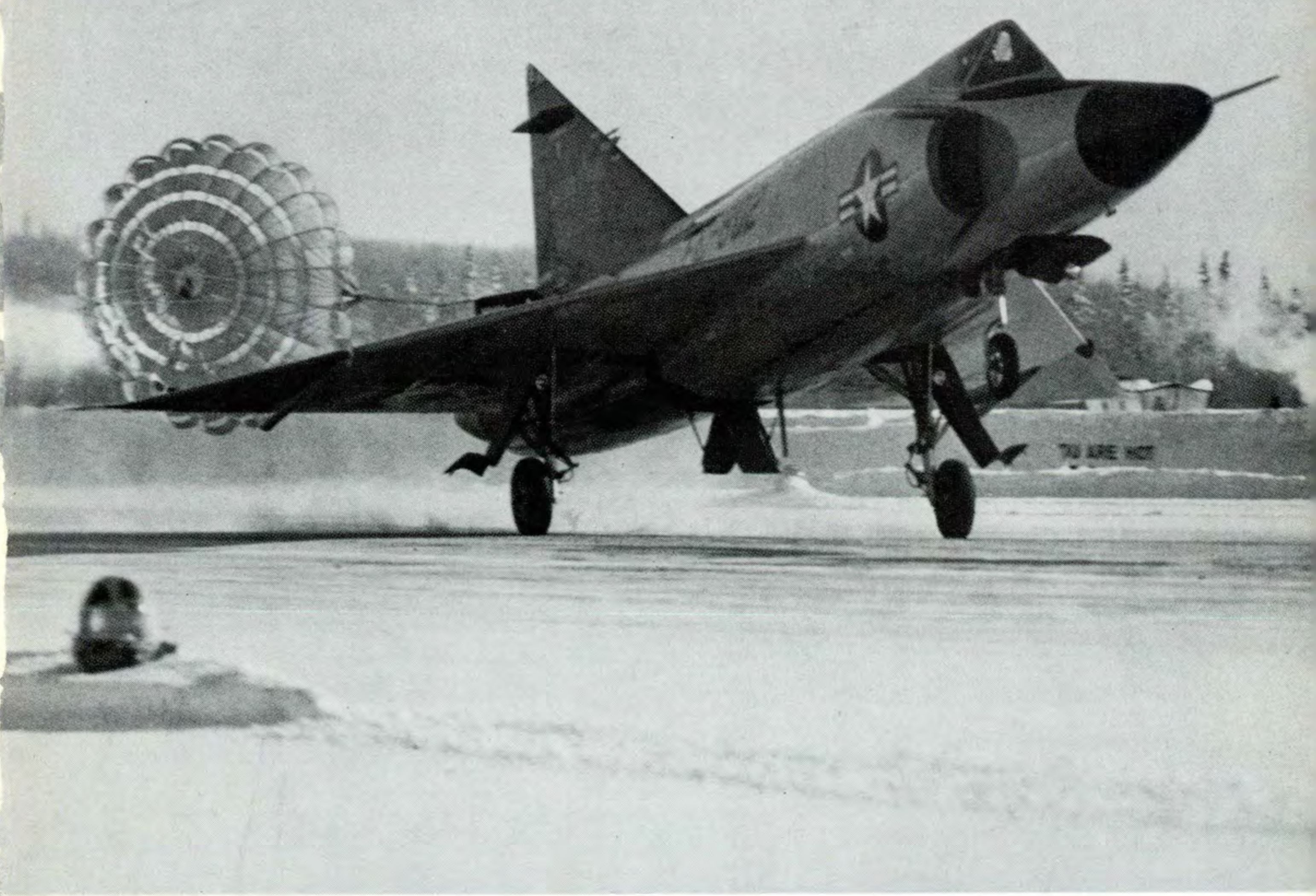
FLYING SAFETY

UNITED STATES AIR FORCE

OCTOBER
1956



The 102 Below Zero • "Casey" Goes Jet

File Thirteen

This month our cover illustrates the F-102 winter tests. The Air Force will soon be operating this bird where it gets mighty cold. . . . An interesting item hit your editor's desk concerning fire equipment at P and PC fields used, on occasion, by Air Force types. Civil fields have no minimum fire protection or aircraft rescue standards. Keep this in mind before clearing to such places or selecting one for an emergency landing. . . . While on the subject of civil fields, check to be sure you do not get a charge of medicinal oxygen in your flying machine. It contains an unsuitable amount of water vapor that may freeze at the higher altitudes. . . . A recent message reiterates the requirement to have runway markers indicating *distance remaining*. The signs should read the same on both sides of the strip. Remember to subtract your computed takeoff roll from the runway length to come up with the marker figure needed. On a 10,000-foot runway and a computed roll of 6000 feet, you should break ground around the 4000-foot sign. . . . The new 60-16 allows a pilot, with his own clearing authority, to clear other aircraft under his control on IFR flights. Amid wails of "no pilot should ever be permitted to clear other than his own aircraft IFR," think about it for a minute. The requirements for obtaining your own clearing authority are more rigid than those required for AO duty, with delegated clearing authority. As such, it seems to me that a flight leader, with his own clearing authority, is much more qualified to clear his flight IFR than possibly a 1000-hour airdrome officer. . . . The yearly subscription to FLYING SAFETY has been reduced to $2.50 (domestic), $3.50 (foreign). Be my guest and send your check to the Government Printing Office.

til next month,

Perry J. Dahl

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CONTENTS

VOLUME TWELVE NUMBER TEN

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USAF PERIODICAL 62-1

LETTERS TO THE EDITOR

More on Wind Shear

The article, "Change Without Notice" by Major Neyland (FLYING SAFETY, April 1956), interested me particularly because of an F-86 undershoot accident which I investigated last year. Just as I began the investigation, I was fortunate enough to read the ADC "Archie Newsflash" which discussed wind shear.

The accident in question brought to light a particularly dangerous type of wind shear. Touchdown was more than one thousand feet north of a north-south runway. The runway slopes uphill from south to north. The terrain for the first few thousand feet north of the runway is substantially lower than the north end of the runway. A south wind was blowing up the runway.

When the south wind reached the end of the runway it was being pushed upwards by the slope of the runway. The wind passing over the low ground north of the approach end of the runway caused a low pressure area which set up the same kind of eddy currents as form downwind of buildings or mountains. The wind flowing into the low ground had both downward and northerly components. A pilot landing to the south who got into the eddy current north of the approach end of the runway would suddenly have a tailwind instead of a headwind.

The pilot thought he was right in the groove as he flew his pattern into the wind announced by the tower. At some point in his final approach the headwind was replaced by a tailwind, caused by the circulation of wind into the low ground north of the approach end of the runway. The airplane which had been flying 15 knots above stall was instantaneously 20 or more knots below stall speed. Before airspeed could be regained the airplane sank to the ground.

This is a good time to try to get across the point that landing 1200 feet short of the runway in a swept-wing aircraft is not necessarily an indication of gross pilot incompetence. If an aircraft is coming in with a glide angle as low as 12 to one, a difference of 100 feet in altitude will mean a difference of 1200 feet in the length of the glide. Wind shear can mean a loss of more than 100 feet in altitude before the pilot can regain flying speed.

Landing techniques developed in the days of conventional aircraft, which are quick to regain lift upon application of power, are responsible for our rash of undershoot and overshoot accidents. Many a pilot of a swept-wing jet has been condemned with a "pilot error" accident, when the real responsibility lies with instructors and supervisors who are—unconsciously—thinking in terms of practice deadstick landings in the PT-17 type aircraft.

Col. Robert C. Brown
AF Sr Adviser, ANG
128D FIW, Louisville, Ky.

Yes, this quirk of Mother Nature and the slow acceleration rate of jet engines can cause havoc. Thank you for your interesting observations.

★ ★ ★

Help Wanted

Reference is made to the article "Riser Sharp" in your May issue.

The type of quick release described is excellent when the person involved in its use is not injured. I had several pilots wounded in one arm or the other, also through shock or loss of blood, not able to work the two releases, which are, at best, in an unnatural position to reach. Ejection bailout of a jet from an unusual position, high G forces or the like, often result in hand or arm injury which again presents difficulties in using this type of quick release. I strongly urge that consideration be given to a quick release mechanism which can be worked with one hand, requiring little force and located in a position that can more readily be seen or felt.

I have previously UR'd this type of quick release and each time received the reply: "If the chute had been properly fitted, no difficulty would have been encountered." This is in error and I solicit comment and support to gain for all personnel involved a better type of quick release.

Col. Harrison R. Thyng
Vice Comdr, 9th AD (Def)
Geiger Fld, Washington

Nice to hear from the main character in our episode "T-Bird in a Tempest" (FLYING SAFETY, July 1955). Your letter and recommendation have been sent to the Aero Med folks. Anybody else care to comment?

★ ★ ★

Intake Hazard

A recent incident at one of our bases revealed that an F-86A intake dust cover can get lost in the throat of the intake duct. Fortunately, this did not develop into a catastrophe. It could, however, and it might. Tests revealed that a strong gust of wind or a jet blast will dislodge the intake dust cover. Several crew chiefs have stated that they found the dust cover lodged under the cover assembly, engine accessory section.

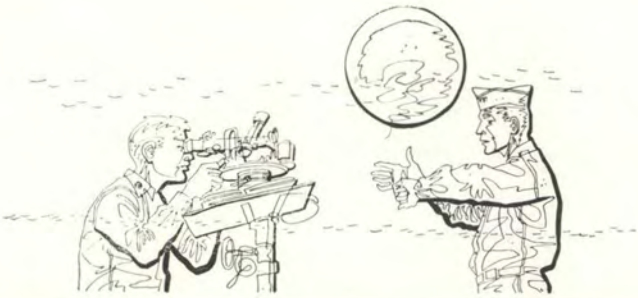
Here's the fix on this problem:

- Paint dust covers with a luminous white paint.
- Attach a long red piece of webbing to the dust cover handle and loop it over the cockpit access handle.
- Have crew chiefs carefully inspect intake chambers and write with white chalk the date of inspection on the front of the cover assembly, engine accessory section.

If the above action is taken, it might not preclude flying the "bent-wing" with foreign objects in the intake but a fellow will have to work to do so.

Capt. Paul L. Smith
Director of Flying Safety
Hqs Fourth Air Force

Kudos to all crewmembers for such an excellent fix!



Weather

Individuals conscientiously observe the weather, code it on a map and prepare it for dispatch to the forecasters.

or *Not.....*

Major Lewis J. Neyland, Ops AWS, MATS

Breathes there a pilot with soul so dead
Who never to himself hath said —
That weatherman should have stood in bed

(Apologies to Mr. Scott)

ONCE UPON a time, long, long ago, there was a weatherman who had never busted a forecast. Then one day someone forced him to make one and his record was broken.

Yes, forecasts do go astray. As a matter of fact, the AWS can tell you quite accurately what percentage of any large group of forecasts will bust. For instance, just about dawn this morning some 220 AWS weather stations prepared eight-hour forecasts for their own terminal weather. If today turns out to be an average one, 95 of these forecasts will prove that the forecaster needs a new crystal ball.

Recognizing that forecasts cannot always be accurate, it is obviously poor judgment to place yourself in a position where unexpected bad weather costs you your airplane. Until we have a major "break-through" in the science of meteorology, a busted forecast is not a valid excuse for an accident except in very unusual operational circumstances! This being the case, let's take a real serious look at the "state-of-the-art" of meteorology so that you and I, as pilots, can intelligently utilize the services of the Air Weather Service.

Every forecast has better or worse odds of being correct. What are those odds and what can I do to allow for them? Those are the basic questions. The dissertation that follows should help you to answer them.

Considering only the weather activities directly related to providing you with a forecast for your next flight, let's look briefly at the setup supporting your forecaster.

Did you know, for instance, that there are over 10,000 internationally recognized weather stations in the world-wide surface weather observing network? The Air Weather Service operates 226 of them. In addition, there are hundreds of upper air observation units and about 20 scheduled aerial reconnaissance tracks. The AWS operates 53 of the upper air stations and its aircraft cover 14 of the reconnaissance tracks.

If it happens to be a scheduled observation time now (while you are reading this), there are well over 10,000 people doing their best to describe their little portions of the beast that is the weather. Meanwhile, at forecast stations over the world, pilots are probably being told in English, French, Turkish and Russian that "The new sequence will be on the teletype in a few minutes; let's see how it looks then."

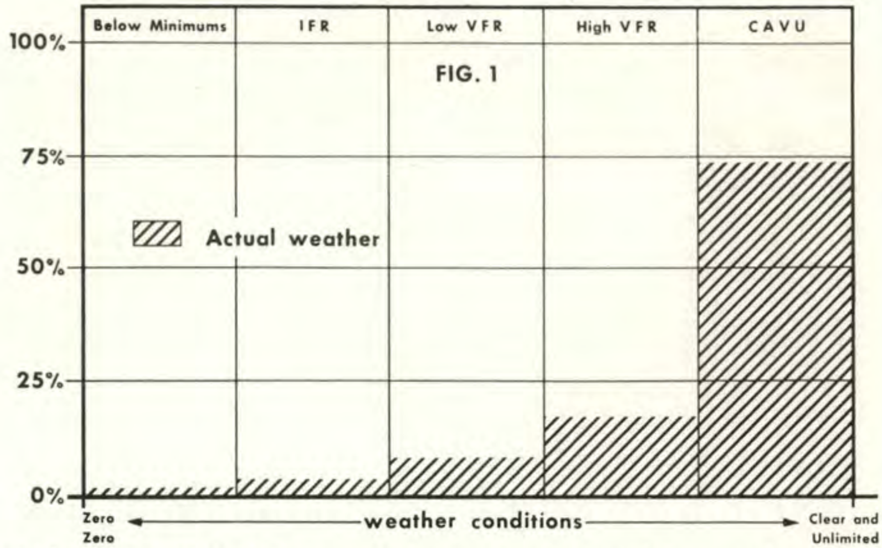
The first part of the problem then (and one which is in no sense adequately solved) is to accurately describe the weather that is out there right now.

Reminds me of the clear, calm summer night at Luke Field some years ago when the ops officer turned the lawn sprinkler on the weather station windows and then came in dripping wet with a Form 23 (DD Form 175 to the youngsters) asking for a briefing. I refuse to identify the duty forecaster or disclose the erroneous forecast he gave (UP Art 31, UCMJ); suffice it to say, if you have the wrong picture of the present weather your chances of coming up with a good forecast are mighty slim.

