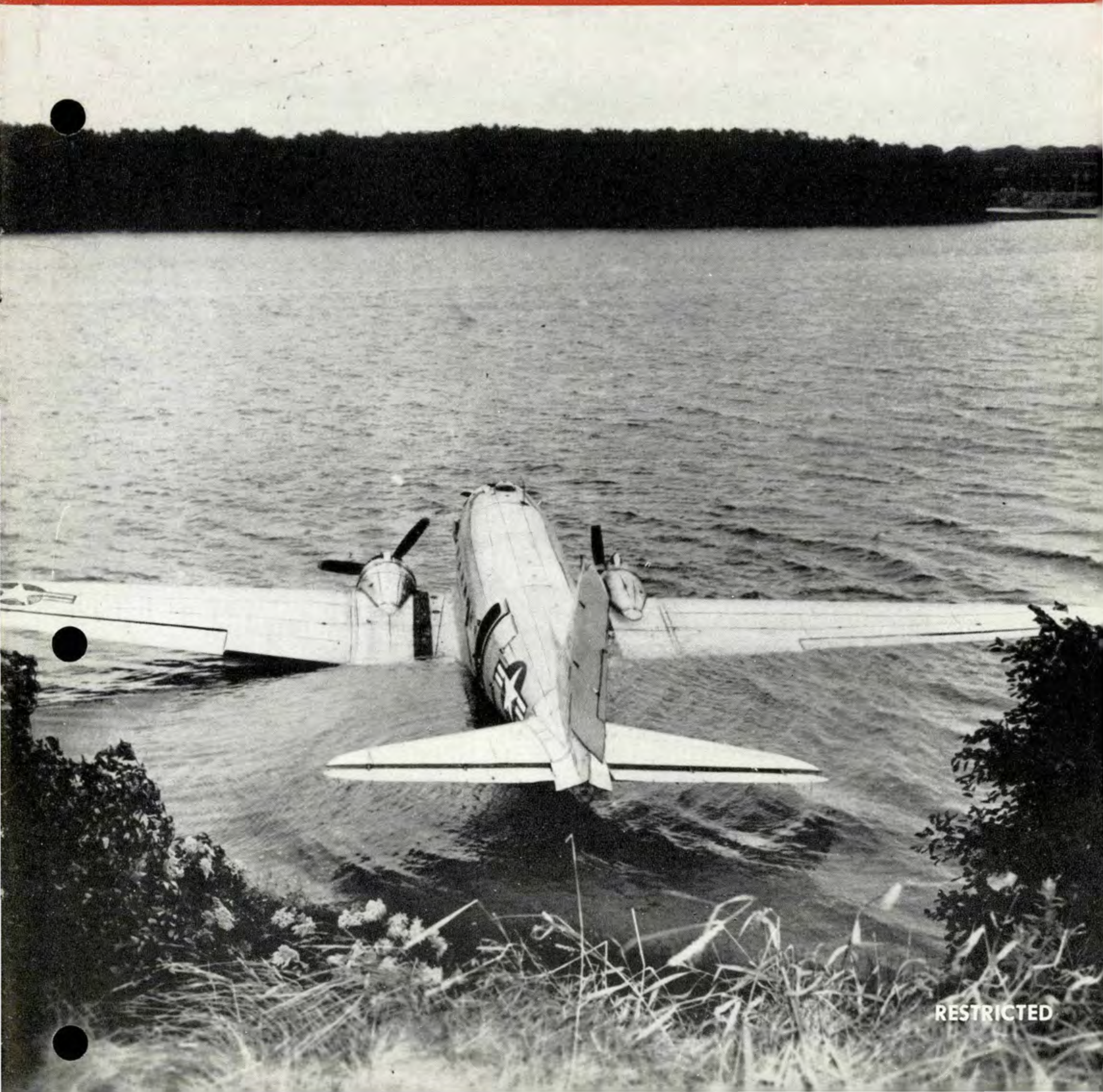

RESTRICTED

FLYING SAFETY

DEPARTMENT OF THE AIR FORCE

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FLYING SAFETY is published monthly with the approval of the Bureau of the Budget, Executive Office of the President of the United States.

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THE COVER PICTURE

In addition to being unprepared for the flight, urged to hurry, and ordered off with no copilot by supervisory personnel, the pilot of the C-47 shown on the cover took off without a valid clearance. Upon arriving at the airport where the crash occurred, the pilot was unsuccessful in getting landing instructions from the tower because of his hurry and no copilot to assist him in reference to radio facility charts. He did not use his experience to check wind direction and without circling the airport, set up a traffic pattern to land on a runway which was directly downwind. After he squared away on his approach, the tower saw him and gave him a red light which neither he nor the airman (an F-80 crew chief) who was riding in the copilot's seat noticed. His approach was high, too fast, and the plane's first touchdown on the 2900-foot runway was approximately at the halfway point.

The plane ballooned on the first touchdown and by the time it settled again was approximately 300 feet farther down the runway. The pilot immediately applied brakes, and tire marks on the runway substantiate the effectiveness of the brakes although there was not space enough left to bring the plane to a stop. The pilot did not attempt to go around, and too late realized he could not bring the airplane to a halt. So he made a futile attempt to groundloop. The plane left the runway, wheels still dragging, rolled 100 feet across the field boundary, hit a 200-foot dike, ballooned into the air at approximately 55 mph, and stalled into the tidal water 150 feet from the embankment.

Fourteen persons aboard received major injuries, and 10 persons received minor injuries.

The plane had taken off with 700 gallons of gas and had burned about 100 gallons during the flight. Thus, the fuel weight upon landing was approximately 3700 pounds, crew and passenger weight was about 4800 pounds, and baggage all in the aft section weighed approximately 500 pounds. Not all the passengers had their safety belts fastened and this, combined with the fact that baggage and other equipment were not lashed down, contributed to the serious injuries of the personnel.

The investigating board considered this accident so inexcusable that it charged 100 per cent supervisory error and 100 per cent pilot error.

(Note: See "Rolling Safely to a Stop," page 24 of this issue.)

ARE WE A GOOD RISK?

THE AMERICAN PEOPLE believe that air power is needed to guarantee their country's security.

They have asked for a strong Air Force—not one bigger than the preservation of our democracy requires, nor one so expensive that it will bankrupt the country. Americans are paying heavily to provide the budget out of which such an Air Force can be built. They have faith that we in the Air Force will match their sacrifices with efficient and economical operations. In effect then, the Air Force has the mission of getting the maximum air power for the minimum funds expended.

In carrying this mission to its goal there is one factor which we must bear in mind constantly. America's resources are not unlimited. Therefore, we must be aware of the danger in squandering any part of them. Otherwise economic suicide could defeat us. By eliminating unnecessary waste in our operations not only will we be able to forego the shadow of economic suicide, but we will also be able to live up to the expectancies of the people who support us.

The question, then, is this: Are we a good risk? Or are the people, our partners and supporters in this Air Force, being cheated? Let's look at the facts.

A pilot puts on a private air show (even though he knows such an act is contrary to regulations) so his home-town folks can see the fine new fighter they helped buy and the fine training thousands of dollars provided. When they gather around the smoking wreckage after a neat buzz job, they are faced with the fact that tax money and resources, perhaps of a higher valuation than the entire village, have been wiped out—squandered.

Was this pilot serving the people?

A mechanic lets a faulty fuel line go until the next inspection. Later the plane bursts into flame and crashes.

Was he aware that every man who wears our country's uniform is in partnership with the American people?

A commander fails to brief his crews properly on procedures to be used during a formation flight. Two planes collide, three others crash-land after becoming separated from the squadron.

Was he trying to help give the American people an Air Force within the price they can afford to pay?

It would be a startling thing to question a man about his loyalty to the country after he had caused an aircraft accident.

Without a doubt he would insist that he as much as anyone else was concerned that this nation be provided with the most powerful air arm possible. Unthinkable that anyone would hint that he had betrayed the trust of his nation or the mission of his service.

General Bradley once said: "A democracy such as ours cannot be defeated in this struggle (for freedom); it can only lose by default. It can only lose if our people deny through indifference and neglect their personal responsibilities for its security and growth.

"Our danger lies not so much in a fifth column whose enmity is avowed. It lies in a first column of unconscionable men who are 100 per cent citizens in their daily routine of neglect."

Our people are buying an insurance policy. In it there is no room for the squanderer, the waster, the careless, or the neglectful. We must strive to see that we do not betray the trust of our nation as a whole or of ourselves as individual servicemen and citizens. We must be a good risk!

Falcons with Savvy

HELP A MAN to learn as much as possible for him to know about a new plane and you will have a pilot or mechanic who will help keep your safety record clean.

That's the operating spirit behind the 27th Fighter Squadron at March AFB. By mid-July the squadron had flown the new North American F-86 Sabre 1273 hours without an accident.

The F-86 may have been a mysterious plane to pilots when they first saw it at Muroc, but by the time key men of the squadron were checked out by AMC pilots, there was no doubt that the entire squadron would get to know the plane intimately.

After pilots and a selected group of mechanics returned to March from Muroc, the squadron started a carefully planned training program for all flight and line personnel. The 3499th Mobile Training Group, with Capt. J. F. Stroud as officer-in-charge, set up classrooms for pilots and mechanics of the First Fighter Group. Mechanics attended courses each morning for three weeks and in the afternoons instructors from the Air Technical Training Command's unit were on the line to give on-the-job maintenance assistance.

Maj. Clayton Peterson, CO of the 27th, believes that the most important part of a pilot's checkout in a new airplane is to give him a complete understanding of it. "You're not afraid of a thing you understand," he says, "and emergencies are made easier to handle when the pilot has the confidence which comes from knowing thoroughly how the airplane operates."

The mobile training unit was given much credit for the pilot's understanding of the new plane.

The operations section instructors watch closely every detail of the pilot checkout. They are very critical of how a pilot performs his exterior and cockpit checks. They have taught pilots to use a standard procedure in the cockpit, going over controls and instruments from left to right.

During every flight the pilot is graded and flight leaders make progress reports on each of their men. Pilots are rated on promptness in reporting for duty, attitude, initiative, starting engines, flying technique, air discipline and executing maneuvers. During landing approaches, each pilot is watched for his method of flying the traffic pattern, approach, flare-out, and final touchdown, as well as his taxiing. Emergency procedures are reviewed constantly, and daily pilots' meetings are used to refresh pilots on procedures and to share experiences.

The squadron is determined that pilots wearing the Falcon insignia of the 27th develop good habits. Quite often after a plane has been landed the flight leader or even the squadron commander will inspect the cockpit to note how the pilot has left switches and controls.

Maj. John P. Benner, squadron operations officer, believes that much of the interest among pilots in helping to iron out bugs in the new airplane has been stimulated by a book called, "Hot Poop Book on the F-86 & Associated Subjects." This is a loose-leaf notebook to which are added almost daily incidents or characteristics of the F-86 as pilots report them. First Lieutenant Felix Asla, Jr., the squadron Flying Safety Officer, compiles the information contained in the book, and the material is written in an easy-to-read and often humorous manner. Other squadrons in the First Fighter Group borrow the book to make use of experiences of the 27th and in turn share their own findings on the Sabre.

