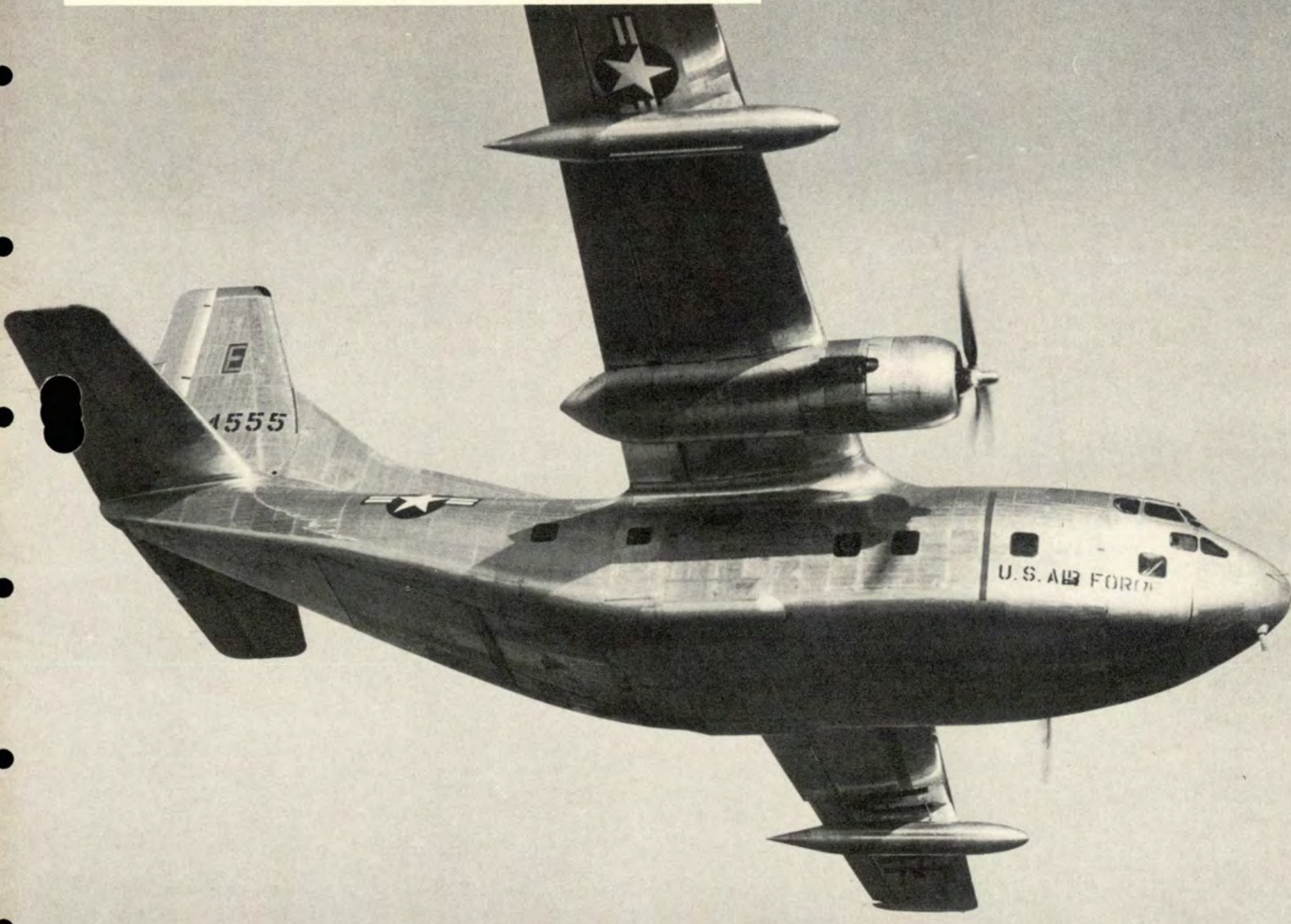
May 1955

FLYING SAFETY

UNITED STATES AIR FORCE



- Rugged but Right
- Stop the Stalling
- After You're Down

FLYING SAFETY

VOLUME ELEVEN NUMBER FOUR

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Our feature article next month will be about the Tactical Air Command's new, high-speed bomber, the twin-jet B-57B.

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SUBSCRIPTIONS

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USAF PERIODICAL 62-1

FLIGHT SAFETY AWARDS

★

Engraved Flying Safety Plaques have been awarded to the ten organizations listed below for exceptional accident prevention records. This presentation is for the period July through December 1954 and is symbolic of the achievements made by the officers and airmen of these units in promoting sound accident prevention programs and displaying exemplary airmanship. Congratulations!

5700th Air Base Group
Albrook AFB, Canal Zone—CAC

36th Fighter Bomber Wing
Bitburg Air Base, Germany—USAFE

67th Tactical Reconnaissance Wing
Itami Air Base, Japan—FEAF

3648th Combat Crew Training Squadron
Laughlin AFB, Texas—ATC

301st Bombardment Wing
Barksdale AFB, Louisiana—SAC

5039th Air Transport Squadron
Elmendorf AFB, Alaska—AAC

439th Fighter Bomber Wing
Selfridge AFB, Michigan (Res)—ConAC

1706th Air Transport Group (AE)
Brooks AFB, Texas—MATS

178th Fighter Interceptor Squadron
North Dakota ANG

Donaldson Air Force Base, South Carolina—TAC

LETTERS TO THE EDITOR

Wrong Valves Again

I read with interest the article on page 9 of the February 1955 issue of FLYING SAFETY regarding the C-45 incident of pulling the oil by-pass valve by mistake for the heat control valve. I had the same experience.

We were flying through the Knoxville ADIZ at night. I was the IP and my student was a reservist who had not had the opportunity of keeping current on present procedures and techniques. He complained of the cockpit being too warm so I pulled what I thought to be both heat valves, partially up. In a few minutes I noticed the oil temperature was up past the red line on the right engine and the cylinder head temperature was also high. I immediately opened the oil cooler, the cowl flaps and put the mixture in full rich. The cylinder head temperature came back down and the oil temperature dropped to the high limit red line. I was able to hold the oil temperature there and the cylinder head temperature stayed normal even after closing the cowl flaps again. We had landed and were closing the aircraft down and shutting off all switches and valves when I noticed what had happened. Unlike the author of the article in the February issue, it never occurred to me that I'd partially opened the oil by-pass valve.

This will never happen to me again but it's quite possible it could happen to others. Sometimes we have to learn from experience, perhaps there should be some sort of a lock or guard to prevent this sort of thing.

Major Donald W. Becker
63d Troop Carrier Wing (H)
Donaldson AFB, S.C.

We wonder how many more cases like this have occurred, perhaps with more serious results? A pilot can't afford to take anything for granted, especially at night, when cockpit visibility is reduced.

Hairy Takeoff

Recently I was a passenger on a routine flight of a C-54. The conditions under which the takeoff was made were, in my opinion, in violation of the principles of flying safety. (To establish my experience, I believe that I am as experienced as the average pilot, with over 12 years and 5000 hours of flying behind me. One tour was spent in Alaska where cold weather flying is the rule rather than the exception.) Since I appeared to be the only person aboard concerned with the safety of the takeoff, I would certainly appreciate the following:

a. The early receipt of the Editor's comments on the safety of the takeoff that was made. Since this incident there have been many discussions on this matter. If I was unduly alarmed over the takeoff, then it would certainly be to my benefit to learn wherein I have mis-evaluated all of the contributing factors.

b. If you consider the incident of significance, how about publishing additional future articles concerned with aircraft takeoffs under varied icing conditions? The winter issue of FLYING SAFETY had two short items on takeoffs under icing conditions (one on page 10 and the other on page 17); however, they were certainly not given the treatment that inflight icing was given.

The incident was as follows: Upon reporting to the aircraft, it was found that from one-half to three-fourths of an inch of snow and slush covered the C-54 (There was not much wind, so the snow had settled on all surfaces exposed to the straight-falling precipitation.). An attempt was made to sweep the wing surfaces clear; however, a broom would not clean them properly, and using a broom on the slippery wing was very dangerous to sweeping personnel. Rather than waste further time (the pilot was very anxious to get home as he had been away a full week!), the aircraft commander (acting also as an instructor pilot) hurried over to the local USAF firehouse.

Arrangements having been suitably completed, the firemen used their high pressure water hoses and attempted to clear all the slush from the aircraft.

While the water cleaned most of the slush from the top of the left wing, the top of the right wing still had many large patches of slush on it, the tops of the four nacelles were covered with slush, and the left top half of the entire fuselage was still covered with slush.

This spraying resulted in the entire aircraft being covered with a thin layer of water.

Immediately after the surfaces had been sprayed (with no attempts being made to further clean or dry them), the engines were started and the aircraft taxied into takeoff position.

During engine run-up, the remaining slush and water on the wings began to freeze. The large patches of slush behind the engines didn't even blow off during the mag checks. You could see the thin coating of water on the wings and ailerons had frozen. Disregarding (or overlooking) this condition, the takeoff was made.

Additional information:
Weather—The ceiling and visibility had been variable throughout the afternoon. There had been light to moderate snow, and the field had been below minimums a short while before takeoff. At takeoff time, the ceiling was 600-800′, with one mile visibility. There were no significant changes forecast. The temperature was 31° F., and the wind was generally down the runway at 10 knots.
Runway—Wet and slippery, with a coating of slush. Length, 7000 feet. Elevation 460.

Destination — The airdrome of intended landing was closed at takeoff time (snow removal was in progress); however a personal call by the aircraft commander had been made to ensure that it would be opened upon his arrival. Weather forecast to be above minimums, with snow.

En route Weather — The en route weather was forecast to be in an area of probable icing, since snow shower activity was to be expected over the "hill" portion of the route.

Aircraft Loading — The aircraft weighed around 60,000 pounds.

After all my apprehensions, the aircraft became airborne using a reasonable amount of runway, and the flight was strictly routine. Although the thin coating of ice (from the water spray) left the wing during the flight, the slush on the nacelles, wings and the fuselage was still on the aircraft upon landing.

Considering all the factors that went into planning the flight, I would be most appreciative of your evaluation of the incident.

Major John W. Abbott
Hq 2d Weather Wg (MATS)
APO 208, NY.

In answer to the Major's questions:

a. The conditions under which this takeoff was made definitely were opposed to all principles of good flying safety practice.

b. We thought we had covered this subject rather thoroughly in the past but it looks as if we need another article before winter returns!

No Light — No Go!

A recent taxi incident indicates the need for an addition to AFR 62-10. Subject regulation has no provision for an emergency stop at night with only one light wand or flashlight functioning.

The failure of a light wand while directing an aircraft at night and an attempt to stop the aircraft with one wand was interpreted by a pilot as a "come ahead" signal, resulting in a taxi incident.

As a solution, Headquarters 374th Troop Carrier Wing has published Wing Regulation No. 62-6 which states:

a. During night taxiing, the pilot will execute an emergency stop any time one or both of the taxi signalman's light wands go out.

b. If one wand becomes inoperative during night taxiing, the taxi signalman will turn off the other wand. Signalmen will not attempt to direct aircraft unless in possession of two lighted wands or flashlights.

Major James M. Bentley
FSO Hq. 374th TC Wg (H)
APO 704 San Francisco

Thank you Major Bentley. No need to wait for a change in regulation to make this SOP for all organizations.

Altimeter Idea

I am writing to you concerning your article "Don't Chance a Glance," appearing in the December 1954 issue of your magazine.

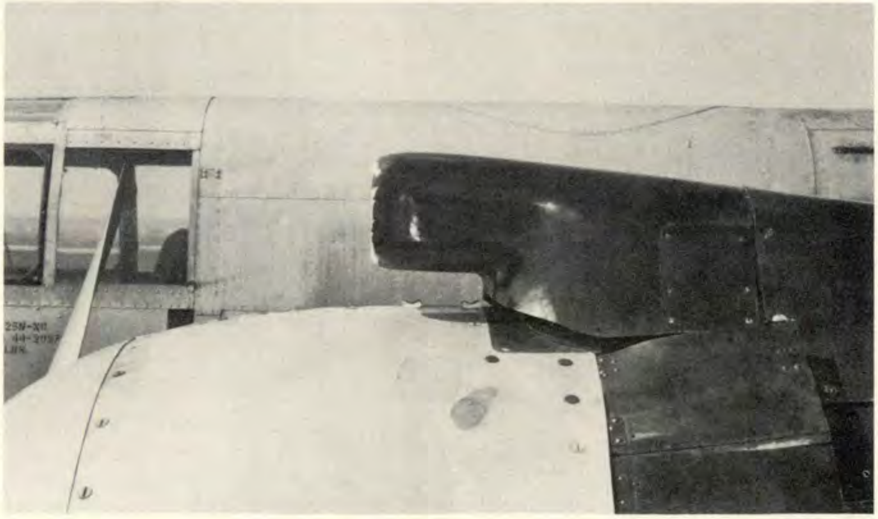
The "hide and seek" 10,000 foot needle is indeed a problem and I am submitting a possible solution. The main idea is to have the 10,000-foot needle long and slender stretching completely across the dial. I think that if the arrow shaft is slender with the distinctive arrow head and tail to eliminate any chance of confusion, there would be no way in which the 10,000-foot needle could be hidden.

I realize that this is a simple solution and in all likelihood it has been tried before. Also, there may be some other objection to it. However, I submit it to you in the hope that it may help in the reduction of accidents.

E. A. Greenwood, Sqdn Ldr RCAF Div.,
Canadian Joint Staff 66 Ennismore
Gardens, London, S. W. 7, England.

Thanks, neighbor, Your idea is one currently being considered by the Wright Air Development Center. As soon as a decision is reached, FLYING SAFETY will run an article on the new altimeter.

We have received many requests from our readers asking for pictures of the B-25N with the Bendix carburetor installation. As you can see from the photos, aircraft so equipped can be recognized by airscoop located on the nacelles. See article on the "N" in last November's issue.



With a propeller feathered, the C-123 handles remarkably well. Turns can be made with ease in either direction.