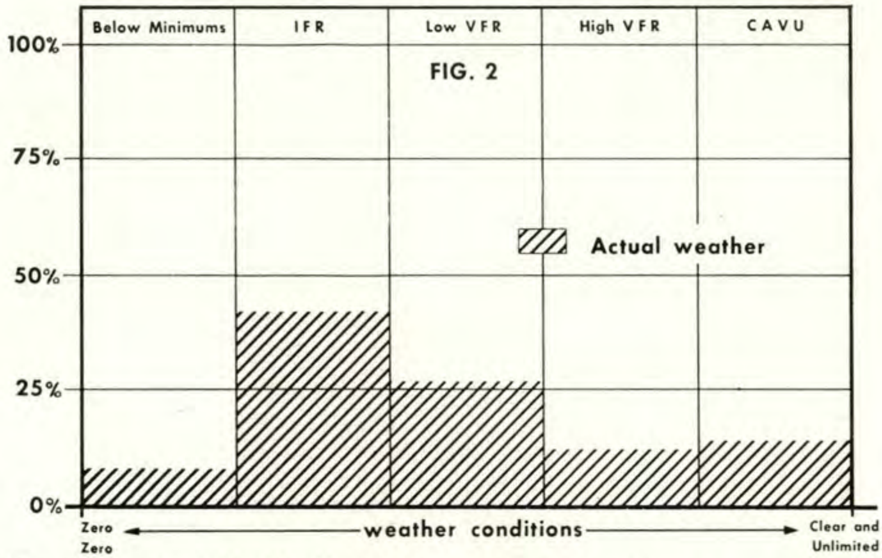
So we have these 10,000 plus individuals conscientiously observing the weather, coding it up and sending it off to the forecasters. Each observer can see only a little patch of sky, generally only the bottom of whatever weather is in his neighborhood, so his idea of what is going on is at best an approximation. (This is why your PIREP is so important.) He takes this estimate and translates it into one of the various weather languages (codes). These codes are only occasionally ambiguous, and certainly are concise, perhaps to the point that even if an observation were a completely accurate representation of the present weather, the observer couldn't convey a wholly true picture to the forecaster many miles away.

Be that as it may, coded weather observations are the building blocks the forecaster must use in making the prognosis for your flight and you can see that right off the bat there are built-in errors.

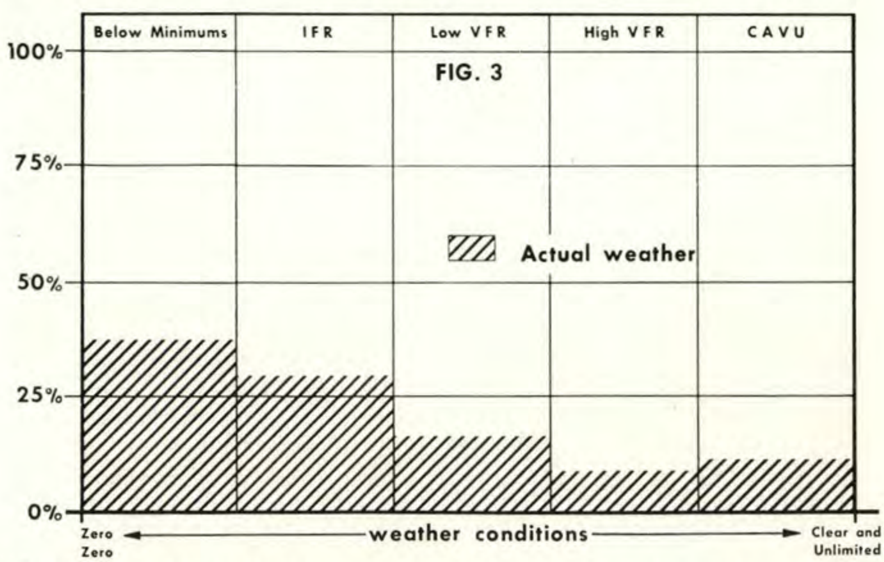
Knowing roughly what the weather was at the time of the last observation, the forecaster must decide how fast and in what direction the weather is changing. That should be a fairly straight-forward problem (and sometime in the foreseeable future I think it will be). All weather processes are governed strictly by the natural laws of physics; for every effect there is a perfectly logical physical (mathematical) relationship to the corresponding cause. The villain in this script, however, is that even the best brains in the business (and we have some real crackerjacks working on the problem) have not yet been successful in



Weather conditions that actually occurred when the forecasters predicted very good weather.



When the forecast called for IFR, this is what happened. Thousands of forecasts were checked.



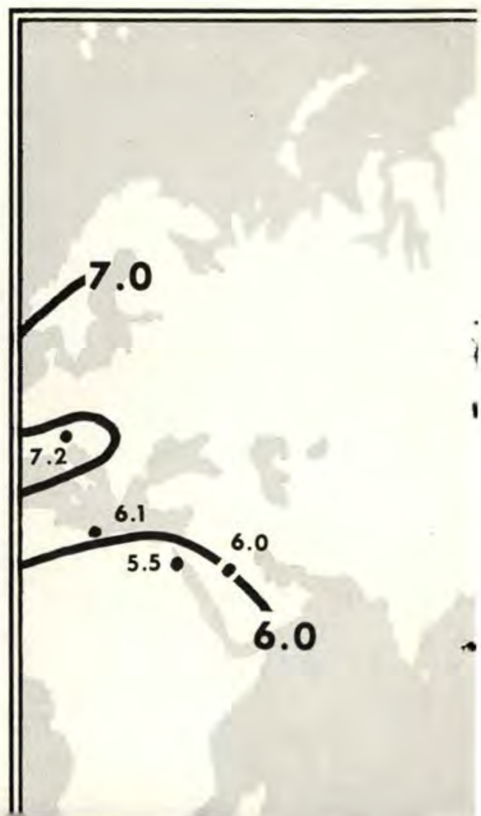
When the forecast called for "below minimums" this is what actually happened to weather.

defining many of these cause-effect relationships in weather.

Progress is being made—the "big brain" of the Joint Numerical Weather Prediction Unit, under the guidance of some half dozen gents with numerous Ph.D.s and Masters Degrees between them, takes a formula as long as your arm and makes a forecast of the 500 mb flow pattern for a time 30 minutes into the future. Starting from there it makes another forecast for a time 30 minutes later and so on until it comes up with a forecast of what the 500 mb chart will look like 24 to 36 hours in the future.

This machine at the present time does only a little better than the experienced duty forecaster at your base weather station, who by the way is no dummy either. You might be interested to know that one of the last two weather officers who briefed you has five or more years of college training and three of the last four had at least a college degree. These boys have the best training that money can buy. But the demonstrated fact that the "intuitive" forecaster can often equal (and sometimes beat) a purely scientific forecast shows that even the best sometimes leaves something to be desired.

Knowing all this, you walk into the weather station to get an important forecast from the weatherman whose



knowledge of the present weather is inherently somewhat distorted, and who has only stone-age caliber tools to translate it into a forecast. What will you get and what should you expect to be able to do with it?

How Good Were They

In order to be able to give their customers an accurate statement of the odds involved in using weather forecasts operationally, the AWS has conducted several comprehensive forecast verification programs. These have checked the accuracy of forecasts of terminal ceiling and visibility and of route winds. Be sure to remember when reading the following that the figures are based on world-wide averages and are not directly applicable to a specific base.

The verification procedures were quite straight-forward and were specifically designed to measure forecast validity in operational rather than purely meteorological terms. For example, terminal weather was categorized into five operationally significant groups (below GCA minimums was one category, 200 feet ceiling, one-half mile visibility to 1000 feet ceiling and three miles visibility was another category). Each terminal forecast was then compared with the actual weather which occurred. If the forecast and actual weather fell within the same category it was scored a "hit," if not, it was a "bust."

Forecasts for periods ranging from three hours to 24 hours were checked.

Let's see just what all this gobble-de-gook means to you in planning your next flight. Figure 1 shows that if you clear to a base that is forecast to be clear and three or better, odds are roughly three to one that the weather will be that good when you arrive. One time out of 50 you will find the weather to be IFR and about one per cent of the time it will actually be below minimums.

Below Minimum Forecasts

On the other hand, if you are clearing to a base that is forecast to be IFR upon your arrival in three hours, you had best be prepared with a sound alternative course of action because, as Figure 2 shows, once out of each 14 times the weather will be below minimums. To me, this means that the smart man (particularly in a jet) will check the latest forecast before he leaves his cruising altitude at destination, because in spite of what he was briefed on, sometimes he will get down there and find the field all clobbered in. When that happens, he may not have sufficient fuel to execute a missed approach and then go on to his alternate.

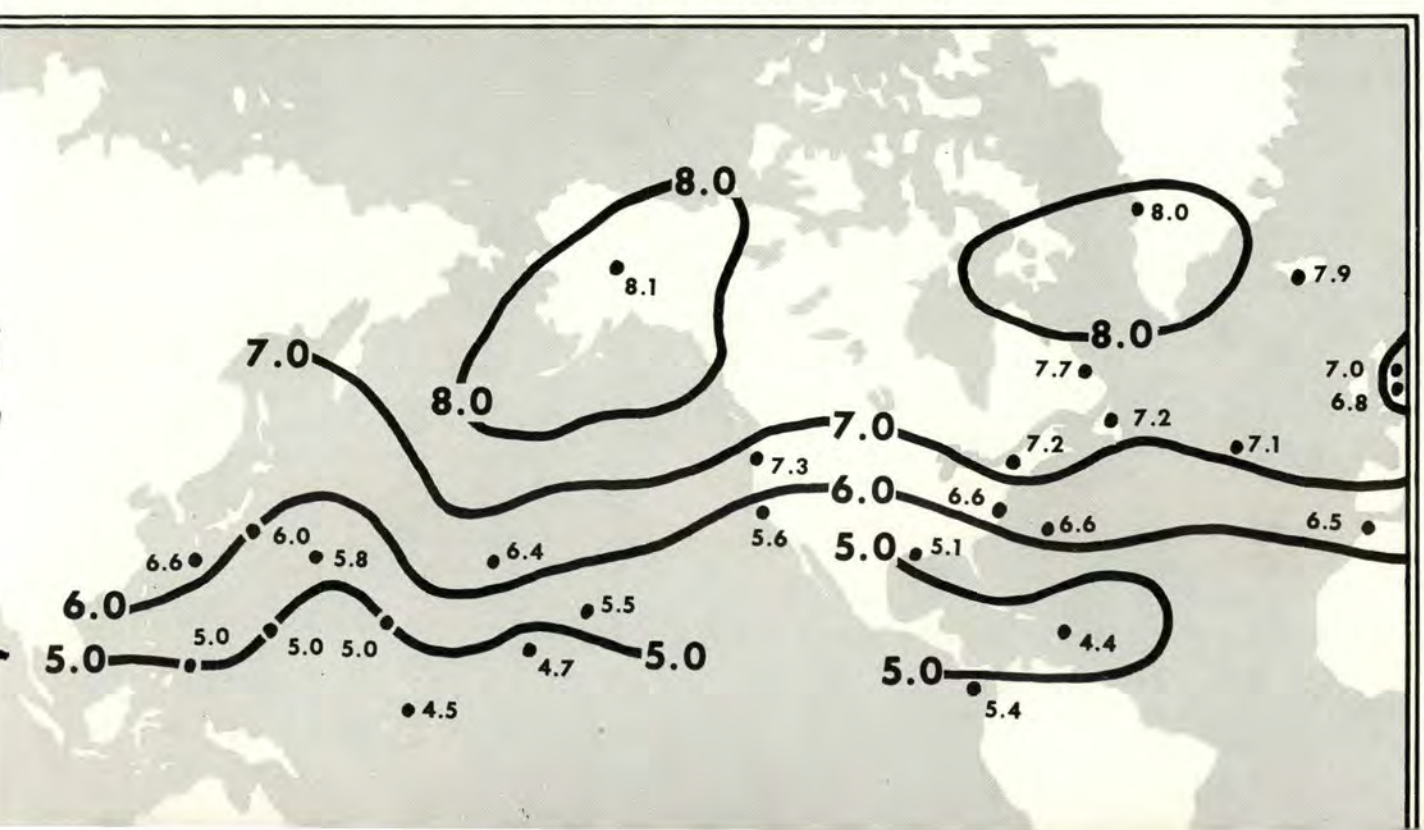
On the average, only about four per cent of all forecasts will call for "below minimum" weather. However, when that's the word from the forecaster but some emergency requires you to make a stab at it anyway, take heart, because the odds are actually almost two to one that the weather will be *above* GCA minimums when you get there. Figure 3 gives the statistical scoop on this situation.

VFR or Not

Leaping off on a cross-country flight without your letdown book is never smart but that is particularly true if the weather is forecast to be marginal VFR. The AWS study shows that one out of every seven forecasts of low VFR terminal weather proves to be too optimistic and the actual weather turns out to be below VFR minimums.

The meat of Figures 1 through 3 is that the better the weather is forecast to be, the more likely it is that the forecast will be correct—and vice versa. There are several reasons for this. Perhaps two of the most important are that a small change in ceiling or visibility in bad weather is much more operationally significant than the same change in good weather. The other reason is that over most of the world, good flying weather occurs oftener and lasts longer than does the bad weather.

Wind factor error (in knots) of all stations for which data from over 100 flights were tabulated.



Winds aloft forecasts were verified in terms of Forecast Wind Factor (FWF), and Actual Wind Factor (AWF) using this formula:

$$\text{Error} = \text{AWF-FWF}$$

Since Wind Factor (WF) is ground speed minus true airspeed ($WF = GS - TAS$), error is expressed in knots with Plus Error meaning that the Actual Wind was less handicap than forecast (you got there ahead of ETA). Minus Error, of course, means that the wind was more adverse than forecast (less tail or more headwind than forecast).

Verification of winds aloft forecasts (primarily on long overseas flights) showed first that forecasters were not being consistently pessimistic or optimistic since all errors almost balanced out to zero (+1.4 knots).

However, more important operationally is the Mean Gross Error—simply the average wind factor error disregarding all the plus or minus signs. The AWS-wide Mean Error was 6.0 knots based on data from 59,022 overseas flights during the period from December, 1951, to December, 1955. This means that if you receive a wind forecast of average accuracy for your next overwater flight, your actual wind will be within six knots of the one forecast for you.