Sometimes it appears that luck has been with the pilots of the 27th, but their efforts to understand emergency procedures and the mechanical operation of the plane before flying it are more responsible than mere good fortune. The poop book contains several such incidents—

One day while Lt. Russel E. Taliaferro was flying at 15,000 feet he lost control boost, so he slowed down the plane and descended without boost. When he came in for a landing he had difficulty keeping the wings level with full flaps, and about one mile out on final decided not to land without more control. He increased power and went around. Upon advice from an officer in mobile control, he raised his flaps to half and found that the stability of the plane increased. Another approach was made and by using both hands on the control stick, he was able to make a good landing.

Pilots of this airplane are advised to keep accurate trim on the controls because if the aileron boost should fail at high speed with the trim slightly off, it is likely that the plane could not be controlled. With boost compensating it is possible for the plane to be flown out of trim without the pilot being aware of the danger. Therefore, at the earliest convenience after takeoff, Sabre pilots put the boost in by-pass position and adjust the trim.

Another pilot contributed this item to the book. On one flight he noted that the radio compass needle failed to operate, but when cabin pressure was reduced, the ADF functioned again. It was found that as a result of high pressure in the cabin, the canopy rose slightly and broke the radio compass connection on the canopy ride leads.

Another pilot found that his speed brakes would not extend. He had been taught to have a healthy respect for the drag received from speed brakes, so he set his base leg out a little further than usual. The landing was hot, but a good one.

The F-86 taxies very well at idling rpm. When more power is required to taxi, something may be wrong—as one pilot of the 27th learned. He noticed that 65 per cent power was required to roll into position on the runway. He stopped the roll and turned off the nearest taxi strip. Just then crew members rushed up to the plane with fire extinguishers. The left brake was smoking. Had he taken off and retracted the left gear into the wheel well with a brake on fire—you speculate on how close that one was.

Capt. John D. Smith, maintenance officer, puts a lot of weight on pilots making accurate reports on the status of the plane after landing. As soon as the pilot lands he talks to the next pilot scheduled to fly the plane, telling him of any discrepancies or peculiar characteristics that he has noted. If the troubles are not easily explained or repaired, engineering checks it and an engineering test pilot flies the plane to determine the trouble. "Cooperation and no secrets between us and the pilots," is the way Captain Smith describes it.

These pilots' thorough knowledge of the gliding radius, power off, has saved at least one F-86. Pilots had flight-tested the gliding range to March AFB from various altitudes by throttling back to idle and putting out speed brakes to simulate a dead engine. After their tests, circles were placed on maps of the local flying area showing the altitudes from

Mechanics of the 27th Squadron are back of safety record.

Below, Mobile Training Unit trains 1st Fighter Group mechanics.

which the plane could be glided back to March for a landing in the event of power failure. In other words, at a given point so many miles from the field, the pilot could determine how high he would have to be in order to glide back to March.

Second Lieutenant Clement L. Bittner, who had eight hours in the F-86 at the time, advanced throttle to 96 per cent to rejoin formation, then reduced it to 85 per cent to keep from over-running the leader. When he had slowed down sufficiently he again advanced the throttle to 96 per cent. As the rpm reached approximately 90 per cent, a slight explosion was heard and a rapid deceleration was noticed on the tachometer. Tailpipe temperature dropped to almost zero. Immediately the throttle was shut off. Lieutenant Bittner turned off the radio and all electrical equipment to conserve the batteries. At 20,000 feet he turned his radio on, notified the tower of his difficulty, and attempted an airstart. After he drained fuel from the tailpipe, the fuel ignited but no more than 20 per cent rpm could be obtained. He tried again at 15,000 feet with negative results. At 10,000 feet he tried a third time but without success. He lowered the gear and pumped the nose gear down. When he reached an altitude of 5000 feet above the field he lined up with the runway and made a 360-degree approach. The landing was uneventful.

Another safety measure adopted at March AFB for local flying in F-86's is the requirement that pilots return to the base with at least 100 gallons of fuel during the daylight hours and 150 gallons at night. In case of a malfunction, such as one pilot of the 27th experienced, the extra fuel may mean the difference between a belly landing and a normal one. This pilot found that the landing gear would not extend. The additional fuel gave him time to make repeated attempts to lower the gear normally. When these attempts failed he was able to "declutch" and pump the gear down by hand.

Because the F-86 is new to the average alert crewman at bases away from the home station, each pilot, before making a cross-country flight, is required to be fully qualified to perform pre-flight and daily checks, and to supervise fuel, oil and hydraulic servicing. As an added precaution he carries a guide sheet which outlines the requirements for starting equipment and ordinary maintenance.

To the maintenance men of the First Fighter Group, working on new airplanes is SOP. Many of these men were the first to perform operational maintenance on the F-80, and consequently when the F-86 came along they took it in stride.

During the early flight tests of the Sabre, as a safety precaution, the J-47 engines were pulled for inspection and overhaul after seven and a half hours flying time. Within a few months the time had been jumped to 100 hours for operational squadrons before the engine was required to be changed. How was this possible? An engineering officer had the answer.

"It developed that as we found the engines could take it, the time was gradually extended. It went from seven and one-half hours last fall, to 15, to 30 and then in March we flew them 50 hours. By May we had reached the hundred-hour figure which we think may still be doubled for operational use. The important thing to remember is that engine life depends much on starting technique and the way the pilot uses the throttle in flight and on takeoffs. Improper technique causing hot starts shortens en-

1st Lt. Felix Asla models instrument hood he devised.

Attached to hard hat, hood has inner and outer visors.

gine life. This is also true of quick changes in power which cause tailpipe temperatures to fluctuate too much."

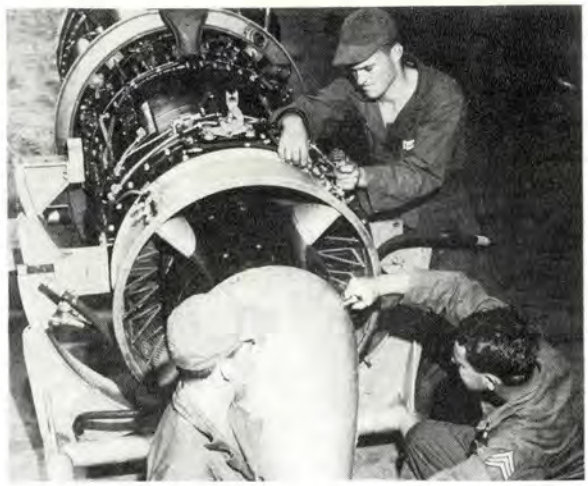
It has been the experience of all squadrons in the First Fighter Group that standardization of pilots pays off in the elimination of costly maintenance. The group standardization board includes pilots from all squadrons. It is easy to see that the group's high level of professional pride comes from the spirit in the squadrons. This spirit is, simply enough, exemplified by the way a new man is welcomed into the squadron; it shows up on the line as cooperation between pilots and ground crews; it carries on through between squadron commanders. An idea developed in one squadron is offered to the others.

That's the way it was with an idea for an instrument hood to be attached to the hard hat. It was tried out by the 27th Squadron, found to work, and now the entire group uses it. The 27th is also working on a desert survival kit to be carried in the balsa wood seat pad and attached to the pilot's parachute harness.

Members of the 27th Fighter Squadron believe they have a record for safety in operating jet airplanes. Before they started flying the new F-86 they had flown other types, including the F-80, for more than 2000 hours without a major or minor accident. They like the challenge of a brand-spanking new airplane, and from their record as the leading squadron of the USAF in F-86 time without an accident, it is obvious that they are well up on the F-86 and Associated Subjects.

MAJ. HOMER P. ANDERSEN.

Proper operation and inspections assure longer engine life.



Old hands agree that disassembly makes inspections easier.

Pilots' thorough preflight checks include inspection of wing slats .

Simple Arithmetic

It is as simple as arithmetic. There were seven men aboard the airplane. One man wore his parachute, six men did not. When the plane caught fire in flight, one man lived, six men died.

It was the kind of day when nobody expects trouble. Blue skies over the western plains, bright sunshine taking the morning chill out of the air, a C-47 up for a routine local flight.

Sgt. Joe Billings left his house early that morning and went directly to base operations. He needed one hour of flying time, and the local C-47 flight was an opportunity to get it. The pilot had not reported in yet, but the dispatcher said there was no radio operator scheduled for the flight, so Joe slung his harness over his shoulder and carried his chest-pack chute on out to the plane.

As he climbed aboard he noticed nine quick-release back-pack chutes stacked neatly against the rear bulkhead, harnesses fastened and folded under each chute.

A few minutes passed. Then the two pilots and the crew chief came out to the plane followed by a radio mechanic and two corporals who wanted to go along just for the ride. Joe was waiting on the back seat as the six men climbed aboard and filed past. No one gave the stack of parachutes more than a glance. The pilot turned halfway to the cabin and asked Joe what crew position he flew.

"Radio operator, sir," Joe replied.

"Okay, sergeant, you can ride up front if you like."

Joe had buckled on his harness when he climbed aboard the airplane, and he picked up his chute pack and started forward. The two corporals had dropped down on seats near the front of the plane and as Joe passed, one man cracked, "You don't figure to jump out on us, do you, sergeant?"

"What's the matter, sarge, don't you trust these pilots," the other passenger quipped, looking meaningfully at Joe's chute.

Joe grinned, "Never can tell, Mack. You never can tell." It didn't bother him; he'd been ribbed before during his 3000 hours in the air about always having his harness on and his chute handy.

The flight proceeded in normal fashion. Finally the pilots brought the plane back to the field and began shooting running landings. On the fourth takeoff the plane climbed straight ahead for a minute or two; then the crew chief rushed back to the passenger compartment and looked out the right window a second, then ran back to the pilots' compartment. Joe stood up and stepped over to the window. He saw a solid sheet of flame pouring from the engine. Instantly he snapped on his chute pack.

Before Joe could return to his seat the crew chief appeared again and shouted in near panic, "We're on fire, everybody bail out."

Joe ran hastily to the door and began trying to open it. A B-29 crewman, he had a little trouble working the emergency release. The door fell free and Joe glanced back inside briefly before he jumped.

The two corporals were fumbling at the fastened parachutes in terror and the copilot and crew chief were getting into their chutes. The copilot shouted, "Get out! Jump! The ship's going into a spin."

As he left the door Joe felt intense heat for a brief moment and delayed pulling his ripcord until the heat was gone. His chute opened and he turned to see the plane in a diving turn. He landed in a deep ravine and was unable to see the plane crash.

Joe walked out to a road nearby and hailed a passing automobile.

One conclusion of the investigating board was that if the other six men aboard had fitted their parachutes on before the flight and had worn them or had them handy as one man had done, they might all be alive today too.

It is as simple as arithmetic.

WHAT'S YOUR PHOBIA?

BY LT. J. D. NUDING, WALKER AFB, ROSWELL, N.M.

MISCONCEPTIONS about flying procedures frequently can be blamed for aircraft accidents.

Take the case of a certain B-25 pilot who went charging down the ramp at a speed estimated by observers at close to 40 mph. The B-25 came to a stop after it had eaten halfway through a temporary maintenance shack on the line. The B-25 pilot claimed that he slammed on the brakes, but obviously not in time to avoid striking the building.

Somewhere along the line he had been told that it was necessary to taxi the B-25 in autolean at 1200 rpm to avoid loading up the plugs. He was somewhat embarrassed when reference was made to T.O. 02A-1-29, Section V. The T.O. states that when properly set, the mixture control should be placed in the full rich position and the B-25 taxied at 600 rpm without fear of loading up the engines.

