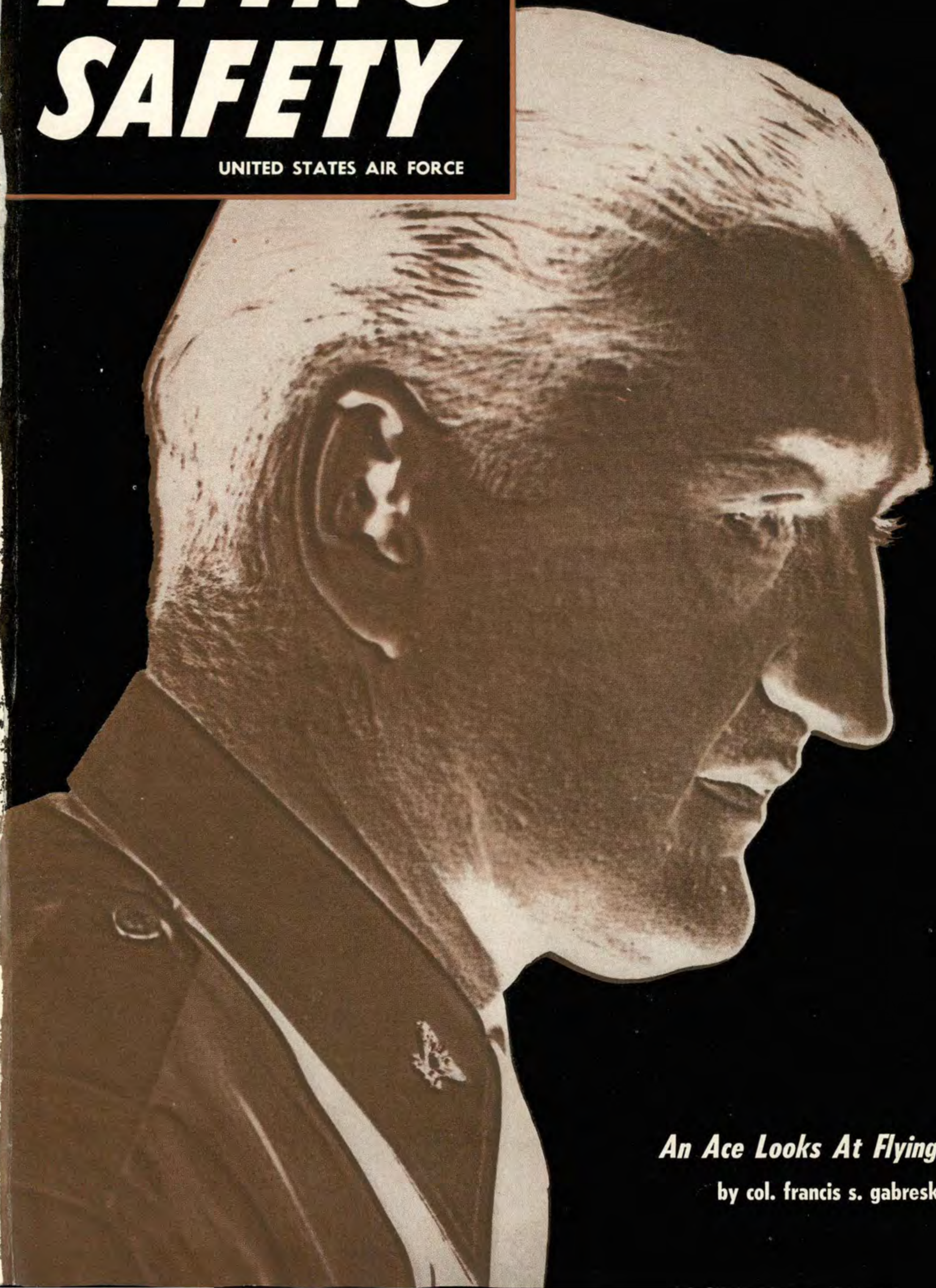
FLYING SAFETY

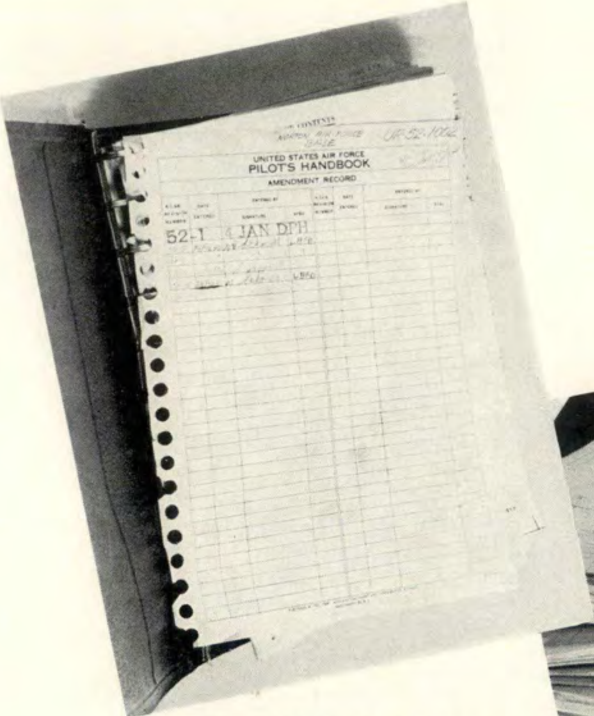
UNITED STATES AIR FORCE

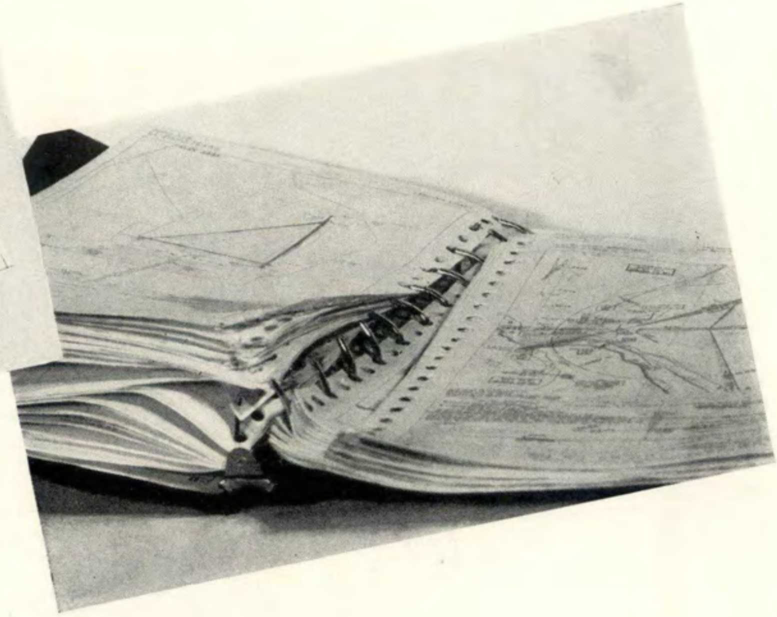
FEBRUARY 1953



An Ace Looks At Flying Safety

by col. francis s. gabreski





*Vernacular for Pilot's Hand book, United States or "East-West Book." AFR 5-34 lays down the rules for keeping up the handbook.

TREAT YOUR  PHACUS*

KINDLY!

Pictured here, gentlemen, is a horrible example of what can happen to your PHACUS when it's mistreated.

Can you imagine yourself approaching a strange range. You ask your copilot for the handbook and here's what you get . . . a battered bulk, with no revisions since February, 1952.

You can't find the letdown for Goofle Corners. So you use your Facility Chart in desperation, and pray that you make it.

CHECK YOUR FLIGHT MANUALS BEFORE EACH TAKEOFF

VOL. 9 NO. 2 FEBRUARY 1953

FLYING SAFETY

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Colonel Francis S. Gabreski's views on flying safety in combat is this month's lead-off. "Gabby" feels strongly about the value of flight safety practices at home and abroad. The story on Arctic flying by Capt. "Shaky" Williams (Page 6) reflects the author's experience based on over 4000 hours of polar flight. Capt. Williams has flown in the Arctic every winter since 1945. The story from the USAF Instrument School on page 22 should be required reading for everyone who ventures on the gages . . . tyro or oldster. "High Speed Flight" on page 14 is a condensation of a manual published through the auspices of Air Material Command, and should be reviewed by all jet pilots. The story on taxi accidents (page 10) has as a basis a very detailed study recently published by the Directorate of Flight Safety Research. Commanders may request copies of this study.

The photographic technique used in reproducing Colonel Gabreski's profile on the front cover is called "bas relief" in the trade. The effect was achieved by superimposing a positive and a negative, slightly off register, which gives a "stereo" or third dimensional effect. Those four queens on the back cover emphasize four very important basic points for every pilot to "pin up" on his bedroom wall!

The March issue of FLYING SAFETY will stress the Air Weather Service and its many operational phases throughout the world. Of particular interest will be a feature article that highlights the results of a very extensive study on weather accidents recently completed by the Directorate of Flight Safety Research.

***The editors of* Flying Safety** are gratified at the marked increase in "Letters to the Editor." This shows increased reader-interest from all parts of the Air Force. We will try to print all your letters, even though we may have to scissor them down to a nub to fit them into the space we have available.

F-86-D's are typical examples of high speed flight; they've got dual personalities, too. See p. 14.

AN ACE LOOKS at FLYING SAFETY

By Colonel Francis S. Gabreski

AT 0655, when the briefing was over, Colonel George Jones, commanding officer of the 51st Fighter-Interceptor Group, sent us out to the ships 15 minutes early with instructions to give everything a careful final going-over, paying particular attention to a thorough cockpit check of instruments and switches. And he also cautioned us about our post-takeoff check.

Takeoff at 0715 was uneventful. Twenty-five minutes later we were over Mig Alley at 38,000 feet; weather, thin and scattered; no activity at the moment.

Suddenly Tiger Red Leader broke radio silence. "I've got a flameout . . . no thrust . . . fuel pressure and RPM down . . . heading home . . . I hope!"

He immediately broke formation and headed in the direction of the U.N. lines, many minutes away.

We got the full story later. Here's what happened.

As soon as Tiger Red Leader felt his flameout he started emergency procedure for an air start. Realizing that he was too high for a successful start, he established his glide, but held off trying a start until he got down to about 18,000 feet. Then he tried to fire-up. No soap. He ran another cockpit check to try and locate his difficulty.

On this second cockpit check, he discovered that his emergency fuel boost was turned on. He had missed it during his post-takeoff check, and it had been on for the entire duration of the flight.

He turned it off, pulled up the nose to let the excess fuel drain out of the tailpipe, and then, at about 9,000 feet (still high enough to elect to eject or ride it down) he tried again. This time it took, and he made it back to the airstrip OK. But . . . the squadron was short a plane during the rest of the mission.

During his climb to 38,000 feet, using high power, Tiger Red Leader's emergency fuel boost never got that final push to set it in operation. But . . . when he reached his assigned altitude, and throttled back to cruise, the emergency fuel boost automatically cut in, and poured an excess of raw fuel into the combustion chambers to give him a rich flameout.

If Tiger Red Leader had made a complete cockpit check after takeoff he would have found the emergency fuel boost still in the "on" position and would have turned it off according to routine procedure . . . flight safety procedure. But he didn't.

Knew Procedure

The fact that he managed to come out of the deal all right is testimony to the fact that at least he *did* know his emergency procedure well, and that he kept calm and found out what was wrong. Another flight safety factor contributing to his eventual success, was the fact that he tried his second airstart at an altitude where he could still eject or plan a crash landing. He would have been in king size trouble if he hadn't been well informed as to what to do, and had the presence of mind to make the second cockpit check that revealed the emergency fuel boost still turned on.

That's where carefully cultivated flight safety habits prove their insurance value.

This particular example of both pro's and con's of flight safety practice has a happy ending. That's not always the case.

I guess there may be a few pilots who have the idea that flight safety is a term that applies primarily to Stateside . . . or peacetime . . . flying. Maybe they have the mistaken idea that once they get into combat some form of magic takes place. Maybe they believe that because of the stepped-up tempo of combat flying, the functional and mechanical hazards of flying conveniently bow out of the picture to make room for the hazards of Mig 15's.

If that *did* happen, it would be swell. It would take a load off the minds of pilots, maintenance personnel, commanding officers, and everyone connected with the operation.

But it doesn't happen!

Regardless of whether you are flying in the States, Europe or Korea; whether you pilot F-86's, B-29's, B-47's or what-have-you, the principles of flight safety keep right on being vital to the success of each individual mission—combat or otherwise.

Any pilot who forgets that automatically relegates himself to the ranks of "Those most apt to run into trouble."

Gadgets Still There

Nothing much changes about your airplane when you go into combat. You don't leave that flock of gadgets and gages, switches and buttons, on the ground when you take off. They stay right there, and they still have to be checked and double-checked. Those "routine" cockpit checks are never "routine" in terms of consequences. The engine that powers your airplane in combat is just about the same engine that you used in training. You'll have some of the same problems . . . get about the same performance . . . need about the same amount of maintenance.

And right here and now, let me explain something about maintenance —even though I know most pilots are already aware of it. In combat areas crews have done, and are continuing to do a remarkable job of taking care of ailing airplanes under some of the toughest conditions you can imagine. It gets mighty uncomfortable and difficult to work on an airplane in a revetment, with the temperature down at the bottom of a thermometer. If it isn't cold, the wind is blowing and the dust is flying. If the wind isn't blowing the sun is beating down on the airplane, making parts hot enough to scorch your hands. Those are problems of nature.

Add to those problems the fact that spare parts and special tools are sometimes slow in getting to the forward areas. Consider the amount of improvisation that the crews are forced to dream-up to get the job done. All these things make the job of field maintenance a tough one, and magnify the reasons why you must check, double-check, then check again.

Wing tanks like these increase range but it's wise to double check predicted fuel consumption and reserve along with winds aloft.

The crews are turning out splendid work, but field maintenance just can't be compared with the formal maintenance possible at a Stateside depot. Remember that, and make flight safety practices and procedures pay off for you.