Figure 4 shows that the accuracy of wind forecasts is not the same throughout the world. We must discount the possibility that this is a function of the skill level of individual forecasters, since during the four-year period represented by this data, each station should have been staffed by a representative cross-section of AWS forecasters. The difference then must be related to the number of reports available to the forecasters and the changeability of the wind flow patterns in the various areas.

All Is Not Lost

Lest you decide from all this that USAF weathermen aren't earning their salt, it's only fair to point out a couple of things in their favor.

First, there is tremendous effort being expended to develop techniques to forecast operationally dangerous weather phenomena. The development and application of the Severe Weather Warnings in the ZI is an outstanding example of progress in this line. Although occasionally an SWW doesn't pan out, they have proven to be so accurate that most of us fly into Severe Weather Warning areas only when necessary and then only VFR if at all possible.

Second, I have yet to find anyone who has actually used the forecasts of other weather services who has not found the AWS operationally tailored forecasts to be superior to any others. To compensate in part for the inadequacy of the science of meteorology the AWS forecaster goes to great lengths to become very familiar with the details of the operation for which he is forecasting. Have you ever had the feeling that the forecaster was being too inquisitive about your plans? It's not just idle curiosity. The more he understands your mission, the more operational value his forecasts will have for you.

Get the Latest Odds

If you were at Santa Anita you'd never bet on a nag straight one to one odds if you could get ten to one at the pari mutuel window. In all the discussion and charts above the forecasts were accepted and scored against one to one odds, i.e., they were either right or wrong.

Their operational value can be greatly increased, however, by taking advantage of the running odds which we can call The Confidence Factor. There are many weather situations that are clear-cut, where the forecaster is highly confident that his forecast will verify. Here the odds are with you so take advantage of them. Likewise, there are situations where the forecaster knows that odds are about even that the weather will be (for example) above or below minimums. This is the time to be very cautious.

In those doubtful situations you do yourself a disservice by insisting that the forecaster give you a clear-cut, black or white forecast. It would be more realistic to evaluate, with the weatherman, the odds of being able to complete your mission, determine whether or not the odds are acceptable in view of the urgency of your mission, and if so, to plan your flight with a sure alternative course of action always available.

Conclusions

We all know that weather can be a critical factor in our flying operations. Realizing that forecasts cannot be 100 per cent accurate, it makes good sense to find out how confident the forecaster is of his forecast and to take this into account in your premission planning. Planning a peacetime flight into a situation where a "busted" forecast will result in an accident is closely akin to playing Russian Roulette and is just as illogical. The same is true throughout the entire execution of a flight. Right up until the time you must commit yourself to landing, keep a close check on the latest forecast as well as actual weather and if there's the slightest shadow of a doubt, leave yourself an alternate course of action. ●

DO'S and DONT'S

DO remember that forecasts carry no guarantee of accuracy.

DO remember that the fresher the forecast, the more accurate it is likely to be.

DO remember that your forecaster is highly qualified—that if he can't forecast it, probably nobody can.

DO always check the latest forecast before you commit yourself to land.

•

DON'T plan a flight where a "busted" forecast will automatically result in an accident.

DON'T forget to keep checking the weather ahead while you are en route.

DON'T get yourself in a hole where you have no alternate course of action.

Captain
Robert J. Kilpatrick
302 Tac Recon Sq

WELL DONE

★ ★ ★

CAPTAIN ROBERT J. KILPATRICK was finishing a Tactical Recon mission in an RF-80. As he entered his initial approach for landing, the airspeed read 300 mph, the speed brakes were out and the throttle was set for 50 per cent power. As Captain Kilpatrick started a roll-out to line up with the runway, he felt a thump on the control stick. The aircraft immediately went into a nose-low attitude.

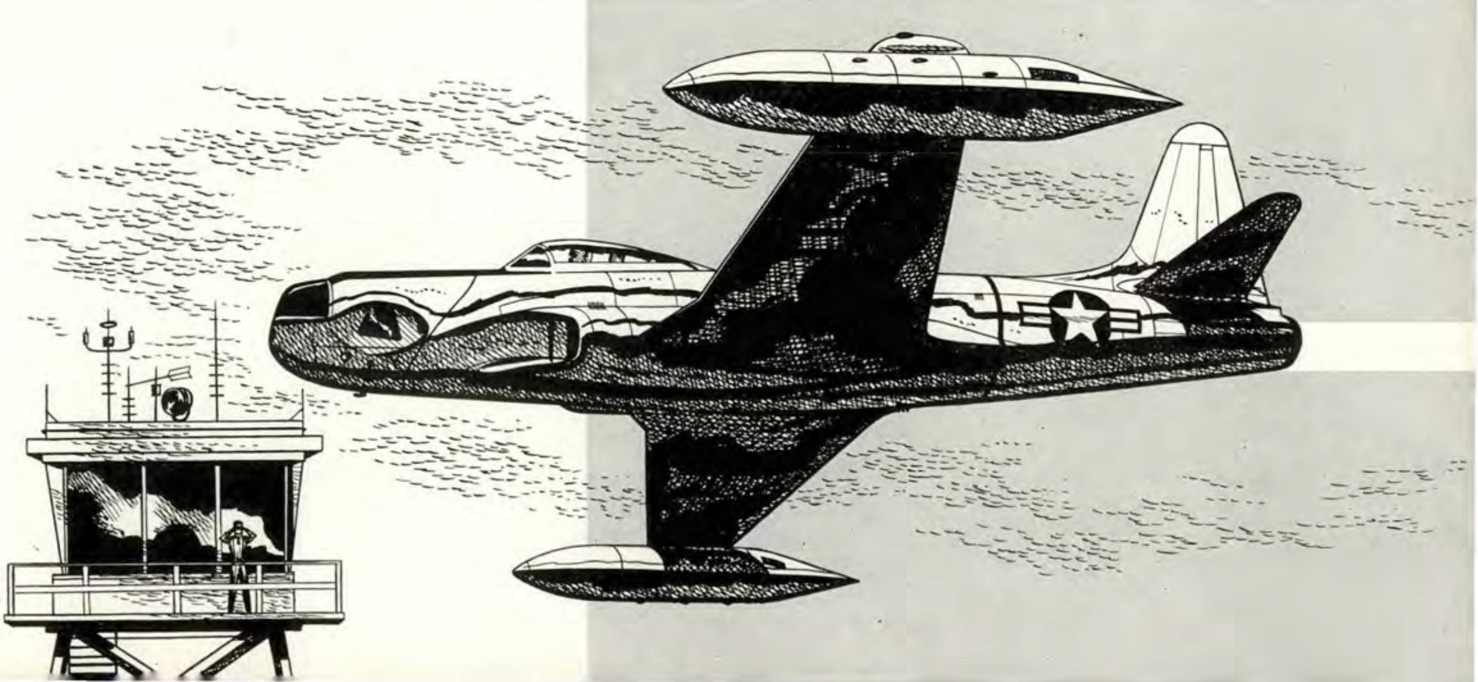
He pulled back on the stick but it would not move past the neutral position. By using both hands on the stick and decreasing his airspeed, he was able to maintain level flight. He found that he could climb at a very slight angle at around 200 mph.

Thinking that something had come loose and was lodged against the elevators, he flew by the control tower to have it checked. He was informed that something was sticking up behind the canopy. He turned and was just able to see the cause of his trouble . . . the upper engine access door. He had checked that before takeoff. It was okay then but now it was sticking up and was jamming the elevator push rods.

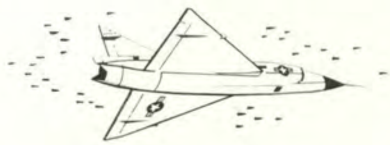
Captain Kilpatrick experimented. He found that he could not control the airplane at speeds below 180 mph or above 200, with the gear and flaps up. When he put the gear down he found that he could control it at speeds down to 152 mph. He knew that flaps would only increase the diving tendency.

Controlling his descent with throttle, he approached for landing at 160 mph. He touched down nosewheel first but braked to a normal stop 6500 feet down the runway.

To his alertness, his ability to analyze his difficulties and his knowledge of the airplane, Captain Kilpatrick added professional skill and judgment. Well Done!



Here is an article on flying the F-102 under severe, winter conditions. It is prepared by the pilot who performed the tests, and covers everything from the preflight to landing.



Captain Tracy B. Mathewson

the 102.

Outside all night, in the snow, let's look it over good. Clear speed brake and drag chute area.

IT WON'T BE long now! Some of you all-weather interceptor jockies will be herding the F-102A around the skies. Naturally, you're going to run into the same old problem as far as the weather is concerned. You'll have clear weather, good visibility, low ceilings, poor visibility, hot and cold, rain, snow, sand and everything else the Old Girl can dream up to throw at you. There's only one way to always come out on top of the pile and that's to be prepared for anything that may come your way.

Perhaps a few words here on cold weather operation of the F-102 may assist you in your personal program of preparedness.

Let's take a typical cold flight, including the planning and post-flight procedures which are necessary to accomplish your mission and terminate it with a real cool landing.

The Paper Work

First off—the weather, existing and forecast, NOTAMS, and aircraft. The weather is suitable. It's cold, say about 20 below on the ground; overcast about 3000 feet and visibility five miles. The runway is icy; there are snowdrifts along the taxi strips and runways. Remember the temperature in degrees Centigrade. You will need it to make the proper adjustment on the ratiometer prior to takeoff.

We have filled in all of the little blocks on the clearance, and the plane is ready to go. Wait a minute, now. Before charging off, we should check a couple of items. First, as always, the Form 1. Read it and make sure you understand all the writeups.

Walk Around

Now, let's look the airplane over externally. If you're a tire kicker,

. . below zero

After start-up and before taxiing, be certain to check for any external leakage in fluid systems.

there are three tires to check. If you want to do a thorough job and come out on top of the pile, then follow me —we'll do it up brown.

Check the left intake duct for foreign objects—snow, ice; and security of panelling — the forward electronics bay doors, secured; the pitot tube and mast—see that it doesn't have any snow or ice in it or on it.

Check the nosewheel tire, strut, safety lock pin, steering damper pin, battery and taxi light. It is important here to see that there is no hydraulic fluid leakage around the nosewheel strut. This may occur when the aircraft is towed in cold temperatures.

Give a check of the nosewheel well switch panel and make certain the switches are in the correct position. Remove any ice formations which may be in or around the gear or well. Check the right side forward electronics bay doors; remove ice that may be there and check for any leakage which may be apparent.

Inspect the leading edge of the wing for ice and damage. Now let's look in the Ram Air Turbine compartment. Here we check the fluid level in the hydraulic reservoir. There are two small pressure gages located in here, too. They are on the hydraulic accumulators and each should indicate 750 psi.

Take care to note the reading, especially if the bird was serviced in a warm hangar, then brought outside to sit in cold temperatures. Now see that the blades on the Ram Air Turbine are free of ice and will rotate smoothly.

Check the condition of the compartment door and close the door. This brings us to the right main landing gear and wheel well. Make certain there is no ice on the gear and that the strut extension is correct.

Tire condition and inflation are important, too. See that the ground safety lock pin moves freely and is not frozen in the gear; this may save you a little delay after starting.

Give a check on the high pressure pneumatic gage; it should be 3000 psi. Watch this in case the aircraft was serviced in a warm hangar. See that the fairing doors are in proper condition and connected to the retracting arms. There's a circuit breaker panel in the main wheel well; make certain the circuit breakers are all in and are clear of ice.

As always, preflight planning is a must. Do it right.

Check wing cleaning operations closely. Remember you are flying it.

Take time with your walk-around. It's more than just tire kicking.

On the underside of the wing, there are three fuel tank vent valves. Look at these vent valves closely. With extremes in low temperatures, the valves have a tendency to leak. If there is any ice formation around a valve, take care — you may have condensation moisture in your fuel plus the fact that you have a leaky vent valve.

Have a look at the elevon for ice formation and general condition. That puts us at the tail cone of the aircraft. Normally, the speed brake will be left open so the drag chute can be installed. This is an ideal condition to have the chute pins frozen in the inserted position. Don't let this happen to you. Clear the ice away from the chute area. Now, see the two little pitot pickups 'way up on the leading edge of the vertical stabilizer? They are dynamic pressure pickups and apply signals to the trim actuator to provide trim changes in a certain Mach range. The system prevents a reversal of required pilot applied forces to maintain level flight as the airplane is accelerated or decelerated through the trim change speed band. You wouldn't want to be without this assist, so check the pickups and make sure they aren't cluttered up with frozen water. By the way, if you leave the covers on, you will get the same results as the ice would cause.

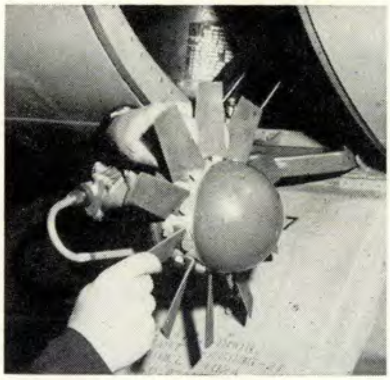
On the left side we will check the elevon, landing gear and wheel well. The single point refueling receptacle is in the aft face of the left main wheel well. Make certain it's not leaking and the entire area is clear of ice. There are also three fuel tank vent valves in the left wing so make the same check as on the right side.

Another item that may be important: Check the fairing cover on the external emergency canopy jettison. Make sure it's not frozen closed. Make certain the old girl is securely chocked. Extremely cold weather plays havoc with hydraulic, pneumatic and fuel systems, so if you make a quick preflight, at least look at these systems.

The Interior

Okay, looks like she's in good shape. Let's climb in and crank up. Watch that ladder. It rests on the upper skin of the left intake duct. When this area has any ice or snow on it, the ladder has a tendency to slide forward, down the duct slope. It will unceremoniously deposit you on the ramp. Use care when entering the cockpit. There is an anti-glare shield mounted over the instrument panel which becomes very brittle in cold weather. If you kick it or hit it when entering the cockpit the aft corner may break off.

In the cockpit, the usual checks are made. There are some items, however, to which special attention should be given in cold weather. First, let's get hooked up. Pay special attention to the safety belt. Make sure that the buckle isn't frozen. Open and close it at least twice. Check the shoulder harness and make sure the reel isn't frozen or sticking. Give your oxygen mask a good once-over. The flapper valve has a bad habit of freezing closed. Before you start the engine,



Be sure these turbine blades are free of ice.

Note cold weather items during cockpit check.

Uncover, clear the dynamic pressure pick-ups.