RUGGED but RIGHT

LAST FALL a photo of a new airplane crossed our desk. We thought at first that it was just a typical public relations release, but on second glance we got the feeling that this airplane might well be the answer to several logistical problems.

With an all-jet Air Force just around the corner, a new twin-engined cargo job doesn't mean much to many military pilots, and it's going to take a bit of doing to convince most members of the team that the C-123B isn't a stunted version of the C-119.

We were guilty of the same thinking when we noted the Fairchild label on the photograph. However, we were wrong, but good. The C-123B is far removed from the freight-car concept. True, it's a load carrier and we'll grant that the cargo compartment is about as plush as a freight-car, but this little machine has an entirely different mission in life.

You'll be seeing the C-123B soon. And many of you will be driving it. It's an easy airplane to fly, is reasonably fast, light on the controls, has time-tested power plants and has single-engine performance that is hard to believe.

Without getting into the genetics of historical growth, it's enough to note that the C-123B started life as a glider, gradually developed engines and has proved its capabilities as a combination jet and reciprocating powered machine, as well as pure jet. For a small cargo job, that's some transition.

The Air Force has been thinking seriously of an assault transport for lo, these many years. We've needed a plane that could operate from hastily prepared strips, short-haul large numbers of combat troops, double in brass as a cargo job, have the inherent ability to operate from pocket handkerchiefs and, above all, perform the missions quickly and effectively. The C-123B may be the answer.

There are many features incorporated within this plane that set it apart from the ordinary reciprocating powered cargo job. The most outstanding feature is the engine installation. Two Pratt and Whitney R-2800s power this craft, but unlike most planes, there are no engine nacelles. The engine mounts are bolted directly to the front spar and the wing leading edge. The engines protrude ahead of the wing itself. Orange-peel cowlings add to the versatility of the airplane by allowing extremely fast opening for inspection and maintenance.

There are no internal fuel tanks in the C-123B. Just aft of the engines are

Here is a flight performance preview on a new assault transport aircraft.

The C-123 has the capability of operating in and out of short, rough fields. Even without the two J-44s, the two Pratt and Whitney R-2800s enable this aircraft to take off quickly fully loaded.

streamlined tanks, attached to the wing by four eyebolts each. Standard bomb shackles, integral within the tanks, complete the assemblies.

One of the least known features is the basic wing design. As noted previously, the C-123B started life as an all-metal glider. The airfoil is of high aspect ratio and consists of a triple-web box spar and truss type ribs.

This construction assures that breakage of one rib will not progress successively to others and that if one or even two spar webs should be damaged, the wing will not collapse or lose its lift.

All fuel, oil, air loads and wiring are quickly detachable to enable an engine replacement to be made in less than an hour. Maybe that wouldn't be a record, but the advantage in this set-up is that such a procedure is possible in the field with a bare minimum of specialized equipment.

Stemming from the original glider design, and still retained, is a special, welded steel nose structure that provides an unusual degree of protection in the event of unexpected and unscheduled contact with virtually immovable objects such as stone fences and allied barriers.

In appearance, the C-123B looks much like any cargo or freighter aircraft except for the sharply upswept tail and the deep squat fuselage. In its evolution from glider to airplane it has grown a progressively larger vertical fin and rudder assembly and a dorsal fin.

The upswept portion of the tail is designed to house a two-piece door assembly featuring a built-in ramp for the loading of cargo and troops. This high tail provides for ample vertical clearance for wheeled vehicles and artillery pieces which can be loaded or unloaded in combat areas without cargo handling equipment.

The most recent additions that have been tacked onto this aircraft include rudder and elevator spring tabs, doors over the main landing gear, redesigned paratroop doors and improved anti-icing equipment.

Just in case you're interested in some statistics, the cargo compartment area is almost 37 feet long, 9 feet wide and 8 feet high. The compartment's treadway for wheeled equipment is stressed for 200 pounds per square foot, and heavy-duty tie-down fittings stressed for a maximum of 20,000 pounds are laid in a grid pattern throughout the cargo compartment. In a nutshell, this baby can carry a load.

You'll like the instrumentation of this plane. Things are where you expect to find them. Quite a few of you have flown many a long hour in Goonies and '46s and you know that those old gals have their good points, and their bad ones as well. But how many times have you had to ask the engineer where some particular gadget was, only to receive the standard answer, "How should I know, I'm not the regular crew chief on this tub?" It seems to us that the C-123B is a bit better in that respect. Standard instrumentation in keeping with HIAD specifications makes it possible to locate gages and controls where you expect to find them. If that's a switch, so be it!

With the decelostat braking system, lift-to-reverse controls for the fans and excellent visibility, the plane incorporates many of the desirable features we've been seeking for a long time.

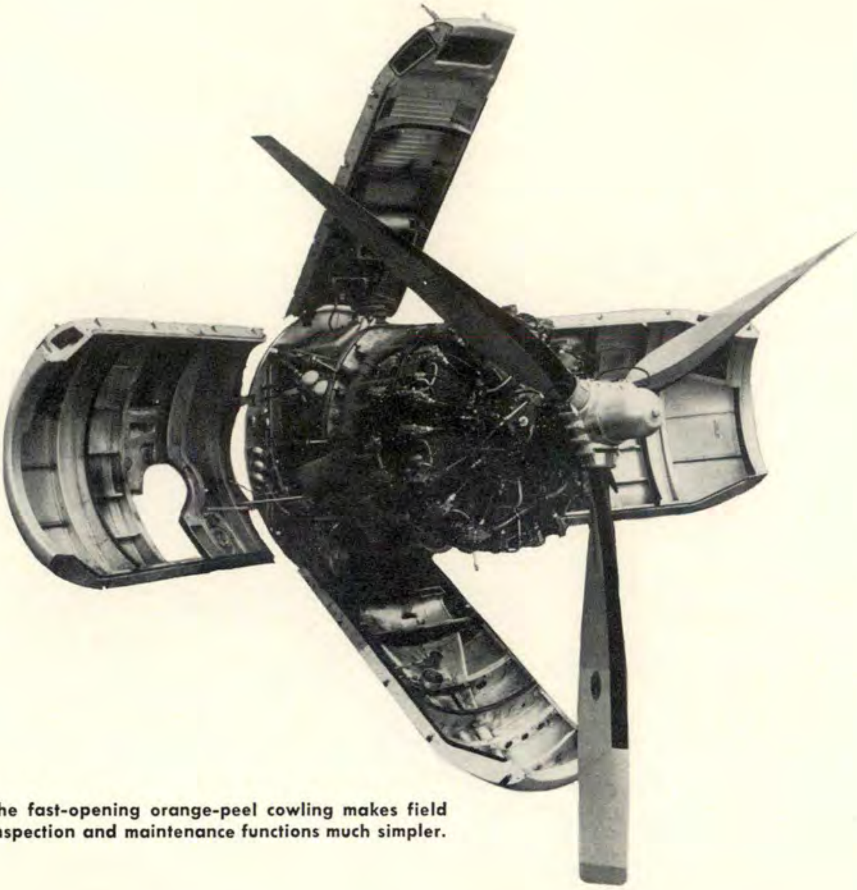
It isn't too often that we are able to break away from piling up hours behind an editorial desk. Once in a while though, we can get our ink-stained hands on an airplane and attempt to give an unbiased report of its potential and capabilities. Such is the case with the C-123B.

We spoke earlier of this plane's having flown with both reciprocating and jet power. It really has, and preliminary flight tests with jet thrust augmentation appeared to work out extremely well. Two J-44 turbojet units were installed on a test model to provide an additional 2000 pounds of thrust. Installations of this type show great promise of increasing performance under both takeoff and emergency flight conditions, especially if a main engine failure occurs.

We didn't have an opportunity to fly the jet-augmented job, but flight data indicates that single-engine rate-of-climb is greatly increased with the jet augmenters in operation. Tests show that with one engine feathered during takeoff, the rate-of-climb was increased by nearly 500 feet per minute over single engine performance. You can imagine how this plane performs with both mills churning and the two J-44s kicking up a fuss.

There are a couple of good features on the C-123B that should be of interest to most military pilots. First is the installation of Hamilton Standard three-bladed propellers that are forged from hard aluminum alloy and are solid in construction. We've all had our share of problems with hollow blades, specially in areas where rocks were constantly nicking the fans. This type of construction should eliminate many of those headaches, and the crew chief who wore his fingers raw with a file will greatly appreciate these new blades.

Second is the anti-skid brake system. Many know this as the decelostat braking system. Just in case you've not been exposed to how anti-skid



The fast-opening orange-peel cowling makes field inspection and maintenance functions much simpler.

The fuselage is built low to the ground and the upswept portion of the tail features a two-piece door assembly with a built-in ramp that affords easy access to the large, reinforced cargo area.

brakes work, here's a brief rundown:

The anti-skid system is provided to prevent the airplane from skidding or sliding during landings. The brake operating valves, controlled by the deceleration controllers, direct hydraulic pressure to the brake assemblies. The deceleration controller's principle of operation is based on the relation of the rotation deceleration rate of an energy wheel, contained in the controller, to the rotation deceleration rate of the main gear wheel. Under normal conditions, the energy wheel in the controller will rotate at the same rate as the main gear wheel. If the rate of deceleration of the main gear wheel exceeds the setting in the main controller, the energy wheel will over-travel, causing the brake operating valve to interrupt the hydraulic pressure supply to the brake assemblies, releasing pressure to the brakes. When the main gear wheel and the energy wheel resume the same rate of rotation, the operating valve allows hydraulic pressure to return to the brake assemblies.

Fortunately, most of our writing is tempered with just a dash of mercy for the long-suffering pilot, so we will let the description of the brakes go at that. In essence, however, what all that means is that you can clamp on the binders just after touchdown and this system will keep you rolling straight and on an even keel in spite of heavy-footed copilots, icy runways or other factors that plague every hard-working fly-boy in the business.

Probably one of the slickest gadgets we've seen and flown with in many a year is the Landing Speed Indicator. Some of you lads who fly B-47s and allied craft are familiar with this little gem, but on the whole most Air Force types have not been exposed to the electric marvel that takes the mental slip-stick business right away from a pilot.

The Landing Speed Indicator gives direct, prompt information which the pilot must otherwise obtain through a series of calculations, and which must then be interpreted in terms of airspeed indications. It eliminates the necessity of estimating the weight of the aircraft prior to landing and interpreting its resultant effect on the aircraft's best approach and landing speed, which varies by load, acceleration, flap settings and gust factors.

Unlike the airspeed indicator, which lags because of the aircraft's momentum, the LSI responds at once to elevator control. By keeping the indicator needle centered it is possible to fly a maximum percentage of maximum lift. The throttle then controls the rate of descent or ascent.

The Landing Speed Indicator is also of great value during takeoff. It provides the optimum attitude during takeoff run, thus assuring that the plane will become airborne at the proper speed for the load being carried.

The workings of the LSI are too lengthy a subject to pursue in this article, but it suffices to note that the instrument has tremendous possibilities in any military airplane.

One feature of the C-123B that we like particularly well is the fire emergency system. Maybe this is too easy. It depends on your point of view. Of course, none of us particularly appreciates glancing out and seeing an engine making like a blow-torch, and fortunately it seldom happens. But, if it does, here's what happens (and this is automatic, son):

Power is furnished through circuit breakers on the overhead panel to the fire emergency switch on the fire emergency panel. As soon as you actuate it, this switch arms the fire extinguishing circuit and then alerts the fire emergency relays.

Next, the power circuits energize the fire emergency relays and this results in the following:

- Opens cowl flaps.
- Feathers propeller.
- Opens oil cooler flaps.
- Closes firewall fuel valves.
- Closes water injection valves.
- Closes firewall hydraulic valve.

Actuation of the fire extinguisher handle results in the following:

- Discharges the fire bottle.
- Closes accessory section vent door in top of cowling.
- Closes oil cooler flaps.
- Closes cowl flaps.

So there you have it. That's certainly a lot easier than trying to get everything shut down in a semblance of logical sequence. As a matter of fact, we seem to be getting nearer to push-button flying every day.

Let's take a stock model of this machine without jet augmenters and fly it the way we did a few weeks ago. We'll take an average of 54,000 pounds as takeoff weight and see what this baby will do.

Our ship had nacelle tanks only. We've mentioned previously that there's no such thing as a true nacelle on this bird, but for the sake of discussion we'll call 'em that. Anyway, they're streamlined in behind the engines and give us a total capacity of 1453 gallons of go-juice. In round figures that's a potential range of something over 1300 nautical miles.

After an easy engine start (anybody can start an R-2800), we warm up and taxi out for takeoff. This is an easy dude to steer on the ground. The control is right on the yoke, and just a touch tools the bird either way without a bit of throttle fiddling.

Getting the C-123B off the ground seemed mighty easy compared with some aircraft we've flown. Flaps were set in the takeoff position (approximately 15 degrees) prior to starting the roll. With brakes off, we advanced power to 52 in. hg. on both mills and the props quickly stabilized at 2800 rpm. We seemed to have rudder control right away and, this was quite noticeable because of a nasty crosswind condition.

The book says that with a no-wind condition, grossing 54,000 pounds, the plane should become airborne after 1520 feet of roll. We can't argue with the book. In this case though, with a bit of breeze to assist, the plane leaped off without any urging or tugging after about 1200 feet and we noted that the Landing Speed Indicator needle stayed right in the center, meaning maximum performance for the load.

After we had the garbage tucked away and were climbing upstairs, Fairchild's E. R. "Dutch" Gelvin gave us a good briefing on the plane. Of course we'd been over it previously, but his theory is to drive home the important points often enough to make 'em stick.

"Now, let's take this particular wing," he began. "I've told you that this bird is just a glider at heart. Know what that really means?"

We nodded, sagely. Looked at the instruments. Gazed off into space and observed the very interesting fact that there was a pall of smoke over Altoona, as usual.