Pilot's Best Friend

After all, you are the only guy in the world who has the maximum of personal interest in being satisfied that your airplane is ready. You are the guy who will put it to the test. You are the one who wants to ride home in that same cockpit.

Even if it's just for review, take down your T. O. book every once in a while. It's a good habit. Regardless of how well you know your airplane, modifications and new fixes are coming out all the time. Your dash-one will help you keep posted on what's new. As far as I'm concerned, I like to go into these changes carefully. I'm not satisfied with someone giving me a verbal rundown on a new installation, or fix. I'm going to fly the airplane, and I'm the one who has to know what to do. I try to study modifications so that I understand *why* they were made, what they mean in terms of performance and safety, and what to do if something goes haywire.

A good, thorough cockpit check takeoff can save a lot of trouble when the chips are down in combat flying.

I think it's a mighty good idea to talk over any changes with your crew, too. I like to make sure we all know what we are talking about, how the changes are going to be made, and what effect they will have on the airplane.

Another important point . . .

The pilot who doesn't know his emergency procedures backward and forward is about as smart as a guy who thinks a fast game of Russian Roulette is a dandy rainy day game for the kiddies.

If an emergency does occur, whether it calls for an airstart or ejection, the pilot with the best chance of beating the rap is the one who knows exactly what to do—and what to do *first!* You need a full understanding of your airplane, equipment, and characteristics when payoff time comes. Don't leave it to chance. That's where study, curiosity and T. O. review come into the picture. I hope the phrase "panic button" is on the way out! Your best insurance against panic is *knowledge*. You won't need a "panic button" if you know what to do! If you know what's wrong you can try to correct it. If it won't fix, you can decide whether to crash land or get out. And you can come to your conclusion *fast* —if you have knowledge.

The briefing is not the end of combat flight planning by a long shot. Things can get pretty well confused once you get under way. It's still up to you to do some careful flight planning on your own.

Always anticipate the "unexpected." Always be prepared for worse weather than you were briefed to expect. Study your maps. Know where your alternates are in terms of your flight plan. Double check your predicted fuel consumption and reserve. Anticipate that you may turn up with less fuel than the experts say you should have. Make sure of whatever navigational aids you may have. Think ahead. Anticipate! Your flight doesn't always go according to Hoyle.

How Far Can You Go . . . ?

We've lost some fine pilots—just because they went a little bit too far in trying to make a successful pass at an enemy plane, a hilltop installation, a road. Be sure you know and understand both the capabilities and the limitations of your airplane. Stay alert! Don't get sucked into a maneuver that you can't get out of with safety. Don't let yourself get put on the spot. We've had some pretty brutal and permanent examples of what happens if you let your airplane get ahead of you.

Sure, it's true that few pilots ever exceed flight limitations *intentionally*. But the fact that the mistake was *unintentional* doesn't alter the consequences. Anticipate the reaction your plane will have to every move you make. Keep your flight limitations in mind every minute of the trip. There's no victory if you can't pull out of a high speed dive, or if you pull off a wing trying!

". . . . Never put yourself 'on the spot'. Anticipate! Plan ahead! Keep Alert! . . ."

And don't forget your own capabilities and limitations! Excessive G's and lack of oxygen are still high on the list of combat flying errors.

In combat it is frequently impossible or mighty inconvenient to try to check your accelerometer when you're tangling with a Mig or when you're strafing or dive bombing. Yet *something* has to warn you if you are getting in a tight spot in terms of speed and G's. I suggest you practice *sensible* G maneuvers in your spare time, using the accelerometer as a check, and develop your own personal *feel* for the symptoms of high G's and indications of your own tolerance. Don't flirt with blackout. You can't control it and you have no way of knowing in advance just how serious your "blackout period" may prove to be. Use your anti-G equipment and be sure it's in good condition. Fly within your own limitations.

You'd think that enough has been said and written about oxygen. Yet every once in a while we lose a pilot and an airplane due to lack of oxygen. Certainly your cockpit check includes your oxygen equipment and supply. How anybody gets set for takeoff without a full supply of oxygen . . . I don't know. As a matter of fact, I think we must assume—in some cases—that although the oxygen supply was adequate, the oxygen equipment was faulty. Make sure you check your mask, your hose, and your connections. If your oxygen system fails, or if, for any reason you start feeling woozy, don't wait around at high altitude while you try to trace your trouble. Get down first—then check your equipment. If you're up around 30,000 feet, you only have a few seconds of consciousness without oxygen. Get down to an altitude where oxygen isn't necessary, then find out what's the trouble.

Another physiological thing worth bringing up again—. Keep yourself in good physical condition and stay on the ball. Nobody wants a wingman with a hangover, or with his mind cluttered up with a lot of per-

COLONEL GABRESKI has been assigned as Chief, Combat Operations Branch, Office of The Inspector General, Norton AFB, since his return from Korea in June of 1952.

The former commanding officer of the 51st Fighter-Interceptor Wing, Colonel Gabreski became history's eighth "jet ace" on 1 April 1952. Later he shot down an enemy aircraft that brought his total number of jets destroyed to 6½, and his total number of aircraft of all types shot down to 37½.

Colonel Gabreski entered pilot training in July, 1940, after having attended the University of Notre Dame for three years as a pre-medical student. His first assignment was with the 45th Fighter Squadron in Hawaii, from where he went to England as Liaison Officer to the Polish Air Force, flying 20 missions with them. In February, 1943, the Colonel was assigned to the 56th Fighter Group. He was shot down over enemy territory in July, 1944, and remained a prisoner of war until May, 1945. During his tour in Europe, Colonel Gabreski flew 166 combat missions, and was credited with shooting down 31 enemy aircraft. After his liberation from prisoner of war camp, Colonel Gabreski returned to the United States and was assigned to Wright Field, Ohio, as Chief, Fighter Test Section. The Colonel was recalled to active duty in April, 1947, and was assigned to the 55th Fighter Squadron, Shaw AFB. After completing his schooling at Columbia, Colonel Gabreski was assigned to his old World War II organization, the 56th Fighter Group. In June, 1951, he was assigned to the 4th Fighter-Interceptor Wing in Korea.

The fundamental principles of flying safety still apply whether you're taking off from a muddy Korean runway with a JATO-equipped jet fighter, or flying a T-6 for training.

sonal problems. Flying is serious business and takes all the powers of concentration you have.

This article doesn't have all the answers. I don't have all the answers. I wish I did. But the things I mentioned are things that I know about and that I think will bear repeating again. I think they represent some of the most important things to keep in mind. Let me summarize them for you in checklist fashion:

- Learn everything you can about your airplane and about your emergency procedures. Keep posted on any modifications or changes and be sure you understand *why* they are made and how they will effect you and your airplane.
- Be sure you know the capabilities of your airplane and yourself, and make it a point never to exceed them.
- Never put yourself "on the spot." Anticipate! Plan ahead! Keep alert!
- Preflight carefully. Always double check your cockpit switches and your instruments. Remember your pitot cover.
- After takeoff, check and double-check again. Sooner or later your post-takeoff check will reveal something important that you overlooked.
- Be ready for weather or other changes in your flight plan. Be sure you allow for alternative. *Always* assume that you will have to use one.
- Develop cockpit procedures that are suited to you, but make sure they include *everything*, and be sure you understand exactly what you are accomplishing by making your checks.
- Always stay on top of the situation. Keep calm, particularly in emergencies. It's then that you need all the concentration you can muster. Knowledge of your airplane and knowledge of proper emergency procedure are the best safeguards against panic.
- Keep in good physical condition and keep your mind free of cobwebs. Keep your mind on your flying.

Sure, I know. You've heard all of this, time and again. OK. But both you and I know that before the week is out, we'll hear about some guy cracking up an airplane because he either forgot or ignored one or more principles of flight safety. Here's hoping it isn't you—or me. ●

WHEN YOU FLY THE

This feature is one of several cold weather subjects suggested by Lt. Gen. Wm. E. Kepner, Commander, Alaskan Command. FLYING SAFETY *magazine plays an important part in the cold weather training program of the Alaskan Command.*

By Capt. Donald E. Williams

IN days gone by, when the fastest form of locomotion in the colder climes was supplied by either a horse or dog hauling a sled, preparation for a journey over the winter wastes was fairly simple. The poor unfortunate doing the driving merely piled on all the fur he could stand, sucked up as much of the local antifreeze as he could handle and still remain upright; and pushed off.

Today, travel in the Arctic, at least using large iron birds, involves slightly more forethought. But, and it is a *big* but, with proper planning, far North travel via aircraft can be less hazardous than the old sled routine. The gimmick lies in the *planning*.

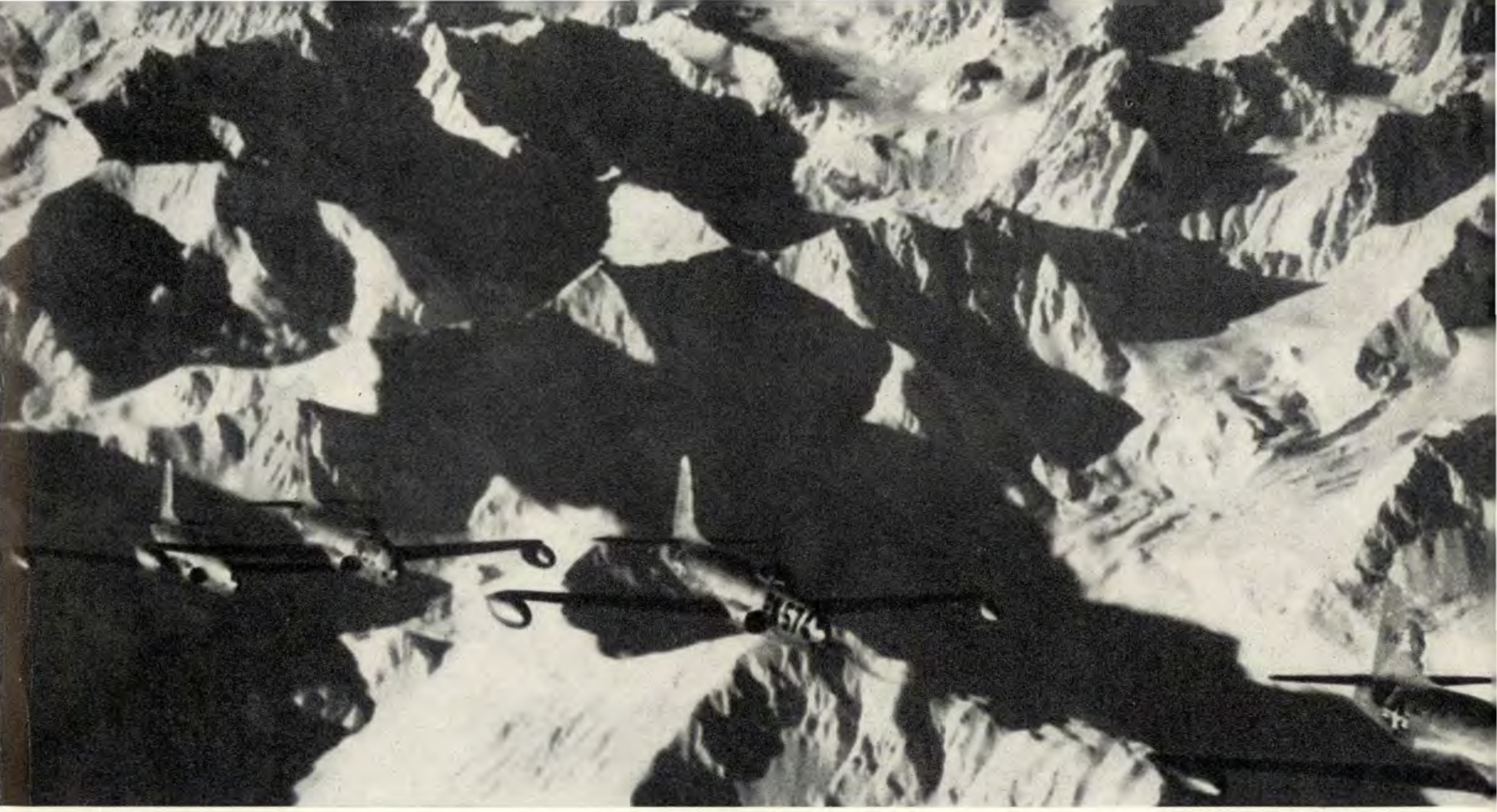
The planning starts when the pilot goes in to get his weather briefing. If he is interested in going all the way with a minimum of sweat he will pay attention whilst the forecaster speaks. Weather up North has a way of sneaking up on a man so that before he knows it, things have become rather uncomfortable. If the forecaster's tale wends toward the pessimistic side it is wiser to prepare for the worst rather than to hope wishfully for the better. It is my opinion that the worst usually is what is encountered. Weather tends to deteriorate rapidly and too many pilots have underestimated the potentialities of a full-blown Arctic storm.

A big factor in planning a flight, both from a navigational and a safety angle, is the strong winds that seem to pick up in northernmost areas with the slightest provocation. Any time the winds are forecast for 40 knots or better, you can figure that somewhere en route you will probably run up against some winds blowing at a good bit better clip than four-o.

Orographic winds of high velocity can present unusual navigation problems due to the amount of crosswind necessary to hold your course. Sometimes drift correction is such that a pilot mistrusts his radio and shortly thereafter wakes up badly misplaced. Other consequences of orographic winds are extreme turbulence, usually over mountainous terrain, and very strong up and down drafts. More than one pilot, flying in the Arctic, has suddenly found himself being pulled down below peak level when all seemed secure. Occasionally, when on one of these one-way elevators, full power is not sufficient to pull out; results are then as always when a moving object meets an irresistible force.

Weather vs. Fuel

Speaking of weather, I make it a habit to use all available sources of weather information, both military and CAA, for in-flight reports, especially when the weather looks like it is forming. Arctic weather has a bad habit of deteriorating rapidly. It is necessary to pay extremely close attention to gas consumption. Know your point of no return on every



NORTHERN ROUTES

flight. On several flights I have made, winds became so strong that my groundspeed dropped below 100 knots. After figuring my gas consumption, based on that groundspeed, I had to return to my departure point even though ordinarily I would have had plenty of fuel in reserve.