After getting a good systems check you are ready to go. Don't pull chocks until ready to go.

check all of the movable switches and knobs. I've found that they will freeze up and you can't move them, particularly the VOR frequency selector. The low temperatures also have caused contraction of the set screws in the selector knobs, making it impossible to select various positions on some of the radial selectors. In one instance, a knob fell off the shaft. Embarrassing! Better to find out on the ground.

The Start

Now we're set to start. I won't go through the start procedure because you will learn that from the pilot's handbook when you check out.

There are several words of caution during starting. If the airplane has just been subjected to sub-zero temperatures, the automatic starting sequence fuel will probably be set slightly low for the cold weather and the first start may be unsuccessful. You can accomplish the start on the emergency fuel system or have the starting fuel adjusted. During the start, check the primary and secondary hydraulic systems gage for a smooth increase in pressure. An erratic or excessively slow pressure rise is an indication of a pump going bad.

Watch the engine oil low pressure warning light during this start. We all know what low temperatures do to oil. After the start is completed, have the Gas Turbine Compressor disconnected, reset the AC and DC generators, then wait at least two minutes before having the external electrical power disconnected. This delay is to allow the oil in the Sundstrand generator unit to warm up and begin circulating properly.

After the external electrical source is disconnected, give the primary and secondary hydraulic systems a thorough check, making certain they return to system pressure in the required two seconds. You will probably have to cycle the flight controls at least three times before the hydraulic fluid begins flowing rapidly enough to return the pressure to normal in the specified time.

Get a check of the emergency AC power system. The emergency alternator is driven by the secondary hydraulic system, so the emergency AC power check will also give you some insight as to the operational capability of the secondary hydraulic system. Have the speed brakes operation checked by the crew chief for smooth retraction and extension. The only other item you may have any trouble

Use brakes and power with care when taxiing. Lined up with full power, brakes won't hold.

After takeoff, the gear may retract slowly in cold weather. Don't exceed the placard speeds.

with at this stage is the takeoff trim. I found the trim actuators were invariably slow after the airplane had been cold soaked. Operate all the trims from one extreme to the opposite extreme and leave it there. Then check the takeoff trim for centering and trim rate. Let's lock the canopy down and get the show on the road, our weather is about to expire.

When locking the canopy down, unless you're wearing gloves, move the locking handle forward slowly or you will leave some knuckle skin on the side wall rivets. Pull the chocks, Chief, and we're off. Watch it when you're taxiing on ice or packed snow. In this airplane, the nosewheel steering is a lot more effective than differential braking for directional control. The brakes have a tendency to make the aft end of the aircraft skid rather than turn the nosewheel.

Another item on taxiing: In case you get the nosewheel turned out of the 50 degrees steering control limit, use extreme caution in trying to get it re-engaged. A little power will cause the airplane to start to skid and there you are—in a snow bank. It may make your face red but it's a lot cheaper to have a crew man come out and straighten out the nose gear until the steering mechanism engages.

I won't go into the pre-takeoff checks here. They are all straight forward checks that never appeared to be affected by low ambient temperatures. IFR? Okay. Lights, pitot heat. Don't worry about that 90°C. exhaust gas temperature. It normally indicates very low at ambient temperatures of below zero.

Off and Running

The tower has cleared us to line up and we're all set to go. Run up the engine, check the instruments and keep an eye on things outside. This job will begin sliding on snow or ice at about 80 per cent rated power even with the brakes locked. At military power pop it into afterburner. Now don't just sit there because by this time (5-7 seconds) you're skipping through the dew. This cold weather really wakes up the '102. You're liable to get the aft end to skidding excessively if you don't stay right on the directional control. There will be some skidding of the main gear apparent but you won't be on the ground long.

We're off. Now watch the acceleration; you're going to exceed the gear limit speed if you don't pull the nose up. The gear is usually pretty stiff and slow on retraction after sitting in subzero weather. This is very important to remember because you will certainly pull a gear fairing door off if you exceed the placard speed. With the thrust available at low temperatures, the climb angle of the airplane is pretty steep by most of our standards so get on the gages and concentrate. The airplane flies like any conventional planform so let's get on with the mission. Watch that altimeter. Going up like a homesick angel.

GCI picks us up, vectors us out; we make a few practice intercepts, then return for a letdown and landing. It's cold and cloudy; get the pitot heat on. Remember the dynamic

Wouldn't want to get caught short here. Thorough knowledge of aircraft procedures is a must.

pressure pickups on the vertical stabilizer? The pitot heat will also keep them cleared for you. Windshield deicing? Don't let it get ahead of us, turn the NESA glass switch on before we start down.

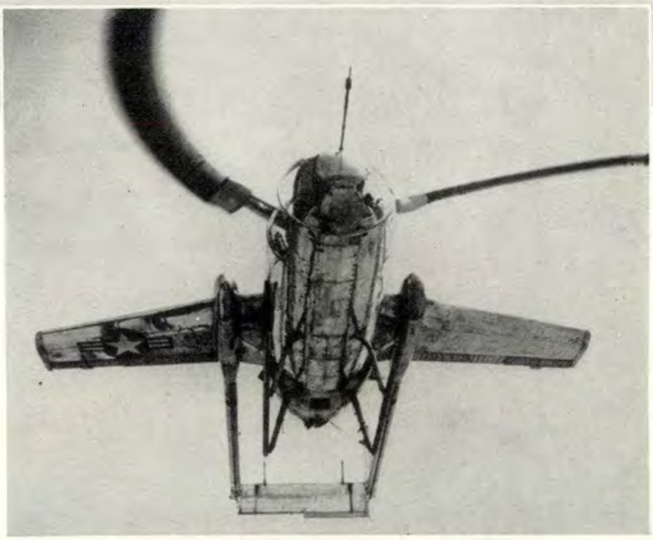
A quick check of hydraulic pressures and electrical system, then we're in the penetration. Icing of the wings doesn't appear to be a problem; it forms lightly, then peels away. GCA has us now, final cockpit check completed, gear down and indicating locked. Just broke out underneath, cancel IFR, we'll finish the approach and landing visually, over the fence and over touchdown. Careful now, you're cocked way up in this bird for landing, about 15 degrees. That places you about 18 feet off the ground when the main gear greases on. It is difficult to obtain a good depth perception over a snow-covered runway so carefully maneuver to maintain the correct attitude and speed. There, the main gear is on; deploy the drag chute and be ready to correct any skidding with rudder. Ease the nose down and carefully apply the brakes. On the ice or snow you can easily skid a tire with brakes and melt the rubber down to the cord before you realize it. Intermittent braking and nosewheel steering is the best combination. The nosewheel steering is very sensitive above 50 knots; use it with caution. Keep the aircraft straight or it will start fishtailing and try to skid. When deploying the drag chute in crosswind, you will realize only a light component of the crosswind effect due to the drag chute. The riser connecting point is about 15 feet behind the main landing gear and about 37 feet behind the nose gear so the lever arm action of the chute is negligible. It may create a small fishtailing effect about the main gear but the yawing moment will be very slight. Check the pitot and NESA heat off now. Taxi in slowly. The tires may break through the packed snow and cause damage if you're too fast. Give the hydraulic systems a final check prior to engine shutdown. You may notice a potential failure. Check the electrical systems again, it only takes a second or two. Into the parking spot, chocks in; leave the speed brakes open, please, the crew has to repack the drag chute. Shut her down according to your Dash One and listen! Sounds normal? Okay, fill out the form, give the cockpit a final check and position all the switches properly. Seat safety pin in. Good gosh! It's getting colder; must be 25 below, now. Let's go and have a cup of coffee.

Existing conditions and local requirements for scrambles will dictate how much of the preflight is performed before the whistle blows. For practice, or training flights, don't miss a bet. Always look it over carefully; know the condition of the bird and I'll see you at 45,000 feet over the field. First one there gets to lead the flight! ●

Taxi in slowly using nosewheel steering. Braking could cause a wheel to break through the snow.

Keep Current NEWS AND VIEWS

The world's first successful convertiplane is the McDonnell XV-1.



Speedy Chopper— Hailed as the world's first successful convertiplane, the McDonnell XV-1, has set a new unofficial speed record for helicopters. The mark is now 200 mph. Previously, a convertiplane of the same type set the mark, again unofficially, at 180 mph. The official record for helicopters is 160. The convertiplane is said to have excellent handling characteristics and minimum maintenance problems. The trick of this craft seems to be that of converting from helicopter-to-airplane in flight. This is done through a complex rigging of controls and a combination of engines. A conventional engine with a pusher propeller provides one element of power, while a specially designed pressure jet installed at the tip of each rotor blade provides the other component.

The XV-1 recently concluded an intensive flight evaluation program conducted by an ARDC flight test staff from Edwards AFB, Calif.

How High Can You Get?— Seems that a couple of our South American neighbors are having "some kind of a contest" with T-Birds. The object seems to be: Who can fly a T-Bird into and out of the highest airfield? First, it was reported that the Peruvian Air Force had operated a T-33 out of Limatobo, Peru (elevation—8100 feet).

This sort of challenged certain members of the Colombian Air Force. Nothing daunted, they flew one of their T-33s to their own field at Bogota. The elevation there is 8398 feet and the runway length is 7000 feet. The pilots shot three touch-and-go landings before they decided to try for a full stop. But try it they did—and made it. They landed with 325 gallons of fuel aboard. They took off again, and as we often hear, the flight was "routine."

Flight Service Shift— Flight Service Centers are scheduled for change. March Flight Service Center is being consolidated with Hamilton. After the shift (early October 1956), Hamilton Center will assume responsibility for the combined area. Future plans call for closing both Lowry and Wright-Patterson centers and establishing a new one to serve the combined areas. The dotted line marks the present boundary separation. Carswell, Olmsted and Montgomery centers remain.

Pictured at right is the two-place version of the Super Sabre F-100. Below depicts the net devised to literally "scoop up" downed airmen.

Here is number five of the series of articles prepared by Lt. Colonel Mulholland for FLYING SAFETY. As the title implies, the success of flight depends on you.

Know Thyself

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

IT'S A DARK and nasty night. Out on the rain-swept ramp a Gooney bird is half revealed in the glow of the floodlights. It has been run up and checked, a patient beast ready to do its pilot's bidding.

In operations the pilot and copilot are running through all the necessary preparations for flight. The string on the big wall chart, the NOTAM file, the weather section—ugh! What a night! Fill out the clearance. Room for any passengers? Sure, eight extra chutes on board. Bring them on!

In Your Hands

So here they come. Private First Class Snodgrass, Battery A, Umpty umpth FA Battalion, on emergency leave; Seaman Hawser of the U.S.S. Oddsfish, off to join his ship, all the rest of them, humbly and gratefully drag their baggage out across the ramp to their free ride. If any of them are a little apprehensive about the weather they say nothing—after all, they're in good hands.

Or are they? How about it, Captain? You're giving these people a free ride—are you sure where? How current are you in this airplane? How much weather time—recently? This is a pretty ugly night and there are mountains around here. Can you really cut the mustard? Maybe you're a little rusty and you figured this flight would be just the thing to sharpen you up. If so, what is the role of Private Snodgrass and Seaman Hawser? And Mrs. Snodgrass and the kids? Are you really going to give them a helping hand, or are they just bit-players in the drama of man versus elements on which the curtain is about to be raised?

Wasn't it old man Socrates who said, "Know thyself?"

Apparently he knew a thing or two because his advice is still most timely after all these years. Nobody really knows an individual's capabilities and limitations like the individual himself, if he is honest about it. If you're confronted with a tough job, nobody knows better than you if you can really hack it. Self-evaluation works both ways — confidence, self-assurance are the by-products at one end of the scale, prudence and caution should lie at the other. Not cockiness, not timidity — these are extremes which should not appear on the scope. In short, honest self-appraisal tells a man just how good he is—not how good he would like others to think he is.

So where does this leave our pilot on the rain-swept ramp? Should he go on, take his trusting passengers into the wild black yonder, or should he forget the whole thing and take in a movie? Assuming all requirements and directives have been complied with, he has a perfectly legal right to take off. Morally, only he is the judge as to whether he is justified in pushing this thing or not. Is he in a rush? Does he know, deep down inside that this flight is going to be a hairy one, that his hands are going to be full? Is he at least partially gambling that the forecaster was overly pessimistic, and that every-

When it comes to flying, good self-evaluation is in order. Can you really cut the mustard?

thing will probably work out okay? Unless he is absolutely sure of his capability to hack this flight, it is his moral obligation to himself, Uncle Sam, and to his crew, to say nothing of Messrs. Snodgrass and Hawser and the others, to cancel this whole project until things look more auspicious. This is not the time to indulge in training—this flight is for keeps for a lot of people.

There are a lot of very basic considerations behind this little story. You remember the jingle that said:

"It takes a hundred thousand nuts to make an automobile. But the only one that wrecks the thing is the nut that holds the wheel."

Well the same thing applies in general to the airplane. The plane itself knows nothing of what's going on around it. Visibility, terrain or winds—they don't bother the machine. It is sublimely unconcerned—tell it to go and it goes. It's the human pilot who is affected by conditions such as these; they limit his ability to direct the machine. And to the extent that he is capable of overcoming these obstacles, the capability of the machine to do its job is enhanced. But when the human sticks his neck into conditions with which he is not prepared to cope, then all he is doing is betraying his trust and jeopardizing his machine, as well as the job it is supposed to do.

I wonder how many disastrous flights have been preceded by the remark, "No sweat." When an accident report turns up the doleful cause factor "attempted flight beyond his capability," it would be interesting to speculate as to when the pilot first realized that was what he was doing. That he realized it sooner or later there is no doubt. But did he blissfully over-estimate his ability until it was too late, or did he knowingly stick his neck out hoping for the best? Either way it's a sad, sad story and it should never have happened.

Why do things like this happen? Why do necks continue to be stuck out? At the risk of tossing a smoking hot potato in the air, maybe our whole Air Force system may be partially at fault. The fact that all our pilots go through a standardized training program, are subject to the same minimum flying requirements and are all required to qualify for an instrument rating, may engender the impression that their capabilities are identical. This we know is not so and never will be. It is an ideal, a concept that is necessary for personnel programming purposes and little else. Statistically it's okay because things average out, but when applied to a given pilot flying a given airplane at a given time, it's entirely unrealistic and misleading. Because Joe Blow with 2000 hours and a green card can bore through a rugged weather situation and come out the other side is no guarantee that Joe Glutz, with similar experience, can do the same thing. He may well come out the bottom instead.

