# FLYING SAFETY

UNITED STATES AIR FORCE

JUNE, 1956

*You . . . from the same mold!*

Page 2

# FLYING SAFETY

VOL. TWELVE NO. SIX

• The C-130, Lockheed's new turbo-prop transport is introduced on page 16. Its missions range from close support to the carrying of paratroopers.

• Is Old Sol going to give you trouble this summer? Hot runways require special takeoff techniques. See page 24.

• "Death by Diversion" on page 12, is prepared by one of USAF's top flight surgeons. It should be "must" reading for you.

Here is an unusual view of the F-104. Overall length is three times wing span.


Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

**Editor**
Major Perry J. Dahl

**Managing Editor**
Major Jesse F. Townshend, Jr.

**Associate Editor**
Major V. R. Stutts

**Art Editor**
M/Sgt. Steven A. Hotch

**Production**
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

## CONTENTS



★ ★ ★

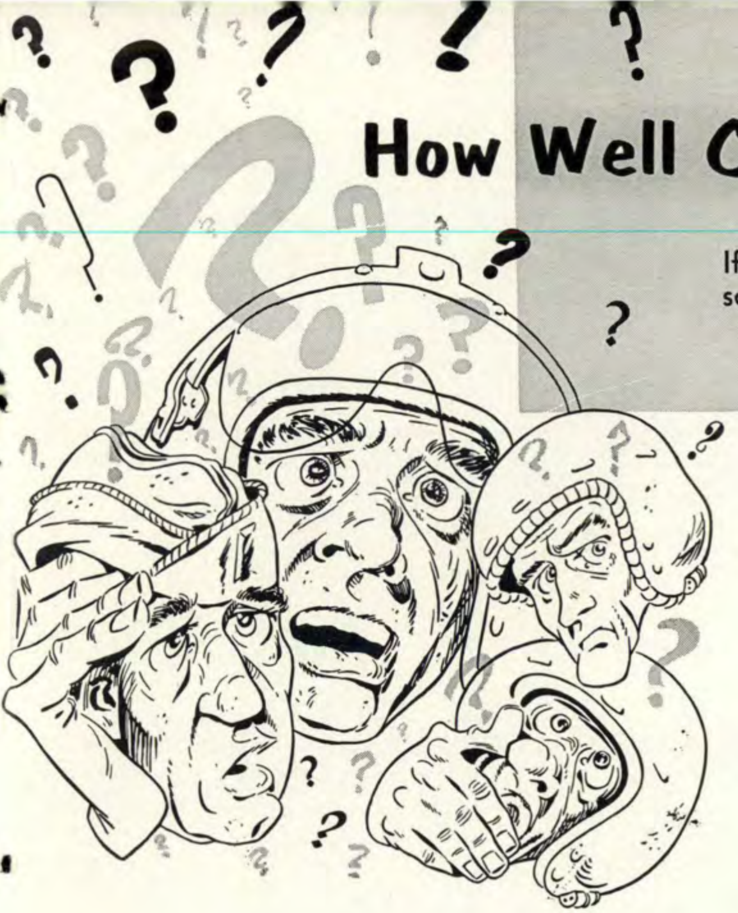
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 6, 1954. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

# How Well Can You Remember?

If you miss more than four, better thumb through some back issues. And don't peek at the answers.



### APRIL

1. High rate rolls are not recommended for:
   a. *Early model F-102s.*
   b. *Late model F-102s.*
   c. *All F-102s.*

2. When landing on a wet strip, how many more feet of runway does a B-47 require?
   a. *300-1000 feet.*
   b. *1000-2500 feet.*
   c. *2500-3300 feet.*

3. You can expect wind shear conditions to exist most often at traffic pattern altitude during:
   a. *High noon.*
   b. *Early morning.*
   c. *Early evening.*

4. Fatty tissue is especially dangerous to pilots because it will:
   a. *Cause bends.*
   b. *Cause kidney disease.*
   c. *Dissolve nitrogen in the blood.*

5. Recommended minimum ejection altitude using the automatic lap belt and parachute is:
   a. *500 feet above the terrain.*
   b. *1000 feet above the terrain.*
   c. *100 feet above the terrain.*

### MAY

6. On a GCA, final landing clearance is authorized by:
   a. *The GCA operator.*
   b. *The control tower.*

7. Successful Ground Controlled Approaches may be made with which of the following inoperative?
   a. *Gyro instruments.*
   b. *Radio transmitter.*
   c. *Either or both of the above.*

8. The first job of an ADC interceptor is to:
   a. *Write violation reports.*
   b. *Identify unknown aircraft.*
   c. *Assume control of violators.*

9. As a final resort, the drag chute may be used in spin recoveries on the F-100.
   a. *True.*
   b. *False.*

10. Scheduled CAA weather reports are broadcast at:
    a. *The hour and half-hour.*
    b. *15 and 45 minutes past the hour.*
    c. *As they are received.*

### JUNE

11. A gimmick called "Circular Polarization" is used to:
    a. *Eliminate rain clutter on radar scopes.*
    b. *Operate the Moving Target Indicator (MTI).*
    c. *Reverse polarity at remote transmitter sites.*

12. The two prime requisites for a good standardization program are:
    a. *Procedures and techniques.*
    b. *Supervision and discipline.*
    c. *Handbooks and Checklists.*

13. On the Allison T-56 engine installed on the C-130, the propeller:
    a. *Is fully controllable throughout normal operating speeds (RPM).*
    b. *Turns at a constant rate of speed.*

14. The C-130 is equipped with a hydraulic control boost system.
    a. *True.*
    b. *False.*

15. The most violent activity of a thunderstorm occurs in the:
    a. *Lower two-thirds.*
    b. *Upper one-third.*

**ANSWERS**

| | | |
|---|---|---|
| 1. a | 6. b | 11. a |
| 2. b | 7. c | 12. b |
| 3. b | 8. b | 13. b |
| 4. c | 9. a | 14. a |
| 5. a | 10. b | 15. a |

# You

*In a previous article we looked at a few aspects of the pilot error problem. We saw that there is no real difference between pilot error and any other human error except in the circumstances and environment of its commission. The point being, obviously, that the errors made while flying are errors to be avoided because the circumstances lend themselves to disaster.*

*Many remedies have been tried for this chronic ailment, some of which appear to have had a little success. One of these is a gimmick called standardization, a rather popular word these days. Let's take a look at this standardization thing, what it is and what it can do for us.*

★ ★ ★

THERE IS SUCH a thing as a pilot who never makes a mistake in judgment, who never miscalculates or guesses wrong. The performance of this pilot is fairly predictable and his psyche quite uncomplicated. Everyone is familiar with this pilot. In fact most people call him by his first name . . . George.

George is a member of a remarkable family of pilots whose performance, when properly used, is utterly standardized. Not being equipped with human brains, emotions or failings, they go about their duties in a professional, uncomplaining manner.

Some of George's more precocious children have gotten to the point where they fly solo. In fact the aircraft they fly no longer have cockpits —they're that good! One of George's most prodigious relatives performed a feat a few years ago that deserves special mention. He flew a C-54 from Clinton County AFB, Ohio, to Newfoundland, to England and return, all by himself. Takeoffs, landings, navigation, everything. A human pilot went along but for all intents and purposes, his sole function was to push one button and sit back. Oh yes, and to taxi in to the ramp after landing and fill out the Form One.

**George and Standardization**

Why our interest in George and his remarkable automatic relatives? Simply that George illustrates an ideal quality in a pilot—standardization. Built to perform a specific task in a specific way, George will always do it the same way as long as there is no mechanical malfunction in his innards. As far as George is concerned there is no "right way" or "wrong way." There is just one way to do the job—the way he was built to do it.

If we knew how to build George to react to every possible set of circumstances arising in flight, if we could now preset into him every conceivable mission we require of an aircraft, we could all retire to pasture. This day may come earlier than we care to think, but it hasn't arrived yet. So in the meantime we had best contemplate George and learn some lessons from him.

Back in the old gay days of stick-and-wire biplanes, of "seat of the pants" flying and "dead pilotage" navigation, there was little place in the scheme of things for George. Flying was a new game and full of question marks. It was accomplished with the help of gobs of imagination and improvisation. Performance of the aircraft was frequently precarious and unpredictable. Weather was an unknown, its forecasting still in the "red sky at night" and aching corns phase. Landing fields were where you found them. In this hairy business the only effective controlling force had to come from a human driver, loaded with resourcefulness, imagination and derring-do. For all his inherent short-

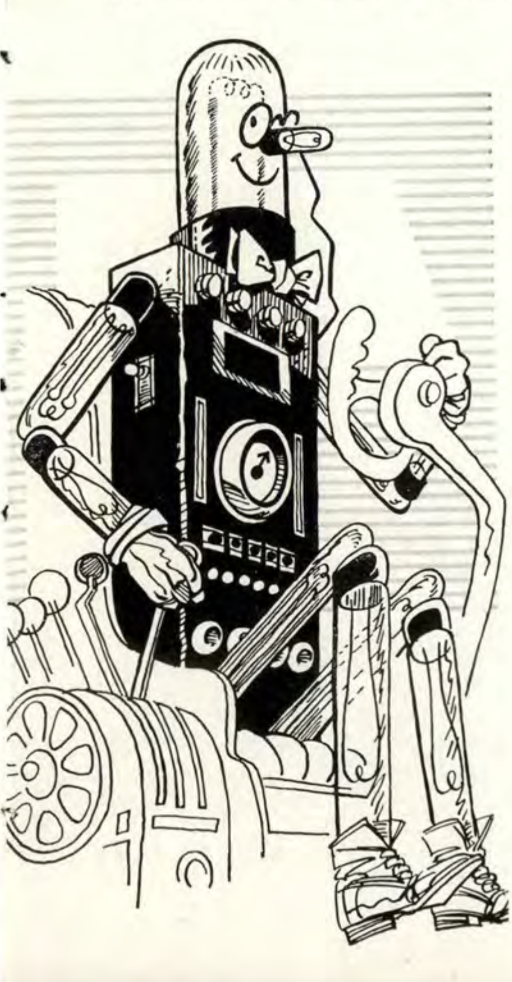
# ...from the same mold!

Lt. Col. Mitchell J. Mulholland, Safety Research and Analysis Division, D/FSR

comings, the variable human has the precious quality of adaptability. He can think, he can adjust to changing situations. He made aviation work.

Inevitably this early type of flying set a premium on individual initiative. It was a day of wooden planes and iron men. And a lot of men got separated from a considerable number of boys. Also, it was inevitable that the successful pilots came to be regarded as supermen—the death or glory boys, sing hey for the goggles and scarf! These were the days when a pilot was considered to be born, not made, when instinctive know-how was his most desirable attribute. One of the surest ways for a young hopeful to get washed out of flying training was to be convicted of "mechanical flying." And who, in the '20s and '30s, ever heard of a Dash-One?

George will always do it the same way just as long as there is no mechanical malfunction



Well, let's face it, this attitude was justifiable. It took a man with imagination and guts to make a precision operation out of the can of worms that the science of flying was at the time. Also, it is understandable that the old bold pilots who proudly wore their crowns under this system would resent a shift in attitude in the direction of mechanization of flying. It is further and finally understandable that flying under this old concept was an undeniably glamorous business and glamor is something we all love.

### New Kind of Guy

BUT. Times change, for better or for worse. The inexorable march of scientific progress makes many lovely things obsolete. The wonderful old Air Corps has taken its place in the museum of nostalgic Americana alongside the Mississippi sternwheeler and the open-top Fifth Avenue bus. Our Air Force pilot today is a new kind of guy. His required ingredients include a lot more Einstein and a lot less Errol Flynn. The boy who once drank to the next man to die now drinks to the square root of pi.

We still have a mission to accomplish—more important than ever. Our airplanes still make a loud bang when they hit the ground, but the really loud noise you hear is the terrific impact on the national debt. Also, with all our progress, we still like to stay alive. So some things don't change, and we still have the job of keeping 'em flying.

When an airplane is built in this day and age, it is capable of performance perilously close to its design limits. The old cushion against the extremes of time, speed, temperature and structural stress is not as fat as it used to be. Our new birds are finely tuned instruments that will do wonders for us if we treat them exactly right. But let's not forget, they're not the forgiving machines some of the old ones were. They don't turn the other cheek when they're abused. Is this bad? Of course not. The B-17 had a safety factor like the 7th Regiment Armory. Automobiles used to carry two spare tires and a crank too. As we learn more, we can dispense with the excess cushion and as a result get more performance safely. Safely? Sure, as long as all the variables are under control. And these variables specifically include the pilot —you, and you, and you!

So there you are, and here we are, and we've got to stop being variable. And how do we do that? Part of the job of designing our new shiny birds and part of the job of directing their tactical employment is figuring out the right way to make them work. These airplanes are too complex, too exacting to be run just any way—there has to be one right way. Do it some other way and we know that something has to give.

We have all at one time or another encountered flying organizations that are obviously on the ball. Their operation is smooth, they don't have accidents. In short, they run professionally. Maybe the outfit you belong to right now is one of these. If so, more power to you. Anyway, one attribute stands out in outfits like this. If you ride with their pilots you find their performance remarkably alike. It doesn't matter which one you pick as your driver, the airplane is flown the same way—the right way.

### Uniform High Standard

What these units have done is eliminate as far as possible the human variations between their people. Their pilots have been brought as close as

The death or glory boys sang Hey! Hey! for the goggles and scarf. Those were the days.

possible to a single common denominator, a uniform high standard. The pilot in such an outfit doesn't fly "my way" or "the way we did it in China." He flies in accordance with his unit SOPs which are in accord with the Dash-One handbook and all other appropriate directives.

The noise you now hear dimly in the background comes from the anguished but fading wails of the diehard flyboys out in the wings of the stage. They cry of "esprit de corps," of the "tiger spirit" and all the rest. They ask piteously if automation has invaded the pilot's domain.