Another little item that can't be overestimated when flying in cold regions is the preflight check. Set up a standard procedure for checking your aircraft, following the checklist and stick to it. Don't take off unless *all* the equipment is functioning perfectly.

On the visual, be sure the external drain lines are short. If they are too long, engine heat is unable to prevent them from clogging. I learned this the hard way when my oil breather lines were too long and gradually clogged up as the oil congealed. After the lines were plugged pressure built up in the oil tank until it blew the top out.

After going through the cockpit checklist it is a good idea to double check all the radio equipment. Tune in the ADF and command and be sure that you are getting the same signal on both, check all VHF channels for operation and UHF if available. In this respect, it is a good idea for a pilot flying in the North to know how to operate the liaison set as well. In cold weather it takes a long time for radar and radio sets to warm up; be positive that yours have had sufficient time to be fully operative.

One of the quickest ways I know to wind up in a tangled heap off the end of the runway is to make an ITO with sluggish instruments. You might be surprised at how easily this can happen in cold weather if the aircraft and instruments have not been warmed up for at least 40 minutes immediately prior to takeoff. If the instruments have frozen they will still be sluggish and partially inoperative after a normal runup.

Psychological Angle

One of the toughest angles of Arctic flying is the psychological angle. A pilot knows that he has got to be extra careful for his troubles only start after ditching or bailing out. After getting on the ground, the big problem is one of survival. I might add that I would only bail out in far North winter weather if it were absolutely impossible for me to make a crash landing due to a bad fire or some major structural failure. Survival chances are very poor without the aircraft and assorted equipment.

If you are a guy who likes the percentage going for you, learn your survival procedures and how to use the equipment correctly. And make sure before takeoff that it is all there, and working properly. If you are down in 50-below temperatures, you don't have much time to fool around with experimentation and hunting equipment.

A grid system of navigation must be substituted for the familiar meridians and parallels of an aeronautical chart. The magnetic compass is useless due to proximity of the magnetic pole which creates dip effects and extreme variation changes.

Radar scope interpretation is also different; it often picks up false reflections. Low lying land gives the same impression as ice in many areas.

Another hazard to watch out for is that pilot's nightmare, a false altimeter reading. Inversions are common in Arctic weather and I have found my altimeter to be as much as 1000 feet off after flying from a warm air mass into a cold air mass. By off, I mean a reading of 1000 feet higher than I actually was. To be absolutely safe I maintain a minimum of at least 2000 feet above all terrain and higher when possible.

Another touchy phase of Arctic flying is icing. Actually icing conditions are no worse than in the States, with one big difference. The big difference is that you can't climb up and melt the clear stuff off. When you start picking up ice it will usually form *very rapidly* and best you do something instantly or sooner. Try and climb out of the freezing level because the ice will almost certainly remain with you and flying speed will drop off very quickly.

Another phenomena which will confuse you is ice fog. Things can be clear all along the route and you figure you have it made when suddenly you arrive at the destination only to find visibility is restricted to straight down. Under certain conditions it can form just by aircraft running up or taking off, and there is nothing to do but go to an alternate, if possible, or use GCA to get down.

Radio Blackouts

Regional phenomena that can cause trouble are the communications blackouts. A blackout can affect any of the radio sets aboard, VHF, command, ADF or liaison. It will not affect the key position on liaison and position reports can be sent and received using a keying frequency. However, it is rare when all the various sets go out at once. Sometimes, using the ten position Collins liaison transmitter, you can by-pass or skip one station and transmit to and receive another station much farther away.

About the Author

Capt. Donald E. Williams, who expresses a preference for flying in the Arctic regions, has logged 4,000-odd hours of flying time in various type aircraft while stationed in Alaska and Labrador. He participated in Project Beetle in 1948; Project Resupply in 1950-51, and has flown the Arctic every winter since 1945. Currently he is assigned to the 1738th Ferry Squadron, Long Beach, California. His latest missions were ferrying C-124's to the Alaskan theater.

A sort of last ditch measure that I have used several times when I had radio trouble was to tune my bird-dog in to the teletype frequency at my destination. Naturally, it is better to use D/F steers if possible, as the teletype frequency carries no identification signals and may be switched to another frequency in the middle of a transmission. You have to obtain the frequency before takeoff as no publication carried aboard the aircraft has it. Don't consider using it unless all else has failed and be sure to tune in accurately as you could pick up the wrong station which might be only a few degrees off. However, as a last resort deal, it can be used and you can pick it up 600 to 700 miles out.

Here, an F-80 cockpit is preheated; watch for windshield ice if ground haze is present during takeoff.

One procedure a pilot should have down pat if he is to fly successfully in the Arctic is the use of the ADF. I have noticed that a good many pilots could stand a little brushing up on bird-dog techniques, so here goes.

I don't believe that Arctic weather causes any more radio interference than equivalent Stateside weather causes. But you do have to cross-check your set more carefully. For one thing be careful in tuning; sometimes you get a beam reversal when on compass position. Be sure which side your A and N are on, and occasionally turn to Antenna position to make sure you haven't got the reversal. I also check the compass position against the aural null frequently as a further safeguard.

Precision is a necessary ingredient for tracking. Procedures for tracking outbound, or away from the station are practically the same as tracking inbound. The drift corrections are made in the same manner with the difference being needle movement relative to the 180 marker on the azimuth scale. If the needle moves to the right, the turn is to the right, and for needle left deflection, turn left.

If you're outbound and off track, turn toward your track and the azimuth needle will indicate the original degree off track plus the degree of intercept. The needle will move toward the tail as you approach the track. When the azimuth needle equals the degree of interception, you're squared away and on track again.

Intercepting a Bearing

If you're IFR and want to track into or away from a radio fix on a definite magnetic bearing and you have to make an interception, then you'll follow the same procedure as simple tracking—except that the degree of intercept will be greater.

Primarily, to intercept a magnetic bearing, your position in relation to the station and the magnetic bearing must be determined. Do this by turning to the mag heading of the bearing and watch the needle to find out whether the station and mag bearing are to your left or right. By turning the plane toward the bearing, the number of degrees the needle is deflected from the zero position, the course set up will intercept the bearing at the station. To reach the bearing before the station, the number of degrees would be increased.

For intercepting an outbound predetermined bearing, the same procedures as inbound techniques are used. Twice the number of degrees the pointer is moved left or right of the 180 position on the azimuth scale is the amount of turn necessary for the intercept.

Time from aircraft to station is the SOP of turning the plane until the pointer gives an indication of 90° or 270°. Note the time and hold a constant mag heading until there is a 5° to 10° bearing change.

Then apply the familiar formula: 60 × minutes between bearings divided by the degrees of bearing change to get the time in minutes to the station.

Radio ranges, while simple and easy to use, do not meet ALL navigation situations. They have been known to be inoperative at times; anyhow, you may strike a field where it will not be convenient to use the range. Consequently, some other means of approach will have to be used, so again you can rely on your ADF. Letdowns can be made using control towers, homing stations or a commercial radio station.

The procedures used in radio compass approaches are closely similar to the range approaches, the difference being that the pilot has to plan his own letdown. The complete approach should be planned before the letdown is started.

After initial station passage, turn the plane to the outbound heading and, if you're cleared for an immediate approach, make good your track until the procedure turn. Make a landing check on passing the station. Be sure the altitudes used safely clear all obstructions and high terrain. Naturally the distance of the "station" from the field will determine the exact procedure to be used.

Aural Null Procedures

If the ADF goes flooey for one reason or another, aural null, the emergency procedures are in order. For aural null operations the selector switch is moved to "Loop" position and the CW-Voice switch turned to CW. Best types of stations to use are homing, the Adcock range, and commercial stations.

The procedures for an aural null the same as for ADF with the exception of manually operating the loop to point the azimuth needle at the station. Homing, tracking, interception of bearings are done the same as in ADF—but the references are no longer visual. The null must be recognized or "heard," and then the azimuth needle checked for relative bearing to station.

Null width is controlled by use of volume. An increase in volume narrows the null, and a decrease will widen the null. For all aural null work the volume should be adjusted for a null width of about five degrees. Far from the station the null is wider than five degrees even with maximum volume. In severe static the width of the null can be increased to eliminate as much of the static as possible.

In solving the 180 degree ambiguity, hold a constant gyro heading, rotate loop and obtain null, note direction and number of degrees to manually turn loop to nearest wingtip position, turn aircraft the same number of degrees in the opposite direction on the gyro. Note heading and time. If the null moves to the right, station is right; if left, station is left.

After solving the 180 ambiguity and the time check, a turn of approximately 100 degrees should put the null on the nose of the plane and you can home to the station.

There are several definite methods of recognizing station passage and two of these techniques are as follows:

The first method is to continue attempting to monitor the position of the null (nose null method); the other procedure is to put the needle on a wingtip position just before reaching the station and waiting for this null to indicate station passage (wing tip null method).

Nose-null:

- Rapid surge of volume, rapid narrowing of null as station is approached.
- Movement of null, while holding heading, from nose to tail.
- Loss of null for 30 degrees to either side of nose after null has been steady during approach.
- Complete loss of null when right over station.
- Shift in null from one side of aircraft heading to the other.
- Reception of modulated signal heard above the CW tone.
- Widening of null. Within 30 seconds after station passage, null will widen with no change in volume control.

Wing Tip Method

For the wing tip null method, if the station has not been passed and a steady heading is being held with passage anticipated within one minute, then: Swing loop to wing tip position; reduce volume to comfortable level; wait for passage of null through wing tip position as station is passed; check time, wait 30 seconds and find null (near tail position), adjust width and track outbound.

Low approach procedures are the same as with ADF, and the choice is up to the man doing the flying. In a situation with only the loop antenna available for reception and the facility to be used is a radio range, there is a choice of either using the regular aural null procedures or using the loop as an auxiliary antenna and carrying out normal radio range procedures. The type of station, Adcock or Loop, must be considered in choosing the procedure to follow.

With an Adcock station either technique may be used with accuracy. If the station is Loop type, aural null procedures are not as accurate, because the loop station does not transmit a continuous wave.

The "bird-dog" equipment or radio compass is one of the best radio aids to navigation in the airplane. Correct and precise procedures go hand in hand with safety. It's familiar equipment and if you use it properly it will come to your aid many times in your future flying.

- When the radio compass is used for ADF the receiver should be tuned for maximum deflection of the tuning needle. If the compass is in the antenna position for range reception, receiver is tuned for maximum readability. There are two standard radio compass sets in use within the Air Force. They include the AN/ARN-7 and the AN/ARN-6. The ARN-6 is the latest type and it operates on the same principle as the ARN-7 but it is a smaller and improved set. ●

Hey, TAXI!

Head In The Cockpit—Eyeballs Caged—Scrub One Aircraft That Could Have Been Saved

IT is whispered about the flying fields, wherever flying men congregate to fight old battles and weep for lost loves, that Captain Georges Guynemer, after downing his forty-first Hun, disengaged himself from the scarf ring of his SPAD, looked at the Sopwith Camel that had just taxied into his wing, and declared, "*Tout les immaneurs rossesant oats pour cerveaux.*" Liberally translated this comes out, "All pilots have oats for brains." Thirty-eight years later, an analysis of USAF taxi accidents proves that things haven't changed too much since Georges' day.

A recent study of taxi accidents shows that personnel error accounted for 89 per cent of the accidents. This was further broken down to show that 42.9 per cent was pilot error; 13 per cent non-rated pilot error (student pilots); 11.5 per cent crew chief error; 9.6 per cent ground crew error, and 4 per cent each to supervisory personnel, vehicle operators and miscellaneous personnel. Any way you slice it, that's a heap of personnel error, with a king sized bite of dollars going down the drain.

The other 11 per cent chargeable to structural or mechanical failure can be written off as acceptable loss. But no one, least of all some sheepish, red-faced pilot who has just nosed up his airplane or tried to drive it through another aircraft, can justify that big 89 per cent.

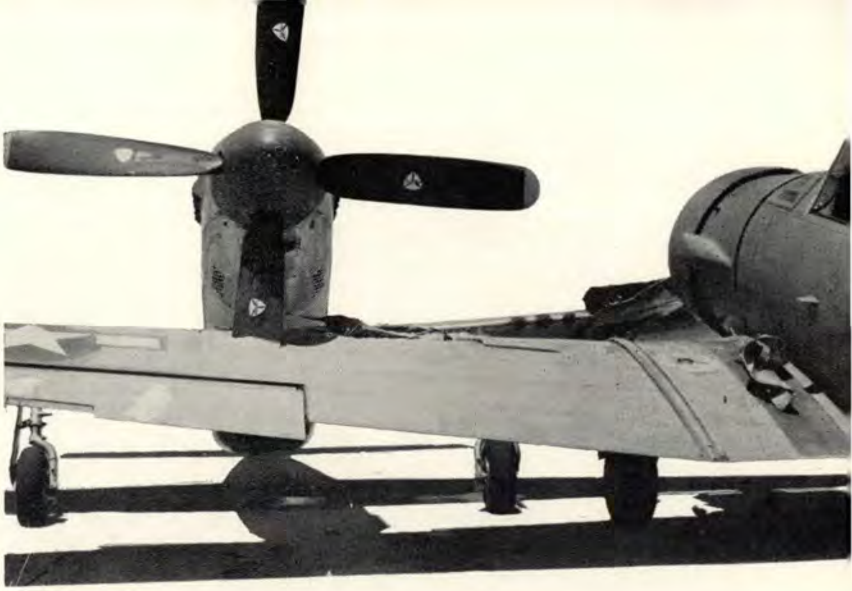
The old saw that to err is human is a handy gag that has been used to cover a multitude of errors. However, it is hardly acceptable to some irate commander who has just had one or more aircraft put out of commission through carelessness or neglect.

Strangely enough, the reliable old gooney bird leads the cargo field. Since most C-47's are flown by administrative and behind-the-lines personnel, it might be assumed that a lack of proper transitional training or disregard for maintaining necessary proficiency is responsible for many of these accidents.