"You take a glider or a sailplane," said Dutch. "It's clean. The really good ones have a full cantilever wing. It's efficient and light as a feather. Most of 'em have an airfoil design of a high aspect ratio and you know what that means?" Apparently we didn't---for he continued. "That means that when you get 'em slowed down and right into a stall, they pay off. Yes, sir, right now! There's no fooling around either. One minute you're flying, and then bingo, you're stalled out and wonder how it happened.

"Now, you take this baby. When we get upstairs you set this airplane up on her tail and watch. If I could disconnect the LSI and the stick shaker, you could fly her into a full-power stall and never know it except, of course, by attitude. Naturally, we've got the shaker set about 20 knots above stall so you can't inadvertently get into such a predicament, but, like I say, she's a glider at heart.

"Here's something else that might be of interest to your readers. When we get the green light to equip all these airplanes with jet augmenters, we'll need something for additional control in case you lose one while going on out. You can hold it of course, but chopping the opposite blow-torch in case of failure of the other would make it easier. Know how we did it? Simple. Just stuck a sensing device in each J-44. The second that pressure begins to drop on one, the other automatically cuts out, too. You've still got your two R-2800s and so you chug on out anyway. Simple, huh? Okay, we're high enough for anything, go ahead and play with this machine. Feel it out and enjoy yourself."

We've flown a few sailplanes ourselves, even back in the days when brother Bowlus was making ribs from laminated cardboard. Somehow, this monster didn't even faintly resemble a powerless aircraft. With 40-odd hundred horses to play with and instantaneous control response, this thing was an airplane.

In climbs, glides, climbing turns and diving turns, the C-123B is solid. There's no buffeting or unreasonable reactions. The spring-tabs probably play a big part in it, but the controls are easy and positive. We racked around in some steep turns and sucked it in hard. Nothing! It just sat there and pivoted. Probably we could have stalled it out, but these ancient arteries would have been sagging toward a blackout before she let go.

Next, we feathered the right fan and tried a bit of single-engine stuff. We deliberately let the airspeed drop down to about 90 knots and still had excellent control. Stepping up, with a bit of power, we waited for about 130 indicated and then did a series of turns *into and away* from the good engine. Maybe we weren't flying an L-5, but it handled just as well. There was no buffeting or fighting of the controls, and the operating temperatures of the left engine remained in the green all of the time.

Bringing back No. 2, we waited for it to warm up and then tried some power-on stalls. With 45 degrees of flaps, 2600 rpm and manifold pressure 27 in. hg. she went out at 75 knots indicated. From about 93 knots on down the stick shaker was giving us fits. Other than that, there didn't appear to be any warning except for the fact that we were looking at the ground over the horizontal stabilizer. As the saying goes, "you just can't hardly get in positions like that no more!"

There's one thing about stalling this plane from an exaggerated nose-up attitude with power on. You just don't know which way she's going to fall. Either wing may drop and the nose is going to fall out from under you. After that, you can throw the controls all over the area and nothing will happen. It's the same with any high aspect ratio airfoil design. Recovery, though, is simple. Center the controls and wait. It only takes a moment and altitude loss under the worst conditions shouldn't be over 500 feet, usually less.

We tried some more stalls, with and without power, with gear up and down, and with flaps in various configurations. Other than the almost vertical attempts with power on, the plane gave a fair amount of warning, and recovery could be effected anywhere along the line using normal procedures. The stick shaker continued to lead every stall, regardless of attitude or speed, by about 20 knots. We were learning to like this friendly little gadget.

Finally, we brought the plane back downstairs and entered the traffic pattern. In this particular case we flew a rectangular pattern, but an overhead with an IP would be handled just about the same. Dutch Gelvin gave us a briefing on procedures before we entered, and we followed 'em to the letter.

On entering the downwind, we reduced speed to 130 knots and lowered the gear. Just before we reached the turn onto base, props were advanced to 2500 rpm and manifold pressure was set at 25 in. hg. This, according to Dutch, is a good average to maintain for normal conditions.

On the turn onto base, the flaps were lowered to 15 degrees (takeoff position), speed further reduced to 110 knots and a rate of descent established right at 500 feet per minute.

Inasmuch as we were flying a fairly close-in pattern, this appeared to be just about right. The turn onto final was made, flaps lowered to 45 degrees and power nudged up just a bit. A couple of inches appeared to be just right to hold 100 knots. The needle of the Landing Speed Indicator remained just a bit on the fast side and the rate-of-descent was pegged at 500.

From that point on it was strictly routine. As we came over the fence we rolled in a bit of trim, eased off on the power and made a normal round out. There was just a bit of floating (Dutch said that 90 on final would have precluded that), and we touched down. It was that easy.

Here is where those whoa fans showed their real value. As we reduced power to idle, the throttles bumped against the stop. There was no mistaking it and no pulling on past, either. Immediately on touchdown we lifted the two throttles an inch and a quarter, moved 'em back and *right now* got reverse thrust that squatted the old gal down on her knees. Landing roll? 800 feet!

We noticed one point here that is important to a pilot. Propeller reversing in the C-123B, especially in a cross-wind, sets up a sudden reaction that will jolt the most iron-nerved. Because of the relatively narrow gear, the plane naturally has a rolling gait at best. With prop reversal, this rolling moment is amplified greatly and as the aircraft settles down at the bow, it also heels sharply, as the Navy would say, to either port or starboard.

Fortunately, directional control is easily maintained with nosewheel

J-44 jets add 2000 pounds of thrust, greatly increasing both takeoff and emergency performance.

steering, and after one gets used to this little idiosyncrasy it ceases to be a problem. We found no directional control problems either upwind or cross-wind once we knew what to expect from the beast.

We flew the plane some more, too. We tried different power settings. Different load conditions. Even with the pylon tanks adding another 5000-odd pounds when full. It still handled well.

Just in case you get the wrong idea, FLYING SAFETY isn't trying to sell the C-123B. The Air Force has already ordered a substantial number of these birds. All we wanted to do was give a first-hand report of its ability, capability and short-comings. Yes, it has some of those, too.

We didn't like the main side windows. They're hinged forward, and if you crack 'em open they're gone for good. Even at taxiing speed that will usually happen. Fairchild says that they plan a retrofit program to change the window design to the conventional, sliding type.

The main landing gear is nice and soft, even on a lousy landing, but when the nosewheel contacts the runway you don't know whether you're driving an airplane or a wheel barrow. It feels and sounds like a major experiment in flat wheel driving. The rough-field gear is slated for the nose soon, and that should take care of that condition.

Present location of the Landing Speed Indicator is entirely unsatisfactory. You've got to peek around the spoke of the yoke (no yoke intended) to see it, and cross-referencing with the airspeed indicator and rate-of-climb is a feat that nobody can quite do.

Heavy duty tie-down fittings, stressed for 20,000 pounds, are spaced throughout the cargo area.

Wheeled vehicles and artillery pieces are loaded or unloaded without cargo handling equipment.

Another thing that's somewhere in the mill is a bit of wiring to insure that the auxiliary fuel tanks can't be jettisoned on the ground. The contractor proposes to hook such a rig into the nosewheel strut so that when it's compressed, it will be impossible to actuate a jettison button and get rid of the pylon tanks. Such a system will preclude inadvertent release, and under some conditions, this should eliminate ground fire accidents.

Probably there are other minor features that will crop up from time to time. We don't claim to have the answers. That's completely impossible when one can be with a new plane for but a few days. However, there is one particularly good feature of the C-123B that we do like:

In the event of landing gear system failure, it's only necessary to place the gear handle in DOWN position to insure a free fall. Then, the emergency crank is placed into the socket (a socket for each gear leg) and turned until positive gear extension is assured.

Finally, the crew chief or flight engineer can put the downlock pins in place manually and actually see what he is doing. That's about the most foolproof rig we've seen for a long time.

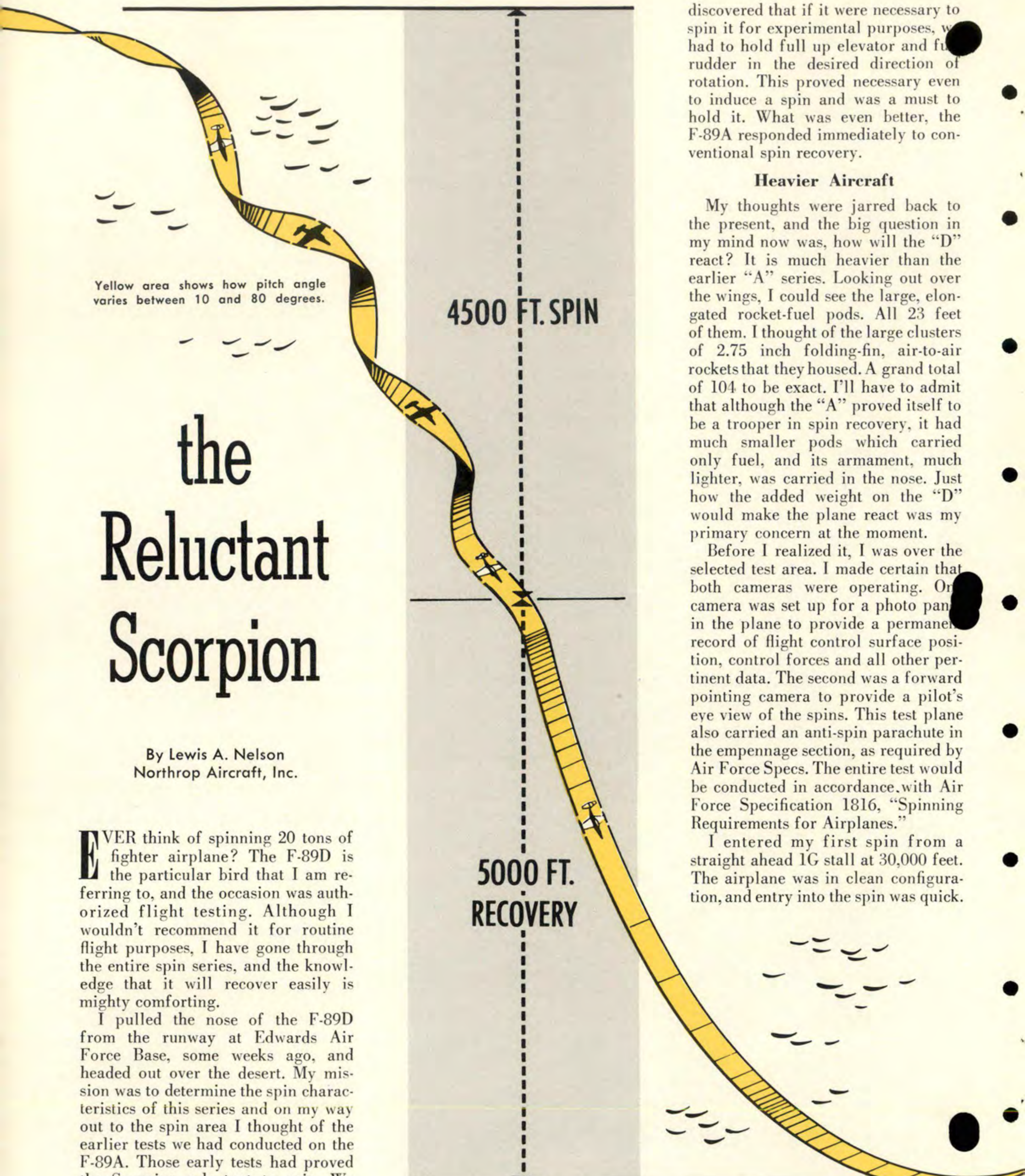
Another nice feature is the ability of the flight crew to open the cargo door in flight. Of course the plane has paratroop doors on both sides, but in an emergency, should it be necessary to bail a big load of troops or kick out a few tons of freight, all the driver has to do is move the cargo door control handle to OPEN and right now he's got a hole in the stern of this craft big enough to dump almost anything.

If the pilot finds he needs still more room, he has only to place the loading ramp control in the OPEN position and dump the ramp down, too. This can and has been done in flight with no noticeable effects on flight characteristics.

All in all, the C-123B appears to be a good airplane with quite a growth potential so far as utility is concerned. Not too long ago we would never have dreamed of stepping from a glider into the reciprocating-jet class in one swift stride. Today, the C-123B makes it possible. ●

the Reluctant Scorpion

By Lewis A. Nelson
Northrop Aircraft, Inc.



Yellow area shows how pitch angle varies between 10 and 80 degrees.

EVER think of spinning 20 tons of fighter airplane? The F-89D is the particular bird that I am referring to, and the occasion was authorized flight testing. Although I wouldn't recommend it for routine flight purposes, I have gone through the entire spin series, and the knowledge that it will recover easily is mighty comforting.

I pulled the nose of the F-89D from the runway at Edwards Air Force Base, some weeks ago, and headed out over the desert. My mission was to determine the spin characteristics of this series and on my way out to the spin area I thought of the earlier tests we had conducted on the F-89A. Those early tests had proved the Scorpion reluctant to spin. We discovered that if it were necessary to spin it for experimental purposes, we had to hold full up elevator and full rudder in the desired direction of rotation. This proved necessary even to induce a spin and was a must to hold it. What was even better, the F-89A responded immediately to conventional spin recovery.

Heavier Aircraft

My thoughts were jarred back to the present, and the big question in my mind now was, how will the "D" react? It is much heavier than the earlier "A" series. Looking out over the wings, I could see the large, elongated rocket-fuel pods. All 23 feet of them. I thought of the large clusters of 2.75 inch folding-fin, air-to-air rockets that they housed. A grand total of 104 to be exact. I'll have to admit that although the "A" proved itself to be a trooper in spin recovery, it had much smaller pods which carried only fuel, and its armament, much lighter, was carried in the nose. Just how the added weight on the "D" would make the plane react was my primary concern at the moment.

Before I realized it, I was over the selected test area. I made certain that both cameras were operating. One camera was set up for a photo panel in the plane to provide a permanent record of flight control surface position, control forces and all other pertinent data. The second was a forward pointing camera to provide a pilot's eye view of the spins. This test plane also carried an anti-spin parachute in the empennage section, as required by Air Force Specs. The entire test would be conducted in accordance with Air Force Specification 1816, "Spinning Requirements for Airplanes."