Take off in haste—repent at leisure. Only there's not much leisure in the gages at 10,000 feet. The best time for a pilot to get his ducks in a row and evaluate his prospects is when he has his feet firmly planted on terra firma. His airplane is sitting dormant, not using a drop of precious fuel. All the professional help is right at hand. This is the time and place for planning, for decisions. Once your airplane is off the ground and up in the murk, it's all yours, brother, your flight, your decision, your neck. Your activities upstairs are going to be pretty demanding and complex enough at best. If you find you have to compound your troubles by trying to figure things out and look things up that you ought to know already—mister, you took off too soon! And if you feel that airplane getting way ahead of you—if you're so busy trying to keep it right side up that you can't keep track of your course or position—you are "attempting flight beyond your capability" whether you like it or not.

There are always going to be some occasions when a pilot is called upon for his maximum performance, when he's going to have his hands full, in order to accomplish a mission. These times though will rarely occur in the course of an administrative cross-country flight. Nor will there be any reason on these occasions to carry passengers other than required crewmembers. Passengers may want to get home but they should not be asked to be part of a calculated risk.

Know thyself. Not how long you have been flying, or the color of your instrument card. Not as a 3-2, 2-2, 2-1 or 1-1 pilot—that's just filling in squares. Not your rank, your job or how many hours you have, or who you are. Know thyself—know your ability, right now, to accomplish this flight in this airplane. The airplane doesn't know anything about your rank or background and couldn't care less.

The weather is going to continue to do what it wants, regardless of you. You may command a thousand men, but now the issue is: How competent are you, personally, with your own hands and brain, to control this machine under these conditions? At the wheel or stick, rank vanishes. General or second balloon, it doesn't matter. It's a personal, direct relationship between human and machine. And what goes for one machine may not go for another if you're not so current in it.

You may well be the hottest smouldering boulder this side of Farmingdale in an F-84F, but you would hardly expect that to qualify you to take off IFR for Thule in a C-124, would you? Or vice versa. The same considerations may well apply to an administrative junket in a Gooney bird or B-25. The old bugaboos of habit interference and lack of currency can be just as deadly. You may be used to streaking across the top of the overcast at 600 knots plus in a jet, but how will you like lurching through the middle of the stuff in a Gooney at 140 with a load of wing and prop ice? If you stop and think, you'll know that doing a precision letdown in rough air with this old bird will be like going down a spiral staircase with two loaded B-4 bags. *Are you ready?*

Variables

We've gone a long way from the days when we could say "an airplane's an airplane. If you can fly one you can fly 'em all!" Why? There are a lot of reasons. We have variations of size from the T-34 to the B-36, variations of speed from the L-20 to the F-100, variations of complexity from the T-6 to the B-52. Aerodynamically, take a stroll through the wing of a C-124, then go shave yourself with the wing of an F-104. These things are designed for vastly different missions, have vastly different peculiarities. You can't leap blithely from one to another and keep a whole skin.

A very high-ranking officer took off in a T-33 on an administrative flight. Weather was reported as 100 feet, 1/16 of a mile. No one questions the high experience level and qualifications of this pilot, but weather like that should make anybody pause. And there are limits beyond which we cannot as yet push our equipment or our people. This flight was no exception. It ended in a fatal crash seconds after takeoff. Remember the little boys who had the contest to see who could lean out the window the farthest? One

This is the time and place for planning, for decisions. Once you're off the ground, in the murk, it's all yours.

We have come a long way since the days of "an airplane's an airplane." We have variations from the F-104 to the huge B-36 and C-124. If you fly one, can you fly them all?

fell out—he won. Aren't we doing the same thing when we try to push a good thing too far?

During and immediately after our last two wars, recurring newspaper headlines kept reminding us of the fallibility of our combat heroes. Time after time aces would return from their glorious combat tours and were killed on some inconsequential flight in the ZI. Buzz Wagner, Bong, Baker, McConnell—the list is impressive. No criticism of these men is implied. The point is that no matter how good you are, no matter who you are or how hot, the aircraft can still getcha if you don't watch out! If you drop your guard you are vulnerable — every time. Or more pertinently, if you overestimate your potential you can be in for a rude shock when the roof falls in.

One of the Air Force's most ludicrous accidents bears eloquent testimony to just how weak we mortals be. An L-20 took off in the wee small hours one morning from somewhere in central Texas, heading west. A couple of hours later the aircraft and the ground met, somewhere in West Texas. It developed, as you might suspect, that both pilots were snoozing, concurrently, and the ground elevation gradually caught up with them. Fortunately they survived, but imagine how you would feel trying to think up a convincing story for the board after a lulu like this one.

Before you laugh, ask yourself how many times you have gone leaping off in the dusk after a full day of work, to get your night time on some nice long administrative cross-country? How often has this involved instrument flight, and how often has it been conducted in the wild and wooly West where you sit for hours at nine or ten thousand feet, maybe without oxygen? Worse yet, how often have you ordered some willing young Second John off on just such a mission?

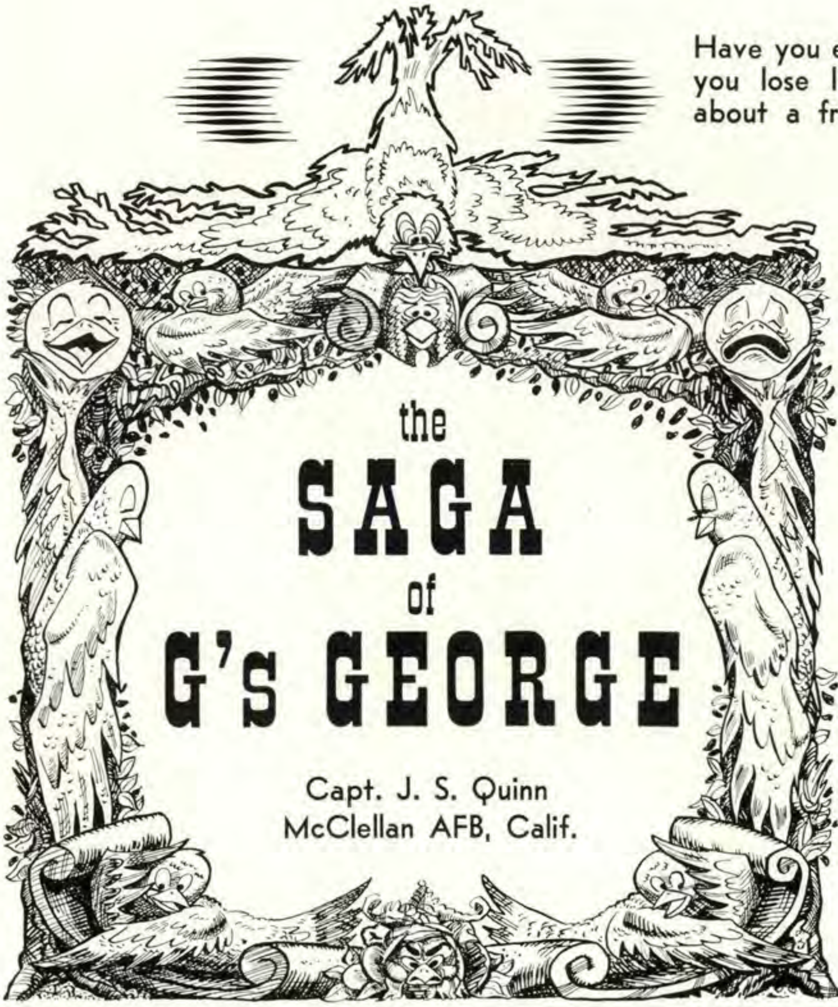
Sure we have operational missions that are long and demanding. But unless we have rocks in our heads, we plan for and take adequate rest before such flights. Proper crew rest is provided for when these missions are laid on. If it isn't we're just begging for trouble. It's on the non-scheduled administrative and proficiency type flights that we commit the greatest abuses. It's easy to forget that a man gets just as tired flying a B-25 as he does a B-47, maybe more so. Certainly if the airlines demanded that a pilot push a slow airplane all the way through from coast to coast after a full day at the office, the pilot's union would have something to say about it. A commander with sense would never demand it, so why should Joe Pilot demand it of himself?

When a pilot pushes his physical limitations unnecessarily he is not proving his manhood, his courage or his ability. All he is proving is that he is not using good sense. The Good Book points out that no man just by taking thought can add to his stature one cubit. By the same token he can't add one foot to his altitude tolerance, one hour to his capacity for going without sleep. All his brave intentions won't silence the querulous growls from his hungry stomach. All the thought in the world won't brighten his night vision, dimmed by lack of sufficient oxygen. Pride won't do much to speed up reflexes that are dulled by lack of sleep or nourishment. Let's face it—the mind of man is a noble creation but it is still hitched to a body that's part animal and part vegetable. A damaged container doesn't hold water very well. Even a Rolls Royce doesn't perform at its best on four flat tires. That physique of yours may be only a dollar's worth of chemicals, but it's hard to replace. You're going to need it if you intend to be around for a while, so why abuse it?

So, know thyself. Know the limitations that are inherent in a human being — beyond which you cannot push yourself. Know the particular physical limitations and tolerances that apply to you as an individual. If you can correct them or improve on yourself, for gosh sakes do it. Finally, know the limitations of your ability, the limitations imposed by your state of training, and do all you can to upgrade yourself.

When you know yourself you need never be guilty of going as a boy on a man's errand. You can allow the job to grow with you, not ahead of you. And PFC Snodgrass and Seaman Hawser can relax in the knowledge that whatever the decision, they will be in good hands. ●

Have you ever stopped to consider exactly why you lose lift in a turn? Here is an article about a friend of ours who spun-in and why.



the SAGA of G's GEORGE

Capt. J. S. Quinn
McClellan AFB, Calif.

ONE VERY WET and sloppy Maryland morning a few years ago, I fell heir to a well-doused dove. With soaked and sagging feathers, his lift weakened by the weather, on the ragged edge of stall, he staggered in. And there he sat, grounded, soaking in a puddle on the patio, until I rescued him.

George, that was the bird's name, was suffering not only from the water. He was suffering from a sorely wounded vanity. George had always considered himself an exceptionally skillful pilot. So skillful, in fact, that he enjoyed comparing himself with human pilots. That was because he generally came out best. And George's favorite comparison was in the tight turn department.

George couldn't remember all the times he'd seen humans crash because they'd tried to "rack it in" a little too tight on final. And the times he's seen them spin, snap or stall out of a steep turn were without number. But he—George (*G's* George, some of the admiring birds called him)—had *never* stalled.

Now what would the birds say? Now he was no better than a human. His point of pride was gone. The worst had happened. "G's" George had stalled in. At least that's what everyone would claim.

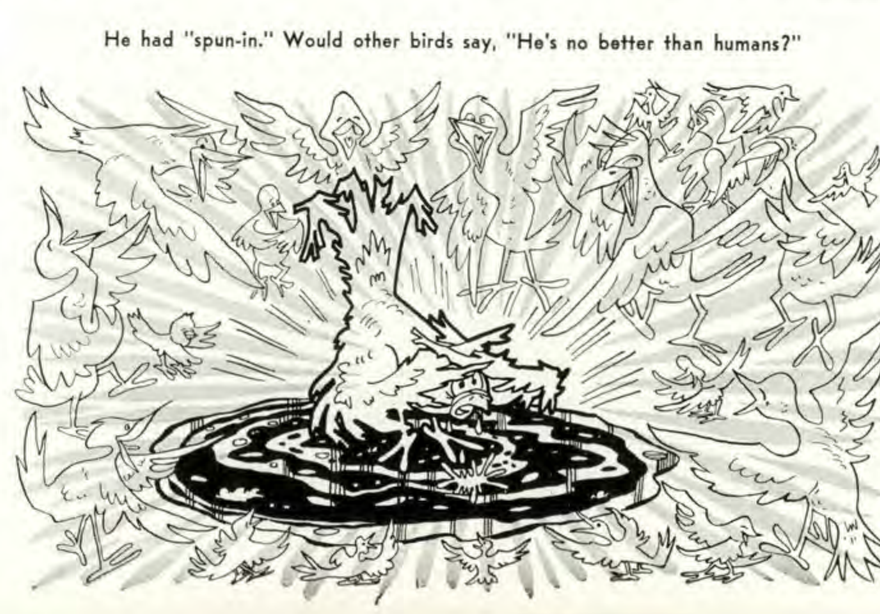
George was a skillful pilot and knew it. He could land on a spot, touching down as gently as one of his downy underfeathers. He could climb and descend at very steep angles. And his turns were something to see. There were those who claimed he didn't turn, he rotated on a wingtip. But the thing that made George so proud of those turns was that he'd never stalled.

It was this all too human tendency to take all the credit to himself that caused George to ignore aerodynamics. What did a pilot like him need that stuff for? He actually put some faith in the claim made by some, that he could fly the egg he came in. But it was aerodynamic ignorance, more than anything else, that was responsible for his sad plight.

Poor, pathetic George, however, had been treated more kindly by fate than he had realized. Soaked and saddened, his vanity for the moment stilled, George was ready and eager to learn. Gratis, he had been granted the virtue of humility, the key to the doors of wisdom.

He found that aerodynamics wasn't nearly as mysterious as he'd always believed. In fact, he was able to work out the entire equation for lift with very little help. He knew from his flying experience that altitude air density affected lift. (He discovered that the engineers called this factor "rho"-ρ). The next thing that came to mind was airspeed—V. It was obvious at a glance that increased velocity meant

He had "spun-in." Would other birds say, "He's no better than humans?"



increased lift. It took a little thought, however, and a little help, to understand that lift varied as the square of the velocity.