If the idle mixture is properly preset, all engines with collector rings should idle at 450 rpm with the exception of the R 2000 (600 rpm) and the B-36 engine (1000 rpm). All engines with individual exhaust stacks are set for 600 rpm. Read the book and slow it down.

Then you have the pilot who uses a minimum amount of power for takeoff. He thinks he is preventing wear and tear on the engines. Every airplane used by the Air Force today can be flown safely with maximum takeoff power for five minutes. The first 1000 feet or so of the takeoff run at full power will tell you a lot about your engines. Lock them at 44, 52 or whatever manifold pressure is prescribed for normal takeoff. True, most airplanes will take off a long enough runway with only normal climb power settings. However, the wear and tear on the tires and landing gear assembly, and the increase in the length of time necessary to obtain safe single- or three-engine airspeed make the use of minimum power more hazardous than helpful in the long run.

Then there is the pilot who loves to fly fast—on the ground. Somewhere he adopted the idea that the longer the ground run the safer the takeoff. Now that may be all well and good if you have 10,000 feet of runway in front of you when you take off. If you haven't, and an engine should quit and you do not have safe single- or three-engine airspeed, then your chances of making it through the trees are rather slim.

After executing the proper feathering or emergency procedure for an engine failure after takeoff, some pilots fly a traffic pattern which almost takes them out of this world. If the pattern is normally flown at 1000, they fly at 1500 when one or more fans are in cold storage. The approach is also usually made 500 feet higher than normal. Then they wax their skis and come booming down the final with excess airspeed. They overshoot in spite of full flaps and then attempt a go-around.

The alibi pattern of this type accident runs something like this:

"I was high so I lowered full flaps. I saw that I was overshooting, so after the flaps were down I pulled all the power off the good engine. But I was still overshooting so I poured the coal to the good engine to go around and the next thing I knew we were in a tight turn with airspeed too low. So, I bellied it in through a fence and skidded to a stop to the left of the runway." The cure? Fly a normal pattern at the normal altitude and never lower more than half flaps until the landing is in the bag.

Another phobia on the subject of single-engine operation is the reluctance of some pilots to turn into the dead engine. Actually, turning into either the good or the dead engine has its drawbacks as well as advantages.

If it becomes necessary to add power when turning into the good engine, the airplane will have a tendency to roll back to level flight. However, if it becomes necessary to reduce power with the good engine on the low side, the airplane will have a tendency to roll into a steeper bank because of the preset rudder trim. In any event, as long as the airplane is trimmed, that is, the ball is in the middle, and a constant safe airspeed is maintained, the airplanes will handle very nicely with either the good or the dead engine on the low side. The main point to remember in making single-engine turns is *constant airspeed.*

Since most single-engine operation accidents result from overshooting caused by too much altitude, airspeed, traffic pattern and panic, it behooves all twin-engine pilots to get out and practice simulated single-engine approaches. A normal pattern flown at the normal altitude with safe single-engine airspeed is not an emergency, but merely single-engine flight.

A recent accident involving a C-47 pilot making a GCApproach with a 250-foot ceiling and one mile of visibility is a good example of another phobia which has rooted itself in the minds of some Air Force pilots. The phobia? *The lower the ceiling, the higher the airspeed.* The approach was good except that the pilot was continually above the glide path. He told GCA that he would fly his final at 120 mph, then promptly pushed it up to 140 mph. The extra 20 was being held in reserve for a rapid departure in the event one became necessary. When the plane broke out about one-half mile short of the end of the runway slightly high on the glide path, the C-47 pilot had considerable trouble unloading that extra 20 mph. With power off he lowered full flaps and floated 3800 feet down a 4500-foot runway. The cure for his phobia is obvious—fly the correct glide path speed, no more, no less.

FAILURE OF AN INVERTER

THE B-29 YOU SEE enveloped in flames crashed shortly after takeoff. The plane had been flown the day before this last flight, and the only malfunction experienced before takeoff was failure of the main inverter which required a change to alternate inverter. The complete flight that day was made utilizing the alternate inverter. Previous inverter trouble had been experienced eight days before, and a couple of months previous to the accident difficulty with the No. 2 engine turbo supercharger system was experienced and resulted in maximum manifold pressure and blown cylinders.

After the daily and preflight were completed on the day of the crash, the airplane was taxied into position for takeoff. No malfunction of inverter or turbo supercharger system was apparent at this time. The regular inverter appeared to be operating normally because the turbo waste gates assumed proper positions as required by the signal set on the turbo supercharger.

Power was applied and a normal takeoff continued until the B-29 reached an altitude of approximately 200 feet. Aircraft weight at this time was 95,574 pounds, fuel load 2600 gallons, and index 46.5.

Wheels and flaps were being retracted when the flight engineer noticed the No. 4 manifold pressure needle go right on around the gage. He immediately notified the pilot and an attempt was made to retard the throttle of No. 4 engine and reduce the turbo supercharger to No. 3 position. While this was being done, manifold pressures on engines 2 and 3 surged in the same manner, with fires breaking out almost simultaneously in these engines. Retarding the throttles did not reduce the manifold pressure, and rpm did not exceed 2800 on either engine during this period.

Airspeed at the time was approximately 150 to 160 mph. After loss of Nos. 2, 3, and 4 engines, the pilots decided to land the B-29 straight ahead. They instructed the crew members to assume crash positions.

A slight turn to the left was made to avoid some low hills, and full flaps were lowered while crew members were assuming crash landing positions. The crash landing was made in a tail-low attitude. The flight engineer shut off the main switch (crash bar) and as many other switches as possible during the time the airplane was sliding on the ground.

After three unsuccessful attempts to open the flight engineer's escape hatch, all members in the front pressurized compartment scheduled for exit through this hatch abandoned the airplane through either of the pilots' windows.

The only injuries received during the crash and evacuation were a cut on the right scanner's leg and temporary loss of breath by the engineer. The engineer's condition was caused by the throttles striking him in the stomach when the flight engineer panel moved forward from its mounts.

Based upon the previous history of inverter difficulties in this airplane and failure of the No. 2 engine two months previously, the malfunctions which occurred in the turbo systems of Nos. 2, 3, and 4 engines were probably caused by failure of the normal inverter.

The history of the inverter system of this B-29 was checked, and the Forms 41B, 1A's and other records showed that the plane had been flown 859 hours without a normal inverter change. Existing TO's require changing of all normal inverters on this type airplane at 500 hours.

A similar turbo incident occurred in 1947 with another B-29. This airplane also had fluctuations of manifold pressure, and *no* increase of rpm was experienced. The condition could not be corrected by use of the turbo supercharger or retarding throttles, so manual turbo controls were used during the remainder of the flight. After a successful landing, this B-29 underwent a change of its entire supercharger system. Upon re-installing the main inverter, the turbo system was again checked and varied positions of the turbo waste gates were noticed. The waste gates would assume unpredictable positions.

It was suggested that the alternate inverter be used. When this was done all malfunctions were corrected. It was concluded that the 400-cycle main inverter was out of phase, and the inverter was forwarded to a depot with a complete record of malfunctions.

It was recommended after the second accident that a proven device for testing voltage and frequency output of the unit grid system be provided for all organizations flying B-29's and that such airplanes' alternating systems be checked at 50 and 100-hour inspections.

The necessity for cooperation between flight and maintenance personnel cannot be overemphasized. The importance of frequent checks of equipment and properly maintained records of inverters and all aircraft accessories should be a lesson learned from this B-29 accident.

TURBO SURGE

By Maj. Vincent M. Crane
Flying Safety Officer, 15th Air Force

Ed. Note: *As a result of the B-29 accident described on these pages and complaints regarding extreme turbo surge encountered during formation flying at or near 30,000 feet, a study was compiled by Headquarters, 15th Air Force regarding turbo surge on B-29 aircraft. The following article highlights the study.*

Turbo surge is a condition of stalling or breakdown of the airflow in the turbo compressor diffuser vanes. This stalling occurs when the airflow being discharged by the turbo is low, and with high turbine rpm and relatively high carburetor deck pressure (turbo discharge pressure).

As the stalling of the air occurs, the turbo discharge pressure falls off because of the air being used by the engine and because of partial reverse flow in the turbo diffuser vanes. When the turbo discharge pressure has decreased sufficiently, normal airflow through the diffuser vanes is re-established and the discharge pressure builds up until stalling in the diffuser occurs again.

This cycle will continue until either more air is used by the engine, such as additional opening of the throttle or increased engine rpm, or until the turbo discharge pressure is reduced by decreasing the setting of the turbo boost selector.

In general, turbo surge is encountered at high altitude at cruise powers, and as altitude is increased higher power settings must be used to provide engine operation above the surge range. For any given power setting, optimum operation away from surge is obtained by use of full throttle and only enough turbo control setting to give the desired manifold pressure. Higher engine rpm settings provide operation further removed from turbo surge.

When planning formation flights at high altitude, it may be necessary to schedule operation at airspeeds somewhat above maximum long-range cruise speeds in order to use power settings that are considerably above the surge range. This will then, without encountering turbo surge, permit some "part throttling" which is a necessity during formation flying.

At high altitudes under certain conditions such as very low power cruise or reduced power for descents, it may be necessary to partly throttle the engines and slightly increase the setting of the turbo boost selector.

This is done in order to maintain sufficient cabin airflow for pressurization. In some cases this may result in turbo surge, and will probably appear on the outboards first because of the additional air that is bled off the inboard induction systems for cabin pressure.

In the event of surge with those conditions, it will be necessary to use a slightly higher engine rpm in order to get out of the turbo surge range. However, if the surge is quite severe, in order to prevent the possibility of propeller overspeeding when increasing the engine rpm setting, it is advisable first to reduce the manifold pressure with the throttle to a stable value, which will be below "closed waste gate."

Some factors that affect engine operation in regard to turbo surge are as follows:

1. An increase in air bleed such as leaky induction system between the turbo compressor and the carburetor, or bleed for cabin pressurization, will tend to move turbo operation away from the surge range.

2. Since each engine on the B-29 airplane has dual turbos with both waste gates linked together and operated by a single waste gate motor, improper synchronization of the waste gates will have an adverse effect on the "surge free" operating range. In other words, if one gate is rigged to a more closed position than the other, then that turbo will enter the surge range much sooner than normal. This is true because of the fact that it will be doing a greater portion of the work and consequently the impeller will be operating at a higher than normally required rpm to provide the induction system pressure (carburetor upper deck pressure) being called for by the pressuretrol and the setting of the turbo boost selector.

3. For any given power setting that is marginally near the turbo surge range, a decrease in carburetor air temperature will move the engine operation away from the surge range a slight amount. This is explained by the fact that with colder carburetor air (increased density) a greater amount of air by weight is flowing from the turbo through the engine.

Turbo surge symptoms first appear as a large fluctuation of the fuel flow meter, followed almost simultaneously by oscillation of manifold pressure indication and oscillation of engine rpm. As the surge condition progresses the manifold pressure will fall and rise as much as five or 10 inches Hg, resulting in engine speed oscillation of two or three hundred rpm. The fuel flow meter fluctuates so severely it creates the impression that the engine is cutting out. If the surge is rather severe the engine will backfire and belch black smoke from the exhaust. This is apparently caused by the fact that the carburetor or master control cannot compensate fast enough for the rapid changes in carburetor deck pressure and results in improper fuel/air ratio during the surge condition.