I entered my first spin from a straight ahead 1G stall at 30,000 feet. The airplane was in clean configuration, and entry into the spin was quick.

With the spin tests on the "D" series of the F-89 recently completed, here is an article on the results as related by Mr. Scorpion himself . . . Lew Nelson.

Lewis A. Nelson is supervisor of engineering test pilots for Northrop Aircraft, Inc.

Lew has been flying since 1940 and has been assigned to F-89 flight testing since joining Northrop in September, 1950. Prior to that time he was an aeronautical engineer with the National Advisory Committee on Aeronautics at Ames Laboratory, Moffett Field, California.

He served in the U. S. Air Force from 1942 to 1947, seeing service in the Central Pacific Theater as a fighter pilot and as Commanding Officer of the 73d Fighter Squadron.

Lew received his aeronautical engineering degree from the University of Southern California and is a member of Tau Beta Pi and Phi Kappa Phi honorary engineering societies.

As I applied rudder, the airplane tended to roll and became inverted at the 90-degree point. In addition to spinning, the F-89 actually "rolled" about the spin. It was really two separate maneuvers simultaneously. I did not let her wind up on this first test and recovery was accomplished in half a turn. The immediate response indicated that the increased weight of the "D" over the "A" had relatively little effect on recovery characteristics.

All Conditions

Subsequent spin tests were conducted under a variety of flight conditions and airplane loading. Spins and recoveries were made under conditions considered most critical, with maximum weight concentration in outer wings (full rocket load plus full tip fuel and nearly full outboard wing fuel) and with minimum wing loading (empty tip pods and empty wing tanks). These two conditions were considered the maximum extremes as they produced the most aft and forward center of gravity locations. Entry in these tests was made from both the straight ahead 1G stall and from 2G power-on turning flight.

The tests established that power had little or no effect on spin characteristics and did not adversely affect recovery. After the first one, I held all spins for three turns before I applied recovery. Altitude loss was about 1500 feet per turn with recovery requiring an additional 4000 to 6000 feet, depending on pitch attitude at the start of recovery. Recovery was accomplished in about one-half turn for minimum wing loading configuration and increased to one turn for maximum weight configuration.

With each test my chagrin at my original apprehensions grew. This was no monster, weight or not, my bird responded like a trainer. The remainder of the tests was duck soup.

Having gone through the complete spin series, I have drawn some mighty firm conclusions about the F-89D. First, this stack of airplane has no dangerous inherent spinning tendencies, being reluctant to spin. Just as in the F-89A, full up elevator and full rudder in the desired direction are necessary to induce the spin. I found that the old conventional recovery techniques are entirely satisfactory; you know, the old full rudder in the opposite direction of the spin and quick, positive forward stick. Matter of fact, the elevator force to stabilize the pitch angle is more positive in stopping rotation than rudder force. This is due to the tendency of the airplane to lag behind rudder in the heavy weight condition.

I noted also that the pitch angle varied slowly from ten to eighty degrees nose-down attitude. Positive elevator control permits you to stabilize the pitch angle and "unstall" the big bird, recovery being accomplished by simply flying out of the spin. Push force required for recovery will vary, depending on the point where recovery is initiated.

All in all, I'd say that the "Big D" puts the "pin" in spin. The pin that pops any hairy balloons of doubt, that is. ●

Here is a valid and practical idea sent to us by Colonel George L. Jones, the Commander of the 3595th CCT Group (Fighter), Nellis AFB, Nevada.

★ ★ ★

A GOOD IDEA is always worth passing on. Sometimes it's the everyday routine occurrences that develop into brainstorms. Sometimes it's the result of real down-to-earth concentration. But regardless of its origin, one thing can be said about any good idea. It developed out of necessity. You know, the old one about necessity being the mother of invention.

How many times have you searched through your back copies of FLYING SAFETY for a particular article that you remember reading? Maybe you want it to prove a point, or maybe you need the article as reference material for your next lecture. No matter what the reason may be, almost all of us at one time or another have been provoked by the elusive article in the misplaced issue.

We have received an excellent idea for a permanent fix on this repetitious situation. Although the author did not title his suggestion, it could very well be called "Where to Find It, When You Want It." The idea in all of its simplicity is to file and index your copies of FLYING SAFETY.

It was suggested that the standard three-ring binder provides the ideal receptacle for the magazines. With very little effort and with about the same amount of time, you can have a completely indexed file of each article appearing in FLYING SAFETY throughout the year. For filing, each copy may be perforated along the stitched edge with a conventional three-hole punch and inserted into the binder. The next item is the real timesaver. It's the index.

In many instances, the subject of each article is reflected in its title, therefore indexing can be relatively simple. Each individual may have his own preferences as to indexing the contents, however, it has been suggested that the stories or articles be grouped according to their subjects. A broad title should be selected for each group category. Listing these categories alphabetically then would provide an efficient means of locating a desired article. This system would also provide an excellent reference for subject matter in the event a specific article is not required.

To illustrate further, the suggested method has been reproduced on the facing page. The index as presented is complete for the year 1954. Inasmuch as we are on the subject of timesavers, got a pair of scissors handy?

Of course the outside cover or the back of your binder lends itself to a countless number of stylings. Organizational emblems or formal titles would be equally attractive. That's up to you. The important gimmick is that now it's where you want it when you want it.

FLYING SAFETY Magazine Annual Index, Volume 10, 1954

1st. Lt. M. M. Harris
5th F.-I. Squadron, McGuire AFB, N.J.

★ ★ ★

1st Lt. M. M. Harris was flying at 30,000 feet when he experienced a loud explosion in the aft section of his F-86D. The aircraft was immediately thrown into a violent skid, and the rudder pedals jammed full right. He realized that he was over the densely populated Philadelphia area and that to abandon the aircraft meant almost certain injury to civilian personnel.

The explosion had rendered all flight instruments except the needle, ball and airspeed inoperative, had severed the rudder cable and had knocked out all radio equipment except the radio compass. The aircraft was vibrating violently, continually jarring the ejection seat handles

KNOWLEDGE →→→→→ **WELL**

Capt. A. E. Oligher
71st F.-I. Squadron, 500th Air Def. Group
Greater Pittsburgh Airport

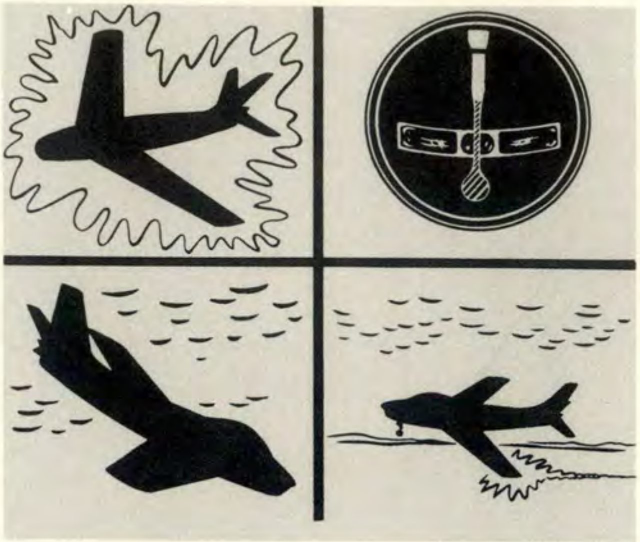
★ ★ ★

The flight had just passed through 32,000 feet when the wingman, Captain Arthur E. Oligher, sensed a noticeable change of sound in the engine of his F-86D. A rapid check of his instruments indicated the nozzles going to full open as the tailpipe temperature went to 1000°C., and the RPM started falling off. Before he could stopcock the throttle, he felt a violent engine explosion and experienced a complete loss of power. Simultaneously, the aircraft whipped into an uncontrollable roll and the cockpit filled with thick smoke.

After the aircraft slowed down, Captain Oligher turned to the partially raised position. He realized that he must descend through IFR conditions and make a letdown and landing in a badly disabled aircraft; still he elected not to bail out.

Lt. Harris homed on the McGuire range and broke out directly over the field at 4000 feet. He had no means of declaring an emergency and had to make a 360 overhead because of another aircraft on the runway. He lowered the gear with the emergency system, and realizing that he was extremely low, turned on a short base and final. In attempting to complete his turn by banking, as there was no rudder control, the left wingtip touched the ground short of the runway. As the wingtip hit, it turned the aircraft to the runway heading and bounced it up onto the concrete. The landing was completed without further damage.

The outstanding courage displayed by Lt Harris in remaining with his aircraft and the superior flying techniques employed are a credit to himself and to the United States Air Force. WELL DONE!



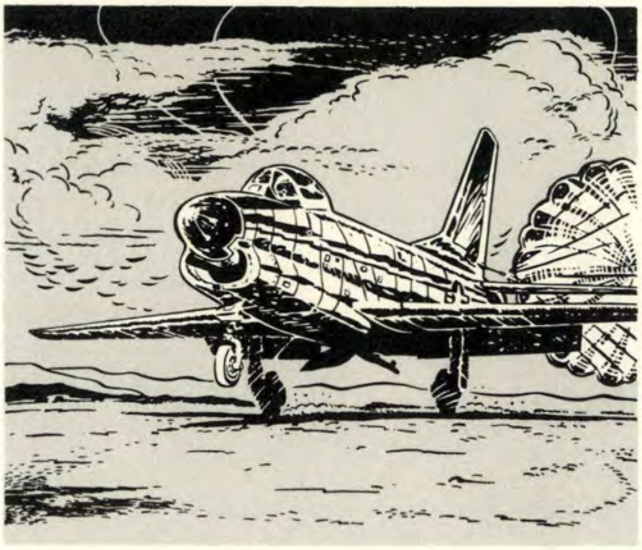
DONE

TRAINING

the engine master switch to the OFF position and was able to regain control of the aircraft. He established a glide toward Ellington Air Force Base and jettisoned the external fuel tanks.

A long straight-in approach was accomplished with a careful balancing of airspeed and altitude against distance. When he was sure of reaching the field, he lowered the gear and flaps. The nose gear did not fully extend. In rapid succession, Captain Oligher actuated the emergency nose gear extension while he held the nose gear off the runway, then he deployed the drag chute. Even though failure of the utility system had eliminated boosted braking action, he was able to stop the aircraft on the 5200-foot runway without further damage.

Captain Oligher's performance was an excellent demonstration of his capability to utilize his knowledge of the F-86D aircraft and his past flying experience to gain superior emergency performance from his aircraft. Captain Oligher's flying skill undoubtedly averted a major aircraft accident. WELL DONE!



Stop the Stalling!

This article is based on information furnished by Pratt and Whitney Aircraft

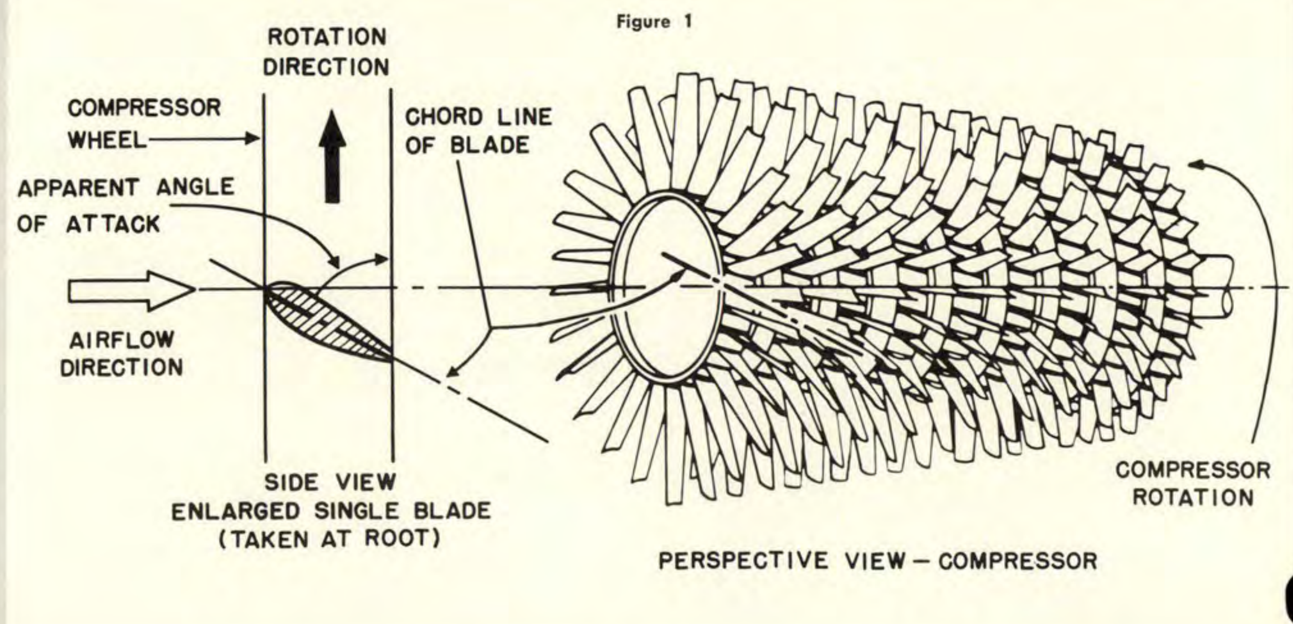
COMPRESSOR stall is a mixture of many complex and difficult-to-understand phenomena. However, it is the intent of this article to explain some of the phenomena in nontechnical terms for the benefit of those who are not versed in the "deltas and thetas" of engine performance. The simplifications and analogies employed herein must not be interpreted as the final explanation, but should be used as a stepping stone to more complex and exact explanations.

The high-output, high-pressure ratio engine is here to stay. And with good fuel consumption, too. However, the law of averages always catches up with us sooner or later. In order to produce high-output engines with superior fuel consumption and rapid acceleration characteristics, it is necessary to operate as close to the stall region as possible. So perhaps a discussion of compressor stall is needed to relieve anxieties that may develop when this phenomenon is experienced. Actually, damage to most engines is very unlikely to occur.