Well, with a softly dropping tear for Lilac Time, we must admit the answer is yes. Automation has hit our happy home. It is the answer to guided missiles, and bids fair to be the answer to instrument flying, bombing, all-weather intercepts and a lot of flying missions. And until Robert the Robot is ready to sit in the left seat all the time, a sort of automation of our human drivers has to be the interim answer to our problems. We don't like a word like automation when we're talking about pilots, so we call it standardization. This we can do, gentlemen, and without losing a drop of "esprit de corps." After all, there's esprit and esprit, and the kind we're talking about, the kind we want, is not the show-off variety. If you're good, and want everybody to know it, then show it off by a perfectly carried out mission, not by flying under the James River bridge. You don't prove a thing by scaring the daylights out of people—you do prove a lot with a pair of command pilot's wings and an accident-free flying record.

The pilots who fly the commercial airliners have been living with this concept for a long time and no one can deny it has paid off for them. And I haven't noticed many long faces at the airline terminal coffee counters. The Flagship and Mainliner people certainly are anything but wild blue yonder boys, but they seem happy. Their pride is professional, not flamboyant. And don't underestimate the personal satisfaction that comes from a professional job professionally done. Their feelings aren't hurt because each flies a DC-7 exactly like the next man. On the contrary, their qualifications are reflected by the fact that the passengers can't tell any difference.

The operating instructions on an Air Force aircraft go through quite a mill before Joe Pilot reads them. The manufacturers who build the airplane have the first say, and they ought to know. The flight test pilots at Edwards AFB and the engineers at Wright-Patterson all burn a lot of midnight oil before the Dash-One is laid before you. A lot of professional talent has gone into the production of the ungarbled word. All of which suggests that when Joe Pilot (Glutztown High School, Class of 1942) decides to differ with the Dash-One and go his own glorious way, some gall is showing someplace. Oh, we know errors appear in the book at times, and we learn new procedures and techniques from day to day, but these things should be passed on for decision by the people who know. Taking the law into our own hands can be a risky business.

### Same Book, Standards

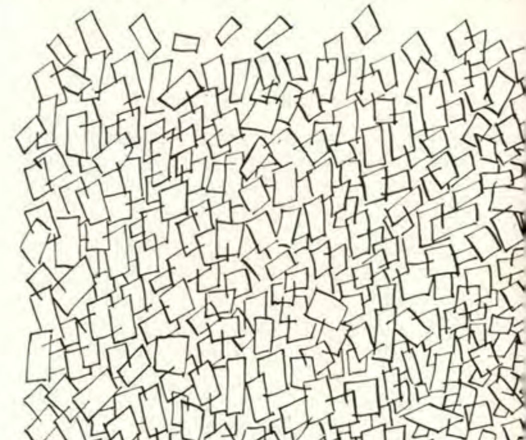
All right—we know we have the wherewithal, the machinery to standardize our pilots initially. If they're all taught from the same book and qualified under the same standards we're off to a good start. What's left? We have to be sure everybody adheres to these standards. Which brings

Automobiles used to carry several tires and a crank too. As we learn more, we can dispense with the excess cushion and as a result get more performance and still have a safer operation.

us to two indispensable ingredients of standardization. They are supervision and discipline.

Supervision—ah yes, one of those glittering generalities, sometimes regarded as a nothing-word, like "deep down locked-in goodness." We do abuse this word horribly, it's true, the same way we maul indoctrination and coordination. Well, what do we mean here? Simply that once you achieve something, you have to ride herd on it to make sure you don't lose it. If our pilots are trained to meet a standard, we must make sure they continue to meet the standard, and that the standards continue to be set. If you shoot an arrow into the air, it'll fall to earth you know not where—but you can be sure it won't stay up there. Neither will standard proficiency, unless you actively support it. Standardization, like anything else, means nothing if all we give it is lip service. If you want to know how your pilots are stacking up, the only way to find out is to fly with them—frequently. That way, if a man starts getting original ideas about how to work his machine you can spot it right away. If the idea is good, then get it to the right people so everyone can benefit. If it is no good, squelch it now before another statistic is made.

In an ideal, utopian organization the CO should be the best qualified pilot in the outfit, the man who knows the unit equipment best. His operations officer should run him a close second. In the old days this ideal was attained in some units, but today we must admit we can't do it. The old man in most cases has logged far more time with a mahogany bomber than in the current flying machine. The paper blizzard keeps him grounded much more than it used to. So the sharp lad with the airplane is likely to be a junior type who has been really logging current hours. This is how the stand-board pilot was born, how he came into his own. If properly used he is an invaluable man to have around. He is the expert on the unit aircraft; he knows it inside and out, and most important his knowledge is current. So he's the gent who can best do what the old man would like to do. That is to ride herd on the pilots in the outfit and make sure their qualifications and procedures are up to snuff. In its proper perspective his job is not one of required periodic checks, just to fill in squares on a chart. He should be the man with the most intimate knowledge of the real proficiency of the pilots in the organization, their weaknesses and strong points. He should be able to



In most cases, the paper blizzard keeps the old hands grounded a great deal of the time.

point the finger at areas where more training or corrective measures are needed. He should be a key man in helping the CO determine the capability of the unit.

The airplanes of today are too complex, too exacting to be run just any old way—there has to be one right way. Do it some other way and something has to give. In short, let's be professional.


### What's Discipline?

Now what's with this discipline? Indispensable to any military operation, sometimes we miss the application of this ingredient in flying. Discipline, as we consider it here, has nothing to do with desk-pounding, with punitive action, with hup, two, three, four and the rigid, quivering brace. Discipline is a quality which

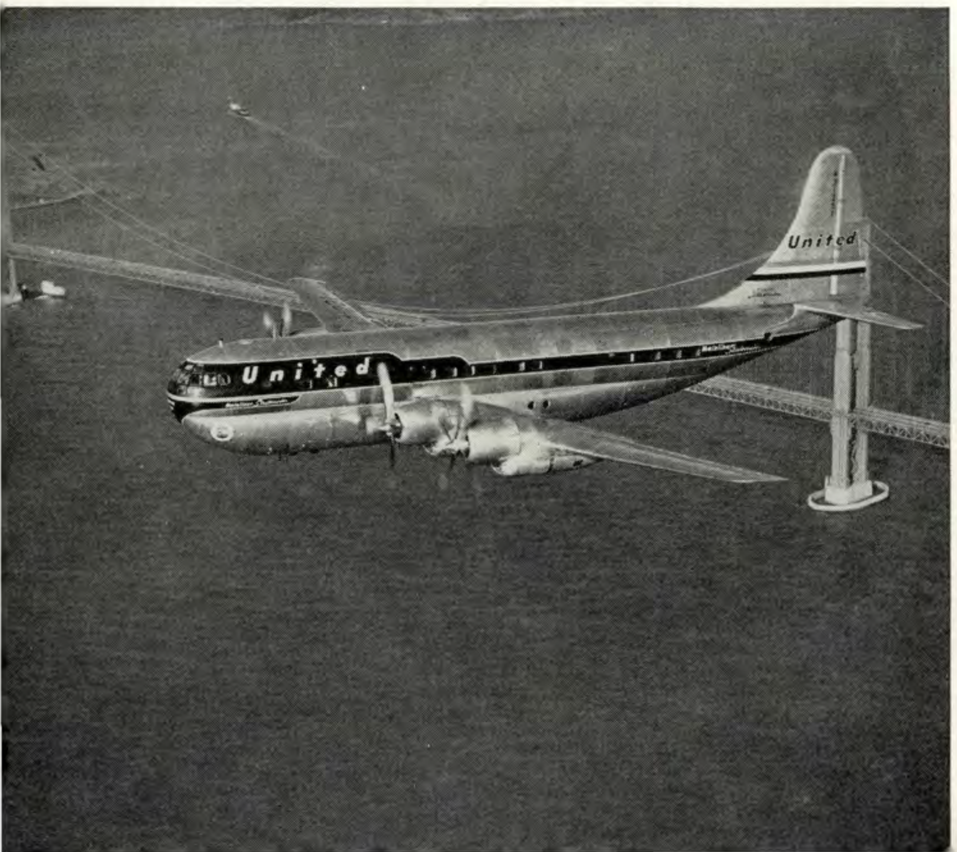
has to infuse every level of command if it is to mean anything. It is something that has to come from the bottom as well as the top.

At its best it consists of a well-founded desire on the part of everyone to do the job right and of individuals to cooperate for the good of the group. If the people in an outfit feel this way, the unit has discipline.

In case the highly technical nature of our mission tends at times to obscure this age-old military principle, it behooves us to remind ourselves that our job is fundamentally the same as that of our forebears at Saratoga or San Jacinto. Only the weapon is different.

Ours is a team operation, for the protection of our nation. Our team has many members and our organization is very complex, but as on any team the players must abide by the rules. Our rules are laid out for us. Every pilot or aircraft commander is a link in a chain of command. No T.O. space is provided for prima donnas. When he diverges from the set rule, a pilot is deliberately setting up an error. And heaven knows we have errors enough without setting them up for ourselves. Do it the right way and learn to like it!

Careless flying doesn't prove a thing. You prove a lot with Command wings and a safe record. This concept is used by the pilots who fly the commercial airliners. It has paid off for them.




### Make It Work

To make standardization work, then, the main ingredients of the program must be:

• A solid, well-prepared SOP to start with. In other words a standard to be met.

• Wholehearted command interest and support.

• A wisely chosen, highly qualified standardization board.

• Interest and support by the pilots themselves.

Proper use of a standardization program should result in a general raising of the proficiency level throughout a unit, and accordingly throughout the Air Force. What actually happens is a lowering of the "error-level" of the average line pilot and a consequent lowering of his accident expectancy. Less errors committed per flight mean less accident exposure per hour of flying. If we could reduce the error level to one-half of what it is, it doesn't take a mathematical genius to see that the pilot error accident rate would take a nosedive. And since pilot error accounts for half of our current accidents, what a bite that would take out of our overall accident losses! The machinery exists to do the job, and it can be done. Some of our commands and units have already achieved remarkable results with this concept. There is no reason why everybody can't do it.

Motorists wise may Simoniz—Aviators wise—standardize. ●


# "In recognition of..."

JUST A MINUTE. Do you recognize this plaque? There aren't too many but maybe you've seen one hanging on somebody else's wall. And maybe you've wondered why it's there and what it means.

This plaque is there because everyone in that outfit has done his level best to put it there. It means that this unit is one of the best, for recent changes in selection criteria make this Flying Safety Award one of the highest peacetime awards that any unit can receive.

Air Force Regulation 62-9, recently revised, tightens control over the plaque and the letter of commendation "For Meritorious Achievement in Flight Safety." More units are eligible now to earn the citation but fewer awards are given than ever before and they're harder than ever to get.

Only ten Flying Safety Awards can be made throughout the Air Force for each six months period ending in June and December every year. This doesn't include two granted to Reserve units and two awards that may be presented to outfits in the Air National Guard.

To earn the Flying Safety Award your unit has to compete with every other unit in your Major Air Command. As outlined in AFR 62-9, certain basic flying time requirements have to be met. But, over and above these prerequisites, the contribution made by your unit to flying safety and to accident prevention is the primary consideration for the Award.

Acting on initial recommendations made by Major Air Commanders, a special Flying Safety Awards board appointed by the Deputy Inspector General makes the final decision. Some of the factors the board takes into consideration in determining where the awards will go, are as follows:

- Overall accident rates, taking into account the difference in accident potentials for different types and models of aircraft flown.
- Causes of accidents—whodunit and why.
- Experience level of flying personnel.
- Outstanding feats or missions accomplished.

That's why when an outfit receives the Flying Safety Award today it has a meaning you may have missed before. It means that the combined effort of everyone assigned piled up a safety record nobody else could beat. It represents outstanding performance of duty by everybody concerned with the completion of every mission flown. It means this outfit is among the best the Air Force has.

Remember this the next time you see the Flying Safety plaque. And remember it, too, when you go back to work. It takes some doing to take off in the birds today, to complete each mission safely and with the extra care that makes the routine job well done. But somewhere somebody does this every day. That's all it takes to help your outfit win one of the top peacetime citations, the Flying Safety Award. ●

# Let's Summerize

*Turbulence, tornadoes, squall lines and thunderstorms usher in summertime flying hazards. FLYING SAFETY feels that this article reprinted from Traveler, a CONVAIR publication, relates the facts in a concise, professional manner.*

★ ★ ★

WEATHER IS of great concern to the pilot and, although he can't change it, he can in many cases avoid it and/or fly his airplane accordingly. He can't rely on old folks' tales or homespun methods of making predictions. He, like the weatherman, must depend primarily on barometric pressure, because he knows that changes in barometric pressure mean changes in weather.