On some occasions operation of the B-29 airplane at an altitude at which a turbo has just reached its governing or "limited" rpm, has erroneously caused the impression of turbo surge. However, this condition, caused by the turbo governor cutting in and out, only results in a manifold pressure fluctuation of approximately one or two inches Hg. and the other instruments remain relatively stable.

WHAT WOULD YOU DO?

WHAT WOULD you do if you lost radio contact while on an IFR flight? Let's see what one T-6 pilot did and how his actions got him into trouble.

This pilot took off at 0914 on an IFR flight plan via airways to a destination one hour and 45 minutes away. ATC cleared him to fly at 5000 feet with no delay expected at destination.

Upon reaching 5000 feet, the pilot was between cloud layers and proceeded on course to a fan marker where he tuned in a station on up the airway. The station was barely audible on his command set, but he attributed this to the distance involved and continued on the airway heading. While flying this heading he noticed the voltmeter fluctuating occasionally.

At approximately 0950 the command set became inoperative. The pilot tried to contact the next radio station along his flight on VHF but received no answer. At this time he was over the cloud layer which had openings at intervals that would have permitted a VFR descent. However, he continued the flight at 5000 feet.

He had estimated his arrival over the next radio station at 1000 so he took up the new heading to destination at that time. All the while he was trying to pick out check points through the breaks in the clouds with no apparent success.

Let's review AF Reg. 60-16 a little at this point. If your radios go out of commission while you are flying IFR, the regulation states first, to proceed in accordance with VFR, if weather conditions permit. Evidently, weather conditions permitted because this pilot was trying to navigate by picking out check points through breaks in the thin clouds. Bases of clouds up to this point along his line of flight were being reported as 4500 feet and visibility was 30 miles.

Yet this pilot still proceeded on at 5000 feet. Perhaps he had read only the *second best* procedure listed in 60-16, which reads that in the event of loss of radio contact, "proceed according to current flight plan maintaining the minimum safe altitude or the last acknowledged assigned altitude, whichever is higher, to the airport of intended landing."

Yes, his alternate was open the whole period, never dropping below a 5000-foot ceiling and eight to 10 miles visibility.

At any rate, this pilot misinterpreted his circumstances or just plain didn't think out his problem. He

continued on until 1055, five minutes before his ETA was up. At this time he descended to 3000 feet and flew on into worse weather for another 15 minutes, trying to keep VFR and identify his position. This procedure was not only unsuccessful but was dangerous because of low clouds and rain in the mountainous area where he was lost.

He decided to land the T-6 although he had at least an hour of fuel left. He selected a newly-plowed field, landed wheels down, and nosed over with the T-6 coming to rest on its back. The pilot wasn't hurt and got a ride into a nearby town to call Flight Service and inform that agency that he had landed in a field approximately 70 miles beyond his destination.

The factors which contributed to this accident were loss of radio and weather. However, they were no excuses for the violation of 60-16 and lack of sound judgment on the part of the pilot. VFR at the time of radio failure seems to be the choice that should have been made in this case.

That isn't always the best choice, however. In mountainous terrain, which this pilot didn't encounter until quite some time after he had made his bad decision, it is wise to continue IFR at your altitude rather than let down VFR and try to sneak over and around mountain tops obscured by clouds.

It is up to the pilot to make sure he is well briefed on the weather before he takes off; to keep a running check on the weather en route, destination, and alternate; and to keep an accurate check of his position at all times. Then if he loses radio contact he has the knowledge and material necessary to make the wise decision, provided of course, that he is familiar with the choices he has as mentioned in the appropriate regulation.

Flying Safety c

By 1st Lt. Hal J. Bas

Behind the men who fly the planes in the Alaskan theater is an army of men and women each of whom becomes a specialist at his job before his tour of duty in the theater is done. While flying a plane in Alaska is quite similar to flying a plane in various sections of the United States, the problems of maintenance, weather forecasting, navigation and communications are quite different.

Maintenance during the cold months has been and remains one of the biggest headaches of all units operating in the Alaskan Theater. Mechanics must work with heavy mittens on when outside or suffer frostbitten hands. Even as simple a job as removing a spark-plug becomes a major task under outdoor working conditions. Maintenance people must also wear heavy, cumbersome outer clothing in order to remain outdoors for any appreciable length of time. When maintenance has to be accomplished outdoors at low temperatures, work must be halted frequently while personnel retire to a heated room or tent to get warm.

Yet despite the problems they face, maintenance personnel have performed some astounding feats in addition to the difficult day-to-day winter task of keeping the planes flying. Twice aircraft which made wheels-up crash landings miles from a base were reclaimed in the dead of winter. Crews fly to the downed aircraft, set up an arctic camp, and repair the planes so they can be flown out.

During the summer months mechanics feel like they're on vacation because their job is so easy—all they have to worry about is keeping the planes in repair.

AACS—Heartbeat of Communications

Problems of navigation and communication in the northern regions are also different from those in the United States. Atmospheric disturbances peculiar to northern latitudes frequently disrupt long-range radio communications and make radar the principal type of polar electronic navigation. Approximately 50 per cent of navigation on long polar flights is done by radar. Radio ranges and short-range radio communications are not blocked out by atmospheric conditions, but over most of the vast reaches of the northern regions there are no radio range stations. There are only 47 in all of Alaska. On the matter of communications, the CAA and Air Force work much more closely together than in the United States.

AACS provides ATC and Flight Service functions for the theater and even operates airways radio range stations beyond Naknek in the Aleutian Chain. Responsibility of AACS in the Aleutians is tremendous because of adverse flying conditions that exist most of the year. On GCA teams especially, the success or failure of much of the flying in this area depends. Some fields have only one approach direction which must be used regardless of winds. As a result, landings with very low ceilings and visibilities and cross winds up to 60 miles per hour must sometimes be made. If GCA were used nowhere else in the world, on the Aleutian Chain alone it would have justified every nickel the Air Force has put into it. There are sometimes periods when for days on end all landings are made by GCA and all takeoffs monitored by them at bases in the Aleutians.

in ALASKA

HAM, FLYING SAFETY STAFF

Much of the credit for the splendid GCA record in Alaska is due AACS headquarters which takes each new GCA operator in hand upon his arrival in the theater and, no matter how much experience he has had, puts him through a special on-the-job-training checkout in which he gets careful training on Alaskan operating conditions from operators experienced in the theater. When he is assigned a station after leaving AACS Headquarters he gets further "dual" instruction at this assigned station on problems unique to his job there. He is kept on training runs until he is thoroughly proficient at his new station. At each base in Alaska crews are assigned so that experienced personnel are always on crews to which new men are assigned.

Even the commercial airlines in Alaska are enthusiastic GCA supporters. The CAA checks all airline pilots on their GCA procedures before allowing them to operate as first pilots in this area. Approximately 90 percent of all final approach controllers on duty in Alaska at the present time are former pilots. A qualified weather observer is required by AACS to be on duty in the GCA trailer during instrument weather.

Sometimes Alaskan weather is such that an observation taken from base operations shows 300 feet and one mile visibility when ceiling and visibility right over the end of the landing runway may be 100 feet and one-eighth mile. Having weather observers on duty in GCA trucks enables AACS to give pilots the exact weather situation at point of touchdown while the plane is in the pattern. Any sudden change of weather is seen immediately and reported by the observer in the GCA truck.

Weather or Not

Approximately 80 percent of the weather forecasters in the theater are rated personnel, a good portion of whom are pilots. Because weather conditions are influenced by a variety of factors almost foreign to forecasting in the United States, weather personnel assigned to Alaskan bases spend much of their first few weeks in the theater under the tutoring of experienced theater personnel. Throughout their tour, pilot forecasters take every opportunity to fly their own route forecasts.

Much of the weather in Alaska depends on the position and movement of the permanent polar front which moves back to the north in summer and south in winter. This front is not a moving line traveling across the country as cold fronts do in the United States, but is the dividing line between the permanent mass of cold air centered over the Arctic region and other air masses which move into the Alaskan theater.

The position of this permanent front determines in large measure the course the storms manufactured in the Aleutian "weather factory" follow as they sweep toward the Alaskan coast and on down into Canada and the United States.

Another important influence on weather in the theater are the mountain ranges. Ladd Air Force Base at Fairbanks lies between the Alaskan and

Brooks ranges, and Elmendorf at Anchorage, the other principal base, lies to the east and south of the Alaskan range. Because of the influence of these mountain ranges it is extremely rare for both bases to be socked in simultaneously, a condition extremely comforting to aircrews flying in the theater.

While weather is the principal hazard to winter flying in the Alaskan theater it is a tribute to the stringent safety policy and the individual proficiency of the pilots and communications personnel that during the winter of 1948-1949, not one single accident resulted from weather as the principal factor.

One of the greatest hazards faced by personnel in the Alaskan theater has been, until recently, a psychological hazard—the resignation to a certain death in the event of an emergency which necessitated ditching or bailout. The combined efforts of the Arctic Indoctrination School, the Arctic Branch of the Aero-Medical Laboratory, the Arctic Division of Alaskan Air Command Headquarters, and the 10th Rescue Squadron during the past two years have almost eliminated this factor. Emergency equipment, food and clothing have been devised and tested which will enable men to live almost indefinitely in the event they go down in Alaska during winter weather. A course in arctic survival conducted by the Arctic Indoctrination School at Nome is entering its third year and soon all aircrew men flying in the theater will have received the benefit of this training. The 10th Rescue Squadron with detachments throughout the theater duplicates the functions of Air Rescue Service in the United States.

The Fabulous Tenth Rescue Squadron

Tenth Rescue works with all flying units directing aerial search activities for lost aircraft, and the unit has established a record little short of fabulous in the field of rescuing downed and distressed military and civilian personnel. Helicopters, ski and float-equipped transports and light planes, dumbo (droppable lifeboat) equipped B-17's and gliders as well as ground crews and facilities are used in rescue activities. Day and night, summer and winter, this unit has set a record of rescues unrivaled in the history of aviation. Rescues by night glider snatch, by helicopter pick-ups from drifting ice floes, and jato-assisted ski-transport takeoffs are routine to men of the 10th Rescue Squadron.

Typical of the ingenuity displayed by 10th Rescue operations personnel was the method used to locate a missing F-80 last winter. After other methods had failed, 10th Rescue sent out a message on the "Mukluk Telegraph," a radio program of personal messages broadcast throughout Alaska each night by an Anchorage radio station, asking whether anyone had heard a crash or explosion or seen a plane go down. The next day replies from trappers, miners, and settlers in the Tanana River region, 200 miles north of Anchorage, began coming in telling what time and in what direction they heard a crash. By drawing lines from the locations of these "reporting stations" in the direction toward which the crash was

reported to have been heard 10th Rescue personnel soon had a "fix" of half a dozen lines crossing in a small area on the Tanana River. Search activities in this region were intensified and the missing plane was found where it had crashed through the ice.

Navigation Polar Style

Navigation in the Alaskan Theater both from the navigator's point of view and the pilot's is something entirely different from stateside navigation. On polar flights navigators must be proficient at grid and celestial navigation. One unique problem confronted by navigators is the necessity for shooting sunlines with the sun as low as a degree and a half *below* the horizon. Most charts for celestial fixes stop at about plus six degrees. This has posed a genuine problem for navigators in the theater. Crews flying in the polar region frequently observe three sunrises in the course of one mission. During the summer months the sun never sets, of course.

Extreme and uncharted changes in variation, dip effect and convergence of the meridians all make normal D. R. navigation in the polar regions almost impossible.