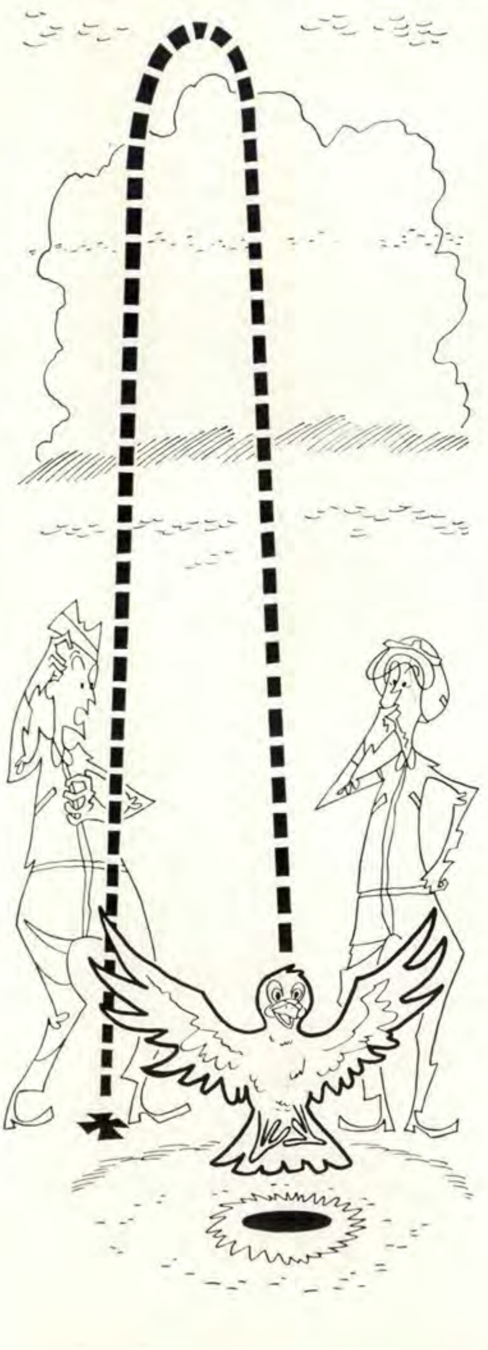
Then George thought of a number of inter-related things, all of which have a very definite effect on lift. He found that this complex of variables could be divided into the simple process of adding area to his wing-stand, the more complicated shape-changing and airflow control of which he was capable. But even this was simplified when he realized that all these complex controls did was to change the relative distribution of pressures above and below the wing. This, then, was the factor referred to as coefficient of lift — C_L. This is George's formula:

$$L = \tfrac{1}{2}\rho V^2 S C_L.$$

With the help of his lift formula, George soon discovered why his lift hadn't been equal to his weight.

First of all, the water had soaked his large wing feathers. This made the effective wing area (S) smaller. Also, it made them ineffective in their low speed, high lift, function as flaps and as boundary layer control devices. All of this restricted his speed (V), but more importantly it had increased his stall speed. The lift required had gone up too by the weight of the water he'd taken aboard. But George regarded this weight factor as insignificant compared with the effective increases in weight he was used to in his extremely high-G turns.

He could climb and descend at steep angles. His turns and banks were something to see.



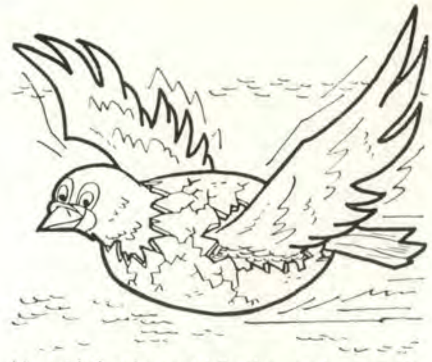
George was beginning to realize that his ability to make those high-G turns couldn't be credited solely to his skill as a pilot. In a large measure those tight turns had been built into him. And he realized with chagrin that he had misjudged his human counterparts. They didn't lack skill. They just didn't have the control available that he did.

How much more he had to call on than they, especially at critical speeds. First of all, he was an ornithopter (wing-flapper), and that paid off big at very low speeds. In addition, if high lift were called for, he could extend his wings and grab more air. And he had many other "specials" that hadn't yet been worked into practical airplanes. Then the light came on, and George realized why so many human pilots had killed themselves in tight turns at low speeds. Since he doesn't write, George made me promise to pass the word along to you.

The essence of George's formula, for practical purposes, states that with a constant angle of attack, lift available varies as the *square* of the velocity. Thus, if 150 knots are required to sustain 2G flight, then 300 knots would be required to sustain 8G level flight.

In memory of George, knowing he would wish us to go "whole hog" in presenting this information, we shall look into the effect of angle of bank on G forces. Thus, we will be able to see at a glance the effect of *bank* on minimum *speed* required to sustain level flight—stall speed.

Bank angles up to 60 degrees create little problem in most aircraft. At this angle the G forces have only doubled, putting little stress on the



He said that he could fly the egg he came in. Why should he bother with aerodynamics?

airframe. The stall speed has increased only 40 per cent, a relatively safe speed under nearly all conditions of flight. The only rub is that anything over 60 degrees rapidly gets worse, both from the standpoint of G required and stall speed. In order to illustrate this as simply as possible and to make the relationships readily apparent, they are charted.

Bank Angle	Effective Weight	Stall Speed
0	1G	100 kts
45°	1.4G	120 kts
60°	2G	140 kts
70°	2.9G	170 kts
75½°	4G	200 kts
80½°	6G	246 kts
83½°	9G	300 kts
85°	11.5G	340 kts

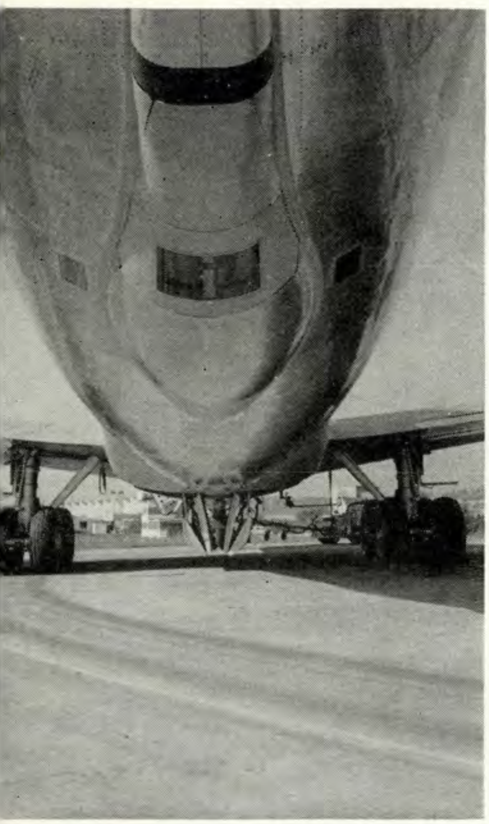
We hope that this is as clear to you as it was to "G's" George. He certainly had your interest at heart.

We had to shut the windows and lock George out. He probably still doesn't know why. But for many days thereafter, my roommate could be heard muttering unkind things about George as he looked at a spot on his girl friend's picture. ●

"Casey" GOES JET

R. L. "Dix" Loesch
Senior Test Pilot, Boeing Airplane Co.

It won't be long until the tankers will be roaming the wild blue area that was once reserved for the fighter and bomber boys.



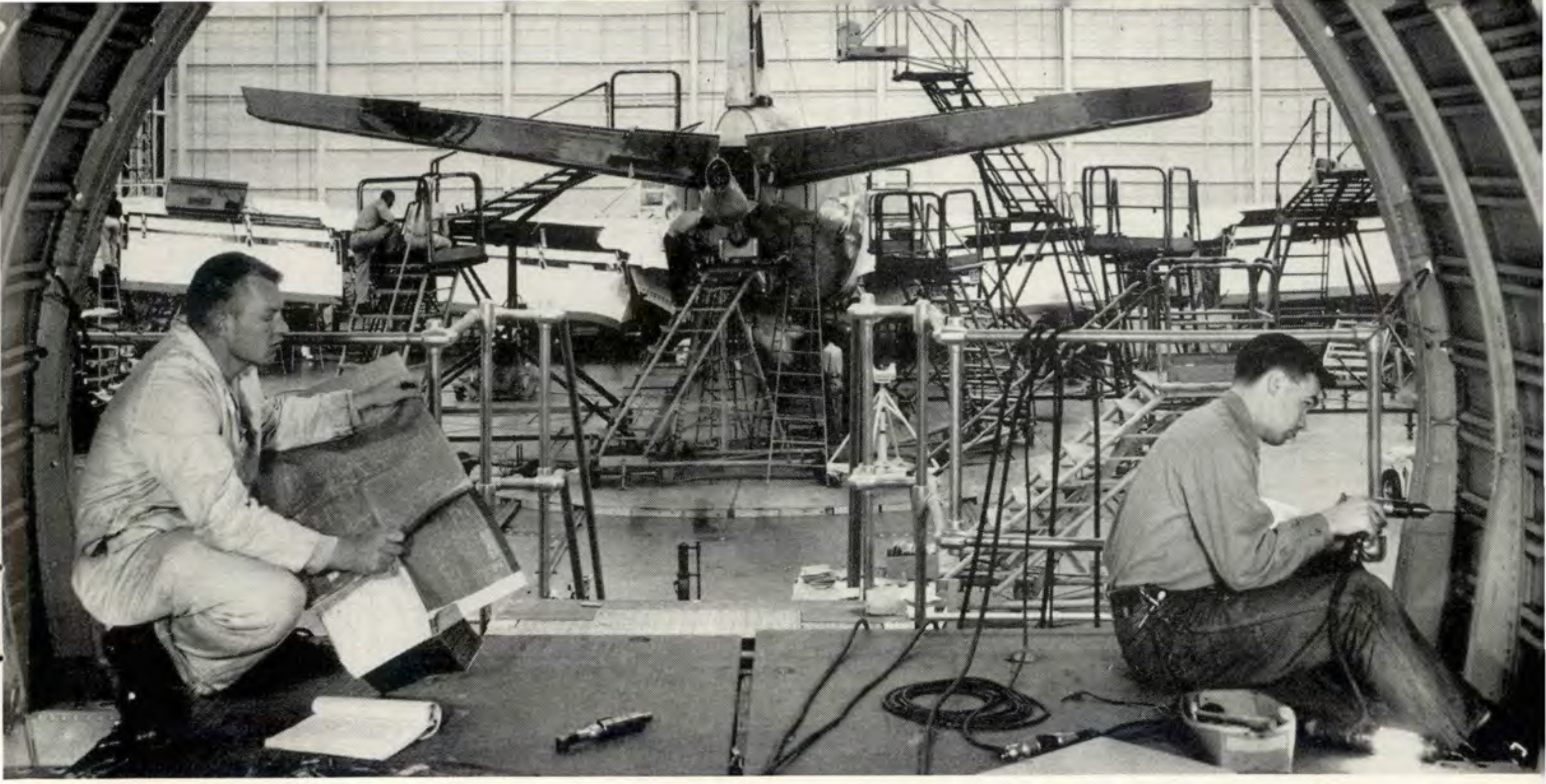
IN A FEW months, the Boeing KC-135 jet tanker-transports will be entering service with the United States Air Force and a good many of the pilots who read FLYING SAFETY regularly will be assigned to these new birds. This is being written to describe some of the characteristics of the KC-135.

This big, four-jet transport type has just made its maiden flight, while the Boeing 707 prototype, from which the KC-135 was developed, has been flying for two years and has logged over 500 hours; and the earmarks of the prototype, with improvements in some areas, will be found in the production tanker-transports. Thus, the 385 hours I've logged in the prototype have given me a good idea of the performance and handling characteristics of the '135s.

Pilots who have been flying transports should find it simple to convert to the '135. The jet tanker-transports will be similar to present-day transports and tankers in handling, with the new airplane having the advantages. It will have excellent stability and control, and generally speaking, control response will be better than you have with today's transports.

The primary controls are all manually operated, internally balanced and tab-controlled. The pilot can check the ailerons, elevators and rudder on the ground for freedom of movement of both the tab and control surface because additional control column or rudder movement at the end of the tab travel moves the entire surface. Also, it's nice to know that there are no gust locks to worry about on this airplane. In place of gust locks there are built-in gust dampers.

The lateral control is a little unusual in comparison with present transports. There are two sets of ailerons, an outboard set which only operates when flaps are down and an in-



board set which operates at all speeds. The ailerons are assisted by wing spoilers on the upper surface which are activated by hydraulic pressure and which are very effective at high speeds and Mach numbers where a wing with ailerons only tends to lose control. These spoilers retain their effectiveness right down to the stalling speed of the aircraft. The spoilers are also effective speed brakes. Using spoilers as speed brakes in conjunction with the landing gear, which can be used at up to 320 knots, indicated descent rates as high as 18,000 feet per minute are possible.

Pilots will find the cockpit well laid out. It is much simpler than that of the usual four-engine transport of today, due to the jet engines. They don't require propeller pitch controls, feathering buttons, manifold pressure gages and other instruments and controls peculiar to piston-engines. Visibility from the cockpit is excellent.

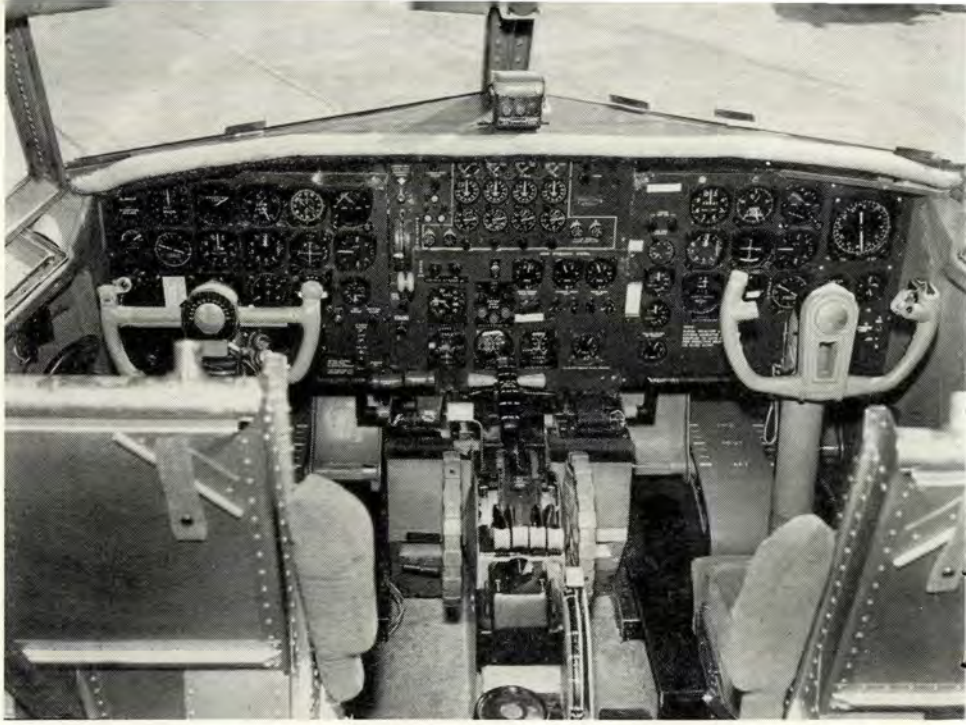
As with other jet aircraft, the KC-135 can be almost entirely checked for flight before starting the engines and takeoff can be made immediately after a power check on the runway.