First of all, let us understand that stall, surge or pulsation as it is also called, is not a phenomenon peculiar to any one particular brand of engine or engine type. On the contrary, it may occur in any engine if conditions are right for it. Even the gas turbine compressors used for starting the larger engines frequently encounter stall as they accelerate to operating speeds. In the past, stalls have been encountered on two-stage or turbo-super-charged piston engines, so there is no need to look upon it as some mysterious product of the current jet age.

Pilots are familiar with the characteristics of reciprocating engines that permit any number of mechanical defects such as bad spark plugs, lean carburetion or sticking valves to result in engine backfiring. Similarly for turbine engines, maintenance, field conditions, temperatures and rapid movements of the throttle can influence the compressor stall problem appreciably. The condition and adjustment of such components as the fuel control, overboard airbleeds or exhaust nozzle assembly (afterburning engines) are of vital importance in maintaining stall-free operation. In general, there has been less stall of high intensity on centrifugal types than on axial types. There are several reasons for this, but probably the one having the greatest bearing is the fact that the centrifugal jet engines operate at much lower pressure ratios than the axial type. The constant demand for more thrust, lower thrust specifics and higher airspeeds and altitudes has broadened the range over which the engine must operate and consequently, made them more vulnerable to stall. Then, too, the fact that centrifugal type engines usually are fed

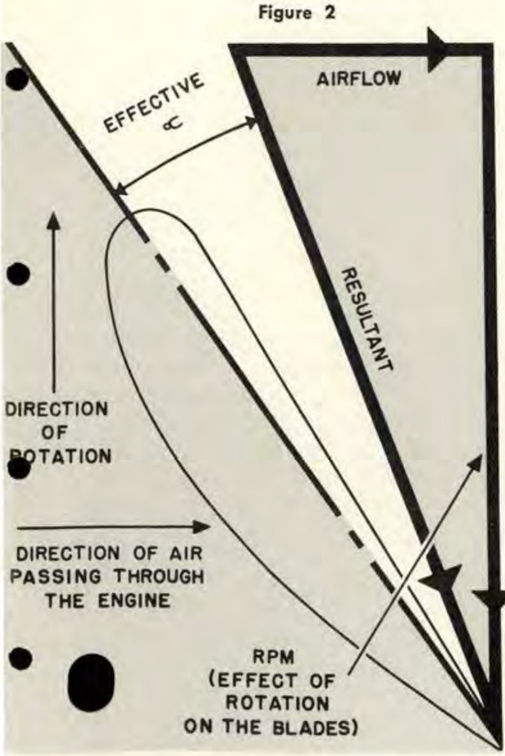
Figure 1



from a plenum chamber helps overcome aircraft duct shortcomings. The following discussions will be confined to the axial type jet engine.

Compressor stall is very much like aircraft wing stall, and compressor blades may be thought of as miniature wings. This analogy is not as easily seen when one considers that the angle of attack can be readily changed for the aircraft wing, as in a pull-up, but the rotating compressor blade remains physically fixed in its hub. Actually, the effective angle of attack of the compressor blade changes and the apparent or mechanical angle of attack (see Figure 1), remains fixed. This variation of the effective angle of attack in Figure 1 is the prime consideration when compressor stall is discussed. Now, let's see how this comes about. Figure 2 illustrates this effective angle of attack at a given or chosen position on a rotating compressor blade at a given operating condition. This effect is similar (if the diagram were rotated to the right) to watching the snow fall from a side window in a moving car. The snow is actually falling vertically, however, the forward motion of the car coupled with the vertical motion of the snow gives the impression that the snow is falling at an angle to the car. This direction of snow fall is similar to the resultant referred to in Figure 2.

Figure 2



The triangle beside the airfoil section is made up of two variables, that is, airflow which occurs along the axis of the engine, and RPM which represents a blade velocity acting perpendicular to the axis of the engine. For a given airflow and RPM (direction and amount as indicated by the arrows) there can be only one resultant which is fixed in both amount and direction and thereby defines the effective angle of attack.

Every airfoil is limited as to the maximum angle of attack it will tolerate under a given operating condition. When this angle of attack is exceeded, the airfoil stalls. (This maximum angle of attack will be referred to as the critical angle of attack.) As with the wing stall experienced in the aircraft, the air separates from the airfoil section. With this separation the lift is greatly reduced on the wing.

In the compressor this loss of lift is evidenced as a loss in pressure ratio and therefore a reduction in pressure level at the compressor discharge. Figure 3 shows how this angle of attack is varied.

In Figure 3 the airflow has decreased for a given RPM (dotted lines), which causes the angle of attack to increase. When this decrease in airflow becomes critical, the airfoil stalls. When the airfoil stalls, there is a relative reduction of pressures within the compressor. Recovery from compressor stalls is the result of the pressures reducing within the engine thereby permitting more airflow, which in turn decreases the angle of attack and allows the compressor to recover normal operation. Then, if the same low airflow condition persists which caused the first stall (no change in operating conditions) the cycle will be repeated.

Now we are ready to apply this condition of low airflow for a given RPM to the actual conditions which may cause it. Of course, the actual causes and effects are considerably more complicated than will be discussed here.

During acceleration, compressor stall may be encountered due to improper fuel scheduling to the burner. For instance, if the fuel flow is too high, temperature and pressure in the burner become higher than that for which the designers planned, thereby causing abnormal back pressure on the compressor. This decreases the airflow for a given RPM (as is illustrated in Figure 3), which increases the effective angle of attack beyond the airfoil's critical angle of attack and causes the airfoil section to stall with the result that airflow reverses for an instant in the compressor and pressures are greatly reduced. However, it is necessary that the acceleration fuel flow be maintained as high as possible so that the best engine acceleration rates may be obtained. Therefore, there must be a compromise between acceleration rate and compressor stall. This requires a margin between actual operating conditions and stall, which can be provided by means of fuel control scheduling.

Another condition of possible compressor stall occurs at high altitude, particularly with high power operation. This condition is brought about by low temperature effects and what is known as Reynolds Number effect. When the air gets thinner, as is the case with high altitude operation, the air has difficulty in following the contours of the airfoil section of the compressor blade, thereby reducing the stall margin.

As the air gets colder, the engine tends to operate closer to stall. Therefore, more care must be exercised when operating at altitude where the air is both thin and cold. In order that the engine may operate efficiently at both high and low altitudes, the apparent angle of attack must be a compromise, and stall margin for these conditions must be designed into the engine before it is built.

Compressor inlet conditions also aggravate the stalling characteristics of the engine. Don't forget that the engine has been designed to function at a certain power level for a given RPM-airflow relationship (see Figure 3). When the airflow for a given RPM is decreased, thereby causing the effective angle of attack to increase, compressor stall can be encountered. Now, let us see how inlet conditions can affect this airflow variable. For a given airplane we will assume that the engine and airplane have been matched properly for normal operations, i.e., the engine will tolerate the amount of airflow loss due to ducting inefficiencies. These inefficiencies coupled with airplane attitude, airspeed and throttle will vary the distribution of the incoming air at the inlet to the compressor as shown in Figure 4. This airflow variation between the high and low areas in Figure 4 must be kept within reasonable limits, or the compressor blades

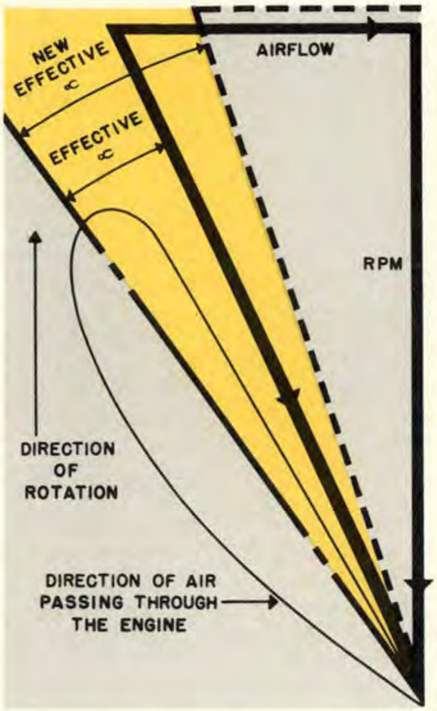


Figure 3

traveling between these areas may stall and unstall with such rapidity that a continuous stall may be the result. This airflow distribution can be varied outside of the acceptable limits of the engine by extreme skidding and slipping of the airplane which may cause the ducts to be unable to deliver the acceptable airflow

Figure 4

to the engine. At high altitudes where the effective angle of attack is close to its critical value and when airspeed is reduced, this stalling condition may be induced by milder skidding and slipping. This indicates that care should be taken to maintain airspeeds at a respectable level, and coordinated flying becomes more important when flying at extreme altitudes.

Supersonic flight may adversely affect ducting efficiency, especially at the entrance to the duct and at any constriction that may be present along the duct.

So here we have a situation in which high performance, good acceleration and low fuel consumption require that an engine and control be designed to operate near conditions where stall is encountered. Working against attaining these goals are the effects of Reynolds Number, cold air and possible inherent or induced maldistribution of air entering the engine. Some measure of control of acceleration stall is afforded by flexibility in fuel control setting, but for the most part the important factors are set when the engine and airplane are designed and built to a given configuration. Airplane and engine manufacturers are working continually to reduce the possibility of compressor stall occuring in the operational range of the engine.

Stalls vary in severity, depending on whether the stall involves only a portion of a stage, a stage, several stages or an entire compressor. Incipient stall may produce roughness with or without the audible accompaniment of a rumble, drone or similar noises. More pronounced stalls may produce noises varying in intensity from pistol shots to cannon fire and can be very frightening if the pilot doesn't know what to expect. This is especially true of fighters in which the pilot may be sitting over or between the long inlet ducts. Extremely bad stalls may produce pulsations which cause flame, vapor or smoke to appear at the exhaust, in the bleed valves or even at the inlet.

Now that we have seen the nature of some of these stall conditions, one would say, "What can I, as the pilot, do to avoid or diminish the intensity of these compressor stalls?" Here it is in a nutshell.

1. Always treat the throttle with respect. No erratic movements.

2. High altitude means more Reynolds Number and cold air effect, thereby enhancing the possibility of stall by a lower acceptable angle of attack on the compressor blades. If the pilot wishes to reduce the possibility of compressor stall, the following points may aid him.

- Coordinated flying helps inlet duct efficiencies.
- Climb at slower rates and higher airspeeds.
- Avoid abnormal airplane attitudes, such as nose-high level flights.
- Maintain airspeeds above acceptable minimums.

The next question is "How do I get out of stall?"

1. If compressor stall occurs during subsonic flight:

- Slowly retard the throttle until compressor stall ceases or IDLE position is attained.
- Correct any abnormal attitude of airplane.
- If stall persists at IDLE position, reduce altitude and increase airspeed (but remain subsonic) until stalls cease. Don't forget that your chances of recovery are getting better as altitude decreases due to Reynolds Number effect and increasing compressor inlet temperatures.

2. If compressor stall occurs during supersonic flight:

- Terminate afterburning and retard the throttle to IDLE.
- Reduce altitude and establish high subsonic airspeed by controlling airplane attitude. Do not manipulate the throttle until normal operation has been obtained.

Under some circumstances it may be necessary to do several of the above corrective measures simultaneously.

As was brought out in the beginning, compressor blade stall is very similar to airplane wing stall. When an airplane is unintentionally stalled, the pilot is usually very concerned, to say the least. The immediate pilot reaction is to recover from the stall. This he usually does satisfactorily if he does not exceed the G loading limitations of the aircraft during the recovery. Normally, the actual aircraft stall has not affected the aircraft structure. This stall situation can also be applied to the compressor stall, except that it is improbable that the compressor blades can be so overloaded as to cause compressor blade structural failure. The engine reaction to overloading may be a flameout, after which an inflight relight may be accomplished. However, the possibility of engine overtemperature during the stalled condition is possible if corrective action is not taken. ●


MAJOR REX RILEY
AIRCRAFT ACCIDENT INVESTIGATOR
by M/SGT. Holcltt
A TRUE STORY
A JET TRANSITION STUDENT INSPECTED HIS AIRCRAFT IN PREPARATION FOR A LOW ALTITUDE CRUISE CONTROL MISSION... CHECKED THE FUEL CAPS FOR SECURITY AND SET THE TOTALIZER... ...HE ALSO TUNED HIS RADIO COMPASS FOR A HOMER NEAR THE BASE.......
AFTER TAKEOFF HE TOOK UP AN EASTERLY HEADING AND PROCEEDED TO WORK HIS PROBLEM... UPON COMPLETING HALF OF THE MISSION HE MADE A 180, SET THE RADIO COMPASS TO HOME ON THE STATION AND BEGAN TO WORK THE PROBLEM IN REVERSE...
USAF
THE PILOT PAID LITTLE ATTENTION TO THE RADIO COMPASS AND PRACTICALLY NONE TO THE GROUND, BUT CONCENTRATED ON THE PROBLEMS OF THE MISSION.........
NEAR THE END OF THE MISSION HE LOOKED ABOUT AND FOUND HIMSELF NEAR A LARGE BODY OF WATER IN AN UNFAMILIAR AREA...THE RADIO COMPASS STILL POINTED TO ZERO....
OTHER STATIONS NEAR HIS HOME BASE WERE TUNED IN BUT THE NEEDLE STILL POINTED TO ZERO...IT BEGAN TO RAIN AND RADIO RECEPTION WAS POOR...DECIDING THE RADIO COMPASS WAS INOPERATIVE HE TURNED NORTH TO TRY AND ORIENT HIMSELF.....
...SIGHTING A LIGHTED AIRPORT HE BUZZED THE TOWER AND RECEIVED A HEADING TO HIS HOME BASE ...AT THIS TIME THE TOTALIZER INDICATED OVER 85 GALLONS .... WEATHER; POOR.....
JUST AS THE PILOT TURNED TO THE NEW HEADING, THE FUEL QUANTITY WARNING LIGHT CAME ON.... HE TURNED BACK TO THE FIELD HE HAD SIGHTED.... LOCATING THE TOWN BUT NOT THE FIELD.....
WITH ONLY 20 GALLONS OF FUEL REMAINING HE LOCATED A LARGE FIELD AND SET UP A FORCED LANDING PATTERN...ON FINAL THE ENGINE FLAMED OUT!
THE FLAMEOUT FORCED THE PILOT TO PICK ANOTHER FIELD....HE WAS SLIGHTLY INJURED IN THE LANDING BUT WAS ABLE TO EVACUATE THE AIRCRAFT...THE TOTALIZER STILL INDICATED 15 GALLONS!
...IT WAS A MISTAKE TO SET THE TOTALIZER WITHOUT FIRST VISUALLY CHECKING THE FUEL SUPPLY...HIS POSITION WAS NOT IDENTIFIED BY LANDMARKS OR RADIO AIDS DURING THE FLIGHT AND HE DISREGARDED HIS PREVIOUS TRAINING BY RELYING ENTIRELY ON THE RADIO COMPASS FOR NAVIGATIONAL ASSISTANCE...THE TOTALIZER WAS USED AS A FUEL GAGE, BUT NO CROSS-CHECK WAS MADE AS TANKS WERE EMPTIED...WHEN THE WEATHER BECAME PROGRESSIVELY WORSE POOR JUDGMENT WAS DISPLAYED BY THE PILOT IN NOT LANDING WHEN HE FIRST LOCATED THE AIRPORT!

