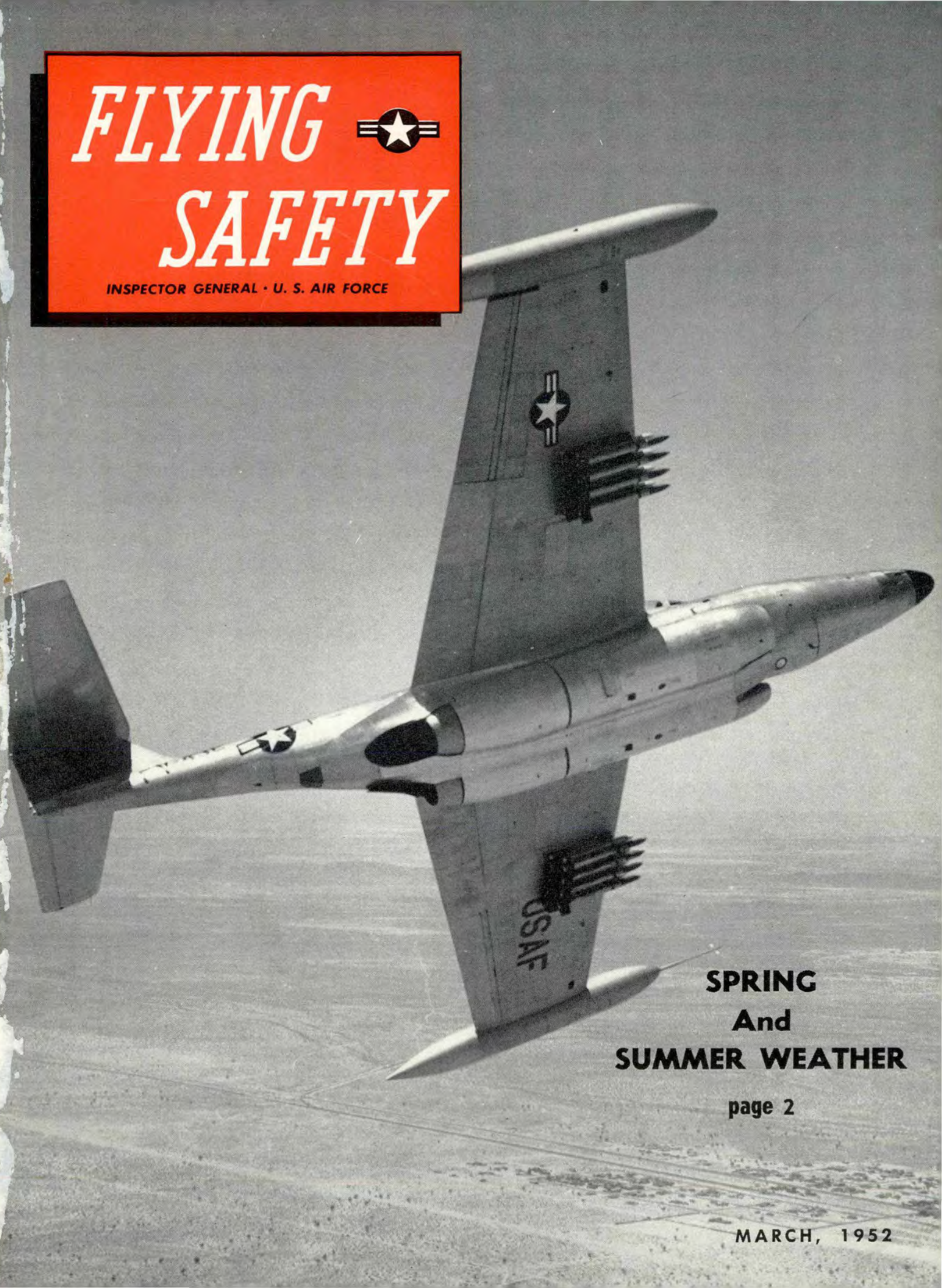
FLYING SAFETY

INSPECTOR GENERAL · U. S. AIR FORCE



SPRING And SUMMER WEATHER

page 2

MARCH, 1952

TELL THE *Truth!*

A FEW years ago there was a very popular song entitled "Little White Lies" making the rounds of the jukeboxes, phonographs, radios and bandstands. (Television was still a thing of the future.) In this ballad, the singer, evidently a masochist, bared his broken heart to an ex-lover and in so doing invited the millions of listeners to join in his sorrow. The fractured heart, of course, was a result of those lies told by the object of the singer's affections, — told with only the moon as a witness.

People are supposed to die of broken hearts, so we can't doubt that the lies were fatal, even though they were little and white. We wonder what would have happened if they'd been big and black, like some people tell.

Who tells big, black lies? Well, first what is a big, black lie? You might define it as a falsehood which will do serious harm of some sort to another person. The harm might be physical, financial, mental—or perhaps it would only hurt a reputation. Just so it hurts.

Some pilots tell big black lies. Occasionally they think they're telling little white ones without realizing just how large and dark they really are. They think they're not hurting anyone, but actually they may be sending fellow airmen to their deaths, or at least driving a nail in the proverbial coffin.

You ask how that can be? The way we have in mind right now is through "non-cooperation" with aircraft accident investigating boards. If a man who has had an accident or who has witnessed an accident tells a little, white lie—thinking he is covering up for himself or a friend, he may, in effect, be helping to cause another accident. And there's really no reason for it.

The purpose—the *only* purpose—of an aircraft accident investigating board is to determine what caused the accident so that appropriate action can be taken to prevent similar accidents to others. Needless to say, if the true cause of the accident is not discovered, then proper preventive action cannot be taken and the efforts and actions of the investigators have been wasted.

Usually, the reason those involved in accidents tell lies (and right here let's get it straight that only a very few fail to tell the truth) is fear of punishment or reflection on professional ability.