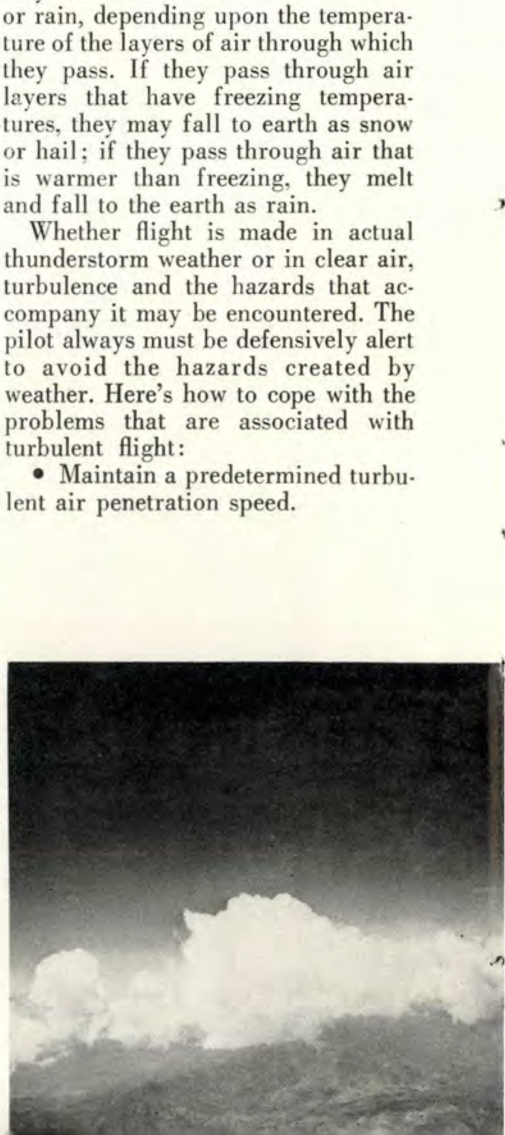
Flight in turbulent air is one of the most frequent weather problems encountered by flight crews. The most severe turbulence, caused by temperature and pressure changes, results in thunderstorms, tornadoes, hail, ice or any number of weather phenomena.

Without radar assistance, either airborne or ground, the pilot must resort to other means of identifying turbulent areas. One such method is knowing something about clouds. They are weather telegrams hiding accumulations of water and snow, and they transmit their messages to anybody who knows how to read the signs. The pilot's knowledge of clouds helps him to predict the weather and to select a flight path of least turbulence. Although clouds are an important guide to weather, most rules concerning them can vary just as the clouds vary as they sweep across the sky.

All clouds, even the fair-weather cumulus and cirrus, contain water or ice crystals. The movement of air currents within a cloud stirs up these crystals and amasses them into larger crystals. When they become heavy, they fall to the earth either as snow or rain, depending upon the temperature of the layers of air through which they pass. If they pass through air layers that have freezing temperatures, they may fall to earth as snow or hail; if they pass through air that is warmer than freezing, they melt and fall to the earth as rain.

Whether flight is made in actual thunderstorm weather or in clear air, turbulence and the hazards that accompany it may be encountered. The pilot always must be defensively alert to avoid the hazards created by weather. Here's how to cope with the problems that are associated with turbulent flight:

• Maintain a predetermined turbulent air penetration speed.



• Maintain proper attitude.

A single turbulent-air penetration speed has been determined as most desirable for each type of aircraft. In the selection of this airspeed, consideration is given to structural integrity, gust intensity, aircraft gross weight, aircraft handling and the normal altitude operating range.

• Structural integrity can be compromised most readily by an undesirable combination of over-controlling (maneuver loads) and severe turbulence (gust loads). Modern structural design of aircraft provides sufficient strength to safely sustain a load 50 per cent greater than the limit load specified. Pilots can further protect the aircraft from structural overloads by flight at airspeeds commensurate with the degree of turbulence encountered. Airspeed, however, can be reduced to a point at which a severe gust will cause a stall, before load limits are exceeded.

• Gust intensity is completely a function of the prevailing atmospheric conditions and cannot be controlled.

• Aircraft gross weight is indirectly concerned in considering this problem since, generally speaking, nothing can be done to alter it in the event turbulence is encountered.

• Aircraft handling. It is well known that instrument flight at the higher airspeeds requires a greater degree of pilot skill and increased concentration. It also is well known that the effects of gust accelerations are greater at these higher airspeeds.

It should be noted that in none of the aforementioned problems is a high airspeed listed as being the best solution for flight in turbulence.

To this point, all of our discussion has been based on the effects of a single gust, in fact, on a theoretical sharp-edge gust. In reality, the possibility of a single gust causing an aircraft to stall is remote. Using the formula for transport aircraft of "stalling speed plus 60 knots," and a conservative stall speed of 90 knots, the aircraft would be flying at 150 knots or approximately 250 feet per second. In this typical example, the aircraft would completely transverse the gust in approximately one-third of a second.

This example demonstrates that the problem of stalling in turbulence is not predicated only on a gust, but more commonly, from the failure of the pilot to use proper techniques to maintain the aircraft in a level attitude, at a predetermined turbulent-air penetration speed.

### Thunderstorms

A thunderstorm always is associated with a large cumulus type cloud that has grown to unusual heights. The vertical growth of the cumulus cloud is due to an invisible rising column of air. Whether thunderstorms are caused by air being heated from below (air mass thunderstorms), or by air being forced up an inclined plane (frontal and orographic thunderstorms), they all have the same general characteristics. These strong updrafts of air, which are the basic cause of the thunderstorm, are offset by downdrafts, both within and outside the thunderstorm cloud. The result is severe turbulence, with the greater portion occurring ahead of the storm in the area known as the "roll cloud." The updrafts of air ahead of the storm and the downdrafts within the storm, cause the roll cloud to form at the base of the leading edge. Slightly ahead of this area on the surface, variable and shifting surface winds prevail. In and around the roll cloud is the region of maximum flight turbulence.

One method of identifying turbulent areas is knowing something about clouds. They are weather telegrams hiding accumulations of water, snow, and they transmit their messages to anybody who knows how to read the signs. The pilot's knowledge of clouds helps him select a flight path of least turbulence.

Eddies that occur along the edge of violent air currents result in the cauliflower appearance of the outside of the cloud. When these vertical currents rise beyond the freezing level of the surrounding atmosphere, it may develop into a cumulo-nimbus cloud, and a thunderstorm is likely.

The thunderstorm's identifying features may not always be visible because they can be masked by other clouds. Low-level clouds may hide the roll cloud, the dark rain area and the base of the actual thunderstorm. Multi-layer shelves of non-violent cumulus and stratus type clouds often extend for many miles in front of the thunderstorm hiding its anvil top from a low-flying airplane or its base from an aircarft at altitude.

When the atmospheric freezing level is relatively close to the earth's surface, as in the spring and fall of the year, tops of thunderstorms are generally low (15,000 to 18,000 feet). Realistically, these storms are not true thunderstorms, but rather rainshowers. The formation generally lacks an anvil top and a well defined or active roll cloud. The entire cloud has a cauliflower appearance with a slight veil of cirrus type clouds usually around the dome.

The thunderstorms that build up to 30,000 to 60,000 feet, however, are a different matter. The height to which these clouds extend is primarily governed by the distance between the ground and the atmospheric freezing level. The greater this distance, the higher the clouds and the more violent the thunderstorm activity.

The most violent activity occurs in the lower two-thirds of thunderstorm clouds. If it is 30,000 feet from the base to the top of the cloud, you may expect the greatest turbulence in the lower 20,000 feet.

At night, lightning is usually the first warning of thunderstorms ahead. The region of the most frequent lightning flashes is ordinarily the most violent point within the storm. If more vertical than horizontal flashes are observed, it indicates that you are approaching the storm from the front, where there is greater violence. Conversely, if you see more horizontal than vertical flashes, you are approaching from the rear. If horizontal flashes are the only type observed, the storm is mild and its base is well above the surface of the earth.

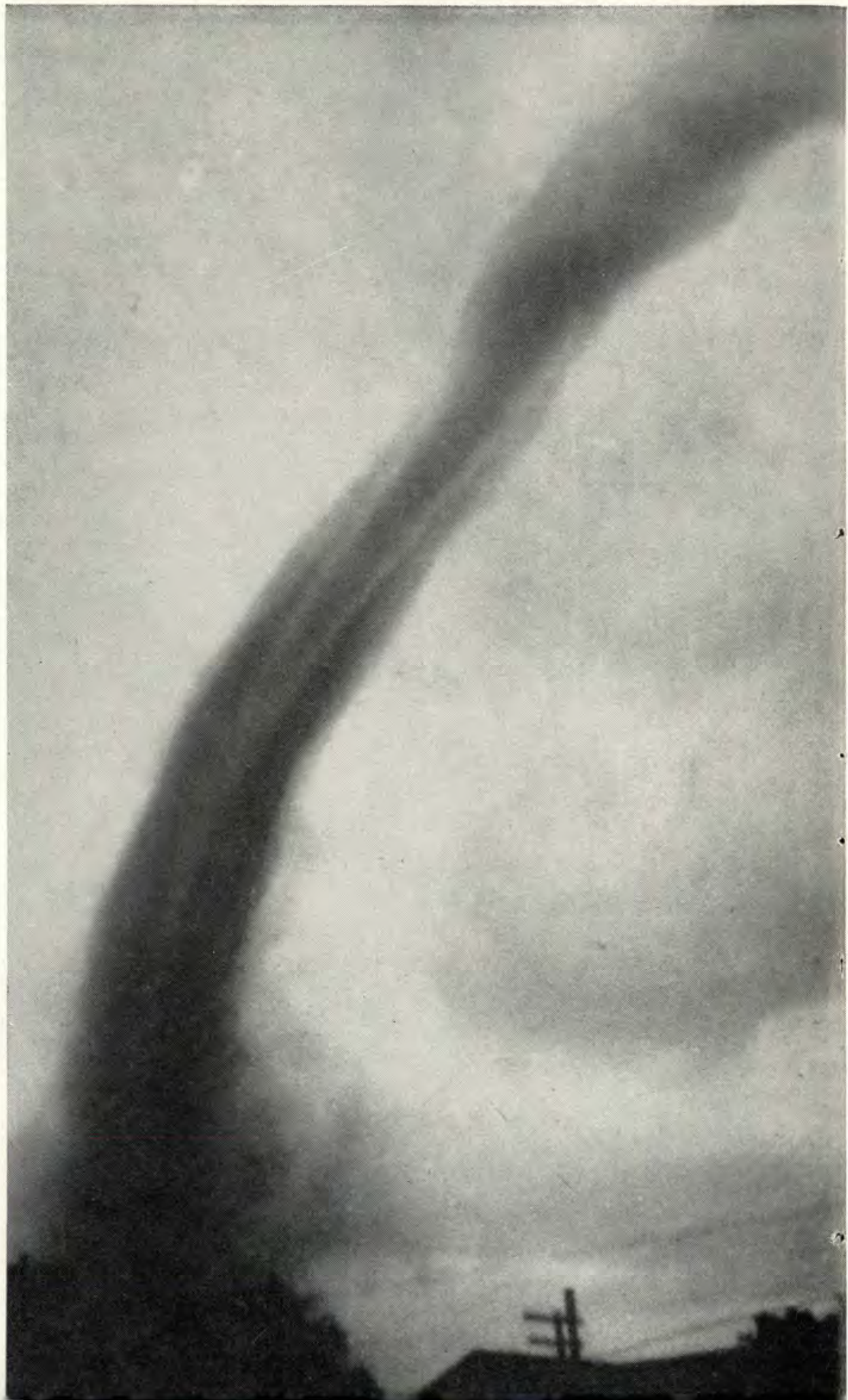
The anvil top of the thunderstorm consists primarily of ice crystals. The anvil top is above the turbulent activity of the storm.

Hail forms in the chimney of the thunderstorm at an altitude above the freezing level. Hailstones are balls or irregular lumps of ice which may vary from the size of a pea to that of a baseball. Severe aircraft damage from hail is exceedingly rare. It takes a vertical current of air exceeding 150 knots to suspend the larger hailstones, and ordinarily the updrafts don't exceed 60 or 80 knots.

Pilots have experienced heavy hail in the clear air outside a thunderstorm, which seems to support the theory that the worst hail is generally encountered around the main storm cloud and underneath the overhanging shelves, rather than in the region of heaviest rain in the core of the storm.

**Squall Lines and Tornadoes**

Squall lines and tornadoes can provide the worst possible flying condi-



There is a possibility that one or more tornadoes may develop in the vicinity of a squall line. They apparently grow out of the roll cloud, often occur along or in advance of the cold front.

tions. During their first few hours of life they are composed of a continuous line of severe thunderstorms. In addition, there is the possibility that one or more tornadoes will develop in the vicinity of a squall line.

Squall lines are rather difficult to forecast. They occur in all degrees of intensity, but for every severe one there are many of slight or only moderate intensity. The squall line is essentially a cold front phenomenon. Unless cold air replaces warm air and also overruns it, a squall line will not occur. Almost any cold front may be a squall line breeder; however, the squall line may be well past the formative stage before it is identified on map analyses by forecasters. Thus, it seldom appears on 24- and 36-hour forecast maps.

Studies of squalls and successful flights through them indicate there is no preferred altitude or level for penetration of violent thunderstorm activity. While squall clouds occur at a height of 5000 to 7000 feet, turbulence may extend twice as high.

If a clear space a mile or more in width is evident, penetrate at that spot because the vertical velocity gradients near the center will probably not be severe enough to prevent safe transit.

A tornado is a violent whirling storm usually a few hundred yards in diameter, having intense cyclonic winds reaching velocities of 200 to 600 mph. Tornadoes differ from hurricanes in both their size and duration. They may occur at any time during the formative stages of a squall line. They result from extreme instability and are usually associated with severe thunderstorms. They apparently grow out of the "roll cloud" as it bends down toward the surface, and usually occur along, or a short distance in advance of a cold surface front between mP and mT air.

A tornado is the most violent of storms, but its life span is exceptionally short, approximately one hour for the average storm, with a track over the ground usually less than 25 miles in length. Its appearance is so typical and its size so limited in daylight it is easily recognized and its path avoided without difficulty. Because, like thunderstorms, they travel with the wind, the path of an observed tornado may be roughly forecast, and such areas avoided. (See "Tale of the Twister," FLYING SAFETY, March 1956.)