As an outstanding example of a needless accident, take a look at what happened when a pilot of a C-47 decided he didn't need to use his lights to taxi into run-up position on a strange field. There must have been an illuminating discussion going on, for they both failed to notice a crash truck parked off to the side of the taxi strip, its parking lights on. At any rate they were rapidly recalled to more mundane things when one wing crunched into and over the rear of the truck. This little episode cost one new wing for the aircraft plus a rebuilt job for the cab of the truck. Many man hours and some few thousands of dollars later the pilot is trying to explain just how it all took place. Needless to say, his somewhat futile explanations were falling on deaf ears.

The perfect example of what happens to those who don't have enough time to wait for a wing walker.

It's better to look out both sides. This T-6 jockey zigged when he should have zagged.



It's tough enough to explain when you nose up but when you meet head-on, oh brother!

Horrid Example

Another pilot became "horrid example" material when he taxied his C-45 off the edge of the taxiway. The soft shoulders skirting the hard top were the type best avoided, as one wheel immediately sank up to the hub in the sand. By judicious use of brake and plenty of throttle the pilot managed to swing the plane even farther off the runway while raising the tail high enough so that one prop contacted the ground. Next, the tail dropped back with sufficient force to shear the tail wheel assembly, damaging the vertical stabilizers and bottom of the fuselage. Discounting the fact that the pilot went off the taxi strip originally, the error here is one of technique and knowledge of the aircraft. Assuming that this particular pilot now knows what to do and what not to do when bogged down in sand, this seems to be a rather costly way to acquire knowledge.

Fighter aircraft are in number two position, accounting for 20.6 per cent of all the accidents. Heading the list of fighters is the F-51. The F-80 is second, followed by the F-86, F-84, F-94 and the F-89.

The quickest way in the world to lose a wheel—taxi off runway onto soft soil.

A perfect illustration of the needless accidents that have been occurring is that of the F-51 jockey who rammed a jeep. The aircraft was parked at the end of the runway while its guns were being cleared. After the armament crew had finished, the tower notified the pilot to return to the line. Without clearing himself he taxied straight ahead; straight ahead, that is, until his prop contacted a jeep, with the usual results. Four bent blades and sudden engine stoppage, with dollar loss well up in the thousands.

Another accident took place when the number two man in a two-plane element taxied into the lead F-51. The two aircraft were positioned on the taxiway behind another flight, both making their pre-takeoff check. The first flight was cleared onto the runway by the tower, but the second element was held while another plane landed. When the leader moved up to the yellow line and held, the wingman promptly followed. The only mistake the second man made was that he didn't bother to keep the first aircraft in sight, but went merrily on his way until he heard the other pilot calling him. He finally noticed the other plane and tried to stop. He failed by two feet. The aircraft nosed up, with the prop chopping into the wing of the other plane before hitting the ground.

Personnel other than pilots also contribute their share to taxi accidents. A snow plow operator made a sudden, sharp turn in front of a taxiing F-80. The plow was on the infield shoulder of an inactive runway, down which an F-80 was taxiing. The runway was icy and the pilot was using extreme caution and taxiing slowly. The plow was suddenly turned on to the runway and in front of the aircraft. The pilot immediately applied brakes but slid into the machine. The driver's excuse was that he thought he had been given a signal by another plow operator. He couldn't account for his failure to look around before starting a sharp turn across a runway area. His carelessness and failure to observe routine safety precautions resulted in another large splash of red ink on the wrong side of the ledger.

Third on the List

Third on the accident list were trainers, which contributed 19.5 per cent of the total. Of all the accidents in which trainers were involved, the

The driver missed being decapitated by the proverbial whisker on this one.

A good way to bank up an iron bird—turn without checking the clearance.

A combination of fast taxiing and a dragging brake put this T-6 on its nose.

T-6 accounted for the most. Heaviest offenders in the T-6 accidents were student pilots who taxied into a stripe painting machine, pulled up the gear instead of the flaps and taxied in behind heavy aircraft as they were being run up.

The need for better supervision and safety indoctrination seemed more obvious in trainer taxi accidents than in any other type of aircraft.

The most common mistakes made by bomber pilots were taxiing in crowded areas where wing clearances were close, without using wing walkers or by disobeying alert crew instructions.

This was most evident when a B-50 pilot decided he was able to park his airplane without bothering with ground crew aid. He parked it all right, but not before he knocked down a pole and put one wing out of commission permanently.

Several accidents clearly demonstrated the need for lights for taxiing at night. Two of them involved B-25's which were being taxied on the ramp without lights when the pilots suddenly found they had run afoul of large fire bottles. Admittedly, the bottles should not have been placed where they were, but both accidents could have been easily avoided if lights had been used while taxiing.

Other factors that have entered into many of the accidents were crowded ramps, faulty or unsafe installations and improper runway, taxiway and ramp clearances.

Such things as too many aircraft in too small an area, unmarked excavations and repair work, structures and vehicles too close to aircraft movement areas all figured in or were the cause of a high percentage of the accidents surveyed.

The entire problem of taxi accidents must be recognized and met by many agencies in the Air Force. Primarily, greater care must be exercised by the pilots flying the aircraft, by other crewmembers responsible for moving aircraft, by ground crewmembers charged with parking the aircraft and by those vehicle operators who drive in areas where aircraft are in motion. But great responsibility also rests on supervisory personnel, particularly those in charge of various phases of training, to see that anyone concerned with aircraft is fully cognizant of fundamental safety rules and has the common sense to obey them. ●

A Fuel MANAGEMENT Problem

By Maj. C. E. Tabor, Jr., Directorate of Flight Safety Research

ALTHOUGH THE necessary information for safe operation of the emergency fuel system in the F-86 aircraft is contained in the Dash One T. O., it is evident from the history of accidents in which mis-use of the system was a factor, that not all pilots understand the limitations of the emergency fuel system and the reasons for them.

The normal fuel system in all F-86 aircraft includes safety factors in engine speed governing which it is impractical to build into the emergency fuel system because of weight, space, and complexity limitations. The emergency fuel system is designed to enable the pilot to return the aircraft safely in the event of failure of the normal fuel system. A portion of this protection is the provision of an uninterrupted fuel supply in event of main fuel system failure on takeoff with the EFS switch in the alert position. It is not designed for any operation in which requirements exist for rapid changes of power setting. If the main fuel system fails, land the aircraft at your home base or other suitable airfield by planning your flight with the limitations of the emergency fuel system in mind.

Operating limitations of the EFS in all series of the F-86 are essentially the same, in spite of the fact that the F-86D has a re-designed normal fuel system. When the aircraft is operating on the EFS, sudden throttle movements will introduce an unbalanced fuel-air mixture into the engine with possibility of compressor stall, fire, explosion and loss of engine power.

The EFS goes into operation when *both* of the following conditions are met:

1. The system is alerted by manual positioning of the emergency fuel pump switch *or by electrical failure which releases the holdout solenoid.*

2. A drop in fuel pressure caused by a failure in the normal fuel supply system or over-riding of the main fuel system by the EFS due to *rapid forward movement of the throttle.*

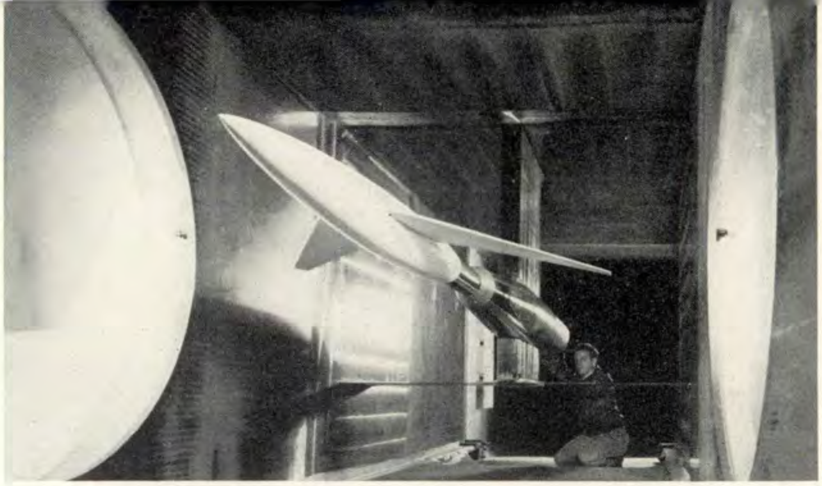
When the EFS goes into operation it provides fuel to the engine at a rate controlled solely by the throttle. So—if the main fuel supply system failed in flight (when the EFS switch is in the OFF position) at a power setting of 92 per cent and the pilot does not note his loss of power until engine rpm is down to 60 per cent, placing the EFS switch in the ON position without pulling the throttle back *would pump far more fuel into the engine than it can handle and may result in an engine fire.* In local bull sessions, this information has been twisted around so that many pilots believe that the EFS should not be turned on below 70 or 80 per cent engine rpm. This is not true. The EFS can be turned on at any engine rpm *if the throttle setting corresponds to or is lower than the engine rpm.* Then, after the EFS is in operation, the throttle can be opened to the desired power setting slowly and smoothly.

Check These Examples

A pilot flies the landing pattern maintaining a power setting of 60 to 70 per cent RPM. Turning on final, he decides to go around. He opens the throttle to the 100 per cent position and the engine does not respond as quickly as he thinks it should. Without changing his throttle position he flips the EFS switch to "ON." An engine turning over at 60 to 70 per cent suddenly receives sufficient fuel for operation at 100 per cent. Result ? . . . Fire, explosion, compressor stall, crash. The whole procedure would have a happy result if one step was changed. When the engine fails to respond as rapidly as the pilot thinks it should, the possibility of failure of the main fuel system certainly exists. So the pilot retards his throttle to a position equal to or lower than that which corresponds with the engine rpm at that time, turns on the EFS switch, and slowly and smoothly opens the throttle to go-around setting. Result? A successful go-around and an aircraft and pilot saved.

A pilot flies a landing pattern at 60 to 70 per cent rpm. Turning on final, he decides to go around. The throttle is advanced to the 100 per cent position and almost immediately a roaring noise is heard, a heavy vibration is felt and a rapid rise in tailpipe temperature is noted. The EFS switch is "Off" and remains "off." If the pilot is familiar with the operation of the EFS, he knows that there is a possibility that electrical failure has released the holdout solenoid and his throttle burst has caused the EFS to over-ride the main fuel system. If he retards the throttle to a position corresponding to the engine rpm or less, holds it there momentarily so that the engine can begin to operate normally, and then slowly and smoothly advances the throttle to the desired power setting, there is a good chance that the engine will pick up rpm, produce normal power, and make possible a successful go-around.

Many of the basic theories of high speed flight must be tested and re-tested in supersonic wind tunnels.



HIGH SPEED *flight*

Present day high speed aircraft have two sets of characteristics — one low speed and one high speed and the pilot should be familiar with each.

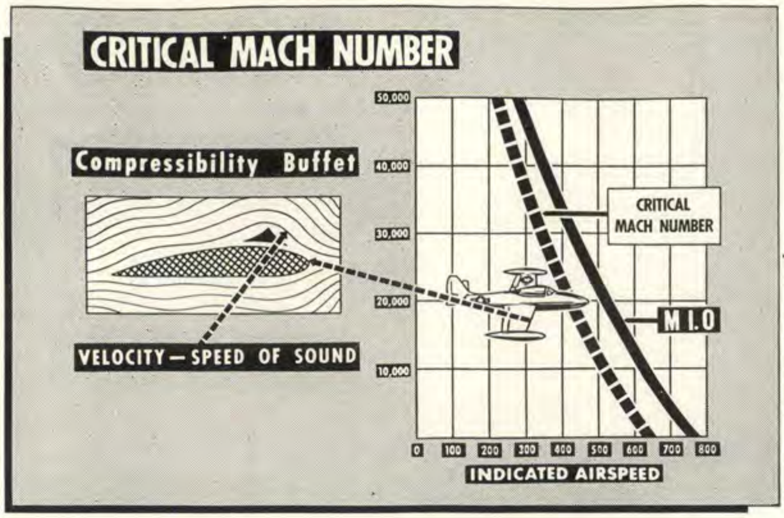
SINCE Wilbur Wright stayed airborne eleven long seconds at Kitty Hawk some 50 years ago, each airplane type has had flight characteristics that were just a little different from any other type. With the development of high speed aircraft, the pattern has changed, in that fast airplanes have two sets of characteristics, one low speed and one high speed. These characteristic differences are so pronounced that for all purposes, you can view them as belonging to two separate types of aircraft.

The purpose of this article is to show you, as a pilot, the reasons why high speed airplanes have dual personalities, and how these personalities differ. Although you may not now be flying high performance airplanes, and may never fly one, you should know the basic laws governing high speed flight in the interest of flight safety, and as part of your general flying knowledge.

To accomplish our presentation in layman's lingo, it has been necessary to take some liberties with the rather technical and involved aspects of aerodynamics. However, we feel that in this simplified form of explanation, no untruths have been presented or implied.

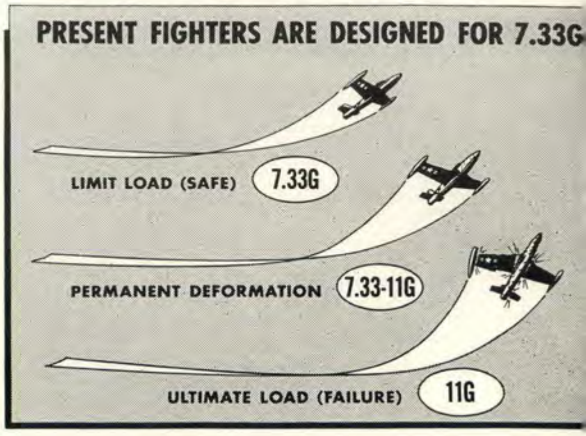
Load Factors

Most present jet fighters in operational use today are designed to a limit load of 7.33G, and to an ulti-



At 50,000 feet altitude the critical mach number may occur at 200 knots.