The airplane has conventional tricycle gear, with the main gear made up of four-wheel bogies. The turning radius is a little greater than with airplanes which have dual-wheel gear because excessive scrubbing and high torque loads would occur on the inside gear if it was used as a pivot. The main gear is a little closer to

Shown here is the first KC-135. Earmarks of the prototype will be found in production model.

Above, KC-135 takes to air on one of early flights in long series of test flights. Below, turning radius is a little greater than with planes having dual-wheel gear because of the excessive scrubbing and high torque loads which would occur on inside gear if used as a pivot.

Above, both entry and escape exit is shown. The door swings out to provide wind screen.



Pilots will find the cockpit much simpler than that of the usual four-engine transport of today. This is due in part to the jet engines. The rest results from concerted efforts of designers.

Above, is dual-tire nose gear installation. Below, is a shot of flight test personnel.

the center of gravity than most transports, and the nose can be lifted off at a speed considerably under normal takeoff speed. The best and safest technique is to leave the nosewheel on the runway until about five knots below takeoff speed, otherwise the airplane will take a little longer to get airborne.

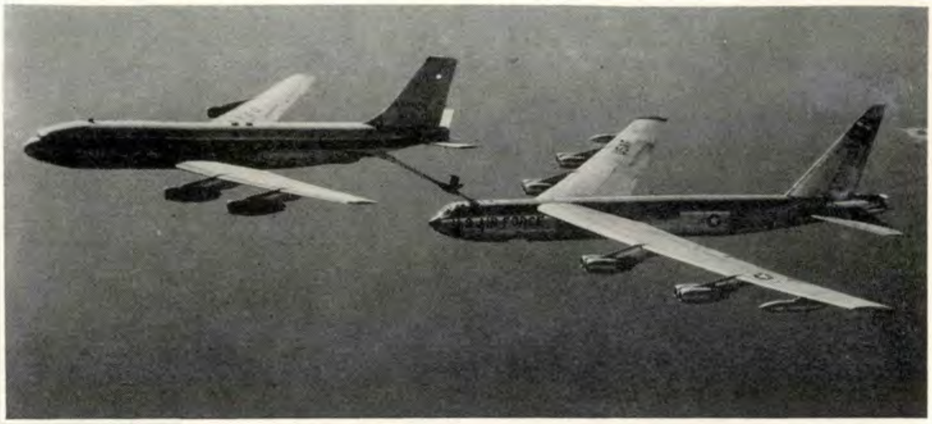
The fore-and-aft trimming on the KC-135 will be done by varying the angle of incidence of the horizontal stabilizer, just as on the prototype. The stabilizer is trimmed by means of an "up" or "down" button on the control wheel. A manual trim wheel on the pedestal can be used to drive the stabilizer in the event the motor system fails. Before takeoff, the stabilizer should be set so that only a small pull force is needed to lift off at takeoff speed. Elevator effectiveness is high enough and forces are low enough such that the airplane can be flown off with almost any setting of the stabilizer. It definitely is less critical than most present-day transports. Once you are off and climbing, or cruising, the pitch trim by the adjustable stabilizer is highly effective at all speeds and the control column is in the same position with the center of gravity at any point. At high Mach numbers, trim remains effective.

Most transport pilots are flying airplanes which do not have the capability of exceeding IAS limits. This is not true of a jet transport which can easily exceed placard speeds at low altitudes. Pilots will need to be alert regarding this until they have acquired a feel for power settings and for the sound and vibration build-up which occurs at higher speeds.

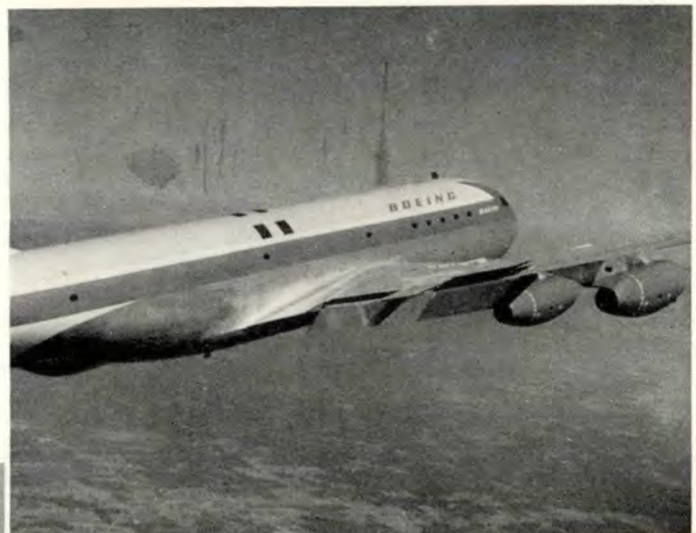
The KC-135 will have nearly two and a half times as good lateral control as the KC-97. Its directional control will be effective enough to handle an outboard engine failure at speeds *below* takeoff speed except at very light weights. In normal flight the KC-135 will be a "one-hand" airplane. Yet stick force per G is high enough to prevent the pilot from accidentally loading the airplane beyond its limits.

Although higher fuel consumption rates are apparent, the attention required to the ground miles versus fuel consumed should not increase since cruising speeds are so much higher and tend to minimize variables such as wind and temperature.

We have done complete stalls in the 707 prototype with the airplane in all configurations and with the stick all the way back. The airplane has nearly perfect stalling characteristics. There is small tendency to roll, and any roll can be counteracted by the lateral control which remains effective throughout the stall. As you approach the stall, buffeting begins 12 to 16 per cent above the stall speed and increases as the stall is approached. You can't mistake it. Then the nose falls straight through the horizon. Absence of propeller slipstream causes power off and power



For high-speed, inflight refueling the KC-135 carries a special boom.



Here is a takeoff and inflight shot of the prototype.

on stalling speeds to be virtually the same.

Letdown can be controlled by means of the spoilers, used as speed brakes. On the approach, if you are above the ILS glide path or desired approach path, you can apply speed brakes to descend to it. In the pattern, and on the approach, the '135 will be able to stay behind today's airplanes. Its speed, while about 600 mph for high-speed cruising, will be only 125 knots during the final at normal landing weights.

Approach is a little more nose-high than in present-day transport and tanker aircraft, but visibility is excellent and there is no difficulty in judging clearance over obstacles or height above the runway. It's a good idea to keep the airplane trimmed hands-off during final approach, rather than with the slight nose-down trim used in some airplanes. Once on the ground, getting the nosewheel down early and raising the speed brakes will greatly aid in minimizing ground roll. Ninety per cent of the weight of the airplane is on the main gear at landing speeds after the nose gear is on and the speed brakes are raised.

A hundred pilots have already flown the prototype. Even those without any previous knowledge of the airplane, or of jet airplanes of any kind, have experienced no difficulty in making successful takeoffs and landings. None of the differences between the KC-135 and present-day transports should be of any real concern. The *general simplicity of operation* will, by far, be the biggest difference encountered and bears out the old maxim that progress marches from the complex to the simple.

If pilot enthusiasm, as far as the prototype is concerned, is a guide for acceptance of the '135, then it should be one of the best liked airplanes in the Air Force. I would predict that any difficulty that arises will not be in getting pilots in the KC-135s but in keeping them out. ●

The "Down to Earth" Approach

John Radick, ACIC

The pilots handbook is undergoing a face-lifting. Gone are the days of wrestling with a large bulging folder. The new book, for both jet and conventional, will be pint-sized and easy to handle.

ONE OF OUR many good instrument pilots was completing a four-hour flight from McGuire Air Force Base, New Jersey, to Lambert Field, St. Louis. The weather was foul—normal IFR conditions. Vibration and turbulence made control of Joe's Gooney bird difficult. He was sweating some, even though it was cold in the cockpit.

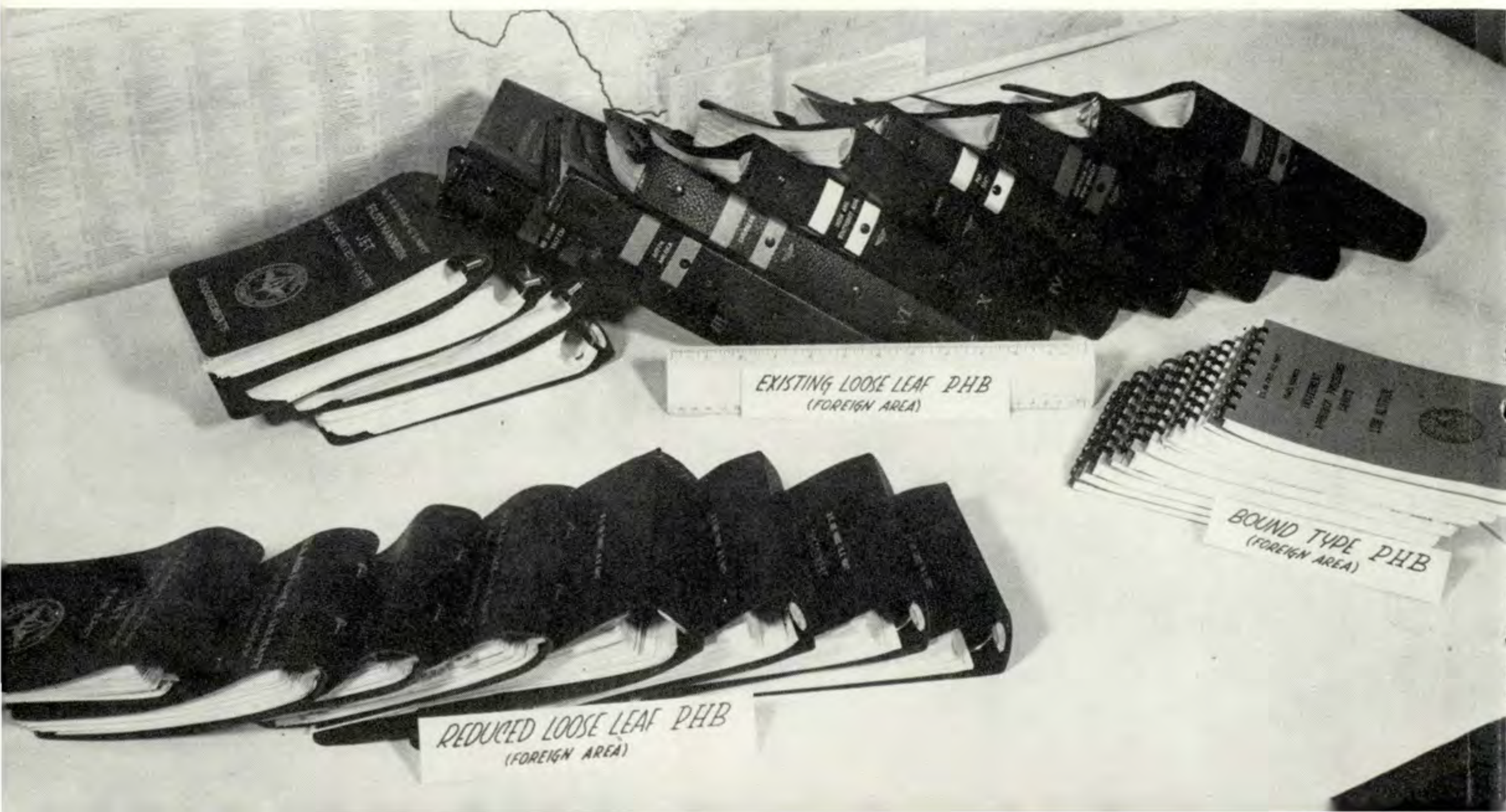
"Air Force 19409, this is St. Louis control. Maintain 3000 feet, hold on Spanish Lake fan marker until further advised. Expected approach time is 43." The voice of the controller came through reasonably clear.

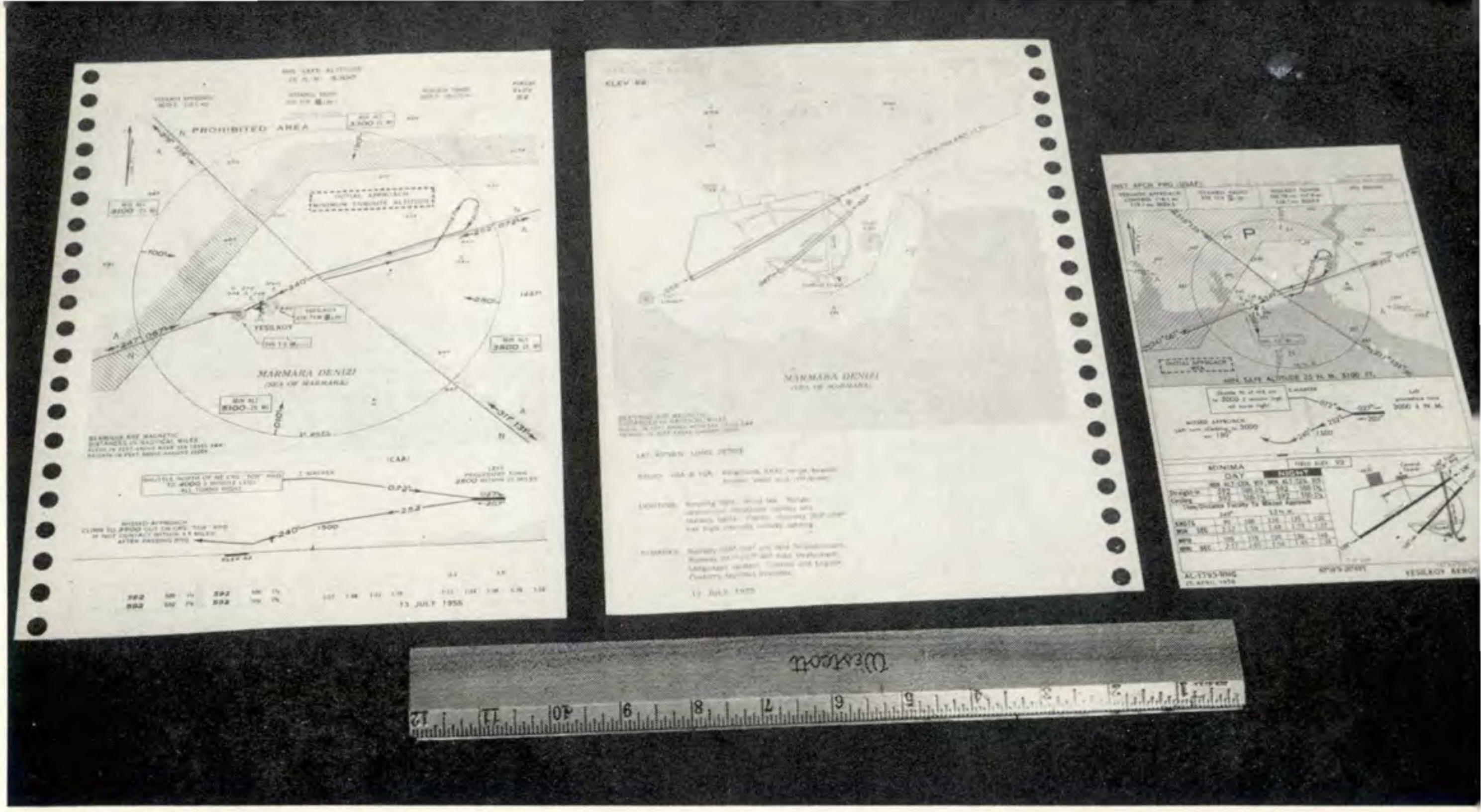
"Air Force fow-er zero nin-er," Joe acknowledged St. Louis' instructions, glancing at his Radio Facility Chart to check the holding pattern at Spanish Lake. Three minutes later they were over Spanish Lake fan marker and started the tedious task of holding. Maybe the delay in landing wouldn't be too great. "Let me have another look at the letdown, Bill," he shouted to his copilot.