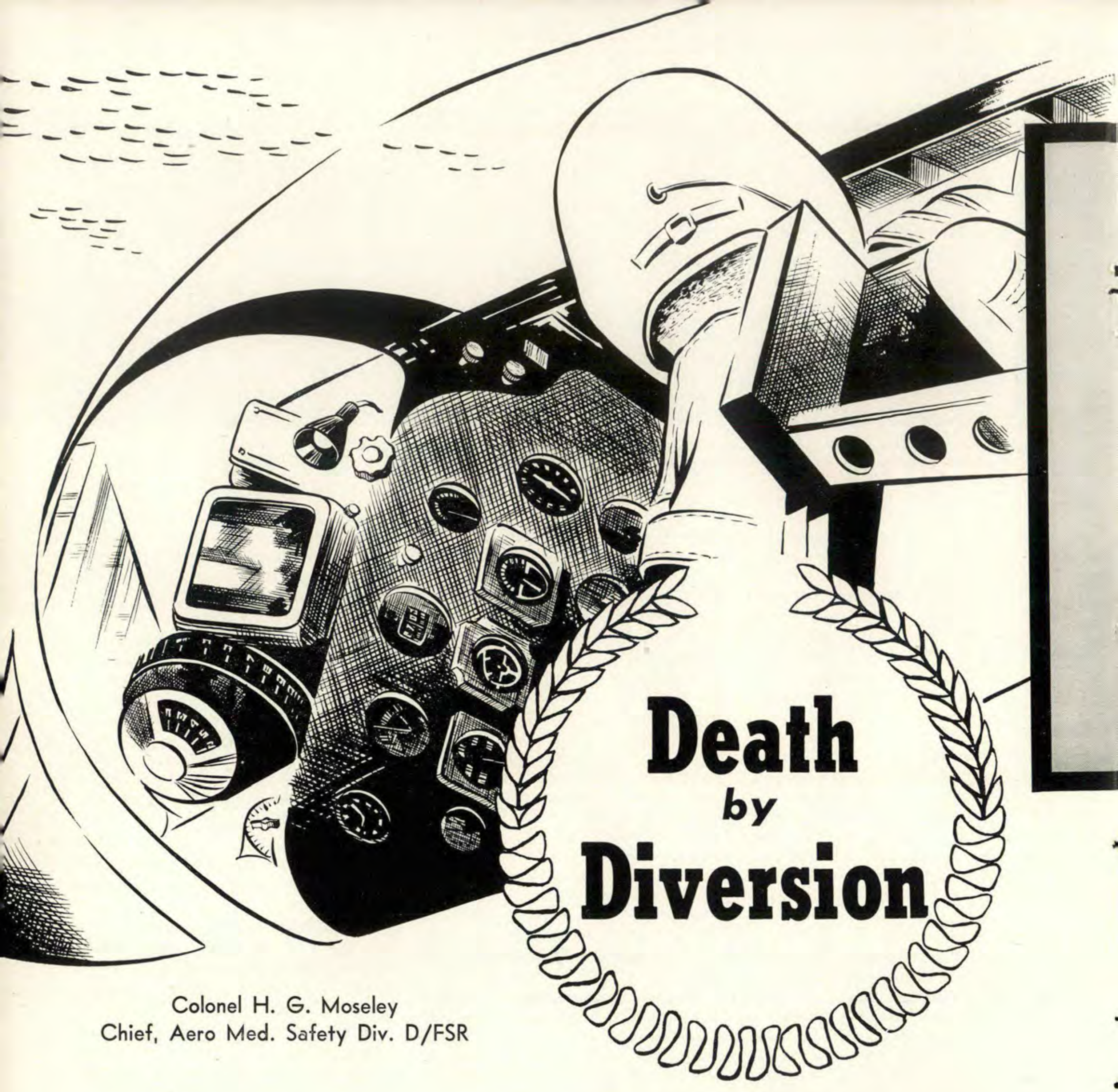
### Areas of Turbulence

Thunderstorms present a problem to the pilot that cannot be disregarded. When encountered in flight, thunderstorms and other related areas of turbulence should be avoided by any of the following methods:

- Circumnavigation.
- Flight below the base of the storm, if a terrain clearance of 3000 feet can be maintained.
- "Over the top."
- A precautionary landing can be made until the thunderstorm passes.

Use the following pertinent conclusions to help you make your decision:

- When encountering cold-front thunderstorms or other extended lines of thunderstorms, where individual thunderheads are separated by clear areas within accessible altitudes (10,000 to 18,000 feet), flights can be conducted through these clear areas and above lower levels of clouds. Do not fly closer than 2500 feet to the cumulo-nimbus build-ups.
- Do not fly in the immediate vicinity of a thunderstorm or a line of thunderstorms, when below an intermediate level overcast. Thunderstorms have a tendency to expand above stratus type clouds and may release heavy rain or hail outside the actual thunderstorm itself. Severe turbulence may be encountered also due to the instability of air in the immediate thunderstorm area.
- Do not attempt flight below prefrontal thunderstorms or cold-front squall lines.
- Summertime thunderstorms occurring at night, not associated with any frontal activity, develop at relatively high levels and are usually weak in intensity.
- Extreme care should be exercised when descending toward a thunderstorm with the intention of flying below its base. The normal glide path of the airplane may be increased by downdrafts, and the rate of descent and indicated airspeed may increase beyond limits. Such descents should be conducted carefully at a greatly reduced airspeed.
- Never attempt to fly through a squall line or cold front thunderstorm unless you have positive knowledge that the individual squalls are loosely connected and can be safely circumnavigated, or unless it is definitely known that flight can be conducted between the build-ups and above the tops of all lower level clouds. ●



# Death by Diversion

Colonel H. G. Moseley
Chief, Aero Med. Safety Div. D/FSR

A CERTAIN percentage of aircraft accidents are never explained. No matter how much effort is put into the investigation, it simply cannot be determined whether the accident was caused by materiel failure, some action the pilot did or did not take, or some other cause. However, among some of these unexplained accidents we find a pattern which periodically recurs. All pilots might do well to look at this pattern and try to avoid it. This is of some importance because the accidents which are about to be described are invariably fatal. Here is the picture.

• The aircraft which are involved and which are about to be destroyed are always jet fighters or interceptors.

• The pilots involved are usually young and relatively inexperienced, although pilots of any age may enact this tragedy.

• The stage of flight is usually somewhere in the landing or approach pattern, although it may occur shortly after takeoff.

• The altitude is relatively low, usually around 2000 feet.

• The aircraft speed is usually around 350 knots.

• The aircraft is often in a procedure turn.

• Flying conditions are IFR. The pilot is either in the soup or it is a black, black night.

• The pilot is requested to change radio channels or modes, or is in a position where routine channel changes should be made.

wise deviate somewhat from the desired flight path.


When flying under IFR, close to the ground, any diversion can be dangerous. Changing radio channels, modes, during procedure turn falls into the category of possibly dangerous diversion.

After the pilot has been requested to change channels, he "Rogers." Or, if it is a routine change he may announce that he is changing to channel 2 or 4 or whatever it may be.

Almost immediately thereafter, the aircraft strikes the ground with terrific velocity and oftentimes in a near-vertical attitude.

As we said before, there are no survivors, and nothing can be found in the wreckage to indicate any type of materiel failure.

So the cause of the accident remains undetermined.

However, in any aircraft accident investigation if we can answer the question of "What was the last thing the pilot was doing or attempting to do?", we can get a good lead on the probable cause of the accident. In these accidents the answer to that question is relatively simple. The last thing the pilot was doing or attempting to do was change radio channels or modes.

"So what?" one may ask. Radio channels or modes are changed all the time without flight being brought to a shattering halt. However, let us look at the position of the radio channel or mode selector which this pilot was trying to handle.

Almost without exception, the aircraft involved in the above pattern have had the radio channel or mode selector far to the rear on the right console. In order to change channels the pilot has to use his right hand and fly with his left. In order to look at the channel or mode selector and see what is being selected, it is necessary for him to turn his head, and look down and to the rear.

Remember, flying conditions are IFR and the pilot is often in a procedure turn. In other words, it is 100 per cent instrument flying. Under these conditions, the pilot who looks to his channel selector must quit monitoring his instruments even if only for an instant. But even in this instant, it is easy to allow the nose to drop or a wing to go down or otherwise deviate somewhat from the desired flight path.

Is this important?

The importance is best illustrated by some experiments which were done a few years back at Wright Air Development Center. In these flight tests, experienced pilots were placed in the left seat of a light transport aircraft and while the copilot flew, they were blindfolded. Then the aircraft was placed in a slightly abnormal position with one wing or the other down, or the nose up or down, and then the blindfold was quickly removed and the pilot was required to recover on instruments. He was timed to see how long it had taken.

It took on the average of 11 seconds for these experienced pilots to again attain level flight by the use of flight instruments.

Sometimes when a wing was down, the immediate response to right the aircraft was in the wrong direction. In other words, instead of trying to bring the aircraft level, the pilot tended to turn it over on its back.

What does that mean to the pilot of our jet fighter or interceptor flying IFR 2000 feet above the terrain? It means that should he accidentally wingover or become diverted and get the nose down, he can strike the ground in less than five seconds.

So here we can say with a fair degree of certainty that these unexplained accidents were probably the result of the pilot's letting his attention be diverted by the radio channel frequency selector.

To help prevent this, the Air Force is rapidly changing the position of the selector in many of these aircraft so that it can be easily handled. In addition, experiments are being conducted to determine whether or not it is feasible to place a small channel indicator somewhere on the instrument panel. Either method will allow the pilot to see the channel he is selecting without turning his head.

However, the important thing is not just the position of the radio channel selector. What is really important is not being diverted no matter what the cause. It is a matter of staying ahead of the game. When a pilot becomes diverted from his instruments during critical stages of flight, he has lost the upper hand. And once those gyros go berserk and the altimeter unwinds, there may be precious few seconds remaining. ●

SCHEDULED TO test hop an F-89C, following a left engine change, Captain Richard A. Jones taxied the aircraft to runup position. After completing the required engine and pre-takeoff checklists, he started the takeoff roll. Immediately after the F-89 became airborne and as the gear was retracting, an explosion occurred in the left engine. The cockpit filled with smoke and the left engine fire warning light came on. Captain Jones shut down the engine, dumped the tiptank fuel and pulled the left engine fire extinguisher handle.

He started a 180 turn back to the field. Through the smoke he could see that the fire warning light was still on, so he decided to crash land on the runway.

Upon completion of his turn, the smoke had dissipated

T R A I

**Captain**

# *Richard A. Jones*

433d FIS, AAC

# ★ WELL

K N O W

and the fire warning light had gone out. Low on the final approach, and with the gear indicating an unsafe position, he decided to try to save the aircraft. Using full power on the right engine, he completed a successful single engine go-around pattern. He extended the gear by use of the emergency system and landed safely.

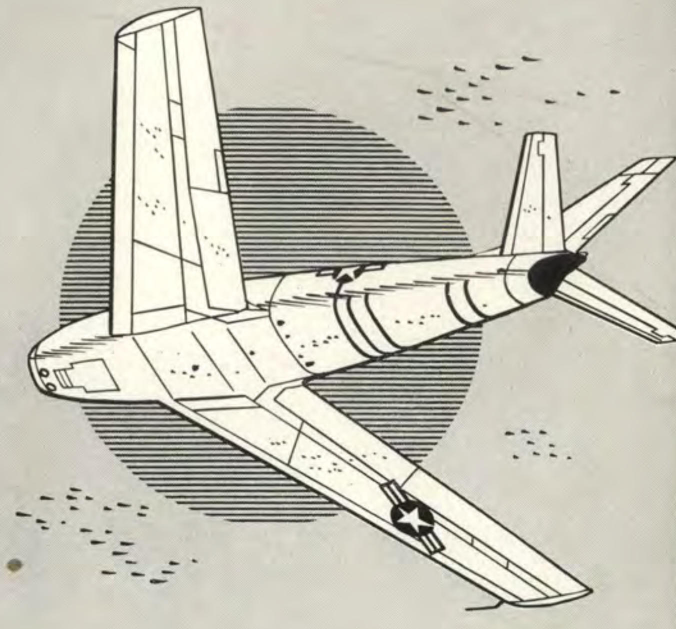
During this short flight, Captain Jones was never able to fly the '89 more than 200 feet above the ground. The flight path beyond the ends of the runway was either over a densely populated area or rough, hilly terrain.

Captain Jones' professional knowledge of the performance and systems of the '89, a desire to save the expensive aircraft and his superior flying skill reflect credit upon himself and the U. S. Air Force. Well Done!

1ST LT. ALBIN OPAROWSKI was number six man in a flight of six F-86s on a night navigation mission. Takeoff was shortly after midnight. Upon reaching cruising altitude at 35,000 feet, he felt a slight vibration in the engine. Then it flamed out. Lt. Oparowski immediately placed the throttle in the stopcock position, established a glide of 185 knots, turned the IFF set to the emergency position and notified the flight leader.

He was flying above a solid overcast. Thunderstorms extended above 35,000 feet, and the high mountains in the area ranged from 6000 to 12,000 ft. high.

At 25,000 feet, Lt. Oparowski attempted several airstarts. None were successful, although he used both normal and emergency fuel systems. He made a decision to



N I N G

# DONE ★

1st Lieutenant

## Albin Oparowski

146th FIW, Calif ANG

L E D G E

eject at 15,000 feet. However, just before reaching this altitude, he attempted one last airstart. The engine rumbled and the tailpipe temperature started to rise. He had to use his flashlight to read the instruments because the battery was very weak. When the tailpipe temperature continued beyond the allowable red marks on the instrument gage, Lt. Oparowski retarded the throttle. Again, the engine flamed out. At this time he broke out under the overcast and saw the airfield at Flagstaff, Arizona.

He then made a successful airstart and flew toward the airfield, using only partial power. Setting up his landing pattern, he landed safely on the 6300-foot strip.

For his superior flying ability in an emergency situation, Well Done!

C-130 features four, constant speed turbo-props.