Excess of 7.33G causes permanent wing and airframe deformation on most fighter aircraft in use now.



mate load of 11G, fully loaded and with external stores normally carried, such as full wing tiptanks. Each airplane must be demonstrated in flight to a limit load of 7.33G without incurring wrinkles or deformations. The airplane is also tested statiscally to insure safety up to ultimate load. and a static test is then conducted to determine what reserve strength the airplane has. Emphasis is placed on the fact that the maximum load factor to be imposed on fighter aircraft by pilots is 7.33G. This holds for all fighter planes in general, as allowable loads for fighters with or without external stores are given in the T. O. for each airplane.

Speed of Sound

You are hearing a lot about transonic airplanes. Did you ever stop to mull over just what this means in terms of physics? The speed of sound changes when the temperature changes, so this figure is not constant. It varies according to a simple mathematical formula:

$$\text{Speed of Sound} = 45 \times \sqrt{\text{Temp. in C° Absolute}}$$

or,

Speed of Sound equals 45 times the square room of the temperature in absolute Centrigade in miles per hour. Absolute temperature equals Temp. C°. plus 273°C. As altitude is increased, the temperature decreases up to the 35,000-foot level. Above this altitude and within the operating altitude of present day aircraft, the temperature remains constant. These altitudes above 35.000 feet are called "isothermal regions." And so, as the speed of sound depends on the temperature. the higher you climb, the lower becomes the speed of sound, until you reach the 35.000-foot mark, where the speed of sound becomes constant.

Why Sweepback?

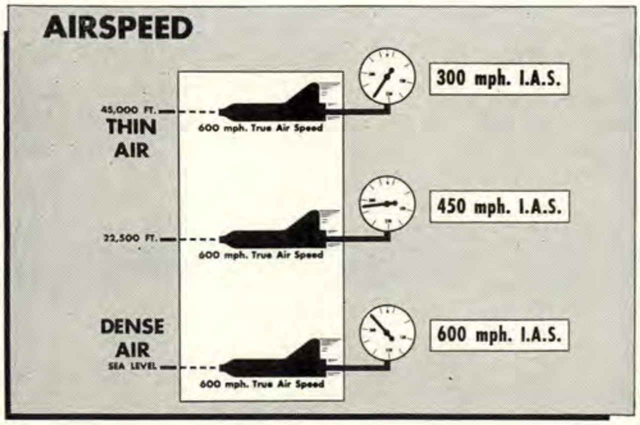
Because of the phenomena of airflow met in the transonic range, there is a certain speed at which the drag increases very rapidly. This speed is called the "critical" speed or "critical mach number." One of the problems facing high speed airplane designers is caused by these phenomena, that is designing an extremely thin air foil; and that is why the swept-back wing theory is becoming prevalent in high speed fighters. The thinner the wing, the higher the critical mach number. Sweeping back the wing makes the wing "thinner," in that the percentage of thickness with respect to the chord is reduced. This gives the same effect as building a thinner wing. Drag is the major factor that limits the attainment of high level flight speed, regardless of power application.

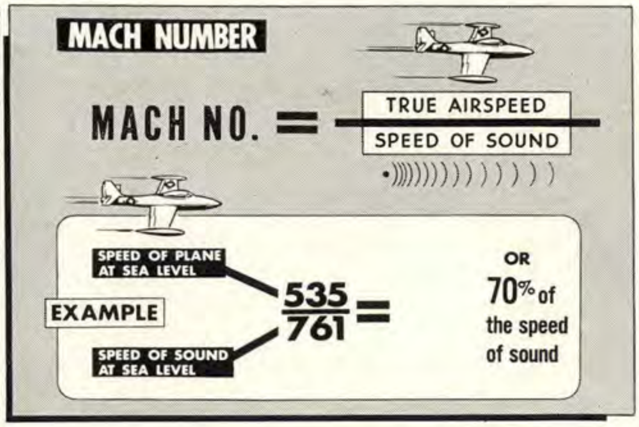
Buffet Affects Lift

When an airplane goes fast enough to experience a sudden drag rise, it also encounters buffeting. Airplanes with thick wings (high thickness to chord ratio) encounter buffeting at lower speeds than airplanes with thin (low thickness to chord ratio) wings, and airplanes with thin sweptback wings can go to still higher speeds without meeting buffet. Also, the higher the G load, the sooner buffeting is encountered. Thus, at 3G the airplane will encounter buffeting at a lower speed than it would at 1G, or in level flight.

Due to the camber of the wing, the speed of the air reaches the speed of sound at some point on the wing before the speed of the airplane itself reaches the speed of sound. When the critical mach number is reached. a shock wave begins to form, which changes the trim of the airplane, and causes a buffeting to be felt throughout the entire airplane structure.

An important thing about this shock wave, is that whatever happens in back of the wave cannot affect what happens in front of the wave. For instance, if the shock wave is lying just in front of the aileron, any movement of the aileron cannot affect the change of pressure over the rest of the wing, and all the work of rolling the airplane must be done by the aileron alone without help from the





Mach Explained

You read a lot in the newspapers and magazines today about "mach" and "mach number." Well, "mach" is pretty simple to figure out. Mach number is the *ratio* of true airspeed to speed of sound, which is a simple way of expressing airplane speed. If an airplane is said to be travelling at 0.8 mach, it is travelling 80 per cent of the speed of sound. This ratio expresses the true speed of the airplane, and the true speed of sound at any given altitude.

The indicated airspeed which corresponds to a given mach number decreases much more rapidly than the speed of sound, due to the faster rate of decrease of air density to temperature at higher altitudes. Where the speed of sound remains constant, the indicated mach number which corresponds to mach one continues to decrease as altitude increases. If an airplane is traveling at mach one at sea level, under standard temperature conditions, the mph speed will be 761, which is equal to the speed of sound, but if this same airplane was traveling at mach one at 45,000 feet, the speed of sound would drop to 660 mph, and the calibrated airspeed of the airplane would be only about 330 mph. A rule of thumb is that calibrated airspeed equals true airspeed at sea level, but at 45,000 feet, calibrated airspeed is approximately one-half of true airspeed.

portion of the wing in front of the aileron. A similar effect takes place on all the control surfaces, which means that the effect of moving the control surfaces will be much less than at lower mach numbers.

You hear a lot about the term "compressibility." This simply means that the air is compressed as it slows down through the shock wave, and this abrupt change in pressure is partly the cause of airplanes "tucking under" or "pitching up." It is the direct cause of buffet at high mach numbers.

One of the most dangerous facets of high speed operation is in relation to the effect of sonic speed on the elevator control, which is the most important control on an airplane. It is important because the movement of the elevators is the movement that creates G loads. As the mach number is increased, the effect of the elevators becomes less and less, with a critical point reached when the airplane reaches 0.9 mach. Because of this decrease in elevator effectiveness, and because of the larger elevator travel or elevator angles required, the stick force required to perform a given maneuver increases in direct proportion to the mach number. It must be remembered that the stick forces experienced at a given mach number at high altitude will also be experienced at low altitude, but the increase will be very much greater because the indicated airspeed will be greater.

In closing, it is important to point out that the higher you go at sonic speeds, the less you can kick the old kite about. At low altitudes it is possible to pull G greater than the limiting load factor, but at extreme altitudes above 30,000 feet, due to decreased maneuverability, turns are shallow and pull-ups gentle, it is difficult to pull excessive G's. At altitude it is often difficult to distinguish a stall buffet from a compressibility buffet, so the best rule to follow is the old rule of "knowing your airplane." If you know the airspeed at which the maximum G may be obtained, you will know the best limits within which to maneuver your airplane.

Outlined here are only a few of the basic concepts of high speed flight. But they serve to illustrate the knowledge today's pilot must have at his fingertips in order to fly and to fight safely. With the onward march of aviation into and even through the barriers of sound, and with tomorrow's vista which tends to stand upon the portal of weight, never has it been so important for flying men to know the intricate complications of today's flying machine. ●

OL' BOREAS!

Beware In Cold Air of Altimeter Error!

BOREAS IS NOT the pilot's best friend. In fact, the ancient God of Winter seems to have a definite antithesis toward flying men and flying machines, with the end result that pilots who increase their distrust of cold weather in inverse ratio to the thermometer tend to have many grandchildren, and often fool the insurance actuaries.

One of the gadgets that Old Man Winter loves to tinker with is, of all things, the altimeter. You go tooling along at what you think is 10,000 feet in the brisk cold night air, and you are actually at 8700 feet, an error great enough to mean the difference between sleeping in your own bed that night, or on some lonely mountainside.

Let's take a look at how this works. First, consider that an altimeter is simply an aneroid barometer, or pressure gage, which gives measurements in feet instead of inches of mercury. Remember that all altimeters are calibrated on the basis of *standard* atmosphere in measuring the relationship of pressure to height. *Standard* is the Magic Word. Keep it in mind whenever you compute altitude corrections in terms of temperature. Because of the fact that altimeters are calibrated on a *standard* condition (15°C.), the existence of nonstandard atmospheric conditions makes for "built-in" errors in computation.

There are many typical examples of altimeter variations caused by temperature. The airplane flying in cold air with an outside temperature of Zero Centigrade is indicating 10,000 feet on the altimeters, but is actually flying at 9450 feet. The airplane flying at 10,000 feet in *standard* temperature (15°C.) is on the money. The airplane flying in warm air (30° C.) is actually at 10,550 feet with the altimeters indicating 10,000 feet.

Principle Explained

The principle behind this is that on a warm day aloft, the air is lighter because of expansion, than it is on a "standard" day; while in cold weather, the air is heavier, due to contraction, and weighs down the "tympan," or aneroid wafer inside the barometer. The needle goes up just like the hand on the Toledo scale when the butcher weighs out a pound of liver for your little bride. The needle goes up, but the airplane doesn't!

Use the E-6-B computer to correct for temperatures aloft, but keep in mind that the resulting correction will be accurate *only* when the existing lapse rate is *standard*. (There's the Magic Word again!)

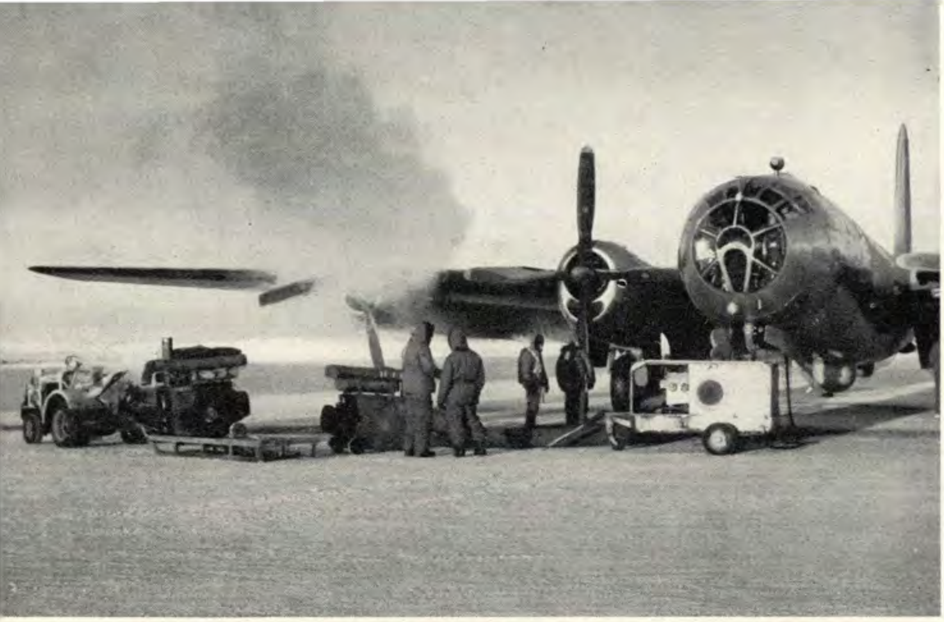
Working temperature correction is extremely simple. Look at the window marked "For Altitude Corrections." Your instrument panel shows that you are cruising at 10,000 feet, with a free air temperature of minus 20 degrees Centigrade. Place the figure "10" in the little window on "—20." Hold everything here. Now look for "10" on the "minute" scale of the outside ring, and read the corrected altitude on the "miles" scale of the outside ring. In this instance, the index will be "94," and 9400 feet will be your corrected temperature altitude.

To illustrate how wide this margin of error can be, figure the correction for minus 30 degrees Centigrade at 10,000 feet, a condition which can easily exist in the Northern United States, Canada and Alaska. Your error will be nearly *one thousand* feet (950 to be exact), and you will be flying at 9050 feet instead of the 10,000 your altimeters show.

Do not assume that the altimeter will indicate correctly in the air because it reads correctly upon landing. At 2000 feet, with a temperature variation of 10°C., the altimeter temperature error is 70 feet. This error decreases to zero as the altitude decreases.

When the snows come, and the mercury drops, the altimeter is your friend.

It should be kept in mind that altimeter corrections, both for pressure and temperature, should be a phase of *pre-flight* planning, as ARTC assigns IFR flight altitudes on the basis of indicated altitudes. ●



In extremely cold weather an APU should be used for starting.

COLD WEATHER STARTING

By 1st Lt. C. F. Brower, Troop Carrier Command

Improper engine starting may result in fouled plugs and backfire.

EVERY effort is being made to make cold weather engine operation easier. Experiments are being conducted with special fuels and with high-pressure priming. However, until satisfactory methods of starting are developed, pre-heating and oil dilution are necessary to obtain maximum efficiency during cold weather engine operation. It is important that pilots, as well as flight engineers understand the limits of cold weather engine operation. You may not always have a ground crew to serve you.

Several types of ground heaters have been developed for pre-heating equipment. Both the D-1 and F-1 heaters are mounted on retractable wheels with auxiliary sled bottoms for use in heavy snow. In sub-zero weather, even these heaters must be heated before use.

In extremely cold weather, the crew chief makes sure to use an external power source for starting the engine and running on the ground. Batteries, when cold, lose most of their capacity and attempting to use them for operating the starter, which has such a large current drain, may ruin them completely.

Also condensation in both oil and fuel tanks is considerable and frequent thawing and draining is required.