For pilots, navigation over Alaska by simple pilotage is entirely different from pilotage in the United States. There is only one railroad 450 miles long in all of Alaska and very few roads in most of the territory. A name on the map does not mean a town will be seen as names frequently mean one trapper's cabin that may be covered with snow at the time you are flying over it.

Pilotage is conducted principally by reference to mountain ranges, rivers, lakes and the ocean. This system, which some find difficult when they first start using it, soon becomes much more popular than the "pinpoint" system. During good weather, visibilities of hundreds of miles make navigation by this system a delightful method, according to experienced pilots in the theater.

That, then, is a sketchy picture of flying and operations in the Alaskan Theater. Books could be written about each phase of the problem only touched upon here. If you are assigned to Alaska, approach the job with an open mind and discount by 80 per cent most of the wild tales you may have been told about it. Flying and living conditions are much like those in various sections of the United States, with a little more emphasis on safety, perhaps.

Everyone in the Alaskan theater is a pioneer today, for despite the progress that has been made in coping with problems of northern flight operations, the surface has only been scratched in fields of maintenance, communication and navigation. You will have the opportunity to pioneer in whatever your occupational specialty happens to be. The strategic importance of Alaska makes continued progress in the science of arctic military aviation a matter of vital importance. The extent of this progress will depend on the energy and initiative of Air Force men and women assigned there.

RADIO RANGE ORIENTATION

By the Flying Safety Committee, USAF Instrument Pilot School

Pilots sometimes arrive at the Air Force Instrument Pilot School to take the instrument course with only a hazy idea of how to work a radio range orientation, make a procedure turn, or hold in a stack. Now you'll probably ask: "Well, what's the school for if it is not to teach this type of instrument flying?" The answer to that question can best be found in the answer to another question: How elementary can a school of this type be without wasting the time of most of the pilots who have clearly in mind the relatively simple procedures for radio range orientation, procedure turns, holding and stacking? The Flying Safety Committee at the Air Force Instrument Pilot School presents this article in the hope that all pilots will gather something new or brush up on key procedures in radio range flying.

A radio range orientation is not an emergency procedure. It is an accurate method of determining the airplane's position by systematic elimination of all conflicting possibilities of the plane's whereabouts in relation to the radio range station.

PROPER TUNING

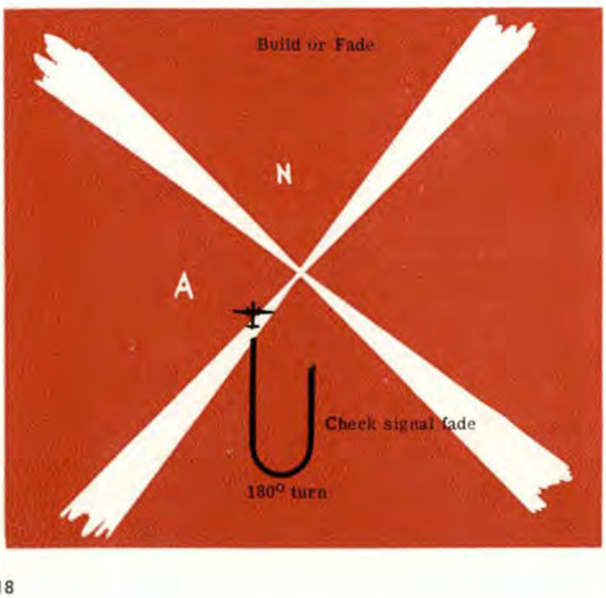
After Air Route Traffic Control clearance has been obtained through the range station, the first step in an orientation is the proper tuning and positive identification of the station. Then the volume is set so that the weaker of the two station identification signals or the bi-signal is barely audible. If the weak station identification signal or the bi-signal increases in intensity, the airplane is heading inbound. If, however, the weak station identification or the bi-signal disappears or fades, the airplane is going away from the station. This check for a build or fade is quicker than the total volume fade or build system and is used whenever the airplane is in the bi-signal zone. (See "Static," July 1949 Flying Safety.)

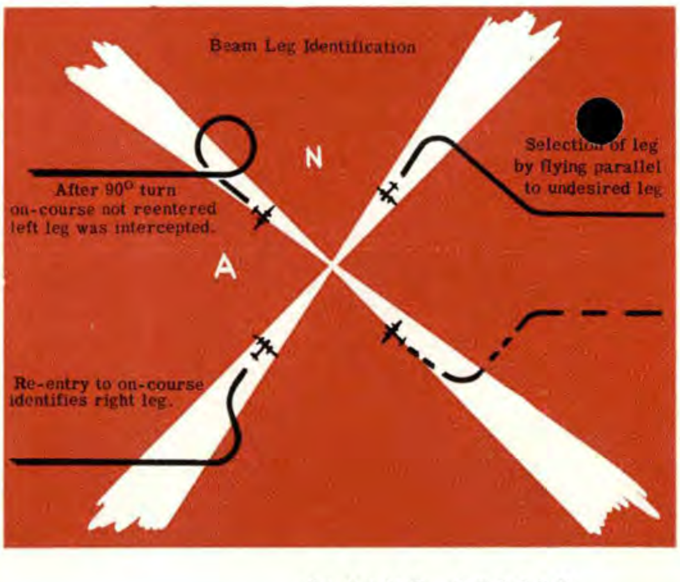
When the pilot is absolutely sure that he is flying inbound, the volume is adjusted to a comfortable level which is maintained throughout the remainder of the procedure.

INTERCEPTING THE LEG

After the quadrant has been identified, a range leg must be intercepted. As the airplane is flown inbound, the range signals are closely monitored to determine the approximate distance from the station that a leg will be intercepted. If the airplane has remained in the clear quadrant for an appreciable length of time and several adjustments in volume have been necessary to allow normal concentration, interception will probably be fairly close to the station.

The most accurate and fastest method of identifying the intercepted beam leg is the "true fade 90° method." The instant the last quadrant signal fades out and the on-course signal is received, the time is checked. The timing is stopped when the first off-course signal of the other quadrant is received. If the total time through the leg is seven seconds or





less, a close-in procedure, which will be described later, should be used. If the time is more than seven seconds, a 90° turn to the left is started immediately after receiving the first off-course signal. If within a minute the on-course is not re-entered, and the background signal fades, the beam to the left of the inbound bi-sector heading has been intercepted.

In that case, a 180° turn to the left and away from the station will place the airplane in a position to intercept the beam again at a 45° angle. Normal beam bracketing procedures are then used to the station. If re-entry is made during or after the 90° identifying turn, the beam to the right of the inbound bi-sector heading was intercepted. An immediate turn to the right to the published inbound beam heading is made and the beam followed to the station.

CLOSE-IN PROCEDURE

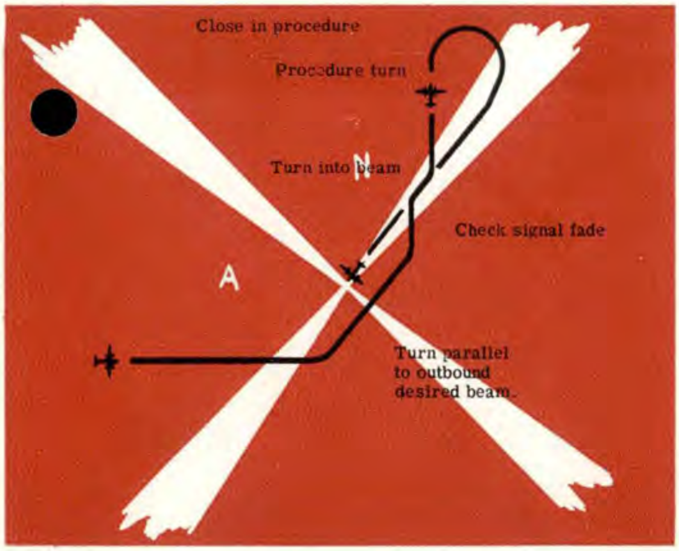
If after crossing the on-course a close-in procedure is necessary, a turn is made immediately to the outbound published heading of the desired beam. If a low approach is to be made, the most desirable beam is the normal holding leg or the outbound final approach beam. After clearance is obtained for the low approach, the airplane is ready for an immediate letdown. During the turn to the desired letdown heading, rapid changes of signals can be expected. The volume should be reduced to a low level in order to receive a quick fade. The outbound heading is held until a fade is definitely determined, and the quadrant signal is checked to determine which side of the beam the airplane is flying. A 45° correction is made towards the beam, and a normal interception accomplished.

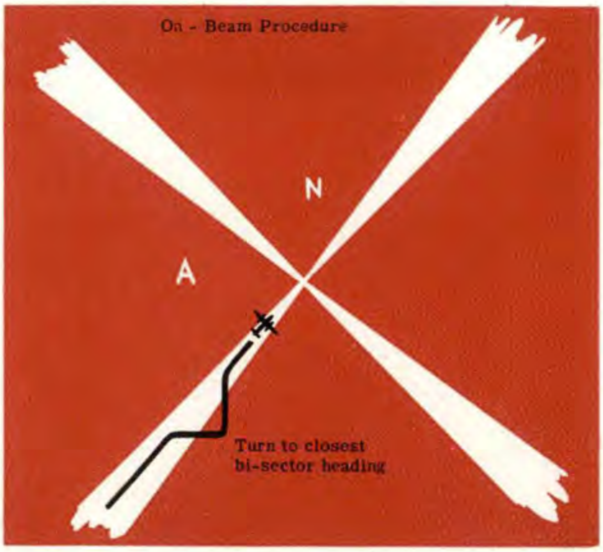
If the airplane is flying on a leg of the range when the radio station is tuned in, "on-the-beam" orientation is accomplished. A turn is made immediately to the closest bi-sector heading of any quadrant. Upon receiving the first off-course signal, two legs of the range are eliminated.

It may be necessary, or desirable, in some instances to intercept a definite leg of the radio range in order to avoid danger areas, restricted areas, etc. This is done by first identifying the quadrant, then turning parallel to the undesired leg (or perpendicular to the desired leg).

HOLDING AND STACKING

Usually when instrument conditions exist at major air terminals a tremendous traffic control problem exists. The greater the volume of traffic, the more acute this problem becomes. It is necessary, therefore, that some delaying procedure be used to separate airplanes safely in the soup. This is the problem of the approach controller, who provides each plane with both lateral and vertical separation at a holding point. The system is known as "stacking." The length of time the top airplane must hold in a stack is determined by the time required for planes in lower positions of the stack to land. Since the delay might be of considerable duration, it is smart to fly the holding pattern at an airspeed with power settings which provide maximum endurance. When the initial position report is given to approach control, the approach controller will provide holding instructions and designate an expected





approach time. The primary reasons for giving an expected approach time are: to permit the safe execution of an approach in the event of air-to-ground communication failure; to designate a time for departing the holding fix inbound; and to indicate a time delay which might necessitate going to an alternate airport because of fuel limitations.