After You're Down...

By Robert B. Gorrill, Boeing Airplane Co.

REVIEW of the B-47 accident records reveals that landing and deceleration are phases of operation in which trouble has been encountered frequently. The incidence of such embarrassing, expensive and hazardous occurrences may be reduced by reviewing a few basic characteristics of the B-47.

A majority of the accidents which have been recorded during these phases of operation may be divided into two categories:

- A wingtip or outboard engine was dragged on the runway.
- The aircraft ran off the side of the runway during the landing roll.

The causes of these two types of accidents are often inter-related, in that each has been frequently, but not exclusively, associated with cross-wind landings. In order to prevent future accidents of this nature, let's take a look at some of the specific cause factors involved.

Failure to keep the wings level during landing is observed to be relatively common in the B-47. This malpractice is made easy by the physical configuration of the aircraft and the nature of and response to its control system. Another influential factor is the specified final approach speed which is closer to the aircraft's stalling speed than is the case in most other aircraft. This results in relatively larger control displacement being required for attitude correction at normal touchdown speeds.

The B-47's swept-wing design results in a significant amount of roll being induced by rudder applied at final approach airspeeds. This rudder-induced roll is slightly out of phase, time-wise, with the normal rudder-produced yawing motion. In this just-prior-to-touchdown situation, it should be recognized that the B-47 has large inertial properties (it's heavy) and is lightly damped aerodynamically. As a result, if a rolling or yawing motion is produced, the desired stopping point for such motion must be anticipated or "led a little bit." As a case in point, it should be understood that at typical final approach speeds, if only 40 per cent of the total rudder control available is applied, 100 per cent of opposite aileron control will be required to prevent rolling of the aircraft.

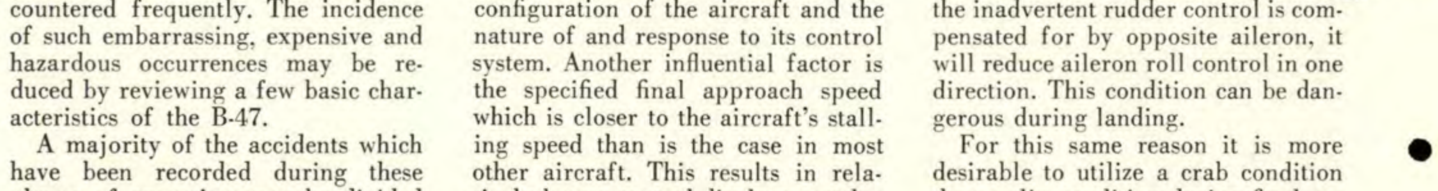
Another point to remember is that the wings extend aft, behind the pilot's normal field of vision, and the bubble canopy offers relatively few attitude reference points. Therefore, in some cases, roll-wise attitude may be detected chiefly by a "seat of the pants" type of perception. A word of caution concerning this "seat of the pants" flying; although recognized as necessary and valuable in certain other phases of operation, it can be misleading when accomplishing an uncoordinated turning maneuver.

At the low IAS normal for the final approach, rudder control self-centering forces are very light near the rudder neutral point. This makes it possible for a small amount of rudder control to be applied inadvertently (or not removed) during the final approach or while touching down causing the wing to be low or to appear to drop as speed is reduced. If the inadvertent rudder control is compensated for by opposite aileron, it will reduce aileron roll control in one direction. This condition can be dangerous during landing.

For this same reason it is more desirable to utilize a crab condition than a slip condition during final approach for a cross-wind landing. (As much as 50 per cent of available aileron and considerable rudder may be required to maintain the proper track in a slip.) The up-wind wing should be lowered *slightly* and the crab removed as the flare is started. Touchdown should be accomplished in a four-point landing attitude, or with the up-wind wing *slightly* lowered to physically assist in maintaining the desired track.

A serious possible consequence of

If the pitch attitude is correct, even with the wings not level, initial contact will be made on an outrigger gear.



landing with one wing too low is revealed by close examination of the geometry of the B-47. When touching down on four points simultaneously, naturally, the wings are level. If the pitch attitude of the aircraft is maintained at the proper angle for four-point simultaneous touchdown, even with the wings displaced somewhat from level, no serious resultant is probable. Initial contact will be made on an outrigger gear, and the wingtip will not touch the runway. However, if the aircraft is held off the runway at minimum altitude until reaching a very nose-high angle, a very *slight* roll-wise displacement will cause a wingtip or outboard engine to contact the runway before the outrigger. Although the pitch attitude required to make this possible is very close to the stalling angle, it can occur easily as the B-47's elevator control is quite positive at speeds below those specified for touchdown.

This excessively nose-high attitude is suspected of being at least partially responsible for some of the accidents in which wingtips or outboard engines have been dragged on the runway. To prevent such accidents, keep the wings as level as possible during landing and avoid inducing a pitch angle appreciably above that required for a four-point touchdown. If the aircraft contacts the runway at the specified indicated airspeed for the touchdown gross weight involved, the pitch attitude will be that which is proper for a four-point landing. The ideal landing is one in which the four wheels contact simultaneously. If this is not possible, the rear gear should contact very slightly before the forward gear.

The directional damper always should be in operation during the approach and landing. It is very effective in suppressing unwanted yaw and roll motions during this phase of operation. The pilot's burden is notably reduced, particularly in rough air, by the action of the directional damper which produces improved stability about both the roll and yaw axes of the aircraft.

Another cause of landing accidents in B-47s is the loss of directional control after touchdown, during the decelerating roll. Some of these accidents possibly could have been avoided if the pilot had considered certain control and stability attributes of the airplane during the landing roll.

During the critical high speed portion of the landing roll, the wings can and should be maintained level by aileron control application. (This is possible until the aircraft is slowed to under approximately 55 knots IAS in a cross-wind of 25 knots or more.) Aerodynamic forces of a directionally destabilizing nature act on the B-47 during its landing roll if its wings are not maintained level. This is particularly true when landing with a cross-wind. These forces normally can be counteracted without difficulty by directional control application but are held to a minimum by keeping the wings level.

If the wings are not held level during the landing roll, the main landing gear wheels on the high wing side of the aircraft are less heavily loaded than those opposite. The result of this light wheel loading is very rapid cycling of the anti-skid brakes on the wheels with the lesser load. This may result in reduced braking effectiveness. Increased volumetric demands are imposed on the hydraulic system by the rapidly cycling brakes tending to reduce hydraulic pressure with the engines at idle rpm. This may decrease steering control effectiveness. Also, abnormally rapid wear of the lightly loaded tires, even with the anti-skid braking system operating, may be evident when heavy braking is applied with the wings off level.

Landing should not be attempted in cross-winds greater than 25 knots unless extreme circumstances force such landings. It is possible to make successful landings in higher cross-winds but pilot technique rapidly becomes more critical. Cross-wind landings require closer observance of optimum pilot technique at extremely low airplane gross weights than when gross weights are somewhat higher.

Flap retraction should never be attempted in the B-47 during the landing roll. The retracting time is relatively long (35 to 40 seconds on the normal system). The flap system was designed in this fashion so that lift would not be lost too rapidly as the flaps retract following takeoff and during acceleration to climbing airspeeds. In an average landing roll, approximately 3500 feet of runway will be used during flap retraction if the retraction is started at touchdown. The small net gain to be realized from flap retraction, with the simultaneous reductions of lift and drag tending to cancel each other is not sufficient to make the concept practical. Also, flaperon action is eliminated as soon as the B-47 flaps move toward retraction. The large scale reduction in roll control available when flaperons are de-activated prohibits retracting the flaps during the landing roll.

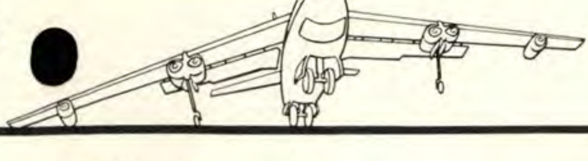
A serious directional stability problem is experienced in the B-47 (or in any aircraft with similar landing gear configuration) if the rear wheels skid prior to the skidding of the forward wheels. This may occur when brakes or steering are applied or possibly may be induced by the drag chute opening in a cross-wind. Regardless of the source of the forces acting to cause the rear gear to skid first, this tendency may be lessened by applying up-elevator, which increases the load on the rear wheels.

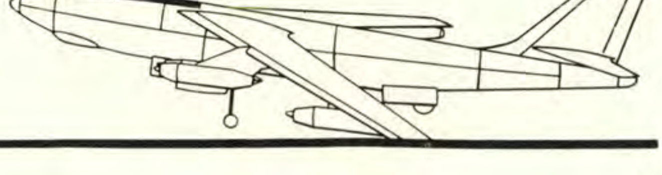
Up-elevator control should be held to some extent throughout each landing roll. The aircraft must be allowed to decelerate to some extent after normal four-point touchdown before up-elevator, in excess of that required in the landing, can be added.

The B-47 brake system is arranged with 67 per cent of total brake capacity on the front wheels and 33 per cent on the rear wheels. This arrangement provides optimum stability and control under maximum braking conditions with consideration having been given to the large number of variables which are influential during such operation.

A major variable that must be con-

In an extremely nose-high attitude, a light rollwise displacement will cause a wingtip or outboard engine to drag.





trolled is the fore and aft gear loading ratio (i.e., the relative distribution of weight on the forward and aft main landing gears). The pilot can control this ratio during all but the non-critical low speed portion of the landing roll by positioning the aircraft's elevator. When the center of gravity is at 25 per cent MAC, approximately five degrees of up-elevator is required during the high speed portion of the landing roll. This achieves the desired result of no alteration of the fore and aft gear load ratio being caused by elevator position. When landings are made with the center of gravity ahead of 25 per cent MAC, additional up-elevator is required to maintain this optimum load ratio.

It should be noted that skidding is not confined to cases in which wheel rotation is entirely stopped by brake action. Any case in which there is relative motion between a tire's surface and the surface of the runway in their plane of contact constitutes a skid. Skidding may result from excessive brake application to a wheel that is too lightly loaded to accommodate such application or by a tire being acted upon by side forces of sufficient magnitude to cause it to slide laterally. In either type of skidding (they often occur simultaneously and in combination), the strength of adhesion of the tire-to-runway contact is diminished.

The anti-skid brake installation of the B-47 serves to allow minimum distance stops by avoiding skids caused by excessive brake application. This, in effect, also reduces the frequency of lateral skids which develop more readily when a forward-skidding condition exists. Thus, the B-47 anti-skid installation serves two purposes. It allows maximum braked stops with minimum tire wear and it improves the directional stability and controllability of the aircraft during the landing roll.

An aircraft is said to be directionally stable during its landing roll, if the forces resulting from a brief uncontrolled motion (direction-wise) are of a nature that will cause the aircraft to resume a straight path when the disturbance has passed. Such brief, divergent motion may be induced by unsymmetrical brake action, by momentary application of incorrect steering control, by a gust of cross-wind, by the initial pull of the opening brake chute in a cross-wind or by any other directionally destabilizing impulse. See Figure 1.

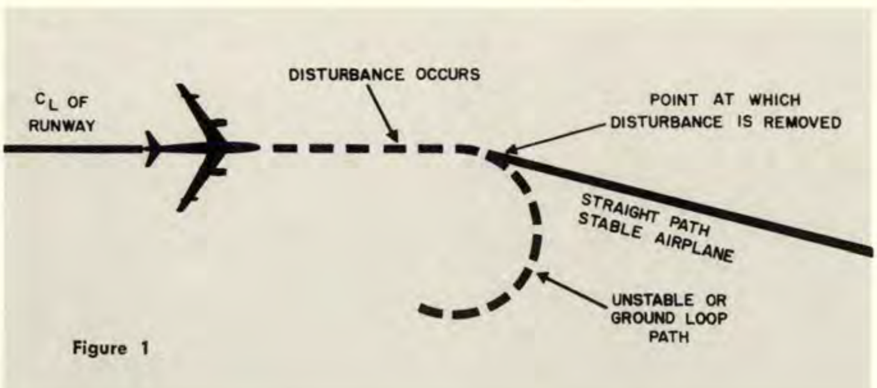


Figure 1

During the landing roll, as in many other phases of aircraft operation, the topics of control and stability are nearly inseparable. If the aircraft is directionally destabilized to the extent of assuming a heading sufficiently out of parallel to the runway, there may not be sufficient directional control available to regain the correct heading before running off the runway. Conversely, directional control, which comes from both the rudder and the forward steerable landing gear in the B-47, must be maintained in order to be able to regain desired heading if directional veering takes place. To gain maximum controllability, elevator position should be optimum, i.e., not full up or full down.