Before starting the engine the propeller must be pulled through by hand to break the seal formed by cold oil. Also, the throttle opening used for the start should be decreased to a position equivalent to about 1200 rpm. Under extremely cold conditions, it may be necessary to place the mixture control momentarily in the "AUTO RICH" position during the engine cranking period to obtain enough vaporized fuel to support combustion. As soon as the engine starts, the oil pressure gage should be watched closely. If the oil pressure fluctuates or falls off when the RPM is increased, the oil is still heavy and cold, and warm-up must be handled carefully. If after a few minutes of ground operation the oil pressure falls off to a lower value than usual, or if it drops to zero, the engine should be stopped immediately and the trouble located.

After the engine has once been started and oil pressure falls into a normal scale, the engine should be warmed up in the usual manner. One main thing to watch is that no attempt is made to use any electrical equipment until the generators cut in to supply electrical power as an aid to the battery.

If a cold start is expected again, the entire oil circulating system should be diluted with fuel before the engine is stopped. The amount of dilution depends on the size of oil system and the expected lowest temperature.

Oil Dilution

During the dilution, the throttle is set at about 1200 rpm and the dilution switch is held in the "ON" position for the required time preferred. While dilution is taking place the oil temperature gage is watched carefully and if the temperature rises above 50°C., the engine is stopped. This allows the oil to cool below 40°C. and then the engine is restarted and the oil dilution continued until finished. Any dilution taking place above 50°C. evaporates the fuel from the oil as fast as it is put in. During the last two minutes of dilution all accessories using engine oil should be operated. At the finish of the oil dilution periods, the engine should be stopped in the normal manner, making sure the oil dilution switch is held in the "ON" position until the propeller stops completely.

The first major crime constantly committed with regard to engine operation is improper starting technique. In this connection, plugs are fouled out and engines backfired due to a misunderstanding of the requirements for a good engine start. This, in turn, results in link rod failures, short spark plug life, and air induction system repairs, which, in turn, impose an unjust load on maintenance personnel.

A starting procedure which is standard for minimizing engine malfunction, as previously described, has been devised. This is known as "control quantity system." It should be borne in mind that engines will start properly only when all phases of operation are correct; hence, we must have the proper fuel-air mixture in the cylinder, and we must have ignition at the proper time. Once the engine has been conditioned, proper ignition is insured providing personnel starting the engines do not foul up the ignition system by improper starting procedure. To obtain the proper fuel-air mixture requires that the proper amount of fuel be mixed with a given or known quantity of air if combustion is to be obtained.

Keeping the requirements in mind together with various mechanical failures caused by improper starting technique, the controlled quantity system involves:

- The carburetor throttle should be adjusted to a position which is equivalent to 1000 to 1200 rpm.
- The master battery switch should then be turned on.
- The fuel booster pump for the engine to be started should be turned to the "on" or "low" position.
- The starter should be energized until the starter is up to speed, which normally requires approximately 15 seconds.
- The starter should then be meshed, and, after the propeller has made one complete revolution, the ignition switch should be turned to the "both" position.
- With the engines turning, the electric primer should then be engaged, held in the "on" position until after the engine has started, and the engine speed has stabilized to the pre-set throttle position. The throttle should never be used as a primer. It should be left in the pre-set starting position.
- The transition from primer operation to carburetor operation may be made leisurely by moving the carburetor mixture control from the idle cut-off position to the automatically rich or run position and disengaging the primer. To prevent the mixture from going lean during the transition, the mixture control should be moved to the "auto-rich" or "run" position slightly ahead of disengaging the primer in order that the carburetor may be allowed to come up to operating pressure and begin functioning.

Several types of ground heaters, some with sled bottoms, have been developed for pre-heating aircraft in colder climes.

Save Your Battery

Conservation of electrical power is an extremely important wintertime topic. Although most of the maintenance people have power units, there are times when a pilot can get caught short without one at his disposal. In the wintertime, a battery can't take its rated charge and retain that charge unless the temperature is above 70°F.

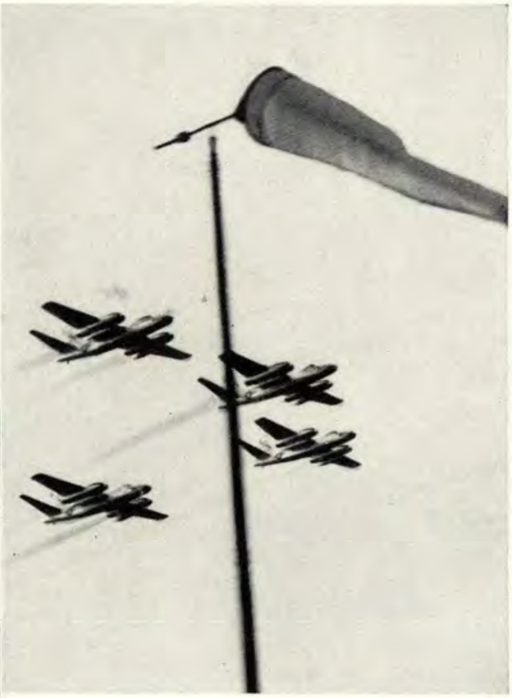
When a battery is charged under cold weather conditions, it gets what is known as a "top charge." This top charge may be sufficient to operate some of your instruments and electrical equipment for the preflight, but it *has* happened that when the pilot had started his engine and was preparing for takeoff, he'd turn on his battery switch and operate his radio equipment. Usually the receiver side of the ARC-3 would tune and the transmitter side wouldn't tune until the engine had exceeded the RPM necessary to cut in the generators. ●

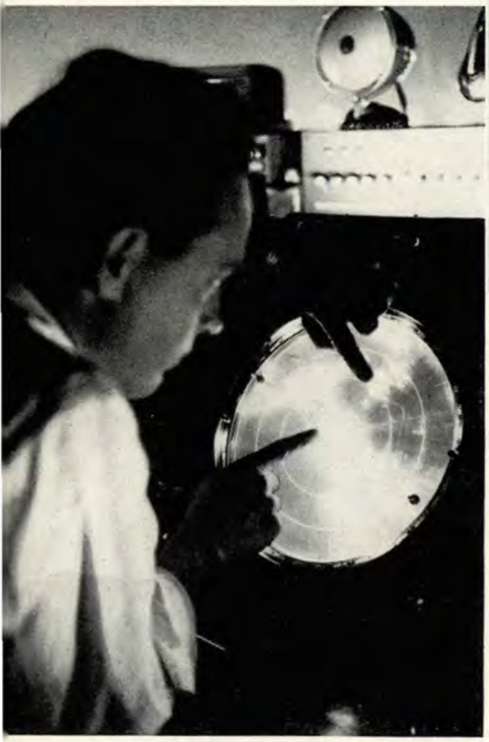
VFR Control!

It's Getting Crowded Upstairs . . .

This Is What the 1707th Wing Did About It

". . . Today's high-speed aircraft don't permit the pilots to spend much time 'looking around' for other traffic in the pattern."





Radar helps eliminate air traffic hazards during IFR conditions, but more emphasis must be placed on VFR control in saturated areas.

TODAY'S modern airplanes with all their knobs, handles, levers, gages, dials, hydraulic systems, electrical systems, fuel systems, etc., are masterpieces of ingenuity and genius. Their increasing speeds are virtually changing the meaning of space—space as the old pilots knew it 20 or 30 years ago.

There was a time when the pilot had nothing to do but crank 'er up, point 'er into the wind, use the stick, rudders and throttle and he was airborne. He could take off, fly around for a spell, and land in almost any cow pasture, never having to touch anything in the cockpit but the stick, rudder and throttle. He had a lot of free time for looking around.

Today's pilot, structurally, is the same human being of 30 years ago, but when he's in a modern, high speed airplane, he doesn't have the same free "looking around" time. He now has to divide this time and concentrate also on the levers and gadgets in the cockpit. This "looking around" time that he is robbing from to check the cockpit dials would not be so dear if the speed of his craft had remained constant through the years.

Every year, the airspeeds of our new aircraft are a little faster. What is happening to the "looking around" time during this progress? It is not at all impossible to conceive of two aircraft approaching each other head-on at a rate of closure of 2000 mph in the near future. If a pilot should glance in the cockpit for two seconds, the distance between the two aircraft will have diminished by almost one and a half miles.

Speed and Numbers

Today, two factors—speed and the number of aircraft—have virtually reduced vast areas of space to small saturation points in terms of minutes and seconds.

Aviation has seemingly harnessed these two factors and eliminated most

Heavy traffic around the airport makes the controller's job hectic and vitally important.

of the traffic hazards during IFR conditions by a well-organized system of airways and control centers. However, these two factors of speed and increasing number of aircraft are being sorely neglected insofar as VFR flying is concerned. More emphasis, in turn, must now be placed on VFR accident prevention. It is inevitable that the same type of control measures will have to be established for VFR flights in the future. Any step taken now to control VFR flights in local control zones or in saturated areas will be a step in the right direction.

In an effort to relieve the congestion in their area, personnel of the 1707th Air Base Wing at Palm Beach International began to make a check of all transient traffic moving through the area of West Palm Beach. The average number of daily flights moving north and south along Blue 19 and Amber 7 airways through their area amounted to approximately 500. This figure does not include the countless "unknowns," small civilian aircraft with no flight plans. If you look at the map, you'll see that Blue 19 cuts right through the local flying area to the west of the airport.

A look into the local traffic picture furnishes the other half of the problem.

Heavy Traffic

The 1707th, a MATS wing, conducts extensive transition training in C-124's, C-97's, and SA-16's, the amphibious workhorse of the Air Rescue Service. In addition to this training, a lot of local flying is done in T-11's and C-47's.

Also operating from Palm Beach International are two commercial airlines which schedule daily flights in and out of the airport. A number of civilian-owned aircraft are based there, and they don't make the traffic problem any easier.

In August, 1952, Maj. James A. Harwell, Jr., 1707th AB Wing Operations Officer, and Capt. James S. Keel, the Flying Safety Officer, brought their problem of airspace control to the attention of all civilian and military agencies in Southern Florida. The problem was discussed at several meetings and a detailed plan of the flying operations conducted in the Palm Beach area was presented to CAA, civilian airlines concerned, and to all other Air Force, Navy and Marine organizations conducting flight training throughout Florida. The main idea was to alert all pilots to the extremely heavy amount of traffic in that area and to avoid flight through the area whenever possible.

Going into the problem a little farther, the 1707th Wing published a regulation which established firm control over altitudinal separation of all aircraft in the local area.

Two separate areas were set up for training flights. One area, to the north of the airport, is used only by SA-16's, C-47's, and T-11's. In this zone, VFR airwork is conducted at odd thousands plus 500 feet; instrument training is flown at odd thousand-foot levels.

The area to the south of Palm Beach International is utilized for C-124, C-97, and C-54 training missions. Airwork in this zone is done at even thousands plus 500 feet; instrument flights stay at even thousand-foot levels.

Altitude Control

Whenever possible, in both of these areas, all training flights are restricted to altitudes between 4,000 and 18,000 feet, leaving the airspace below 4,000 and above 18,000 feet clear for any transient traffic flying through the local area.

Carrying on the intensive flying safety program, a wing SOP makes it mandatory that a minimum of three people be present in the cockpit of any aircraft while performing instrument training. Scanners are standing by on interphone to warn of other aircraft in the area.

Colonel Fred O. Easley, the Base C.O., puts it this way:

"A given airspace can safely hold only a given number of aircraft. When the saturation point is reached, then strict control and supervision must be maintained in order to avoid disastrous accidents. When the ceiling is below 2500 feet, but still VFR, we limit the number of aircraft in the area and in the traffic pattern. During this period, aircraft are cleared to an altitude on top of the cloud layer or overcast where they may accomplish their assigned missions. Each aircraft is monitored and controlled throughout its climb and descent through an agreement with West Palm Beach Radio and CAA. We have established 2500 feet and five miles visibility as the local minimums for VFR military training flights." ●

when you fly at USAF Instrument

"TOO many pilots are wasting time on instrument practice flights. They get an airplane, go out and take off with nothing planned and end up sightseeing or aimlessly grinding around the area under the hood."

You say that this quote doesn't apply to you? That you know exactly what you are going to do before you leave the ground and that you do it? Perhaps you do but the veteran instrument instructors in the USAF Instrument Pilot School at Moody AFB, who made this statement, maintain that the average pilot doesn't.