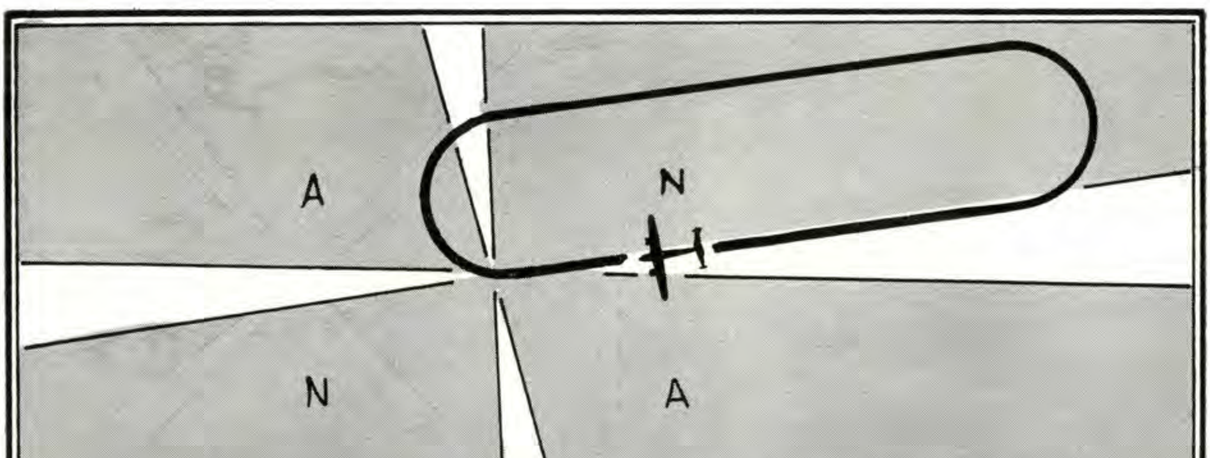
If the airplane is entering a holding pattern maneuvering for a low approach, then a procedure turn is made as soon as possible after the beam has been intercepted. The new standard holding pattern is elliptical. Holding instructions are given to the pilot by approach control at destination or en route by the appropriate Air Route Traffic Control agency. A specified holding point may be a radio range station, fan marker, or an intersection of two radio range legs, etc.

The elliptical (or race track) holding pattern is a simplified method of holding which is designed to expedite approaches. Follow the beam inbound on the holding leg. Upon crossing the holding fix, make a standard rate turn to the outbound beam heading corrected for any known wind drift. This turn is normally to the right unless otherwise instructed. The outbound beam heading is maintained for a maximum of two minutes followed by a turn to the inbound beam heading. If the airplane is approaching the holding fix while going outbound from the station, the holding pattern is entered by making a procedure turn one minute beyond the fix. This pattern is very flexible and enables the pilot to maneuver the airplane in such a manner as to be able to depart from the holding fix at any time the control agency may designate.

Flying two-minute legs requires six minutes to complete a holding circuit. If the expected approach time is moved up, the pattern should be shortened accordingly. Proper planning of the holding pattern will do much to expedite an approach and if each pilot, for example, would save four minutes, then 100 pilots would save over six hours.

When the plane making the approach reports below all clouds, the controller clears the next one to make an approach. The remaining planes are then lowered 1000 feet as soon as the altitudes are open. It is important to start descending as soon as instructed to do so, and to report when departing from an altitude. Often an airplane is given an altitude two or three thousand feet lower, and to expedite the control of traffic, descent should be made as rapidly as possible. A 2000-fpm rate of descent affords safe control while saving considerable time in the overall operation of the stack.

When the designated holding point is an intersection of two range legs, a definite procedure is used to determine whether the airplane is over the intersection. The control agency will specify the leg and the direction of the pattern. If the airplane is limited to one receiver, the radio must be retuned to the station transmitting the intersecting leg to determine the airplane's position relative to the intersection. When the on-course of the intersecting leg is received, the elliptical holding pattern is started. This procedure is repeated until the control agency provides other instructions. In airplanes equipped with two low-frequency radio receivers, one is tuned to the holding station and the second is tuned to the intersecting station. The stations are selected on the jackbox as required to determine the position relative to the intersection.



ALTIMETER FACTS

IT IS OF prime importance that pilots fully understand the errors altimeters are subject to. Listed below are a few of the most important facts about the altimeter and its ways.

THE BASIC FACTS

The altimeter is calibrated according to standard conditions of temperature and pressure. At sea level these standard conditions exist when barometric pressure is 29.92 inches Hg., and the temperature is 15 degrees C.

Because standard conditions seldom prevail, modern altimeters are equipped with an adjustable barometric scale. Setting the altimeter to the proper barometric scale reduces the possibility of incorrect readings.

The weight of the air column measured by the altimeter will vary because of changes in the air's density, which in turn is affected by variations in temperature and the flow of air over mountains. These are the factors which most frequently cause incorrect altimeter readings.

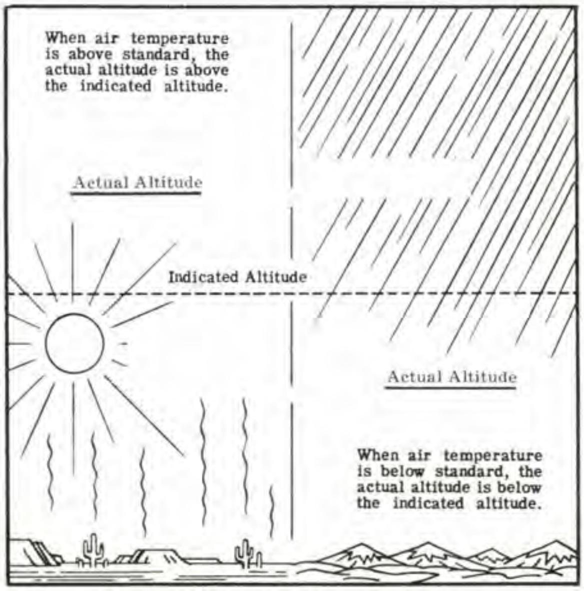
WEATHER EFFECTS

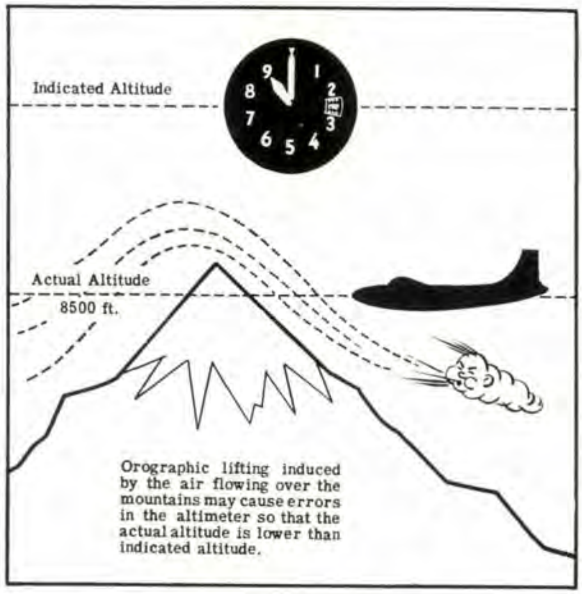
When flying into an area of higher barometric pressure, the actual altitude becomes higher than the indicated altitude, whereas when entering an area of lower barometric pressure the actual altitude becomes lower than the indicated altitude. The same is true when entering areas of higher or lower temperatures.

Venturi action or orographic lifting induced by the air flowing over the mountains may cause errors in the altimeter so that the actual altitude is lower than the indicated altitude. In extreme cases actual altitude may be 2500 feet below the indicated altitude.

In warmer than normal air a plane usually flies higher than indicated; in colder than normal air, lower. Operations in sub-zero weather with clear skies or over desert areas which radiate extreme heat will induce large errors between the actual and indicated altitude.

Squall lines and thunderstorms will cause major differences between true and indicated altitude because of fluctuating pressures. Altimeter errors are roughly proportioned to the intensity of the thunderstorms.





COMMON ERRORS (DONT'S)

Listed here are the most common pilot errors in regard to altimeters:

(1) Failure of pilot to set correct barometric pressure into his altimeter before takeoff and to check reading against field elevation.

(2) Failure of pilot to adjust altimeter setting while flying on course.

(3) Failure of pilot to adjust altitude for temperature.

(4) Failure of pilot to read altimeter correctly.

REMEMBER

Altimeter settings are computed with an artificial scale based on sea level normals. The sum of errors mounts with the effect of wind, temperature, terrain, and storms. Failure of pilots to know terrain elevation, either because they did not check it on maps or because they were off course, has caused many crashes.

POINTERS (DO'S)

(1) Before takeoff obtain the latest altimeter setting for the field from the tower, then set the barometric scale on the instrument to this setting. The hands of the altimeter should then indicate the surveyed altitude of the field above sea level.

(2) During flight you must continually correct the altimeter by resetting the barometric scale according to the latest altimeter setting of the area in which you are flying. Request it from the nearest radio facility.

(3) Before landing, again request the latest altimeter setting from the tower and reset the instrument accordingly so that you can depend on its accuracy.

Before clearing for an instrument flight, be sure the altitude you have requested gives you sufficient terrain clearance over your entire route. Then keep your altimeter reading at this altitude. Don't make mental corrections and try to figure your true altitude. Keep your indicated altitude corrected by resetting your altimeter from settings given you over your radio check points.

CENTRIFUGAL FORCES

Flight Safety Foundation reports an incident in which the tread tore off completely around the circumference of a transport plane's tire, damaged some of the skin and mechanism, and struck the handle of a combustion heater fuel valve. The valve opened and permitted fuel to drain from a tank.

Several years ago the blades of a centrifugal compressor on a military plane whirled off and cut the control cables.

These look like very unusual incidents, but are representative of the nature of the things that create trouble in aviation. Designers are seeking to relocate, as far as practical, any critical part that lies in the path of materiel that may be thrown off by centrifugal action.

Along this line, CAA regulations require that the plane of propeller blades be such that no crew or passenger seats are located within five degrees of that plane.

SMOKING HAZARD

A question has been raised as to the hazards of fire which may result from the drift of gasoline fumes to a point where spectators are smoking or where the exhaust of a piece of automotive equipment emits a hot spark. If the fumes were ignited, the resulting flash might go back to the airplane being refueled.

One oil company has written as follows:

"As to the danger from a spectator smoking a cigaret about 100 feet from a refueling point, it is possible for drifting gas fumes to be ignited, but in our opinion this would be liable to occur only under most unusual conditions. The greatest danger would occur, it seems, on a windless, warm, humid day when there would be very little circulation of air. Again, a temperature inversion, keeping still, cold air close to the ground would also give rise to a dangerous situation."

Smoking is always dangerous within 50 feet of a refueling point, and 100 feet is considered the minimum distance to offer safety under most conditions.

NOT FOR PILOTS

Pilots are being advised by the Civil Aeronautics Administration that use of the new drug, dramamine, as a cure or preventive for air sickness may cause undesirable effects.

Results of tests show that drowsiness is a common "side reaction" to taking dramamine. Slight dizziness, chills and detached sensations, loss of balance and difficulty of focusing eyes occur occasionally. The manufacturer of the drug previously issued a statement advising that side reactions may occur to an occasional individual. CAA officials believe that while these effects would not be harmful to passengers, they could prove hazardous to a pilot flying a plane.

However, the drug might be placed in life rafts to prevent sea sickness.

NEW AIR NAVIGATION PROGRAM

The preliminary phases of America's revolutionary new air navigation and traffic control system are moving rapidly toward completion.

At the same time, the Air Navigation Development Board is preparing to carry out the huge research and development program which must precede installation of the ultimate system planned for general use 12 to 15 years from now. Much of the equipment of the transition, or preliminary phase of the program is already in operation and will be in general use by the early 1950s.

The ultimate program calls for ingenious electronic computers to provide each pilot with a reserved landing time at his destination before he even begins his flight from a distant field. His progress toward his destination will be checked continuously by the electronic "brains." If he gets behind or ahead of schedule, he will be notified automatically by ground stations to slow down or speed up to the extent necessary to land at the proper moment.