As an aid in preventing the B-47 from diverging from the runway heading during the landing roll, adequate loading should be maintained on the rear main landing gear by up-elevator. This is particularly important when brakes are being applied. If the brake-chute is to be deployed under high cross-wind conditions, an adequately loaded aft landing gear will minimize the tendency of the opening chute to veer the aircraft off the runway. When stopping distances are critical, maintaining any position other than optimum elevator throughout the landing roll will increase the distance required to brake to a stop and may induce accelerated tire wear.

The foregoing observations on the use of the elevator during the landing roll may be contrary to the instinctive reaction of some pilots. It may appear that steering control during the B-47's landing roll is best obtained through firm contact of the front wheels with the runway and that, when maximum directional controllability is desired, the forward gear should be "pushed down" on the runway. While this technique will increase the load on the forward gear and increase its tires "cornering" capabilities (delay skidding), it will simultaneously lighten the load on the rear tires to a point where they will skid readily and thus produce a very unstable condition. A near accurate analogy may be drawn by comparing the familiar case of a heavy tractor-trailer truck "jack-knifing" with braking applied only to the tractor's wheels.

Over-inflated tires for a given airplane weight reduce steering effectivity (reduce "cornering" capacity of tires), reduce braking effectiveness and, by predisposing to skids, reduce the directional stability and controllability of the aircraft during the landing roll. This over-inflated condition of tires during landing is sometimes inescapable in aircraft similar to the B-47, because of the requirement for takeoff at a very high gross weight and the ensuing landings being made at a greatly reduced weight. All braking and steering performance calculations and demonstrations should be accomplished with tires at near optimum inflation for the existing airplane gross weight. Caution should be exercised when landing at low gross weights with this known over inflated-tire condition.

Well, that about wraps it up. This article was aimed specifically at you big bird drivers. I hope these special aspects of landing the B-47 may prove of value to you. At least it should provide food for thought. ●

Give 'em a Break

EVER have your brakes decide to give up the struggle while you're still on the landing roll? More than a few otherwise perfect missions have been undone during that final phase of flight. And it is a phase of flight, even if some pilots have forgotten the fact. Sudden loss of brakes, with the end of the runway coming at you, is a sickening sensation no matter what aids are still available to help you get stopped or turned.

The embarrassment of a situation such as this is further enhanced by the fact that adequate braking systems are standard equipment on all airplanes. Brakes definitely will do their job if they have been maintained properly and are treated in a like manner by a pilot. Naturally, pilots cannot be answerable for the maintenance of the many and complex systems employed currently in military aircraft, but the driver is the one who uses and sometimes abuses the brakes of his great iron bird.

Here are two examples:

In the process of transition, one touch-and-go and four full-stop landings were made in a B-57 during a period of one hour and 13 minutes. The second in the series of full-stop landings was made under a simulated emergency condition by maintaining a high approach speed and forcing the aircraft onto the runway. The brakes stopped the aircraft quickly on this landing; however, the high energy required to stop the aircraft heated the brake discs until they were glowing. The pilot neglected to cancel the flight and have the aircraft towed from the runway as required by Tech Order. Instead he elected to continue shooting landings which resulted in subsequent fire in the main landing gear and brakes.

Incident number two involves a T-33. But for the natural forces of friction and deceleration, coupled with the happy combination of a 14,500-foot runway and a stiff breeze, this one would have bolted right out of the incident class.

The pilot, while on his second solo flight, made five touch-and-go landings with a five-minute interval between each. The fifth landing was climaxed with a roll that packed as much of a thrill as a free-fall parachute jump. Just how far can a free wheeling T-33 roll? He found out. When this one finally did stop and was towed back to the ramp, the reason for the long ride was revealed: Completely disintegrated brake linings and warped, scored discs.

Excessive use of the brakes during the four previous landings was denied by the pilot. "Everything seemed normal until that last landing." Unfortunately, in some instances, the pilot involved in the incident is not necessarily the pilot responsible for the abuse of the brakes.

To help reduce aircraft accidents attributed to brake failures, flying and maintenance personnel should become aware of and be familiar with the written word governing the proper use and maintenance of this all important assembly. The good book (T. O. 4B-1-1) states that at least 15 minutes should be allowed to elapse between landings when the landing gear is left extended. It further states that a minimum of 30 minutes should be allowed between landings when the gear is retracted. These restrictions do not apply to touch-and-go landings where there is no application of brakes. This same source of information gives instructions to follow after the brakes have been used excessively for an emergency stop.

Actually, the need for operating personnel to heed the good offices of our technical advisors is now greater than ever. Consider the higher gross weights and the faster landing speeds of today's aircraft and then plan your braking technique to fit the advanced situation. Oversight on the part of the pilot to report improper braking of his aircraft is as much a part of brake failure as careless operation.

Whenever a high energy stop has been accomplished, because of an aborted takeoff or emergency landing, and excessive use of the brakes is required, the brakes should be inspected. Excessive braking or high energy stop-braking may well result in worn linings, scored segments, warped or scored discs or overheating. If any doubt exists as to the serviceability of a brake, the brake should be replaced.

Remember, a bad brake usually leads to a bad break. ●

No Wheels, Louie? — "Drive that runway over here and let's get some aircraft in the air." This strange patter may turn out to be a reality in the light of recent developments at Edwards Air Force Base, California. The mobile airport referred to is a launching platform mounted on a truck. Jet planes have been successfully sent aloft from the gad-about launching platforms with less shock to the pilot than that experienced during catapult takeoffs. During this unconventional takeoff, the plane is always under the pilot's control and peak acceleration is 4G.

The technique of launching conventional jet fighters without preliminary takeoff runs was developed in tests at Edwards Air Force Base, conducted by the Air Force's Air Research and Development Command and the Glenn L. Martin Company. The launching platform is the same used normally in launching the Martin Matador. F-84Gs were modified to make the tests and kicked off so swiftly that they were immediately airborne. Highly mobile trucks with "arms" raise the fighter planes to the launching angle, becoming in effect the world's smallest airports. With the aircraft's jet engines running at full speed, and with the additional thrust of booster bottles, zero-length launching is achieved.

This development is another step in the Air Force's research and development program to explore the possibility of eliminating the requirement for runways under certain combat conditions.

★ ★ ★

Pressure Ratio Indicator — Highly successful results have been obtained in tests performed on the new Kollsman Pressure Ratio Indicator which is used to measure jet engine performance. It will be of great value to jet pilots for pre-takeoff engine checks and will help to obtain optimum power settings for cruise and climb.

The pressure ratio instrument measures jet engine performance and is designed to indicate the optimum power settings for cruise and climb.

It tells the pilot whether or not he is getting best engine performance by indicating on a dial the ratio of total pressure at the tailpipe and at the inlet. Pre-determined readings of pressure ratio for takeoff and cruise are set on the pilot indicator by means of a manually operated knob. In operation, the pilot merely matches a pointer with markers on a dial for most efficient power settings.

The Pressure Ratio Indicator is available in two basic types. One type is a direct reading unit, and the other is a remote indicating system. The direct reading is self-contained, while the remote system has the basic measuring mechanism mounted near the engine. Although the direct system is lighter in weight, the remote system eliminates tubing to the cockpit, a factor desirable in various applications. Recently put into production, the Pressure Ratio Indicator will be installed in the McDonnell twin-jet, swept-wing F-101.

★ ★ ★

How High Is Up? — If one hundred and eleven Empire State Buildings were placed one on top of the other, they would equal the height recently attained by a weather balloon. Twenty six miles up to be exact. The balloon was released by the USAF Air Weather Service detachment at Holloman Air Force Base, New Mexico. Bursting at 26 miles above the earth, the balloon helped to set a record average height for Air Force rawinsonde runs.

In one month the Holloman detachment, which operates in support of the special weather requirements of the Holloman Air Development Center, made 13 runs to an average height of 22½ miles, using specially built high-altitude balloons.

Holloman's detachment of the 4th Weather group is one of many rawinsonde units operated by the Air Weather Service in support of Air Force and Army units around the world. Such upper-air units regularly observe high-level winds by releasing balloons bearing rawinsondes (miniature observing units which automatically broadcast their findings to observers below).

Charting upper-air conditions, the AWS detachment is an integral part of the guided missile research program at Holloman. Increased capabilities of modern aircraft have made it necessary for AWS to extend its area of interest higher above the earth's surface.

Record heights reached by balloons of the Holloman and other AWS detachments are indications of routine advances in weather-observing techniques, made possible by improved equipment and methods.

★ ★ ★

The Eyes Have It — Makes no difference what the weatherman says, most pilots still scan the sky throughout their route for signs of misplaced weather. Did you know

This jet, the first to take off from the highly mobile zero-length launcher, is propelled to flying speed by a droppable boost bottle.

A probe on the nose of an F-84 fighter engages the boom of an RB-36 as initial contact in the mid-air hook-up is made.

With the aircraft securely anchored to the boom mechanism, operators in the big bomber start hoisting the "84" upward.

The "landing" completed, the fighter is snuggled into the belly of the "36" where it can remain or be launched again.

that besides your two, there are 10,000 other pairs of eyes doing the same thing? Did you know that since the advent of "goreps," your chances of being advised of hazardous weather are now 5000 times better than they were before?

A Continental Air Defense Command agency, the Ground Observer Corps (GOC) consists of nearly 300,000 civilian volunteers manning more than 5000 watching stations in the United States. In cooperation with the USAF Air Weather Service, the GOC, in addition to its normal duties, will soon begin an extensive weather watch. Although some GOC units have been reporting unusual weather for over a year, a new regulation is being issued requiring the reporting of tornadoes, hail and surface winds in excess of 50 knots. The name "goreps" (ground observer reports) has been given to reports of severe weather sent in by GOC observers.

Under the new program, ground observer personnel at designated stations will be trained in the recognition of severe weather conditions. Stations will be selected for this duty by virture of their location in areas where severe weather is frequent. The observation posts will forward severe weather reports to filter centers, giving the location of a tornado or other severe storms, the direction of travel plus area of coverage. From filter centers, reports will go out by special teletype to control centers and local U. S. Weather Bureau and AWS stations.

The Third Weather Group, which provides weather support to defense command agencies, cooperated with the ADC in planning and setting up the new reporting program. The group pointed out that although both the Air Weather Service and the U. S. Weather Bureau maintain severe weather warning centers, observing stations are so sparsely located that weather reporting on even a small scale is difficult. Adding the strength of GOC reporting personnel is another big step in doing something about the weather.

Extra Omni Angles

Major Jack L. Mercer, 28th Log. Supp. Sq., Hill AFB, Utah.

MY hat is off to the inventor of the omni range and the airborne equipment that is used in conjunction with it. What these gadgets can do for you is practically unlimited, if you know how to use them.

Now I'm not going to waste your time covering the normal everyday use of the omni equipment. If you are not already familiar with that, better get with the books and your Link instructor, first thing tomorrow. I hope I can tell you something different as applied to the various parts of omni.

So let's break down the airborne equipment and show how each component is used.

The first part under consideration is the Radio Magnetic Indicator (RMI). The omni usually uses the double-barreled needle which is labeled number two on most aircraft. This needle works just like the ADF on the ARN-6 or 7. It can be used for homing or tracking to or from an omni station in exactly the same manner as the ADF is used. Of course there is no manual usage such as aural null, but otherwise the procedure for both systems is the same.

The second component to be discussed is the ambiguity indicator (To-From window). Contrary to popular belief, it does not indicate whether you are going to or from the station. Instead, it registers whether the bearing you have selected in your course window is the bearing of plane to station, or station to plane. In other words, you can have a To indication and yet be going away, and vice versa.

For example, let's suppose you've become lost and want to orient yourself. Let's further suppose that the RMI is inoperative, which prevents you from using it to determine the bearing to the station. First, tune in and identify the desired station. Then merely hold your present heading and turn the course selector knob until the vertical cross pointer needle (VCPN) is centered. Continue to hold your heading and check it against that which shows in the course window. If they are not the same, turn the aircraft until they agree. You will note that now your heading pointer is at top center. Now check your ambiguity indicator. Does it indicate To or From? If it indicates To, just continue to hold the heading you have, making necessary corrections for drift to keep your VCPN centered, and you will fly to the station.

But should it read From, turn both the aircraft and your course selector knob 180 degrees until you have again created the above situation. Elementary, yes, but let's look at another problem. For example:

Suppose both our RMI and course selector window are not functioning. You merely go through the same motions but add a few others. With the course selector knob, center your VCPN. Check the ambiguity indicator. It may read To or From. So where are you? Your present heading may be taking you to or from the station regardless of what it shows.

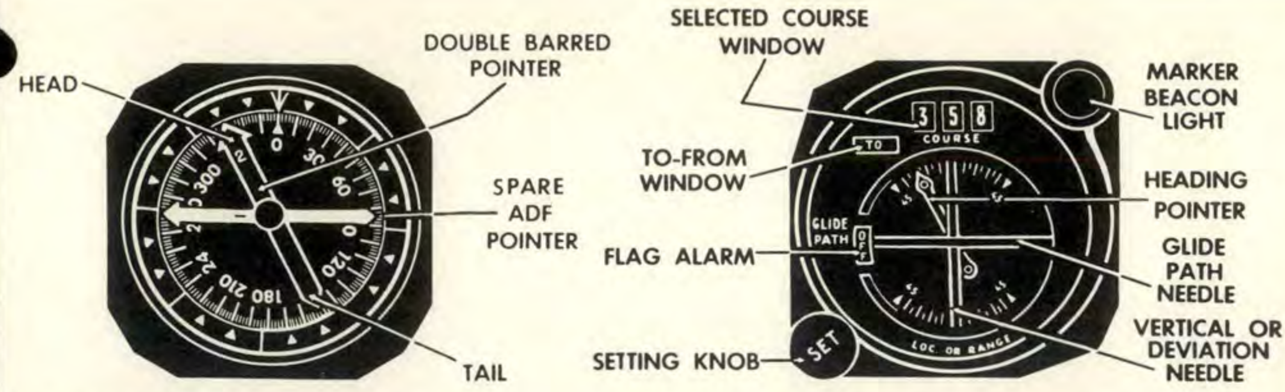
Okay, how do you determine which? Now comes the added maneuvers. Remember the heading pointer? Check it to see where it is. If it is in the top 180-degree portion of the instrument and you read To, merely turn the aircraft until the heading pointer is centered at the top and note the gyro heading. This is your course to the station. Should you find that it is in the bottom 180 degrees of the instrument and you read To, again turn the aircraft until the heading pointer is centered *at the top*. Your ambiguity indicator will still read To. Continue to fly the gyro heading you now have, plus or minus drift correction, and you'll fly to the station. If the ambiguity indicator reads From in this instance, merely turn the course selector knob around until the VCPN is again centered. The reading will now be To. Again turn the aircraft until the heading pointer is centered *at the top* and proceed as before. But remember, in both instances, to keep your heading pointer in the top 180-degree portion of the instrument.