# C-130 TURBO TRANSPORT

Major Joseph P. Tracy
Safety Education Division, D/FSR


You can handle the Hercules with one hand in the landing pattern. Below, it is very stable in all flight configurations and gives you an honest warning on all stalls.

EVER SINCE THE YC-130 first lifted off the runway at Burbank, California, we've been following the development of the machine with a great deal of interest. It's not a particularly big airplane when compared with such aircraft as the C-124 or the C-133, but it appears now that it can carry a whopping load on relatively short hauls and in all probability beat the tar out of its bigger brothers when it comes to speed. In all fairness, this is a comparison only to acquaint you with size difference rather than performance.

The C-130A is one of the first turbo-prop jobs and from our limited flight experience with the plane, we'll make book that such type power is here to stay. True, there are still some bugs to be ironed out of the propeller system and we look for a few minor modifications in the bird itself. However, on the whole, the Hercules is nearly ready for operational absorption into the Air Force and as this is written, preliminary USAF crew training has commenced.

Through the good offices of Mr. B. A. (Bud) Martin, Chief Pilot of the Georgia Division, Lockheed Aircraft Corporation, arrangements were made for FLYING SAFETY to get acquainted with the C-130A and to do a bit of flying in the aircraft. We're not going to even try to give a complete flight evaluation at this time but we can say that it is a kindly machine with no apparent bad habits.

You'll be seeing more and more of these high-tailed dudes in the near future. Its distinctive profile is hard to miss. If the upswept empennage deludes you into thinking that it's a C-123, just glance at the Roman nose and there won't be any doubt in your mind. The front of the C-130 resembles a goat but you may rest assured it's nowhere near as stubborn.

### Versatile Transport

Getting down to basics, the Hercules is a high-wing, all-metal construction, medium-range, land-based transport. That's what the book says. Its mission is to provide rapid transportation of personnel or cargo for delivery by parachute or landing. It can be used as an assault transport carrying 92 ground troops or 64 paratroops and equipment, and it can be

**This article features the C-130A, Lockheed's brand new, turbo-prop transport. Powered by four Allison, T-56 engines, the "Hercules" will soon be operational in Air Force units.**



The Hercules is 95 feet long, 38 feet tall and has a wing span of 132 feet.

converted for ambulance or aerial delivery missions.

Power for this aircraft is supplied by four Allison T-56-A-1 turbo-prop, constant speed engines. We'll discuss power plants later. When delivered to the customers, each engine will drive a three-bladed Aero-products constant speed propeller having full feathering and reverse pitch.

The fuselage of the C-130A is divided into the cargo compartment and the flight station. After climbing four steps to get into the main compartment, it is necessary to scramble up four more to get to the pilot's office. You're a fair distance off the ground.

An auxiliary power plant, consisting of a gas turbine compressor and air turbine motor, provides a ground source for engine starting, nacelle preheating and air conditioning. The air turbine motor provides emergency hydraulic pressure and D.C. power for both air and ground operation.

The landing gear system is actuated hydraulically and consists of a dual nosewheel and two tandem mounted main landing wheels on each side of the fuselage.

Cargo may be loaded either through the forward cargo door on the left side of the airplane or via the aft cargo ramp and door. Loading through the forward door is done at truck-bed level. The aft door can be opened and the ramp lowered. The aft cargo door and ramp are used for aerial delivery. Paratroop jump doors are located forward of the ramp hinge line on each side of the airplane. The doors are guided to an overhead position within the plane when opened. Electrically actuated air deflectors are located just forward of each jump door.

And finally, just for a few last figures, the C-130A has a wing span of 132 feet. It is 95 feet long and sticks up in the air for 38 feet at the top of the rudder. If the engineers are right, this gal will gross out at 108,000 pounds which sort of takes it out of the Cub category.

Probably the most important difference between the C-130A and any aircraft you've flown previously is the power plants. In essence the manufacturer has taken a gas turbine and combined it with a propeller. This is sort of a double-barrelled shot for not only is ample power supplied by the propellers for all the pull needed but a bit of jet augmentation is an everpresent booster as well.

## Two Assemblies

Like for any jet engine, the ideal fuel is JP-4. However, in an emergency, aviation gasoline may be used with, of course, the penalty of decreased efficiency range-wise.

Each T-56 engine consists of two assemblies: the power section, containing the gas turbine, and the reduction gear assembly, having a single propeller shaft.

The power section has a 14-stage compressor and six through-flow-type

Opening the loading doors in flight has no effect on the flying characteristics of the plane. If the loading ramp is lowered full down, a slight nosedown tendency is produced. Add power.

combustion chambers which port directly to a four-stage turbine. The power section also provides an accessory drive decoupling assembly, a propeller brake, an engine negative torque control system and necessary gearing to provide a 12.5 to one reduction in propeller shaft speed. This results in prop speed of 1106 rpm at 13,820 rpm, normal engine speed.

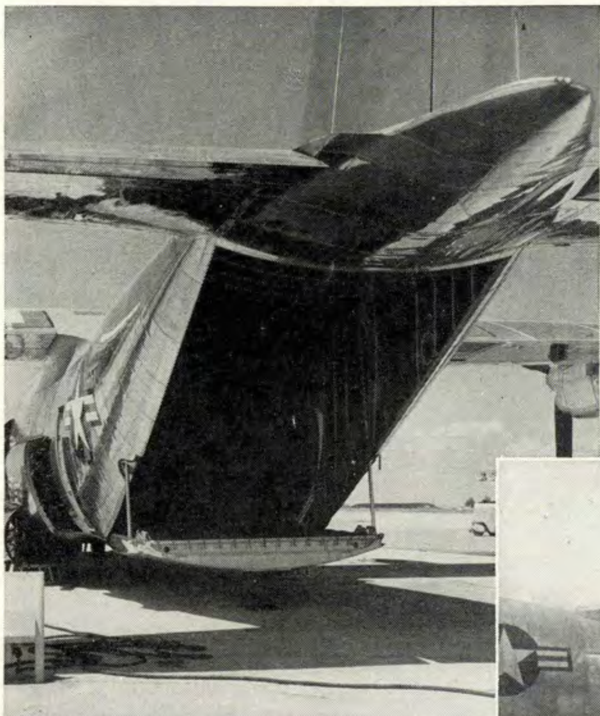
Now you might just as well try to follow the rest of this business. Maybe it's a bit on the dry side, but if you can get a reasonably good picture in your mind as to the "how" of the turbo-prop assembly, you won't be floundering completely the first time you fly behind one.

### Axial Flow

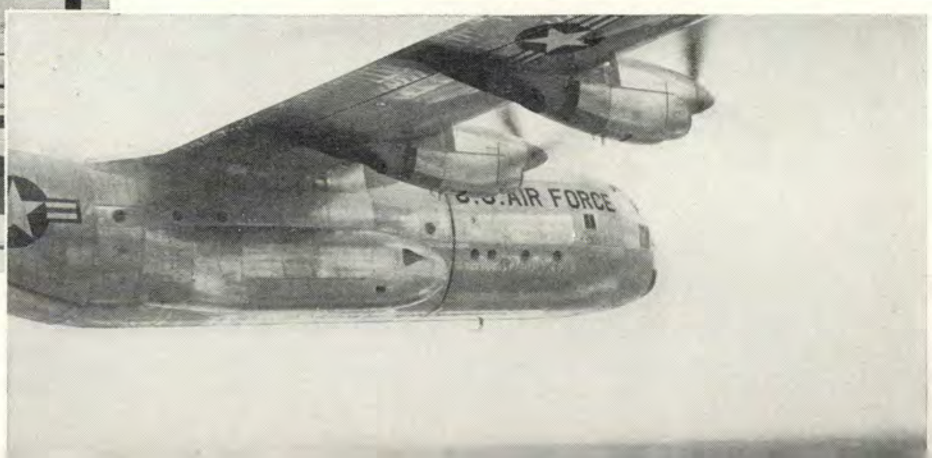
Back to the T-56. Air enters the engine airscoop and is progressively compressed through the axial flow compressor. This compressed air flows through the diffuser into the combustion section. This section consists of six combustion chambers where fuel is introduced and the fuel-air mixture is burned. The resultant hot gases pass through the aft ends of the combustion liners and expand through the turbine section, causing the turbine to rotate. The turbine then drives the compressor rotor and the reduction gear assembly. The gases travel from the turbine through an opening formed by the inner exhaust cone and the turbine rear bearing support. From there on, gases are discharged almost as a jet and that explains the jet augmentation effect.

At this point, let's remember that the Allison T-56 is a constant speed engine. Remember too that the propeller turns at a constant speed while in flight and if that sounds a little confusing, it is. Here, however, is a simple explanation of the whole thing.

If the pilot wants more power from



Cargo can be loaded through aft cargo ramp and door. Paratroop jump doors, below, have electrically actuated air deflectors in front of them.



The Hercules can be used as an assault transport carrying 92 ground troops or 64 paratroops and equipment. It will gross out at 108,000 pounds. It can carry a whopping load on relatively short cargo hauls.

his engines while tooling along in the blue, he opens the throttles. That's fair enough. In this case though, the throttles are known as "power levers." Okay, so he opens the power levers a little and feeds more fuel into the engines. Unlike anything you've flown before, there just ain't no more increase in RPM. Because why? The mills are already turning up 100 per cent. Naturally, there's only one other out and maybe you've already guessed the answer. As the power levers are moved forward the propeller blade angle increases. End results? More speed and if you don't think this takes a bit of complicated gearing, governing and fuel scheduling, you're wrong. However, it works!

### Negative Torque Control

Two inherent safety devices incorporated are the decoupling set-up and the engine negative torque control. The coupling is provided to disengage the reduction gear in the event the power unit is operating below approximately 400 ft/pounds torque at the power unit. This means that in the event of an engine failure or an abnormally rapid reduction in power setting, the decoupler goes to work and physically separates the propeller coupling from the engine and leaves it in the free-wheeling state. Normally, if an engine fails on a reciprocating engine, the pilot can feather the propeller. Such is the case with the T-56. But, in the event of internal failure of the engine, you can see what might well happen if the prop didn't have some system ready to snap it into free-wheeling until things got under control a bit. The decoupler takes care of such emergencies where the pilot may not have the time to feather normally.

The engine negative torque control is installed on all engines. The purpose of this unit is to limit the negative thrust horsepower that may occur during engine failure. There are three things which could cause a negative torque load to be applied to the engine: (1) a rapid power reduction: (2) a severe gust; (3) engine failure or flameout. As long as the power section is driving the propeller, the engine negative torque control will remain inoperative. If the propeller attempts to drive the power section, the engine negative torque control senses negative torque, and at about minus 275 horsepower, actuates the propeller pitch circuit, moving the propeller toward feather condition. As the propeller starts toward feather, the negative torque decreases, causing the engine negative torque control unit to become inoperative when the negative torque drops below the minus 275 horsepower value. The propeller blade angle will then return toward the governing range. If the negative torque rises again, the same cycle will automatically recur and the negative torque will be limited to the minus 275 horsepower.

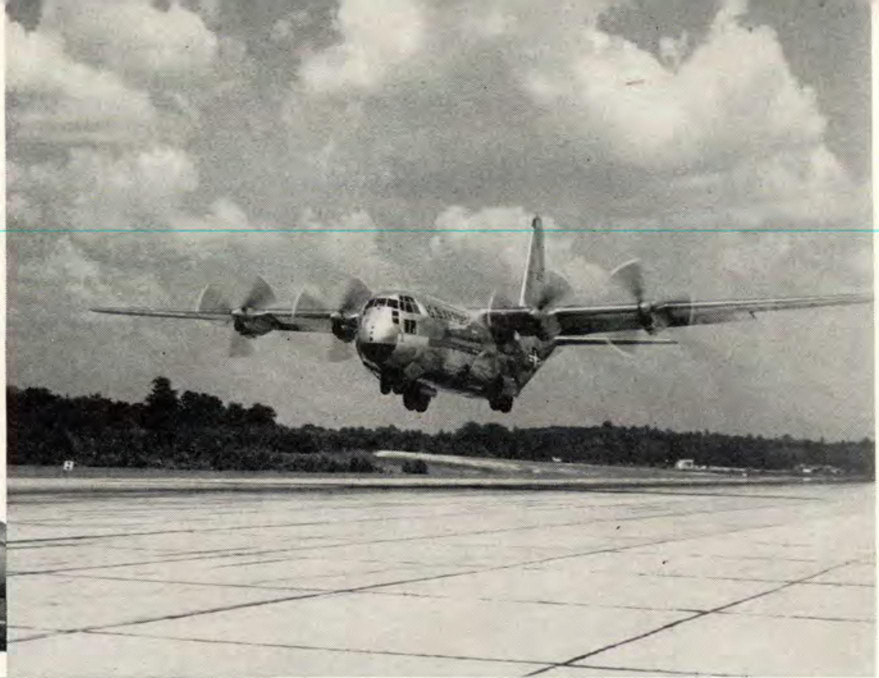
The first time you climb into a C-130A, you're going to be facing a new control quadrant set-up in some respects. A couple of the more important things are the power levers and the condition levers.

The four power levers are quadrant-mounted on the flight control pedestal. The quadrant is divided into two ranges. The taxi range is the section of the quadrant between MAXIMUM REVERSE and FLIGHT IDLE positions. In the taxi range, all ground operating controls are in effect. Further movement of the power levers forward of the FLIGHT IDLE and up to the TAKEOFF position places the engine in the governing range. Now, in this range, all controls for both fuel and propeller are automatically set for flight requirements. A step or detent, located at the FLIGHT IDLE position, prevents accidental movement of the power levers into the taxi range.

### Condition Lever

The other controls we spoke of, the condition levers, have the following positions: AIRSTART, RUN, GROUND STOP and FEATHER. Placing a condition lever in the AIRSTART position energizes a circuit which turns the propeller blades to a present angle suitable for starting the engine in the air. When the engine is started, the condition lever is released to the RUN position.