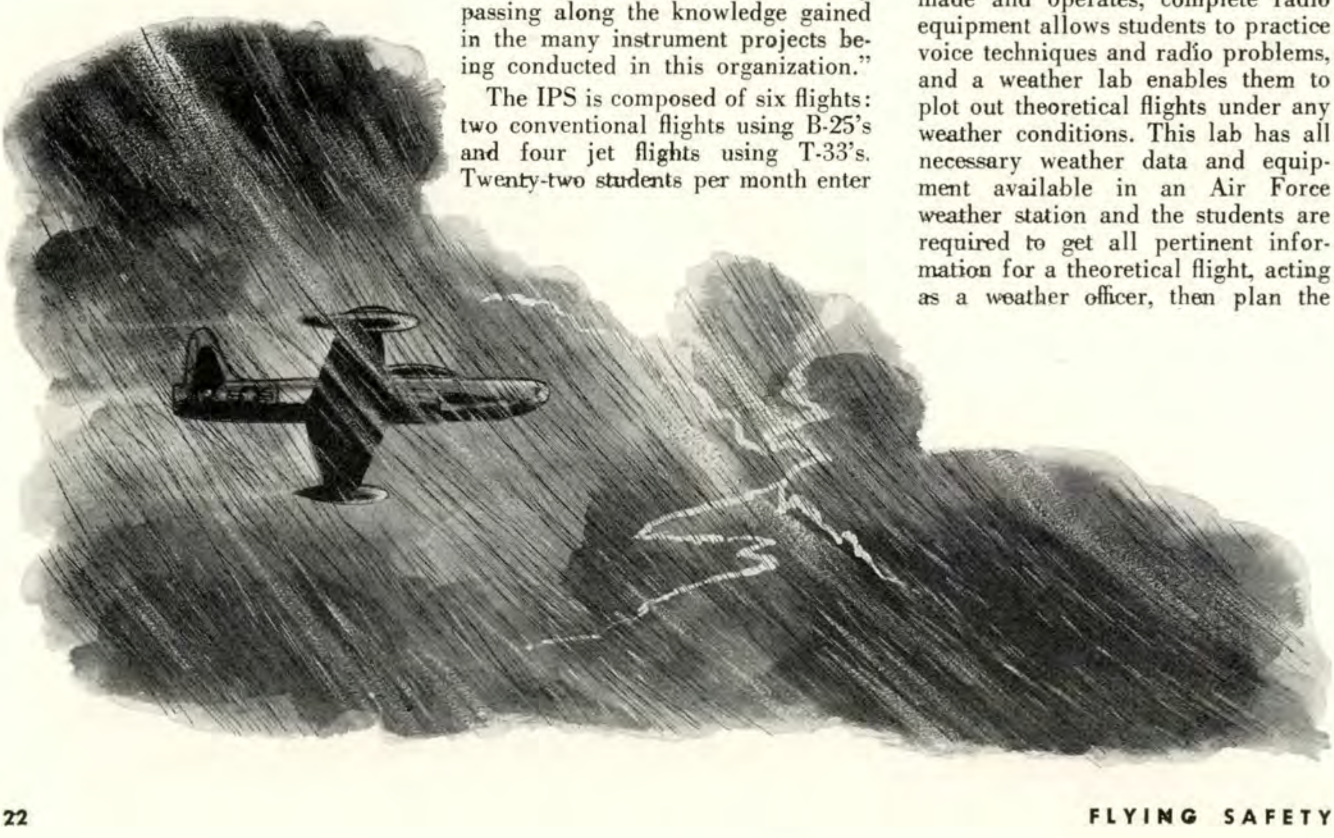
They do say that the fault doesn't lie wholly with the individual pilot as, "Frequently a pilot fully intends to devote the period to instrument practice but can find no one qualified to give him proper instruction. When this happens the pilot doesn't take the time to look up good practice procedures in an instrument manual but goes up and wastes the time in unplanned practice."

That the instructors in the Instrument Pilot School are qualified to analyze the faults of the average instrument pilot goes without saying. Many of them are veterans of the old instrument school at Bryan and the average instructor time is 3300 hours.

The Instrument Pilot School is part of the 3550th Training Group, commanded by Col. Dean Davenport, one of General Doolittle's Tokyo raiders and a veteran fighter pilot with tours during World War II and in Korea.

Regarding the school, Colonel Davenport said, "The mission of the United States Air Force in the over-all problem of world peace today dictates that it be able to accomplish its tasks under any conditions. It is our aim, through the instructor's training program, to increase the level of proficiency in the field to that comparable to our instructors by passing along the knowledge gained in the many instrument projects being conducted in this organization."

The IPS is composed of six flights: two conventional flights using B-25's and four jet flights using T-33's. Twenty-two students per month enter the eight-weeks course in conventional aircraft and 30 students per month in the eight-weeks jet course.



Academic Instruction

Academic instructors in the ground school are all rated and are highly qualified instrument instructors. Students receive 140 hours of ground school instruction during the course. Fundamentally, ground school for both jet and conventional courses is the same except that the jet pilots get special training in cruise control and have additional courses in single heading flight and high altitude weather.

Ground school is broken down into basic instruments—18 hours; all phases of navigation—48 hours; all phases of weather—48 hours; teaching and instructor techniques—23 hours; critiques—3 hours. The school uses training aids extensively. Cutaways and mockups of instruments show exactly how an instrument is made and operates, complete radio equipment allows students to practice voice techniques and radio problems, and a weather lab enables them to plot out theoretical flights under any weather conditions. This lab has all necessary weather data and equipment available in an Air Force weather station and the students are required to get all pertinent information for a theoretical flight, acting as a weather officer, then plan the

School . . .

flight as a pilot, even filling out a form 175.

An important phase in the instrument course is the link trainer. A student's flight instructor also acts as his link instructor. Jet flights use the C-11A trainer and the conventional flights use the Z-1 trainer.

Students get three phase instruction on each lesson. First, the lesson is given in ground school where the theory and purpose, as well as the actual maneuvers, are discussed and taught. Next, the student is briefed by his instructor and given the same lesson in the link trainer. Finally, on the following day, the student flies the lesson after being briefed on the actual flight by his instructor. After the flight the instructor holds a critique during which he analyzes the mistakes made during the flight and answers any questions.

The reason for this three-step method of teaching is two-fold; it insures that the student thoroughly understands each individual lesson and it keeps actual demonstration in the air to a minimum which permits the student to get maximum utilization of flying time, particularly in jets.

An interesting aspect of the school, and one closely allied to its flying safety program, is the care taken to maintain a high proficiency rate among the instructors through standardization. Group operations include a standardization board which pulls constant spot checks on instructors to see that they are maintaining a high degree of proficiency. Also important in this respect is a section of the school composed of a group of hand picked instructors who have the special job of analyzing all techniques and procedures used in the course, from both a performance and a safety standpoint.

On the day prior to each new lesson or to any new maneuver each flight commander holds a standardization meeting for all instructors. Here the instructors are briefed in exactly how each maneuver should be given to the students. This same briefing is then given to the students by the instructors prior to the next flight.

Pilots in the conventional school are taught a comprehensive instrument check to be used before each flight.

- Set altimeter to current altimeter setting. Then to field elevation. Check for error. After establishing the error make all future settings, using the plus or minus error.
- Adjust vertical speed indicator to zero.
- Set the miniature aircraft on the artificial horizon so that the white "lubber" line barely shows.
- Check turn-and-bank indicator which should register same direction aircraft is turning.
- Get a time hack.
- Check all radio and radio navigational equipment for correct operation.
- Check navigation publications. Make sure none is missing and all pages are in the book, especially destination, alternate and all fields along route.
- Turn on pitot heater and check for operation.
- Check deicing and anti-icing equipment.

Flight Simulators keep students sharp on procedures.

Instructors are completely briefed on the next day's lesson.

Conventional Course

The first few lessons are devoted to basic instruments. As one instructor put it, "A student must get basic instruments solid before he can fly radio work."

Pitch attitudes are demonstrated to show how they affect other instruments. Students are shown how each basic maneuver reacts on each correlated instrument, both primary and secondary. For example, on power changes they are told not to watch the manifold pressure but to bring it into the over-all cross check and then make any necessary adjustments after the initial change, as needed. After learning what the instruments will do, practice maneuvers are needed to build necessary proficiency. IPS instructors recommend both "A" and "B" patterns as being ideal for practice as they incorporate all phases of basic instrument maneuvers. They feel that any pilot who has completely mastered these patterns will have no trouble later with radio work.

Radio work at the school places equal emphasis on ADF and range work. When teaching ADF great stress is placed on proper tuning. It is felt that many pilots do not tune a set carefully and consequently fail to get maximum reception and range.

Considerable time is spent teaching procedure turns, holding and low approaches on ADF. Before takeoff the student draws his entire letdown procedure on a map, working out time from station to field and safe inbound heading which avoids high terrain, danger areas or industrial sites. Tracking inbound and out, intercepting bearings and time-distance checks are also practiced extensively.

In the school it is felt that the secret of good aural null work lies in proficiency in basic instruments. Students learn to tune in the null by ear and then to bring it into the cross check, making necessary adjustments as they go. The instructors believe that if the student is sharp on basic instruments time-distance problems, solving for 180-degree ambiguity, tracking, bearing interception and station passage using aural null procedures, all will come quickly and naturally.

Radio range work starts out with a familiarization pattern in box form. Primary emphasis at first is on beam interception and bracketing with a 30-degree correction used as the initial heading change. Next, procedure and timed turns and holding and stacking are practiced. In this connection, considerable time is devoted to voice procedures where it is evident that in most cases much more practice is needed.

After the student becomes familiar with all phases of primary beam work, he advances to orientation and low visibility approaches. In low visibility approach practice, planning is emphasized. A student soon realizes that he must know just how low he can go safely, exactly where all obstructions are located and which way he is going to turn before letting down.

Complete GCA and ILAS procedures are covered thoroughly, with a GCA landing being shot after every flight. VOR familiarization and usage is taught, both in link trainers and in B-25's equipped with omni.

The last stages of the course are taken up with short cross country flights, under actual instrument conditions when possible, so that the students learn to use strange ranges and gain practical experience in instrument navigation.

Jet Instrument Course

In the jet course the same instrument cockpit check is taught as that used in the B-25's. Basic instruments are flown at 20,000 with enough high altitude work to familiarize the pilots with the aircraft's flight characteristics at higher levels. During unusual attitude instruction students are taught to use full panel rather than partial panel in recovery. The initial correction is made with needle, ball and airspeed and the attitude gyro is then brought into the cross check as it comes into limits that are readable.

ADF and aural null instruction is the same for both conventional and jet flights except that more time is spent on penetrations.

On low approach practice, the school teaches that one and a half minutes is maximum time outbound prior to the procedure turn as a fuel conservation policy. They point out that on a low approach in a jet the most important thing is to know the weather at the intended destination before letting down. Once the letdown is accomplished the pilot is committed to getting in as he almost certainly won't have enough fuel to go to another base.

Students learn to plan the flight so that there will be bases available en route suitable for landing if the weather is forecast incorrectly. They set up definite amounts of fuel that they must have over each of these stations; if the fuel falls below these minimum amounts over any check field they know they must land there as they can't continue safely.

Three-fourths of the instructors in the school are green card pilots and many of them have over six years experience in instrument instruction. They fly under any weather condition, using the finest of teaching methods that make the USAFIPS the finest school of its kind in the world.

Here are a few tips on instrument flying from the boys who have the word:

- *When flying instruments be careful not to get eye fixation. This can be avoided by constantly cross checking the panel.*
- *Most jet pilots use the attitude gyro as the center of the cross check; which allows them to look at the bank and vertical speed instruments as well.*
- *Keep relaxed. Don't tense up and move closer to the instruments. This will result in restricted vision and tightening up on the controls.*
- *Be sure and trim the aircraft up to fly as near to hands off as possible.*
- *Use the "A" and "B" patterns for practice, both at altitude and near the ground. Too many jet pilots do not practice instruments near the ground; they forget that the flight characteristics change materially at lower altitudes. A good altitude for low level instrument practice is from 2000 to 4000 feet, depending on ability and not forgetting to use an economical power setting.*

WINTER

Equipment for the airplane.

WEATHER

Enroute and at destination.

WISDOM

On cruise control and alternates.

ON a stage, the "Winter Wonderland" of the song is always good for a few moments of whistled enjoyment and nostalgia, but the same music strikes a few notes of discord on the snow-covered flying field. It is well to respect the winter months because statistics show that cold weather is a major contributing factor in many aircraft accidents.

Invariably, hindsight shows that many of these wintertime accidents should never have happened — if (that word again) the pilots had known before takeoff just what line of action to take when they encountered unexpected bad weather conditions, and then recognized the conditions in time to do some inflight planning for safety.

The forecaster can, with a reasonable degree of accuracy, tell the pilot what weather to expect. However, as weather forecasting is still an inexact science, forecasts do sometimes go wrong. It is in these cases that the professional pilot's experience and ability to "interpret" the weather pays off in success or failure of his winter flight.

A forecast that icing conditions will not be encountered at a certain altitude is of no help to the pilot when he encounters ice at that level—the man in command of the airplane must make the decision. There are four general rules which may govern the businesslike pilot who is planning his flight with respect to weather.

- In preflight planning, get a good "picture" of the weather that is expected over the area that may be covered by the flight. This should not mean merely the weather along just one line at a set altitude, but the weather prevailing over the entire area at all operating altitudes. Plan before the flight what to do in case of the "unexpected."

- In flight, check the forecast of flight weather against observations. Such a check will usually verify the correctness of the forecast.

- Make the decision when a forecast has gone "wrong." The decision, of course, must be based on an understanding of the weather situation.

- Recognize and make accurate reports of the weather encountered. *PIREPS* are of much value to the weatherman and to pilots of other aircraft flying in or through the same area.

Every experienced pilot has had a good basic training in weather knowledge; how well he has kept up or has increased his ability to "read" the weather signs reflects on his technique of flying for an "all-weather" air force.

Known Conditions

From a combination of the weather "signs," source characteristics and temperature relationships, the pilot should know with a pretty good degree of accuracy just what type of flying conditions are likely to be found within a given air mass.

The general motion of the atmosphere over the ZI is toward the east; polar and arctic air masses generally move toward the southeast and tropical and equatorial air masses move toward the northeast. The speed varies according to the season and the type of air mass, but it averages around 500 to 700 miles a day. The cold air masses move more rapidly than the warm.

Warm fronts: As this type front moves forward, warm air slides up over a wedge of cold air. This up-

Before a flight through weather is made, the possibility of ice formation should be carefully considered.

slope movement is very gradual, rising about 1000 feet every 20 miles. First signs of recognition would be cirrus clouds, forming around 25,000 feet altitude, which could appear as far as 500 miles in advance of the front itself.

As with fingerprints, no two fronts are exactly alike but the general pattern is the same. Consider the weather conditions which might exist with a warm front moving eastward from the St. Louis area.

Here, the weather would be drizzly and foggy. At Indianapolis, 200 miles in advance of the front, skies would be overcast with nimbostratus clouds and rain. Four hundred miles in advance of the front, at Columbus, ceiling would be broken, with stratus and altostratus clouds predominating with a steady rain about to begin. In the Pittsburgh area, some 600 miles ahead of the front, there would probably be high cirrus aand cirrostratus clouds.

On a flight into the Pittsburgh area from the east, the pilot would experience, of course, a steady decrease in ceiling and visibility.

Cold fronts: The slope of a cold front is much steeper than that of a warm front and its speed is faster—usually 20 to 35 miles an hour with the more violent weather activity taking place at the front instead of in advance.

Altostratus clouds sometimes form slightly ahead of the cold front, but these are seldom more than 100 miles in advance. On flight from Pittsburgh area toward the midwest, with a cold front hanging around St. Louis, the ceiling would probably be overcast on departure, the air smooth and low visibility.