Remember also that once you have set yourself up as outlined above you will probably have to make some corrections for wind drift to keep the VCPN in the center. Any such corrections will cause the heading pointer to move off center in the direction and amount of the turn. This is normal. You merely fly whatever heading is necessary to keep the VCPN centered, making corrections in the same direction in which it is displaced.

Another important point to remember is that any time the heading pointer is in the bottom 180-degree portion of the instrument, you have to *correct away* from the VCPN to keep it centered, regardless of what the ambiguity indicator reads and regardless of whether you are flying to or from the station.

Now suppose your ambiguity indicator goes out along with the RMI and course window. Brother! What do we do now? All you have left is your VCPN and heading pointer. Can you still orient yourself? Yes. "How," you say? Easy! Tune in and identify your station. Get a grip on your course selector knob, turn it until the VCPN is centered. Check to see where the heading pointer is, and turn the aircraft until it is centered *at the top*. If it is at the bottom when you first check it, it will save a lot of aircraft turning if you will continue to turn the course selector knob until the VCPN is recentered with the heading pointer in the top 180 degrees of the instrument. That way a maximum of 90 degrees of turn will place it at the top. After you have done this, you are now flying the radial you have selected. But are you going to or from the station? You can't tell, you say? Oh yes you can. Let me tell you how.

Remember the old compass rose they put around the omni stations? Well, all of the bearings listed thereon are station to plane. Let's reverse this 180 degrees and make them bearings of plane to station. You now see that when you are inbound to the station, any bearing you choose to fly that is greater than the one you are now on lies to your left. The ones that are less lie to your right. If you are outbound from the station the opposite is true. Bet you are beginning to see the light. Yes, using this principle you turn your course selector knob *to the right*, remembering that this would increase the heading you would have in the course window if it were working, which it isn't, but the effect is the same. You have selected a radial that is greater than the one you are now on. Therefore, your VCPN will move right or left, indicating where



RMI Radio Magnetic Indicator

1D249 Course Indicator

AN/ARN-14 Instrumentation.

this new radial, or track, lies in relation to the one you are presently on. Should the VCPN move left you are inbound; to the right, outbound.

To prove that this is so, merely look at your revised compass rose which we mentioned earlier. If you are inbound, just re-center the VCPN by turning the course selector knob back to the left and make whatever correction is necessary for drift and fly to the station. If you are going away, do a 180-degree turn and re-center the heading pointer at the top by turning the course selector knob and fly into the station, keeping the VCPN centered.

Now what do you do once you reach the station and want to make a letdown? How do you tell when you have the desired course set up? Easy. Remember the heading pointer? Wonderful gadget. Here's how you do it.

Let's take the Salt Lake City omni letdown for example. As soon as you pass over the station your VCPN begins to waver from side to side. That's the station. You then turn the aircraft to a gyro heading of 329 degrees, which is your outbound heading. It is very important at this point that you get the aircraft exactly on 329 degrees and hold it there, for you are now going to set up your equipment for an approach that will thread the hills around Salt Lake City. You can select your course two different ways. One way, and the way I recommend because it requires no resetting, is to turn the course selector knob until the heading pointer is centered at the bottom. At this time you will note that your VCPN is probably not in the center. That's okay. All you have done is to select the inbound course for a letdown, the reciprocal of 329 degrees, or 149 degrees. How do you know this is what you've selected? Because your gyro heading is 329 degrees and your heading pointer is centered at the bottom, telling you that you've selected a course 180 degrees from the one you are holding.

You are now prepared for an approach. So, since your VCPN is not centered, you correct your heading to center it. Now remember what we said before — if your heading pointer is at the bottom of the instrument, you correct away from the VCPN to center it. So, now it's at the bottom and you do just that.

As soon as it is centered, you keep it there by flying 329 degrees plus or minus drift correction. When this procedure is used the VCPN works just the same as it does on an ILS approach. Corrections are made away from the needle outbound and toward it inbound, and no resetting of the course is necessary.

However, if you prefer to fly toward the needle at all times as you do normally with the omni, it can be done in the same manner, except that you pass over the station and turn to the outbound heading of 329 degrees, and center the heading pointer at the *top* instead of at the bottom. The same thing will have to be done after you have completed your procedure turn and are inbound. I recommend, however, that you practice the first procedure set forth since it may be necessary to shuttle back and forth. You will find it equally as simple after you have done it a couple of times. You can't get confused if you just remember that when the heading pointer is at the bottom, correct away from the vertical cross pointer needle.

I say that if you set up your equipment properly and hold your heading as you set it, the course you select using the above procedure will not be off more than one degree. Allowing for that error, your letdown will be all right even in such close quarters as Salt Lake City. You can also see that with your vertical cross pointer needle and heading pointer functioning with or without any other one of the components of the equipment, you can use it with no trouble.

I know all this probably sounds complicated, but it's really very simple. Try it a few times and you'll see. I also realize that you will rarely, if ever, find yourself in a position where it is necessary to use this procedure, but if you ever should have to use it and you know about it, you're in good shape. Along this line, how often do you have to orient yourself on a low frequency range or use the null? But we practice both of them, just in case. ●

VFR

Foggy Facts

"Here it is ten o'clock and we haven't got a plane off the ground. Sure losing the flying time this morning," remarked Lt. Grange, as he gazed out at the row of parked airplanes.

"Yeah," the Ops Officer replied, "it's those streaks of ground fog between the runway and the flats. You can expect that condition every morning at this time for the next month-and-a-half. It's banked up at the north end of the strip, too — comes from the marsh-land just off the end of the active runway."

"That shouldn't make any difference," drawled Grange. He had been standing by for two hours now, along with 10 other pilots of the squadron. "We take off to the south, fly over that 300-foot stuff, and the valley is clear as a bell."

"Sure, Major Dee," said another of the waiting pilots to the Operations Officer. "You know that this stuff will be burned off by eleven. Heck, you could almost set your watch by it."

"Now look, fellas," the Ops Officer was losing patience, "I want this flying time and the training just as much as you do. We go through this same deal every morning during this season. Weather says that visibility is below minimums, and the Reg says that it's got to be VFR to fly local, so there you are! I know that in three minutes you'd be away from this stuff and that it would be gone long before you got back, but it just won't work."

But it will work. Yes, sir, someone finally did something about the weather. The foregoing dialog has echoed off the walls of many ready rooms the Air Force over. The conditions may not have been exactly as portrayed in our short visit to Major Dee's Ops office, but you can be sure that the cause was similar; strictly local, below-minimum weather, preventing takeoff into areas of known VFR conditions. Lots of flying time has been lost because of these local, below-minimum conditions, and many necessary flights have been held up for light planes not fully instrument-equipped. However, if a pilot will follow a few simple procedures, the way has been paved for a VFR departure from, and a VFR arrival at a base where localized IFR weather conditions exist.

These privileges are extended in a control zone when, in the opinion of the airport traffic controller, adequate separation can be provided by the tower, and each aircraft is continuously visible to the tower controller; or each aircraft is continuously visible to pilots of other aircraft concerned, and the pilots thereof can maintain their own separation and so advise. It is all in paragraph 3.800 (a) and (b) of the ANC Manual.

Your authority for the special clearance is based upon the decision by USAF that compliance with the provisions of Paragraph 3.8, ANC Manual, "Procedures for the Control of Air Traffic," satisfies the requirements of paragraph 35b, AFR 60-16, relative to special VFR flight in control zones.

Like everything else that is worth having, there are a few important DOs and DON'Ts. To assist you in staying on the right side, thereby keeping the privilege of these special clearance intact, here they are:

DO — Request clearance for special VFR flight from the air traffic control facility well in advance. Prior to issuing such clearance, coordination must be effected with all of the ARTC agencies — Air Route Traffic Control Center, Approach Control and Control Tower—by the controller.

DO — Obtain your special VFR clearance prior to entering the control zone or before commencing special VFR flight.

DO—Become completely familiar with the contents of paragraph 3.8, ANC Manual, "Procedures for the Control of Air Traffic."

DON'T — Expect automatic or routine approval of requests for special VFR clearances.

DON'T — Attempt to complete an instrument or GCA approach under special VFR instead of following the missed approach procedure. Prior permission is required for special VFR flight to enable the air traffic controller to take the necessary steps for providing separation between all aircraft arriving, departing or operating in the control zone. Failure to obtain clearance prior to special VFR operation may result in a collision.

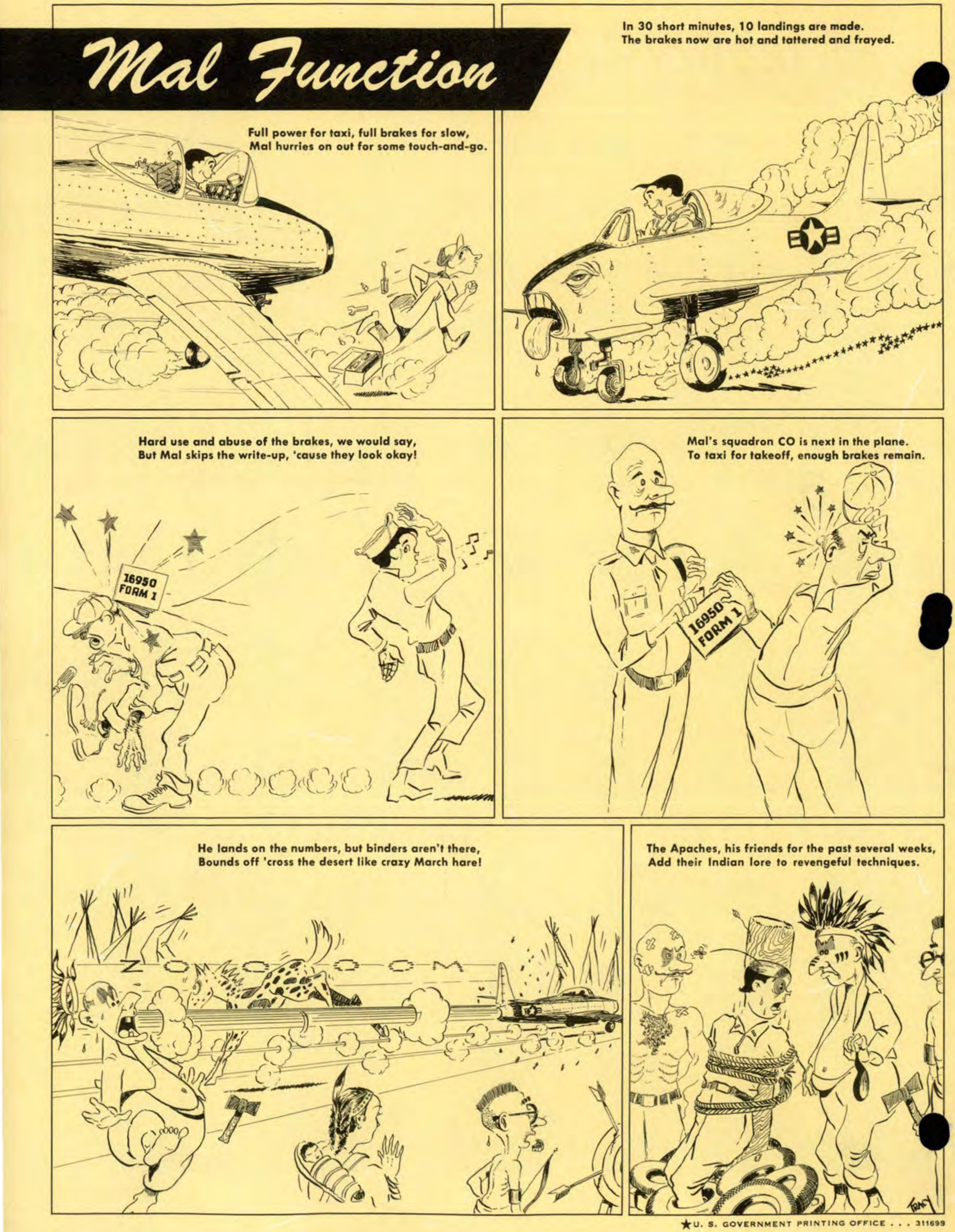
DON'T — Become guilty of careless or reckless operation. Under special VFR clearance, the pilot remains responsible for appropriate clearance from houses, cars, boats, populated areas and terrain, even though authorized to operate "clear of clouds" when ceilings are less than 1000 feet above the surface.

It would be well to remember that Air Traffic Control agencies may deny requests for special VFR clearances on the basis of other traffic, inadequate airport or terminal area facilities, unsatisfactory communications with any aircraft involved, or in the event adequate safety cannot be maintained in relation to other air traffic. The controller's judgment in this respect is not subject to question. He cannot be required to provide special VFR clearance by any agency. USAF pilots should expect to realize the greatest benefits from the special VFR clearance through its application to departures or arrivals at airfields having weather conditions which are less than VFR minimums.

There it is. Treat it with care and abide by those DO's and DON'Ts. ●

springtime's net result . . .

This month our gal looks as if she might be smitten with that annual malaise more commonly known as spring fever (just plain lazy, man). In her case that's okay, there's not much question but that she'll recover. But for you jet jockeys who may suddenly find yourself with a lazy, or more properly, a stalled out engine, best you *turn to page 16* *and learn what causes compressor stalls, and how to avoid them.*



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