Placing the condition lever in the GROUND STOP position removes power from the ignition exciters, shuts

". . . gear up, flaps up, nose up and you're on the way up, too—but good."

Quick loading of many types of cargo makes the C-130 an ideal medium-range transport.

off fuel to the engine and engages the propeller brake as the prop slows down. And lastly, moving the condition lever to FEATHER opens the normal propeller circuits and runs the propeller to the feather angle. From this you can see that a condition lever is sort of a combined mag switch, mixture control and feathering button. As a matter of fact, forthcoming condition levers will have the familiar standard mixture control knob configuration.

There are a goodly number of toggle switches and circuit breakers scattered around the office that the pilot must become familiar with but the power levers and condition levers will be the two controls new to the average driver. One thing we like is the fact that almost everything is within reach of either the pilot or copilot.

The C-130A uses heat for anti-icing, has an extremely simple fuel system, a normal oxygen system that we're all used to; has a pressurized cabin (including flight deck and cargo compartment) and generally is an aircraft that will be pretty much normal to the average cargo-type driver. The anti-skid brakes will come in mighty handy during crosswind landings or touching down on icy runways.

Okay, let's say that we've gone over the airplane carefully and it's time to leap off. That takes care of takeoff performance. It just leaps off, period. You run the power levers up to maximum TIT (turbine inlet temperature, 927°C.), release the brakes and rather casually nudge the nosewheel steering as needed. The airspeed comes up fast and in nothing flat you're airborne. Eight hundred feet or so ground run and—jump! Sure, that's empty, but pretty fair performance for an airplane that weighs in this heavy.

### Steep Climb

On your first takeoff, you'll be startled by the steep angle of attack that constitutes a normal climb. As a matter of fact, we found it a trifle uncomfortable. You sit there on your tailbone and wonder what's going to happen. Gear up, flaps up, nose up and you're on the way up, too—but real good.

The C-130A has no apparent bad habits. We checked it rather carefully in all possible configurations and at practically all speeds. It accelerates fast when the power levers are advanced; it's very stable under all flight conditions. There are no heavy control loads and response is positive.

### Honest Warning

This plane gives a lot of honest warning before stalling, power on or off. The buffet is pronounced but not in the least violent and there is no evidenced tendency to fall off on a wing. We found that even when completely stalled, aileron and rudder remained exceedingly effective.

It doesn't appear that an engine failure in flight would present too much difficulty. We tried shutting down and feathering each mill right across the board and had no trouble holding altitude and heading.

Each pilot has a trim button on the control wheel, so located that it can be reached and actuated by thumb pressure. In the event one trim button is actuated too much or for too long a period by either pilot, the other can stop the operation at any time by merely applying opposite trim. Then, too, a manual trim toggle is located on the pedestal beside the pilot which will override both trim buttons. This arrangement should prove very helpful during student or transition training.

". . . no sweat in getting reverse thrust. It's like hitting a brick wall."

Because of the ease of handling, a few words on the control boost system appear in order. A booster hydraulic system, a utility hydraulic system and an emergency hydraulic system distribute pressure to the hydraulically operated parts of the airplane.

The booster and utility systems are interconnected to the extent that normal operation of the aileron and elevator boost cylinders make use of pressure from both sources. The utility hydraulic system also serves as a standby source of pressure for operation of the rudder boost cylinder in case of a pressure failure in the booster system.

### Three Hydraulic Systems

The emergency hydraulic system can be actuated for emergency landing services and normal or emergency ramp operation. Normal operating pressure for the systems is 3000 psi.

The C-130A is a beautiful flying machine. However, with the boost off, the picture changes rather drastically. It is possible to fly this brute by straight manual control but we guarantee it to be a two-man job in every sense of the word. Of course, with three hydraulic systems to depend on, the chances of complete boost failure are remote.

Preliminary USAF crew training has commenced in the C-130 at Marietta, Ga. plant.


We noticed a tendency to overcontrol the ailerons a little at first. Wheel pressure is very light and it took a bit of experimenting to get the hang of leaving that control alone. T-bird drivers and fighter jocks will appreciate what we mean, although the '130 isn't quite as sensitive as fighters.

Landing the C-130A doesn't present any particular problem. In fact, it's an easier aircraft to set down than many we've flown. We found it to be an entirely normal machine in all respects except for quite a lot of burbling after the gear is extended. This is a peculiarity of the C-123 also and apparently is induced by both positive and negative airflow in the wheel wells. This makes the plane quite noisy after the gear is down and the buffeting is a trifle uncomfortable. But, there is no control problem.

On the final approach, airspeed is held approximately 20 knots above the computed stalling speed right on down to the deck. Control is excellent and you'll like the ease of handling with one hand.

### Reversible Props

The reverse pitch feature of the C-130A is really something. It's necessary to go through the usual "lift-to-reverse" act on the quadrant and then haul the power levers aft. That's all. There's no hesitation in securing reverse thrust. It's about like running into a brick wall. There's no doubt in your mind about deceleration for you feel as though you're heading for the windshield.

It's entirely possible to stop the airplane without ever touching the brakes. Getting right on the nosewheel steering insures positive directional control and by keeping the fans in reverse, the beast stops. It's normal procedure however, to come out of reverse when forward speed has been reduced down to about 40 knots and then use the brakes to finish the job.

Naturally, there are a few things that could be improved.

From the pilot's point of view, the transmitter selector for interphone or command position could be relocated onto the yoke instead of on the pedestal. As currently employed, the selector is awkward to reach and it is possible to forget to switch from command to interphone while working in traffic and thereby confuse the tower operators and leave your crew in the dark when they should be going through the pre-landing checks.

We are not particularly happy with the repositioning of the condition levers. The first models had the levers mounted on the forward, overhead panel where they were completely accessible but still out of the way. The latest configuration places them on the quadrant. Admittedly, they are handier for the pilots, but, we hate to see a nice, simple quadrant all cluttered up.

The plastic guard that protects the propeller synchronizer reset buttons could certainly be beefed up or redesigned of a stronger material and some of the spring-loaded safety guards on various toggle switches could stand heavier springs.

### Easy to Fly

Perhaps we've made the C-130A sound like a complicated piece of machinery. In a sense, it is. There are many electric and electronic systems and there is no doubt that we are putting an ever-increasing load on the maintenance specialist. That, however, cannot be avoided if we hope to keep progressing. But, from the pilot's point of view, this airplane will prove itself to be an easy craft to fly and we predict that you'll like it. ●

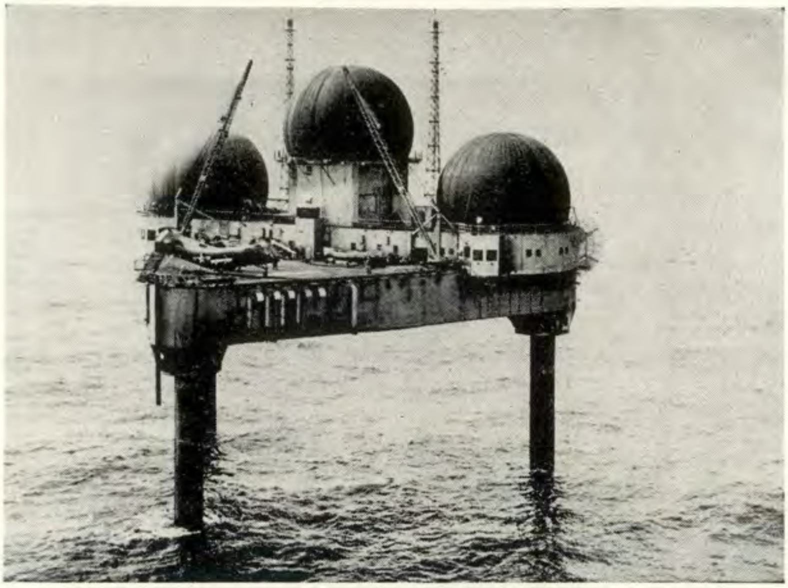
# Keep Current

## NEWS AND VIEWS

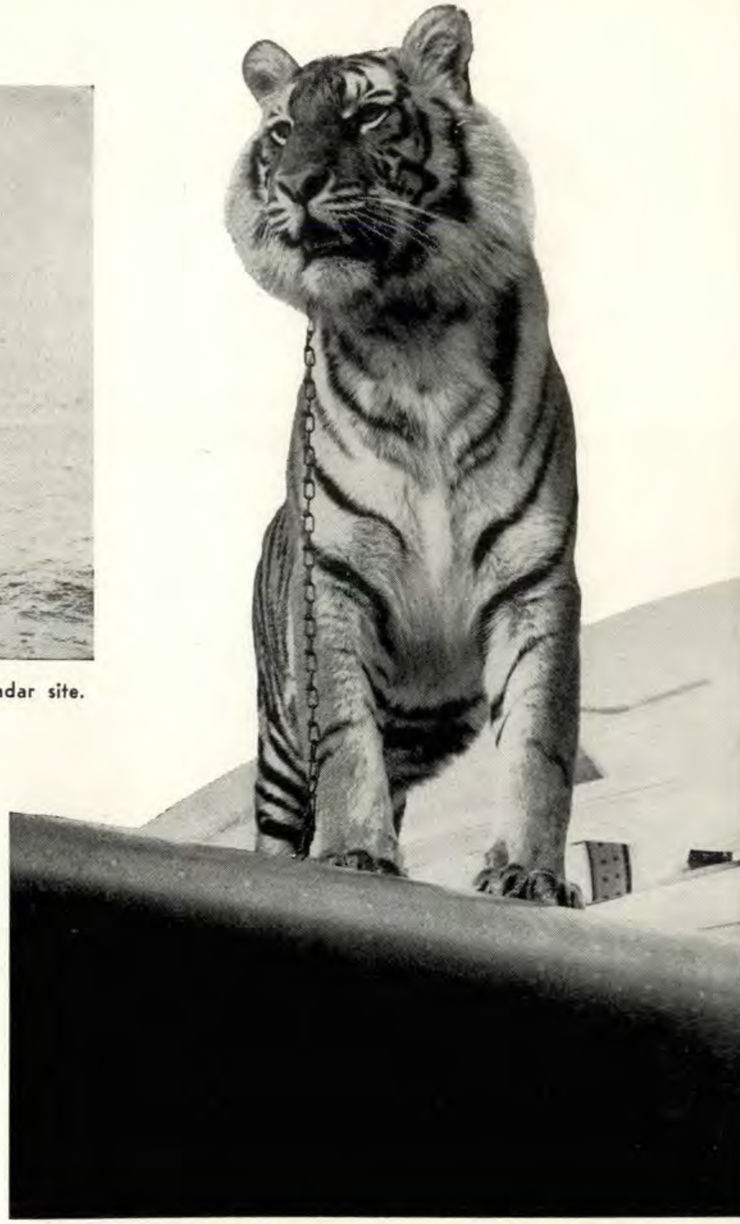

Above is B-52 performing air-to-air refueling mission with KC-135.

Using outrigger and rear landing gear as high-speed brakes, this B-47 Stratojet medium bomber is shown beginning a 6000 feet-per-minute descent from high altitude during a penetration mission.

Technicians work at control panel of new high altitude chamber.



H-21 helicopter makes two trips daily to Texas Tower early warning radar site.



Ever see a "flying tiger?" M/Sgt. "Satan" is mascot of 437th FIS.

**Texas Towers Yet**—An H-21 helicopter lands on the Texas Tower radar site, which is part of the early warning radar chain. The site is located approximately 100 miles offshore in the Atlantic Ocean. H-21 helicopters will soon be the sole transportation support for this site on a regular basis. They will make two trips a day, carrying loads of approximately 1550 pounds each trip. Personnel, supplies and equipment for the "man-made" island have first priority. During the winter months, the H-21s have been carrying all types of cargo while working out flight and navigational procedures.

The helicopters are equipped with specially designed emergency flotation gear for over-water flying.

★ ★ ★

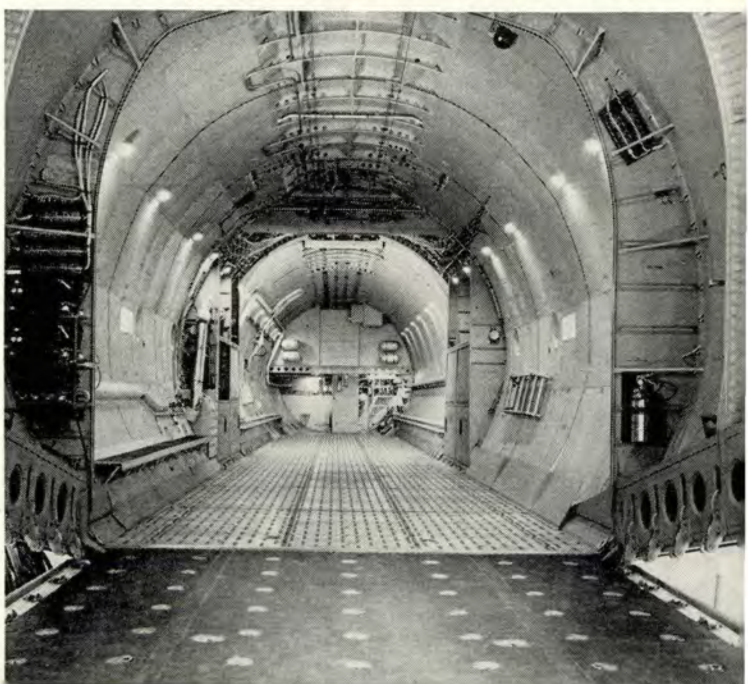
**New Altitude Test Chamber**—ARDC has a new test chamber that can simulate altitudes that are in excess of 150,000 feet.