On the flight, these weather conditions would probably hold until the pilot checked in at Indianapolis. By this time the pilot would find that the front was now located about 75 miles west of Indianapolis and would be faced with a decision; and his judgment would be based upon his knowledge of frontal conditions.

Occluded fronts: One other form of front with which the pilot should be familiar is the occlusion. Weathermen divide the occluded front into two types; but for the pilot, the weather to expect in any occlusion is a combination of warm front and cold front conditions. As the occluded front approches, the usual warm front indications prevail — lowering ceilings and visibilities with rain. Generally, the warm front weather is followed almost immediately by the cold front type.

Consider Ice

Before a flight through weather is made, the possibility of ice formation should be carefully considered. For information, the pilot should look to the pseudo-adiabatic diagram and forecasts for the route to be flown. Careful study (with the forecaster) of the temperature lapse rate and moisture distribution aloft will reveal the presence or absence of icing conditions.

• If the temperature of the air is below freezing and there are clouds along the route, icing will likely occur.

• Stability of the air will largely determine the type of ice which may be encountered. In stable air, the possibility is rime ice. The more unstable the air, the greater the possibility of glaze.

In planning a flight through regions of icing conditions the pilot should note areas of possible icing, realize the severity of weather conditions, and consider his own limitations as well as that of his equipment.

Common sense is the best aid any pilot will have in determining the altitudes at which a flight may be completed with maximum safety, and in determining whether or not it is advisable to remain ground-bound. However, in nearly all instances, study of the temperature lapse rate and moisture distribution will bring out some altitude at which a flight can be carried through with the least risk of icing hazard.

Obviously, all flights on which icing conditions are encountered should be flown by the shortest route through the icing regions, regardless of departure from the shortest *map* route to the destination. This will result in maintaining maximum efficiency of the plane and neither time nor fuel will be expended in overcoming increased drag. Also, the safety factor will be greater.

Hints on Icing

• On encountering ice while IFR in smooth air, a letdown should be made only if above freezing temperatures are known to exist at an altitude with safe terrain clearance. Both liquid water content and temperature increase with decreasing altitude in stable clouds. The likelihood of glaze is increased by descending.

• The presence of freezing rain indicates the existence of warm temperature inversion a few hundred feet higher. It is never necessary to continue flight in freezing rain, since a climb to above-freezing temperatures can be made. The climb should be stopped when temperatures start decreasing, as another icing level will invariably exist above.

• Sleet is no hazard in itself, but it is a warning that freezing rain exists at a slightly higher altitude.

• Snow presents little or no icing hazard. However, if wet sticky snow clings to the plane, or rime ice forms, a climb to colder air must be made.

If, after a best altitude has been found, icing still exists, a reduction of airspeed will decrease both the rate and density of ice deposit. A drastic reduction of airspeed will cause ice to form on the underside of the wings, behind the de-icing boots.

• **Nation's Busiest**—To settle a controversy that has been quietly raging through the pages of FLYING SAFETY on the subject of airport traffic counts, here are the official C.A.A. figures for the past fiscal year.

Busiest airport was Cleveland, with 327,943 takeoffs and landings. Number 2 was Chicago Midway with 277,411 takeoffs and landings; while Denver jumped from 18th to third place, with a count of 254,239. Miami held fourth place with 246,426. Honolulu dropped from third to eleventh place, with traffic off eight per cent.

Figures showed airline traffic up ten per cent, and military traffic up eleven per cent for the fiscal period.

• **How to Lose Weight**—in an Airplane. One of the primary chores of today's aircraft engineers is to devise means of keeping down the weight of new jet fighters.

The weight-savers who labor at this task take comfort, cool as it is, from an interesting and quick solution suggested recently by William C. Schoolfield, chief of aerodynamics at Chance Vought.

Developing his theme, Schoolfield says that any pilot who is interested in reducing the weight of his jet fighter can do it by following three easy steps:

First, he must fly at top speed. Let us assume that top speed is 600 knots, about 690 mph.

Second, he must maintain a constant altitude.

Third, he must head due east. If these simple directions are followed, Schoolfield maintains, the weight of a 25,000-pound fighter will decrease approximately 135 pounds. The faster the pilot flies, the more weight his airplane will lose. If he can get his airplane up to approximately 14,600 knots, it won't weigh anything.

If the pilot wants to increase the weight of his aircraft, an improbable situation, he may do so by following the same procedure, with the exception of the third step. In this case, he must fly due west. Results will not be gratifying, Schoolfield warns, as the most the pilot can hope to gain in a jet fighter of average weight, is about 60 pounds at 600 knots. At speeds beyond 760 knots, however, the airplane will start losing weight until, at 16,100 knots, it will again weigh nothing, even going west.

In scientific parlance, his explanation shows that the reduction in weight is the result of a conflict between gravitational and centrifugal forces. At the equator, the earth is turning at a rate of 900 knots; at the latitude of Dallas the surface (rotational) speed is 760 knots. A jet fighter, flying at constant altitude (that is, in a curved path around the earth's surface) at a speed of 600 knots, is subject to a centrifugal force factor proportional to the square of 760 plus 600 knots, divided by the radius of the earth's curvature. This centrifugal force factor acts in the opposite direction to the force of gravity to reduce the airplane's weight (that is, the effect of the force of gravity on the airplane) by approximately 135 pounds.

Putting it another way, Schoolfield says, "If you tie a rock on the end of a rope and swing it in a circle, it will tend to fly off into space. In the same way, a jet fighter, traveling in the same direction that the earth turns, increases its tendency to fly off into space from the circle to which the earth's gravity holds it. Gravity has the same function as the man at the end of the rope."

All a person of experimental mind has to do to check the validity of this theory is to put a jet fighter in a railroad car moving east on level ground at 600 knots, and the airplane will show a loss of about 135 pounds.

• **Shoestring Story**—It seems that this party is inspecting an F-84-G, and while squirming around in the cockpit placed his left foot under the left rudder pedal, so he could stretch his legs a bit. When the inspector attempted to move his left foot to the rear, the loop of his shoelace caught on a zerk fitting intended to lubricate the pedal action, which was installed on the aft lower edge of the pedal. It was necessary for the inspector to reach down and unfasten his shoelace by hand. The shoestring was new, and made of strong material. It is quite conceivable that if this condition had occurred during flight, the pilot would have been forced to loosen safety belt and shoulder harness, stoop over from a sitting position, and unloop his lace from the fitting. It is also conceivable that a dangerous flight condition could occur while the pilot was in this vulnerable position. The man was wearing a low-cut shoe at the time, similar to those worn by many pilots in flight during normal weather conditions.

This condition has been called to the attention of those in authority, and it is quite possible that a fix will be published changing the position of the fitting. In the meantime, you may have to fly barefoot, wear high button shoes, or strain-test your present shoelaces for quick breakaway.

. . . Been Messing with the Auto-Pilot again, Filagree?

Cross Feed

flying safety idea exchange

A Bouquet

The October copy of FLYING SAFETY was appreciated. I ended up by reading most of it myself. I have turned it over to the staff of our Flight Safety Program. They will receive this magazine and it will be available in our special library that is now being set up for the use of personnel to be sent to us as students.

The project is well under way and the instructional material is rapidly taking shape. We are looking forward to its use with the first group of students.

Carl Hancey
Dean, University College
University of Southern California

Fisher Approach

From the pilots of the 37th Fighter-Interceptor Squadron, at Burlington Airport, Vermont: ". . . would like to get all the information available on the system, with the view of setting it up for use at this base."

Two letters from Lake Charles AFB, La.,—one from Hqs 806th Air Division, and one from the 68th Bombardment Wing (M): " . . . at present there is no GCA unit located at this station . . . would like information on the construction and operation of the Fisher equipment."

ED. NOTE: *In reply to all letters about Fisher Controlled Approach* (FLYING SAFETY, *November, 1952), we have suggested that inquiries be addressed to Lt. Martin A. Fisher of the 435th Troop Carrier Wing, Miami International Airport, Miami, Fla.*

That Belt Again

Regarding the article "Fallen Belt" in Crossfeed, FLYING SAFETY, November, 1952, it appears to me that the author is making reference to the button on the landing gear lever (safety spring of the landing gear control) which is pushed in to actuate the landing gear lever. If so, the safety belt of the T-33 cannot possibly actuate the button and move the gear handle to the up position as long as the weight of the aircraft is on the wheels.

I would like to direct your attention to Par. 1-51, Landing Gear Controls, Section 1 of AN 01-75FJC-1, Handbook Flight Operating Instructions T-33, dated 24 April 1951, which states that the gear lever cannot be moved out of the down locked position until the *Landing Gear Downlock Release Control* is actuated, and then the release button on the gear lever pushed in when the airplane is resting on the landing gear. The Landing Gear Downlock Release Control is located *inside* the wall of the cockpit and is actuated by reaching inside the wall with the fingers and pushing down. Unless the pilot reaches in with his fingers and pushes the Landing Gear Downlock Release Control *down*, considerable force can be applied to the landing gear lever with the release button pushed in, and the gear handle will not raise. It appears doubtful that the safety belt could enter the access hole to the Landing Gear Downlock Release Control (considering the small opening for the fingers available), actuate the control, push the button in on the landing gear lever, and lift the lever all in one operation.

Capt. William S. Slater, Jr.
Asst. Deputy for Operations
4708th Defense Wing
Selfridge AFB, Michigan

ED. NOTE: *Captain Slater is correct, except for the correct TO reference, which should be Sec. 1, AN 01-75FC-1.*

GCA

Members of the GCA section at this station would like to compliment your staff on the fine article on GCA in the November issue of FLYING SAFETY. Such articles as this give pilots a better understanding of GCA and make our job easier.

We are, however, in disagreement with one statement contained in the sub-section titled "Third Method" (page 23). Regarding the "locked gyro" method of approach, the statement that this method is not accurate is contrary to the beliefs and training received by GCA operators. If instructions are accurately given by the controller and properly followed by the pilot, then there is no reason why this type of approach shouldn't be just as accurate as a normal approach.

It is felt that pilots should be cognizant of the fact that although "locked gyro" approaches are usually made for practice and under VFR conditions, we can give them accurate service also under IFR conditions, when and if circumstances require it. A confident pilot makes a better and smoother GCA approach.

M/Sgt Russell J. Wilcoxen
GCA, Chief Controller—AACS
Det 1919-3, Barksdale AFB, La.

ED. NOTE: *Accuracy of any GCA run depends on the experience level of the controller. The accuracy of a no gyro run depends upon this factor. The no gyro run is included in the GCA controller's flight check. A no gyro run can be just as accurate as a regular run.*

KEEP IT SHORT!

The "letters to the editor" file is constantly growing. This is most gratifying, because it means that you people are reading our magazine minutely. But PLEASE keep your letters down to a maximum of 100 words. We wish we could print all your letters, but this page will only hold 1200 words. Keep those letters coming . . . but say it in 100 words or less.

Facilities Charts

This is in reference to the letter from Major Ehart published on the "Cross Feed" page of the April 1952 issue of FLYING SAFETY magazine with regard to the new format of the U. S. Radio Facility Charts. * * * The following will give a review of the work accomplished and proposed plans, and will comment on your suggestion that a loose-leaf system should be adopted.

The Planning Chart has been reinstated. It will be found on the center spread of the Radio Facility Chart, and immediately following it a blow-up of the northeast area of the United States.

Comments with regard to difficulty in differentiating between the blue and black lines and letters under fluorescent lighting are pertinent and well founded. This particular color system was selected, however, after comparative tests both in the research laboratory and in the cockpit with regard to the efficiency of several color combinations. * * * The matter of securing a satisfactory two-color depiction is under continuing study. * * *

This headquarters has had a continuing program of work on the improvement of current "blow-ups" of congested areas. * * * It is hoped that in the solution of the problem of proper depiction of the new VOR airways, the question of easy identification of all airways at intersections and terminations may be resolved.

The first issue of Radio Facility Charts using the two-color system and the succeeding one did contain certain errors that "crept in" in the transfer of data from the old charts to the new. These errors, however, were notamized as soon as detected for correction of publications at base level, and the publication was suspended for a one-month period in order that a thorough screening with regard to all detail might be given so as to assure absolute accuracy.

This headquarters considers constructive criticism an invaluable aid in the accomplishment of its mission. If further comments and suggestions will be furnished directly, immediate consideration will be given to them.

Commanding Officer
Aeronautical Chart and Information Service.

ED. NOTE: *Proper address to send suggested changes is given on page 1 of each issue of the Radio Facilities Chart.*

WELL DONE!

Lt. L. E. Vosburgh

An incident which might be "old hat" to an old-timer oftentimes can cause a young, inexperienced pilot to hit the "panic button." However, 2nd Lt. L. E. Vosburgh, an F-94 pilot with only 183 jet hours (488 total hours), recently demonstrated excellent pilot ability and cool thinking that speaks rather well for the younger generation of jet pilots.

Lt. Vosburgh, of the 318th Fighter-Interceptor Squadron, McChord AFB, Wash., was the No. 2 man in a two-ship element on instruments at 27,000 feet. He experienced a power loss, and on checking instruments, found that he had only 52% rpm. Throttle movement would bring no results. The flight was above the McChord radio range station, and Lt. Vosburgh advised his flight leader of his trouble, declared an emergency and started to descend.

He discovered that by switching to the emergency fuel control, he could get 90% power. However, the throttle still brought no response from the engine. His letdown was successful and upon arriving over the field, he found that he had 97% rpm. Visibility was about 15 miles, with a ragged, 3,000 foot ceiling. Lt. Vosburgh made a successful dead-engine landing by cutting off his emergency fuel shut-off switch at approximately 1½ miles from the end of the runway.

Inspection of the engine revealed that a thrown bucket had caused a high-frequency vibration, which in turn caused the failure of the Bendix fuel control shaft.

FOUR QUEENS . . .

A pat hand in this game of flying airplanes!

A wise old philosopher said, "Know thyself." To his admonition we add, "also know thy airplane, know thy procedures, know thy facilities . . . and live to raise many grandchildren!"

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