A private-line radio system between plane and ground will permit instant automatic communication without interfering with other airplanes or ground stations, and much information now relayed by voice radio will be transmitted automatically and displayed in the airplane and on the ground by simple symbols.

From takeoff to landing, and even while taxiing on the airfield, each plane will be under the watchful eye of radar and similar equipment. Probably through applications of television, the pilot will be able to "see" his own plane and all traffic hazards about him on a pictorial display in his cockpit.

Eventually, the system as a whole will operate almost entirely automatically, with ground controllers serving largely as monitors. The system will be flexible enough, however, so that human controllers can take over instantly in case of a breakdown of equipment or an unexpected hazard in the air.

F-80 ELECTRIC CANOPY

According to Lockheed Aircraft Corporation, pilot safety was the prime consideration in the design of the new electrically-operated canopy for the F-80. It was purposely planned to operate slowly in order to utilize the greatest output of the actuating motor which allows the pilot to open or close the canopy in flight. The open-close switch has been placed in a strategic position, allowing the pilot to operate the canopy and yet keep his hand on the stick.

Enough retrofit kits are being manufactured for all F-80 series airplanes in order that this desirable safety feature may be incorporated in the future on Shooting Stars in service.

FLYING SAFETY AWARDS IN THE NATIONAL GUARD

In recognition of the efforts of Air National Guard units to eliminate aircraft accidents, the National Guard Bureau is adopting a system of Flying Safety Awards.

After due consideration, it appeared that the awards would best be made on a calendar year basis and given to Air Base Areas, which would include the squadron, its attached utility flight and group, and wing headquarters when attached for flying.

Total flying time and overall accidents will be computed into accident rates based upon 100,000 hours flying time.

Separate accident rates will be computed for fighter squadrons and light bombardment squadrons, or two squadrons of the same basic aircraft occupying the same Air Base Area. In the event of ties, the award will go to the Air Base Area recording the greatest amount of flying time.

ROLLING SAFELY TO A STOP

STOPPING AN AIRPLANE'S roll after landing without excessive wear and tear on tires and brakes is a demonstration of normal, good pilot procedure.

But sometimes conditions aren't normal, and it is obvious from the number of accidents caused when planes are not stopped before the end of the runway is reached that not all pilots know what to do to stop in the shortest possible distance when it becomes necessary. This is particularly true during periods of limited visibility or when runways are short, wet or icy.

When these unfavorable conditions exist, pilots sometimes undershoot in their efforts to land on the very first edge of the runway so that they will have room left to bring the plane to a stop. At other times planes are landed long through faulty judgment, and the pilot may damage the airplane attempting to stop. Likewise, it is sometimes necessary to abort a takeoff with little runway remaining.

Before discussing the best techniques to assist in bringing an airplane to a stop safely in an emergency, let us consider the various conditions other than pilot technique which affect landing-roll distances.

Ground-roll distance is almost tripled under some conditions. (Note chart prepared by an airline using a four-engine transport under varying load, wind and runway conditions.)

Friction available must be considered. Braking action is different on wet, icy or snow-covered runways, and the type of runway (concrete, macadam, sod, gravel) is important.

Weight is a factor. A lighter airplane will have less weight on the wheels, thus, skidding might occur with lightly loaded planes at lower speeds than would occur when brakes are applied on airplanes more heavily loaded. But at the same time, a heavily loaded airplane has increased landing speed and kinetic energy and, therefore, will require more braking action with possibilities for more wear on tires and damage to brakes.

Air density is a vital point to consider. The higher the airport the higher the landing ground speed even though the stalling indicated airspeed is the same. Faster landings mean more kinetic energy must be dissipated. High temperatures mean lower air densities and consequently faster landing speeds.

From the standpoint of pilot technique, the touchdown speed is important and the lowest speeds consistent with a safe approach are desirable. The touchdown point similarly is a key to safe landings which will not require excessive braking; the nearer the approach end of the runway, the better.

Landing direction should be into the wind, and uphill too, if possible. Both these favorable factors tend to lessen the amount of runway flown over, and both slow ground speed quickly.

There are two basic ways to assist in stopping an airplane after landing: (1) use of aerodynamic drag, and (2) use of mechanical braking.

It must be kept in mind that reducing the angle of attack quickly on landing, and retracting the flaps reduces the aerodynamic drag as well as the lift. Therefore, in ordinary landing rolls where emergency stopping is not a factor, it is better to use the aerodynamic drag available (full flaps and high angle of attack). This saves wear on brakes and tires, and eliminates costly repairs and maintenance.

When an emergency demands that the pilot obtain the most effective use of brakes, the following points are of extreme importance to put more weight on the wheels and thereby make the brakes more effective:

1. (a) Reduce the lift of the wings by raising flaps on contacting the ground; (b) decrease the angle of attack by keeping tail high on tailwheel airplanes and by putting the nosewheel on the ground quickly on nosewheel airplanes. (Research has indicated that increasing the weight on the main gear is more important *for quick stopping* than the aerodynamic braking of flaps and high angle of attack.)

2. Approach the point of incipient skid when braking an airplane, but *don't* skid the wheels. Maximum effective use of the brakes is accomplished in this way, but the pilot must be so well experienced in the feel of his airplane that there is no danger of nosing it up with the misuse of brakes.

Several instances of tire skidding and tire blowout have been attributed to improper application of the brakes. Tire blowout is apt to occur if the pilot applies the brakes before the airplane is firmly on the ground. Light brake application before the airplane is on the ground will start a skid when the wheels contact the runway. When the skid starts, the tire rubber begins to melt and lubricate the contact area. Once the skid is started, it will continue with very little brake pressure. Gravel on the runway will aggravate this condition.

There is a recent development called the "brake equalizer" which allows braking action up to the point of incipient skid but does not allow skidding no matter how hard the brakes are applied. A fraction of a second before the point is reached where a skid would normally set in on either wheel, the deceleration of the wheels on the runway causes a supplemental valve in the hydraulic system to open and reduce the braking power just enough to retain maximum braking action without skid. Should either wheel decrease in speed again to a point where a skid becomes imminent, the valve regulating it reopens and repeats the action as often as necessary until the airplane stops, always giving maximum braking power without skidding. This may be as great an advance as reversible pitch propellers in helping to solve the problem of stopping the airplane safely.

However, until these devices are made available on all USAF aircraft, it is up to the pilot to use with utmost care and safety the present equipment and apply basic knowledge and techniques in the safest possible manner.

Landing distances under various conditions—Distances (1) through (5) of the above graph indicate the effect of various factors other than pilot technique, upon airplane landing roll. Note that under the assumed conditions, the ground roll distance is almost tripled by the combination of an increase in weight and landing speed, a wind shift, and a wet runway. Although the figures have been determined for a Constellation, they may be conisdered as representative of any airplane.

Cross Feed

FLYING SAFETY
IDEA EXCHANGE

NIGHT MAPS

IT IS EVIDENT that night maps are a needed item as a navigational aid and safety factor.

Night maps should be printed marking all outstanding check points such as rivers, large cities, lakes, light lines and airfields. The shapes of these check points should be outlined as they appear to the pilot when he flies over the terrain at night. Airfields should be outlined for identification by the layout of their runways.

To avoid having to use a flashlight, which is awkward to handle and temporarily blinds the pilot when he uses it, these points should be printed in some kind of fluorescent or light-reflecting ink which could be seen under the fluorescent lights in the cockpit. The color of the ink could vary as to the point it depicts, such as red for danger areas, green for wooded areas, blue for water, and yellow for the outlines of cities.

The benefits which would be derived from such maps would more than compensate for the initial cost of printing.

1st Lt. Vidal J. Cortez
3555th Basic Pilot Tng Wg
Perrin AFB, Texas

RADIO FILTERS

The article "Static" (FLYING SAFETY, July 1949) is certainly a step toward more intelligent and better usage of the radio equipment presently installed in USAF aircraft. I believe the article should also have discussed use of the radio filter unit.

Intelligent use of the radio filter equipment and its three selector switch positions, "Range," "Voice," and "Both," in conjunction with the volume control on the interphone jackbox is highly important when combating static.

In conjunction with the loop position on the radio compass, the "CW" position makes it possible to identify signals under severe static conditions. The user does have to learn to switch from the "CW" position to the "Both" or "Voice" position when transmitting or listening to range weather broadcasts. Actually, the clarity of ranges on the "CW" position at extreme range when listening under severe static conditions is amazing.

Despite my being a communicator, it took me a long time to realize the real value of the radio filter equipment and judicious usage of the "CW," "Voice" and "Both" positions as conditions warrant. Too many pilots leave the selector switch on "Both" or "Voice" and never investigate the "CW" position which actually works like magic, to my way of thinking, in cutting down the static level.

Maj. Mike M. Kovacevich, USAF
1851st AACS Liaison Unit
RCAF Station, Edmonton, Alberta

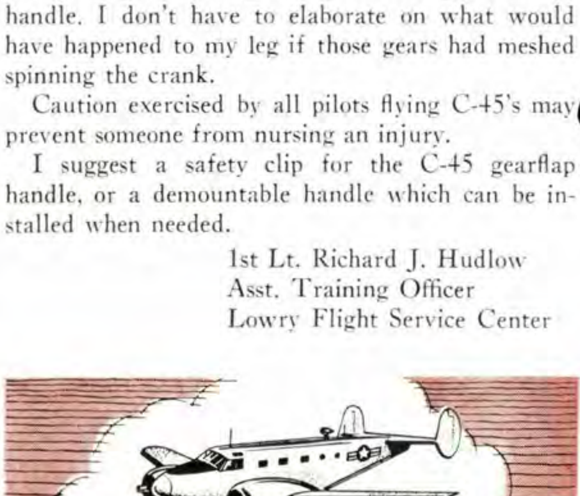
C-45 FLAP CRANK

Recently, I had finished giving some practice landings to a newly-assigned pilot and was occupying the left seat in a C-45. The airplane had been parked, and I was in the process of removing myself from the pilot's seat when the copilot decided to lower the flaps. While the flaps were going down, and while I was on the way out, my foot brushed against the emergency flap handle, pushing it in enough to cause the gears driven by the flaps in motion to growl and grind against the gears on the handle. I don't have to elaborate on what would have happened to my leg if those gears had meshed spinning the crank.

Caution exercised by all pilots flying C-45's may prevent someone from nursing an injury.

I suggest a safety clip for the C-45 gearflap handle, or a demountable handle which can be installed when needed.

1st Lt. Richard J. Hudlow
Asst. Training Officer
Lowry Flight Service Center



ENGINE FIRE PREVENTION

(ED. NOTE: In the interest of fire prevention in aircraft engines, Major Robertson advances the following as an explanation of how many such fires occur.)

A high percentage of all engine fires occur immediately after the engine power is interrupted or reduced. Continued study of this finding reveals what I believe is the reason for the igniting of leaking combustibles in the vicinity of aircraft reciprocating engines.

During ground tests, 100-octane fuel was sprayed on the exhaust stack of a B-17 outboard engine operating at a cruise power setting and auto-lean mixture. No fires resulted.

However, on changing the mixture setting to auto-rich with all other conditions remaining the same, a fire resulted in every instance.

Figures 1 and 2 show the difference in length of the flame emitted from the exhaust outlets in auto-lean and auto-rich conditions.