The chamber will be used to study effects of very high altitude flight on men and to aid in designing protective equipment for Air Force personnel. Special pumps and valves make it possible to decompress the chamber as quickly as an airplane would decompress if its canopy were blown off. This is a condition that most other chambers can only approximate.

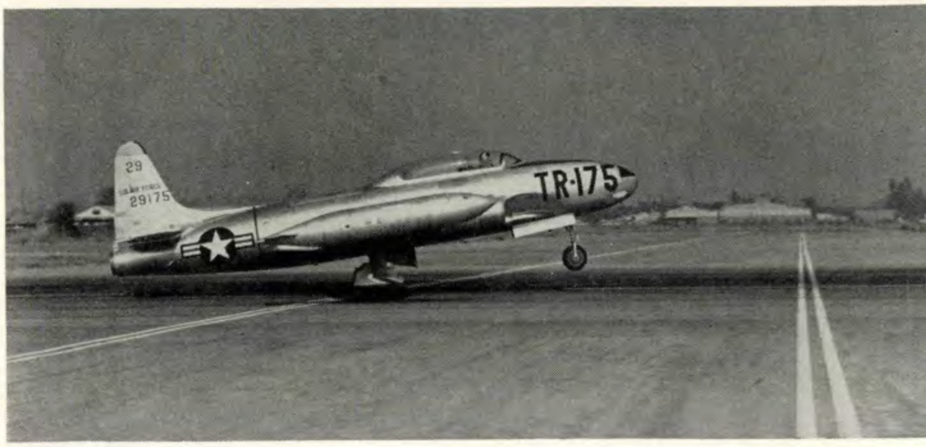
The new chamber is divided into six compartments. The largest, or main chamber, is used primarily for tests of instruments and systems at altitude and has a 7 x 8-foot door through which large and bulky equipment can be wheeled. Personnel and personal equipment are taken to high altitude in a training chamber, while off to one side of this smaller compartment is a one-man chamber which simulates a cockpit.

The sixth compartment is the animal chamber for experiments that might call for human volunteers. ●

Cargo section of C-133 can carry payloads twice capacity of C-124.



# Sizzling STRIPS




SUMMERTIME . . . June, July, August and September . . . visions of gorgeous lovelies cavorting at the beach or languishing on the side of a swimming pool. Summertime . . . air-conditioned offices and khaki uniforms. Summertime . . . premature gear retractions on takeoff. Summertime . . . the season of the year when the combination of hot weather, hot runway temperatures and hot pilots team up to class 26 jet type aircraft during takeoff.

Here are some ways that this is done:

- Attempting to take off at too low an airspeed.
- Apprehension concerning length of runway remaining.
- Using a runway of insufficient length for takeoff.
- Improper calculation of required takeoff roll.

If you're a jet pilot, the above items are all familiar. However, premature retraction of gear on takeoff does happen. Why? Primarily from faulty pilot takeoff practices and techniques.

You, as a jet pilot, know what density altitude is and how to interpret it when computing your takeoff roll; you are familiar with the Dash One and how to use it in determining your "unstick" point on the runway; you are required by AFR 60-16 to record takeoff distance on the Form 175, and you should know how to use runway distance markers.

Nevertheless, if past trends reflect future accidents, there are going to be some premature gear retractions on takeoff by jet pilots this summer. While you are reading the following actual accident accounts, visualize yourself at the controls of the aircraft. Would you fly the airplane like these pilots did?

You have two flights scheduled in one day. The first is early in the morning. You tool down the runway. That familiar intersection zips by. You take a final split-second glance at the airspeed indicator. The jet fairly leaps off the strip. You pull up on the gear handle and climb to altitude.

### Second Flight

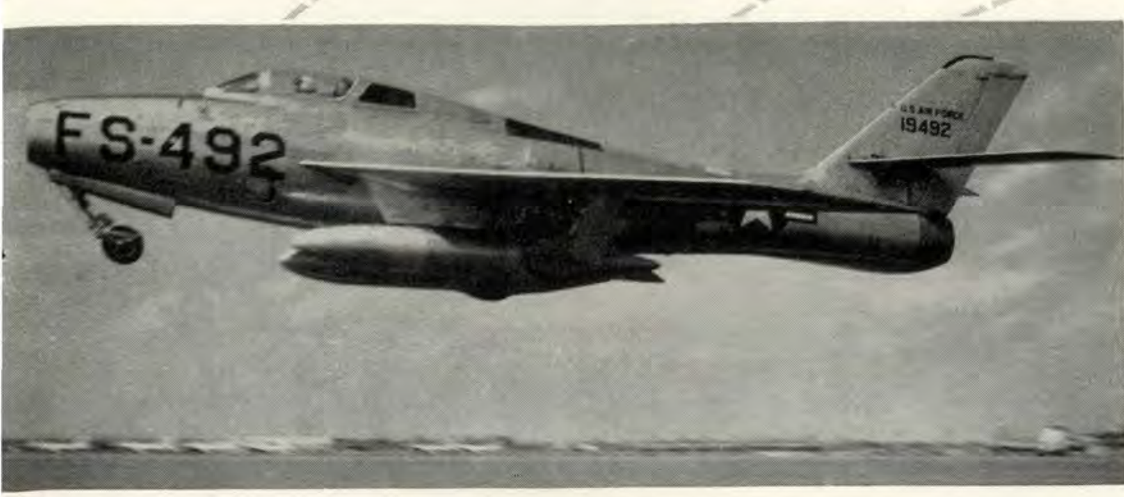
Second flight of the day. The sun is straight overhead. Runway temperature hovers around 100°F. You jot down the precomputed takeoff distance on your thigh pad. You climb into the too-hot-to-touch cockpit.

Down the runway that familiar intersection goes by. You take a final glance at the airspeed indicator. The jet skips off the rough runway. *But it isn't ready to fly yet.* Your fingers automatically close around the gear knob. You pull up. The aircraft settles back down on the runway. It skids to a crunching halt.

Invariably, the comments of the pilot to the investigation board sound like this: "I had a power failure. . . ." Yet, when the jet is hauled off to the base shops and the engine tested, it runs perfectly. 'Twon't work, bub, you've just prematurely retracted the landing gear.

Picture yourself in the position of the pilot who had the following accident. You probably have used a similar takeoff technique.

The heat waves shimmer off the runway. You firewall the throttle. Sluggishly the jet starts its roll. Finally, the airspeed indicator needle swings past nose unstick speed. You pull back on the stick a little. The nose comes off. Your eyes glance momentarily toward the far end of the runway. You can see the boundary fence and some telephone lines loom ahead. Unconsciously, you tug back on the stick a little more. Slowly the airspeed indicator moves up a few more knots. No rapid acceleration today. The end of the runway looks mighty close. You haul back forcefully on the stick.




Left is example of nose-high attitude during takeoff roll. On a very hot day the aircraft may never get off. Get sufficient airspeed working for you and then lift the nose slightly off the runway. Let it fly off. Above, you'll be flying hot and heavy, so let it roll 'til it's ready.

Why go on—you're on the back side of the power curve—you abort.

Here is one last clincher that might convince you that hot days and high runway temperatures demand your complete concentration and skill when taking off.

The pilot released the brakes and started the takeoff roll. At the approximate point where he should have become airborne, the pilot "horsed" the jet off the strip.

The aircraft flew for a short distance and then settled back on the runway. The pilot lowered the nose, then again "horsed" the jet back into the air, this time in an exceedingly nose-high attitude. Again the jet settled back on the runway.

### Nose High Attitude

At this point, the pilot decided to abort. The aircraft bounced over the barrier and continued to roll down the overrun. The nose gear sheared when it struck some rough terrain but the aircraft kept skidding until it came to a stop about 4000 feet from the end of the runway.

What do these accidents indicate? That some pilots are continuing to maintain an extremely nose-high attitude during the takeoff roll and attempting to take off before flying speed is obtained.

How can you improve your takeoff technique? There is no magic remedy. However, you can abide by this well-established procedure:

Get sufficient airspeed working for you and then lift the nose slightly off the runway. Now, hold it there for a spell. Be content to let the beast build up some knots. If it starts to skip on you, repress that tendency to haul back on the control column and yank the gear handle up. Make sure the bird is ready to fly, then have at it.

On most jet aircraft there is about an eight-knot range difference between takeoff speed and stall speed during takeoff. Make sure that difference is working for you, not against you.

Take the T-33 for example. The Dash One states: "At about 85 knots apply back pressure on the stick and raise the nose of the aircraft until the nosewheel just clears the runway."

Many pilots, at this point, tend to pull the stick too far back with the result that the aircraft assumes this nose-high attitude. The takeoff run is thus greatly increased. On a very hot day the aircraft may never take off.

The T-33 has a tendency to bounce. ". . . It gets light on its feet" just prior to reaching flying speed. These bounces vary in intensity with the roughness of the runway. If not careful, you may believe that the aircraft has started to fly when in reality it is skipping between bounces. Jerk the gear up during one of these bounces and you may be through flying. Period.

### Quick Refreshers

You know that the higher the temperature, the more runway you are going to use. You get into trouble when you try to make the aircraft fly before it is ready to do so.

For a quick refresher, here are some items you should remember about everyday summertime flying.

- There is a four to five per cent loss in thrust per 10°F. rise in ambient air temperature above sea level standard.
- There is a two to three per cent loss in thrust per 1000 feet elevation.
- The rated thrust of a jet engine is not your net thrust because of installation loss.
- The static measured installed thrust is not all available to you to accelerate with.
- Excess thrust is what is available above that being used at the moment to hold speed already attained.
- Excess thrust is the thrust that takes the big loss due to high ambient air temperature.

Check the figures below and you will see that they come close to your takeoff performance charts.

- For each 10°F. ambient air temperature above sea level standard of 60°F., increase your rolling distance by 10 per cent.
- For each 1000 feet elevation above sea level increase your rolling distance by 10 per cent.
- For clearing obstacles, convert obstacle height in feet to per cent. Add this to the takeoff distance. For example: A 25-foot obstacle increases takeoff distance 25 per cent.

You're going to be flying hot and heavy this summer. Like one Texas-based instructor said, "Making a jet takeoff is just like rolling your own cigarettes. You let 'em both roll 'til they're ready. ●

# Drip Blip

**Many a pilot has had to execute a missed approach because of lost radar contact. This article may help you anticipate and plan for that possibility.**

I'VE BEEN flying in this man's Air Force for a good many years and I thought I knew most of the tricks of the trade. But, "you learn something new everyday."

My boss wanted me to take some cargo up to Martini Air Force Base. I arrived at base ops, met my copilot and proceeded to the weather station. We received a thorough briefing. Weather at Martini AFB on arrival was forecast to be 600 overcast, two miles visibility, intermittent rain showers reducing visibility to one mile. I said to myself, "Guess this will mean a radar approach."

After getting into the blue—correction, 'gray,' and while cruising on course, I started talking to Charlie, the copilot.

"What's your job, Charlie?"

"Air traffic controller, Joe. Just returned from Germany."

"ATC man, huh? Guess that's why you gave that position report so precisely, eh? Only thing, you didn't tell those boys our point of departure, route of flight and destination. How do you expect them to know where we're going?"

He answered, "You know, Joe, too many pilots are still stating all of that superfluous information. It doesn't help the ATC controllers at all. In fact, it hinders them. Frequency congestion is bad enough as it is. If pilots would follow the position report sequence as listed in the back of the Radio Facility Chart, everyone would be happy. ATC would have just what they need. And there wouldn't be so much radio congestion. So why waste your breath?"

We neared our destination, after flying for a couple of hours. Our clearance from Four Roses radio read, "Cleared to the Manhattan Range, to contact Martini Approach Control five minutes prior to reaching the Daiquiri beacon."

"Martini Approach Control, this is Air Force 46647—over."

"Air Force 46647, Martini Approach Control. You are cleared to the Manhattan Range; descend to and maintain 3000 feet. Martini weather, 1100 hours observation is 500 overcast, visibility one-half mile in rain showers, surface wind west 14 knots, altimeter 29.86. *Radar not available.* Base operations advises weather is below minimums; hold for improvement or proceed to your alternate."

"Roger, Martini Approach Control. Understand 46647 cleared to Manhattan Range at 3000 feet, leaving 5000 at 15. How long will this rain remain in the local area?"

"46647, weather advises moderate rain until 1145 changing to light showers until 1600."

"Roger, Martini Approach Control. We'll wait for improvement."

"Air Force 46647 when over Manhattan range, hold northeast, expect approach clearance at 1145."

The rain diminished to a light drizzle at 1130 and we made a precision radar approach. No sweat.