Bill reached down beside his seat and brought up two large bulky Pilots Handbooks he had been saving for rainy days. "Let's see," he thought to himself, "since the ceiling is reported at 500 feet, we may have to use ILS."

He opened the East United States book to the Lambert St. Louis letdown sheet and held the bulky volume across one knee. Then he opened the ILS book, making a grab at the other book as it began to slip from his lap. He muttered a few well-chosen words which were lost to posterity in the noise of the engines.

The two types of books in foreground are being tested to determine which one is acceptable.





Shown, above and below, are comparisons of sizes. Note that the airfield layout and letdown procedures are both portrayed on one side of chart.

"Look at this, Joe. Did you ever see such unnecessary bulk?" He ripped the range procedure from the Handbook and stuck it on the panel while he continued his question. "And why the devil does all this information appear on an instrument approach chart? We only need the procedure and required altitudes."

"Beats me," Joe replied, already fully occupied with his own problems.

Many Complaints

These have been common complaints of pilots in the Air Force for some time, but complaints that we hope won't continue. Not that Joe and Bill didn't get down from the Spanish Lake fan marker. We wouldn't have you think they clobbered themselves just because of a bulky Handbook.

The Future

With these complaints in mind, let's see what the future holds for pilots like Joe and Bill. Bill's main complaints were about the bulk and unnecessary detail on the charts.

Through the aid of one slightly used crystal ball, we can see that Pilots Handbooks of 1957 won't be so big—about 5 x 8 inches. That's a far cry from the 8 x 10½ job which Bill fumbled around with, as obsolete as the aircraft it was designed for. This new size binder will be combined with an improved, simpler instrument approach procedure chart, designed along functional lines.

Let's take a look at Joe in base ops after the new Pilots Handbook is operational. Picking up materials to use in flight, he looks for a Pilots Handbook. He will find the terms "low altitude" or "high altitude" procedures used instead of "standard" and "jet." These new terms are based on normal altitudes associated with the initial phase of an instrument approach. Conventional aircraft will normally be expected to use the "low altitude" procedure, while jet aircraft that make initial penetrations from 20,000 feet or above, will follow the "high altitude" procedure.

With the new letdown book, Joe Pilot is less weighted down with bulky aeronautical publications.

Joe, still driving a Gooney, will want the "low altitude" book. When he looks inside, he'll find a much simpler instrument approach procedure. Complete information will be on one side of the sheet, including the aerodrome diagram. No more flipping of pages while in the landing pattern. And, if there is more than one procedure to choose from, it will be found on the opposite side of the sheet or on adjacent pages.

Other Features

Joe once again is airborne, but less weighted down with bulky aeronautical publications, and when the time comes for his transition to jets, he'll find his Pilots Handbook easier to use despite additional flight gear required for jet flying. (See the July issue of FLYING SAFETY for changes to Radio Fac Charts.)

Only an outline of the instrument approach will be shown, together with related bearings and altitudes. No need to show obstructions along the procedure track, since the procedure allows sufficient clearance as long as prescribed altitudes are maintained. Joe shouldn't have to add an extra thousand feet for the wife and a few for the kids. We believe that even limited cultural information, such as a few trees and telephone poles, may encourage Joe to deviate from good practice. What is good practice? To use the established letdown as an IFR procedure and not a combination of an instrument and visual technique.

In the box at the lower left portion of the chart, Joe will find all visibility and minimum altitude requirements. Air Force Regulations 55-24 and 60-16 may be referred to for more information on current USAF policy and the lowest minimums permissible for operations.

If Joe is going into an unfamiliar field and he wants to refer to a sketch prior to landing, the aerodrome is "laid out" on the lower right portion of the chart. Some pilots say you need an outline of the aerodrome, others say you don't. Nevertheless, to provide information needed for landing, this diagram does show the runways, the associated taxiways, approach lighting and critical obstructions around the aerodrome.

One more time Joe has made a safe instrument approach and landing, only this time without juggling a cockpit full of bulky publications.

More Facts

You may be wondering why the small size charts (5 x 8½) you now receive are printed on 8 x 10½ pages. This is the first step in converting the Pilots Handbook to the new format. We have to revise all existing charts to the new format before the smaller size binders may be issued. Conversion should be completed and charts issued in the smaller size during the early part of 1957.

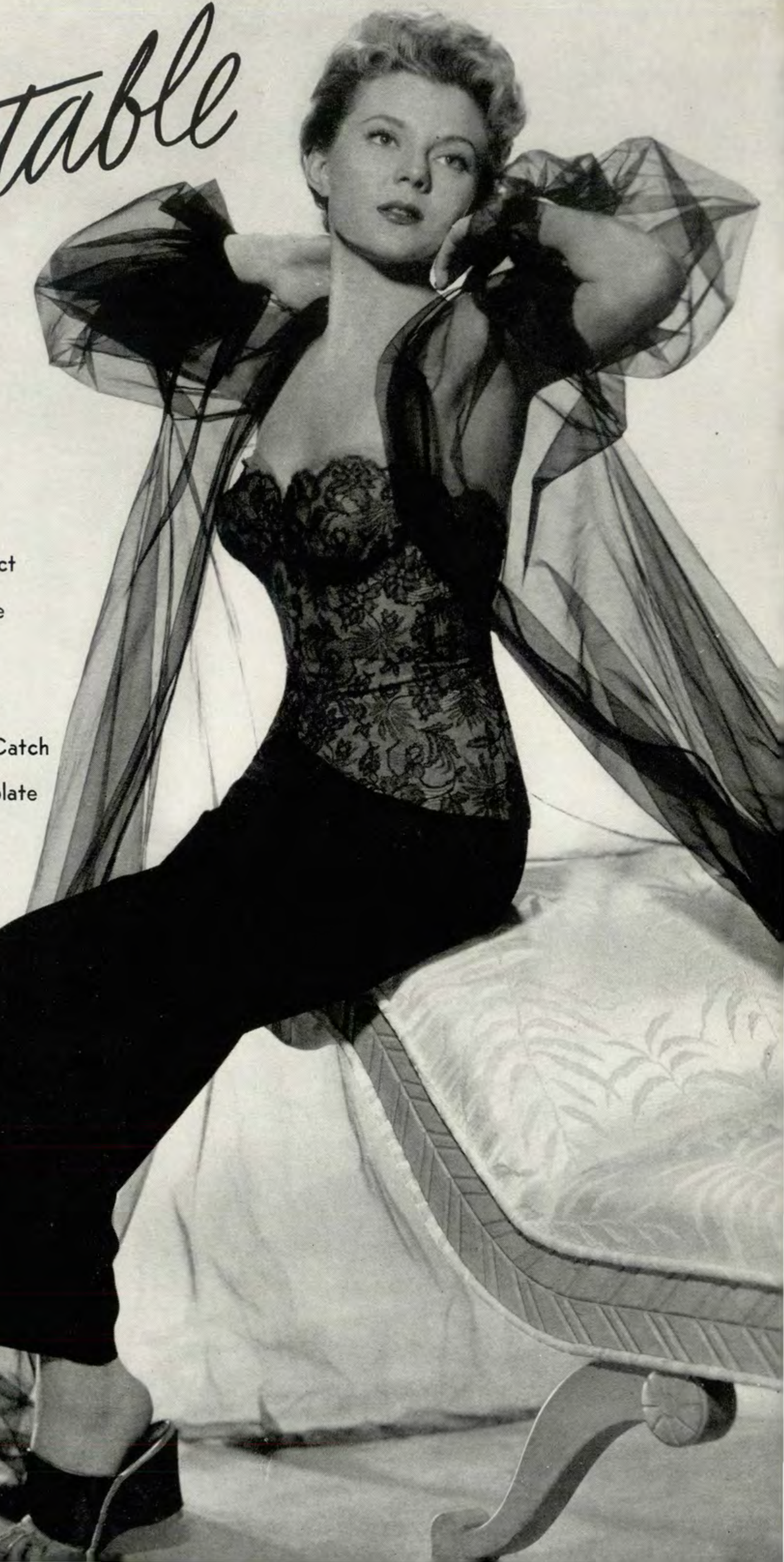
In the meantime, some question exists as to the type of binder that will best suit the needs of the user. Some have requested that we retain the loose-leaf principle while others have indicated a preference for a bound type Pilots Handbook.

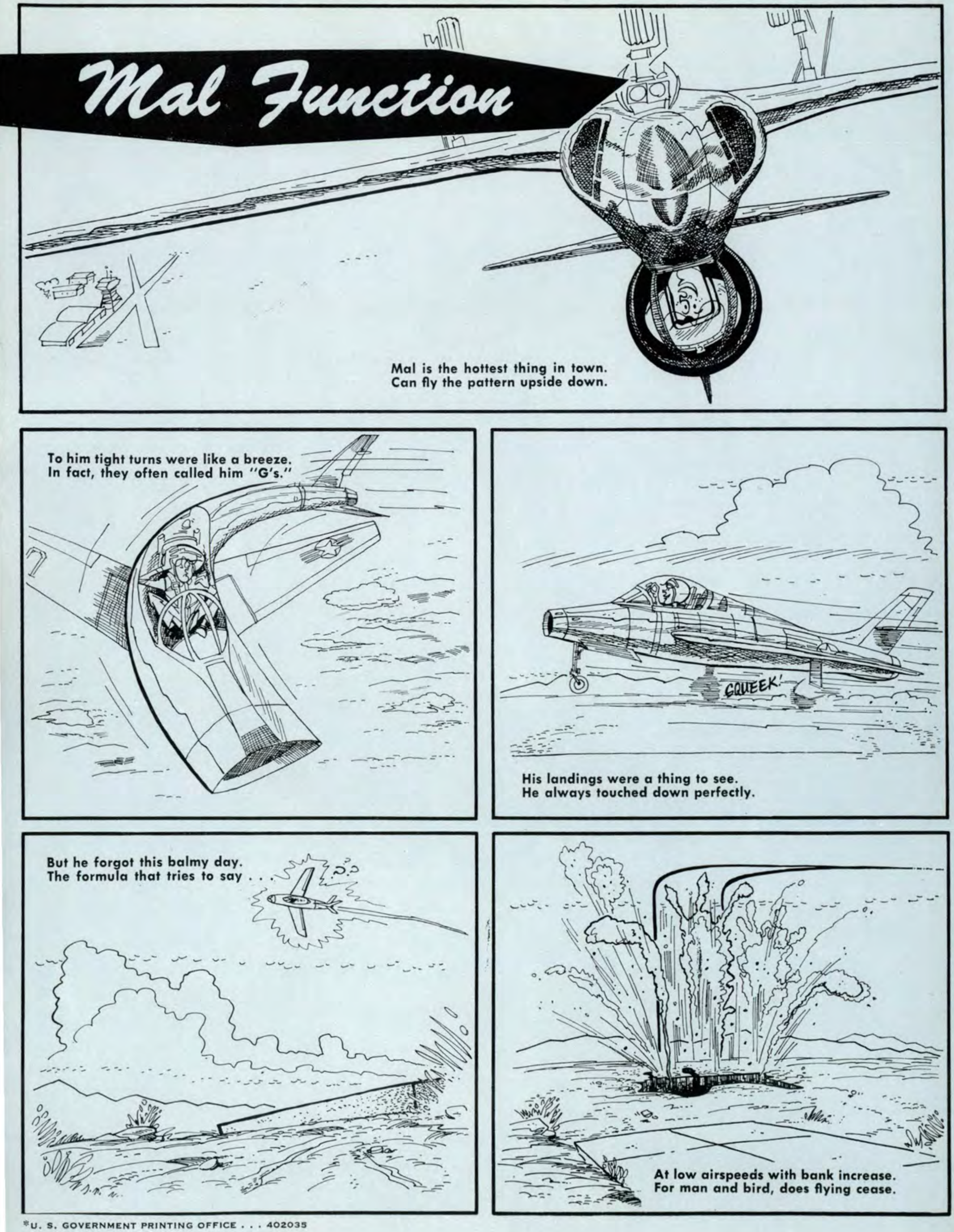
Preliminary plans call for issuance of the new small loose-leaf book for use in the FEAF and USAFE areas during the latter part of 1956. During the same period, both the loose-leaf and bound type Pilots Handbook will be issued in the FEAF area. Headquarters USAF has authorized the issuance of the two types in this area for a period of six months in order that both methods may be thoroughly tested and evaluated. You should know the results early in 1957. Issuance of one of the two types of binders will be Air Force-wide.

Regardless of the aircraft type or mission, the new Pilots Handbook should make getting "Down to Earth" an easier process. ●

Predictable!

How successfully could you predict
The whims of this little doll? More
Important, what are the odds on
Successfully forecasting the moods
Of another gal, Mother Nature? Catch
The story on page 4 and contemplate
Your chances when you place too
Much store in a weather forecast.





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