It will be seen from figure 1 that under auto-lean conditions the exhaust flame does not extend past zone A. A study of flame propagation velocity versus relative mixture shows that under auto-lean conditions depicted in figure 1, the air velocity (Va) is greater than the flame propagation velocity of the air-fuel mixture exposed to the exhaust flame.

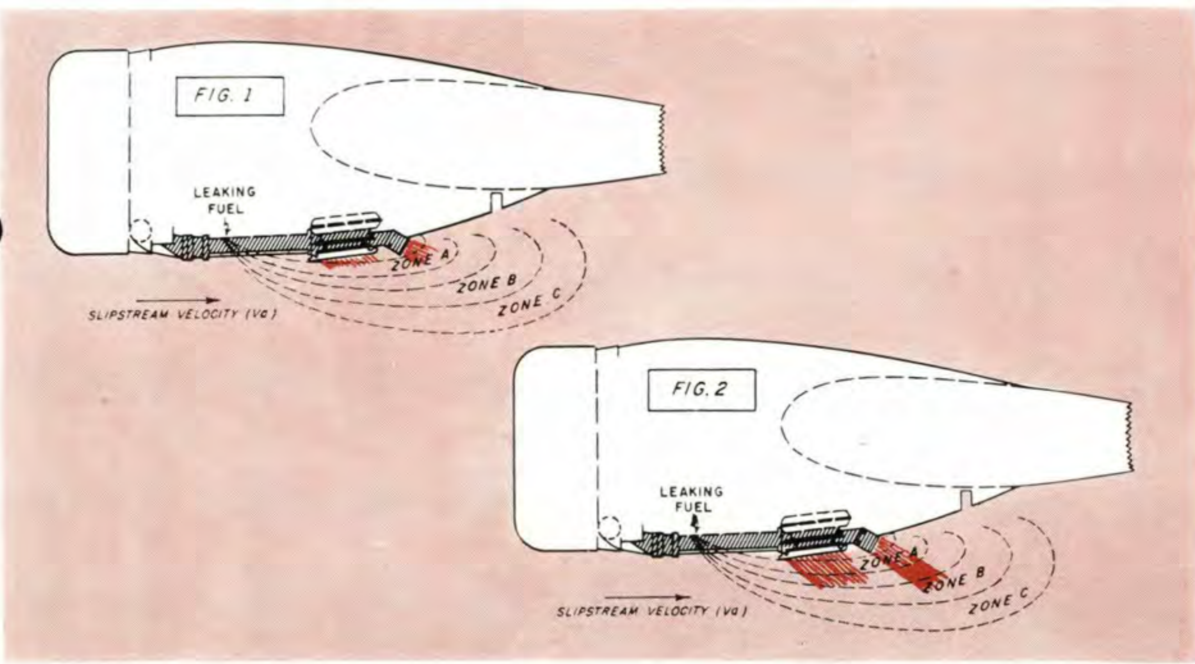
Therefore, the flame front cannot propagate forward to the source of the leaking fuel within the nacelle. Under these conditions the slipstream is an impenetrable fireproof barrier *even though it carried combustible mixtures within itself.*

Placing the mixture control in a rich position greatly extended the exhaust flame, and, in tests, resulted in a fire each time. As the blue exhaust flame extended with rich engine mixture, small flickers of yellow flame appeared toward the end of the exhaust flame, indicating optimum extension of exhaust flame before a fire was to be incurred. The yellow flickers of flame appeared only when leaking fuel was present in the slipstream.

Any further increase in richness of mixture will extend the exhaust flame into zone B, figure 2, where the flame propagation velocity of the air-fuel mixture exposed to the extended exhaust flame is greater than the air velocity (Va) of the slipstream. Theoretically, the flame front then moves forward at a velocity equal to the difference of the mixture's flame propagation velocity and the air stream velocity.

The above indicates the all-importance of air-fuel mixture flame propagation velocities, and it should now become obvious that disaster will occur if the slipstream velocity (Va) containing the leaking combustible is decelerated by either power failure, throttling the engine, opening the cowl flaps or reducing the aircraft velocity materially.

Maj. John A. Robertson
Kirtland AFB, New Mexico



DOUBLE-CHECK YOUR CLEARANCE

AIR TRAFFIC CONTROL TOWER, WASHINGTON NATIONAL AIRPORT, D. C.

IT IS THE prerogative of any pilot filing an IFR flight plan to request a desired altitude and route for his flight. However, because of other traffic, Air Traffic Control frequently finds it necessary to specify an altitude and/or route different from that requested by the pilot.

The air traffic controllers who make these changes don't make them just for amusement. It is their primary job to route air traffic along the airways to achieve the highest possible degree of safety.

The pilot who does not pay strict attention to altitude and route changes made by Air Traffic Control is not only lax and careless, but is literally taking his life in his own hands as well as the lives of other Air Force personnel and the crew and passengers of commercial airlines that fly the airways. Most pilots are aware of this, but several recent incidents have brought to light the fact that there are still a few pilots who evidently do not honor the judgment of ATC.

A recently published CAA NOTAM emphasized the situation in the following manner: "Air Traffic Control normally attempts to issue a traffic clearance specifying the altitude and route proposed in the flight plan. However, due to traffic conditions, it is frequently necessary that Air Traffic Control specify an altitude or route different from that requested by the pilot.

"It is important that pilots pay particular attention to the air traffic clearance and not assume that the route and altitude is the same as that requested in the flight plan. It is suggested that a written record be made at the time the clearance is received and that if any doubt exists, the pilot verify the clearance with Air Traffic Control."

In the majority of cases the pilot will be in his plane and ready to go by the time the ARTC clearance reaches him. It is at this point that the mistakes are made. A pilot might listen to the clearance; make a mental note of it; have that mental note blurred when his attention is distracted elsewhere; and then erroneously assume that the clearance is the same as the flight plan he filed.

There is a simple way to avoid such mistakes. Write it down. Not only will the writing give you a clearer mental retention of the facts, but you will have them down in black and white for fast reference in the air. The paper record will also simplify the matter of reading back your clearance for verification. It will eliminate guess work and erroneous conclusions.

In any case, if there is any doubt at all about your final flight plan or about changes in altitudes en route, don't be satisfied with a "Well, I guess it's right." Double-check your clearance.

WHY?

THESE TWO B-25's were allowed to get cozy when the assistant crew chief of one was preflighting the airplane.

Both he and the crew chief had approached their plane early in the morning and prepared it for preflight by removing the tie-down ropes and wheel covers. Chocks were left in place and the assistant crawled into the airplane to perform the preflight. The crew chief stood fireguard for him and then went into the hangar to transcribe from the Form 1 to 41B.

The assistant claims he set the parking brake upon entering the cockpit and checked the brake pressure as normal. After warmup, he checked the magnetos and found that one of them caused an excessive rpm drop. So power was increased on both engines to 2400 rpm to clear out the engines and check the manifold pressure.

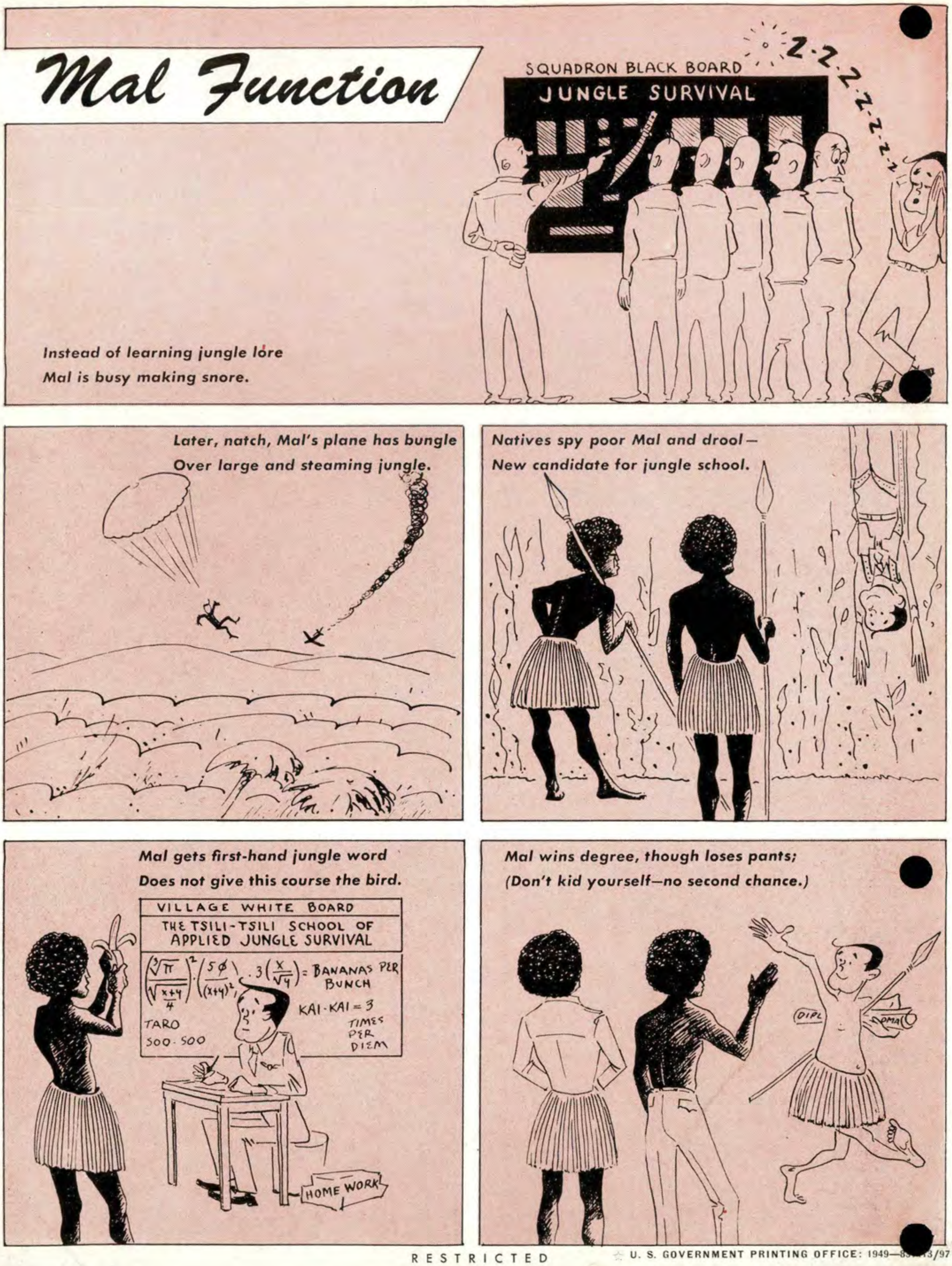
At this time he noticed one manifold pressure reading 30" Hg. and the other 28" Hg. Consequently he put his head down into the cockpit to get a better view of the instruments. Then he felt a jar as the B-25 jumped the chocks.

When the assistant looked up he saw the B-25 moving towards its stablemate parked about 50 yards in front. He retarded throttles and applied brakes, but with no effect. Finally he applied power to the right engine in an effort to clear the other B-25. Instead, the airplane swung around so that its nose section bored into the left rear nacelle of the parked B-25. The results are visible above.

Pressure was said to be normal in the brake system before preflight, yet the brakes didn't hold during runup of the engines.

Why weren't the emergency air brakes used?

Investigation revealed that the assistant crew chief was on orders as "qualified" to preflight.



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