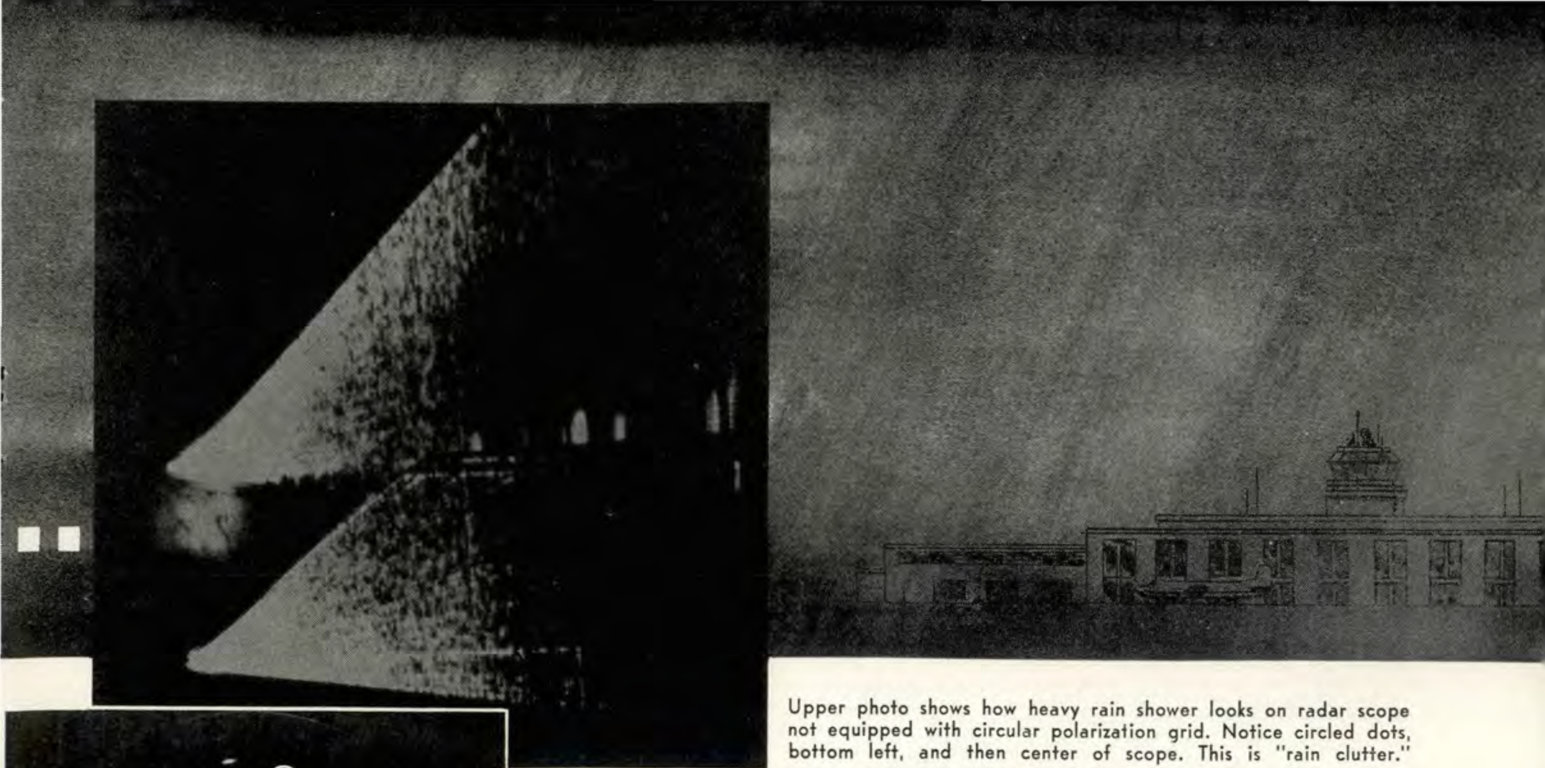
On the return trip we contacted Highball Approach Control for our clearance.

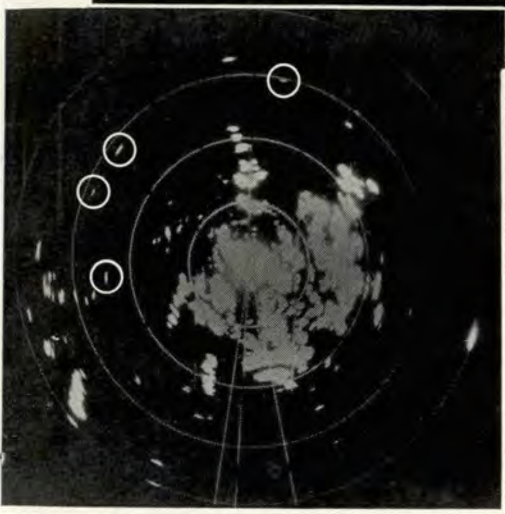
"Air Force 46647, this is Highball Approach Control. You are cleared for a precision approach, active runway 19. Highball weather—precipitation ceiling 300 feet, visibility one-half mile in heavy rain showers, surface wind south 8 knots, altimeter 30.14—over."

We "Rogered" and were instructed to contact the radar controller on channel 17.

After the flight was over I said to my copilot, "Charlie, I must admit that I'm a little confused. At Martini, where the rain wasn't nearly as bad as it is here at Highball, we had to hold for improvement in the weather. It's raining cats and dogs outside now, yet we were cleared to make an immediate approach. Since you're in the business, how come?"

He replied, "Joe, I suggest that we make a trip over to the RAPCON





Upper photo shows how heavy rain shower looks on radar scope not equipped with circular polarization grid. Notice circled dots, bottom left, and then center of scope. This is "rain clutter."

building. The difference is that here at Highball the radar set is equipped with a gadget known as 'Circular Polarization.' This practically eliminates rain clutter from the radar scope. I'll show you what I mean when we get to RAPCON."

Entering the semi-darkness of the radar room, we walked over to the far end of the room where the precision radar equipment is located. A controller was "bringing in" an aircraft on final approach through the heavy rain, with no difficulty.

He commenced, "Take a look at this precision scope. As you can see there is no intereference from the rain. This is because the precision equipment has circular polarization installed. If traffic permits, let me try to show you what this scope would look like without the circular polarization feature."

He tapped the controller on the shoulder, "Mac, how's your traffic load for the next few minutes?"

"Oh, I have about a 10-minute breather. Why?"

"Will you call the remote site and ask them to remove the screens for a few minutes?" he said.

"Okay." Mac flipped a key on the console and spoke to someone for a few minutes. Immediately, the precision scope presentation changed. It was practically a solid mass of white reflections. I saw why it would be impossible to track an aircraft through that stuff.

Charlie continued, "This is how a precision scope looks during heavy rain without circular polarization. The radar scope at Martini looked like this while we were holding and waiting for the rain to pass. See the surveillance scope now. Plenty of precipitation interference showing.

"Symmetrical objects, such as raindrops, are circular polarized, but with a reverse twist. We have discovered that by inserting some grids into the antenna radiation field, these reversed reflecting waves are rejected. Only those non-reversed waves (coming back from the aircraft) will be accepted by the antenna. Thus, no rain clutter will appear on the scope.

"Most of our precision radar sets are equipped with these grids. The precision radar is used for the final approach. It gives elevation as well as distance and direction from the runway.

"The surveillance radar set which is used by a controller to feed aircraft to the precision radar controller doesn't have this gimmick yet. It's coming, but until it's installed the surveillance controllers may have trouble seeing aircraft during heavy rain. When this occurs, the pilot may get that phrase '*radar not available*.' That's what happened to us."

I nodded, "Mighty interesting. This, then, is the reason why pilots who are flying in areas of heavy precipitation are advised that 'radar clutter' may make some types of radar equipment unreliable."

He summarized, "That's right. Remember I said that the surveillance radar equipment doesn't have this circular polarization gimmick yet. Usually, a pilot will be observed first on a surveillance scope. Then he will be turned over to the precision approach radar controller. Don't confuse circular polarization with MTI equipment (Moving Target Indicator) that is used on late model surveillance radar sets. The MTI picks up any *moving* target. Also, it eliminates most background reflections. Incidentally, the May issue of FLYING SAFETY has an article on types of radar approaches and equipment in the story 'All the Way?' "

"Thanks, Charlie. See you later." ●

# ROUND AND ROUND YOU GO

*Types of radar approaches and GCA phraseology were featured in the article, "All The Way?", FLYING SAFETY, May, 1956. Since then, new terminology regarding the type of landing approach (straight-in or circling) has been incorporated by AACS operating personnel. The object is to tell the pilot, as soon as possible, the type of landing pattern he will be cleared to make. Here is how one lad got the word.*

HOLDING NORTH of the range station in a standard holding pattern at 25,000 feet, Captain Little looked down and saw the two other jets below him flying their respective orbits. They, too, were awaiting penetration clearances.

Two minutes later, the first of the two orbiting jets was told to switch to channel 15. Anticipating similar penetration instructions, Captain Little switched channels to listen to the controller.

"Air Force jet 35974—Ceiling 800 feet, visibility five miles. Wind south at 15 knots, altimeter setting 30.06. You are cleared for a jet ADF approach, runway 35. Upon reaching 500 feet (circling minimum altitude) you are cleared for circling approach to runway 17."

Captain Little glanced at his letdown book. He noted the flight path the descending pilot should make good. At the bottom of the page he also noticed the published minimum altitude for a circular approach. In this case it was a little higher than that given for a straight-in. This was the first time he had ever heard a controller give the type of landing approach along with the clearance for descent.

He thought, "Hmmmm. . . . To clue the pilot in on the type of landing approach before even breaking out, is good stuff. It gives him a chance to plan his landing pattern. It used to be that you had to switch over to the tower after you became VFR."

He heard the second jet receive similar penetration and approach clearances.

Ten minutes later, after his own penetration, he relaxed at the base operations counter.

"What's this new deal on giving circling approaches?" he asked.

Having had several such questions recently, the Clearance Officer was ready with the answers—almost a lecture. He started with basic reasons.

"Pilots flying high speed jet aircraft in instrument weather should never have to change frequency for landing clearance. When making other than a straight-in approach for landing (except radar approaches) they will be issued a clearance some time before they report over the low cone. Something like: 'Upon reaching (circling minimum altitude) feet, cleared for circling approach to runway (number).'

"However, it could happen that you would receive clearance for a circular approach before starting your letdown without receiving actual clearance to land. In that case, they will tell you when to expect landing clearance. For example, they might say, 'Cleared for a standard ADF letdown. Upon reaching 500 feet, you are cleared for a circling approach to runway 34. Expect landing clearance (a) at three miles, (b) when over the range, or (c) when the field is in sight.' "

"Well, what about an aircraft making a radar approach?" Captain Little questioned.

"Aircraft making a radar approach to other than the landing runway will be given a litte bit different deal. They'll say, 'This precision (or surveillance) approach is being made to runway 5. Upon reaching 500 feet, you are cleared for circling approach to runway 34.'

"Normally," he continued, "they'll get the landing clearance from the tower and relay it to you at the same time the circling approach clearance is issued.

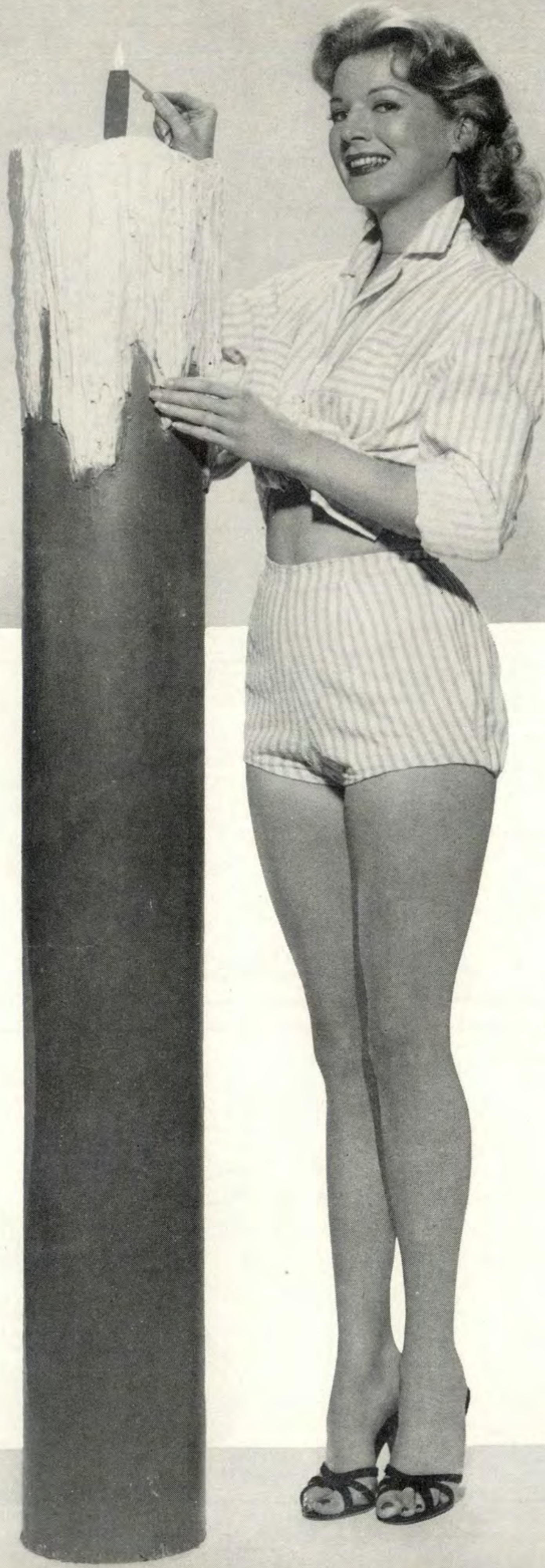
"Of course, if you're making an approach to one runway and they want you to land on another, they will tell you when you reach your circling minimum altitude. You should not descend any lower. If they do see you going lower, they'll remind you. If they've got you lined up on a runway other than the GCA runway (where they have the elevation scope), they won't know your altitude, and will tell you, 'You should be at 500 feet, circling minimum altitude, report field in sight.'

"If you don't report the field in sight within one mile from the end of the runway, they'll give you a wave-off."

The jet pilot nodded as he flipped his unfolded Form 175 to the dispatcher.

"I'm glad AACS has come out with this. This way there's no reason why any pilot should mistake the runway he's supposed to land on or what type of landing approach he is supposed to use. All he has to do is listen to his clearance."

"That's right, Captain," came the reply. "All you have to do is listen." ●



FLYING SAFETY has it on pretty good authority that, next to the cover, this page seems to attract the most attention. Just why, we don't know but we are going to take advantage of the pulling power of this page to call your attention to the quiz on page one. Light the candle of knowledge and see if you can come up with the correct answers.


*U. S. GOVERNMENT PRINTING OFFICE . . . 362335