The first of these is completely groundless. The purpose of the investigating board is given above and AF Reg. 62-14, par. 46, prohibits the use of the board's proceedings or findings for any other purpose than accident prevention. No statement, testimony or data obtained during an accident investigation may be used in any action concerning discipline, pecuniary liability, line-of-duty status, revocation of commission, demotion, etc.

As for the possibility of a reflection on professional ability, there are two choices. The airman can lie to cover up his own failure, or he can disregard himself and consciously try to help in the prevention of other accidents. He can't do both; which he chooses is up to him. It does seem though, that the lives of fellow flyers should be pretty important.

Remember that where accident prevention is concerned, no lie is harmless. It's much better to tell the truth.

IN THIS ISSUE

Comes now the season when old man weather begins to relax his icy hold upon the land, at least in the northern hemisphere, and joins forces with Thor. These two combine their talents for several months each year to throw into the paths of innocent aeronauts the flying hazard known as THUNDERSTORM. Some claim that this is the worst of weather hazards, regardless of season. Others place the thunderstorm second to icing, while many conclude that there is little to choose between the two. It behooves every pilot to get himself ready to cope with these monsters of the sky. For further information on this subject, see "Weather—Spring and Summer," page 2.

If by the time you read this, the shooting business in Korea is not a thing of the past, then you jet fighter pilots who are still mixing it up should be happy to read Quality in the Cockpit. The story which starts on page 10 concerns the combat training program at Nellis AFB. You should draw comfort from the fact that graduates of this school are getting the finest training possible.

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WELL DONE

The feature, "Well Done," which we started in FLYING SAFETY over a year ago has proved quite popular, if the number of contributions can be used as a measure of popularity. We're getting quite a few recommendations that individuals be made the subjects of "Well Dones," and we're very happy to get them. One result of the increased number of recommendations is that henceforth we'll be able to be a bit more selective . . . some months we might even be choosy. But there will be a reward for the man who does make our "Well Done" column. He will get the original art work from which the engraving for FLYING SAFETY is made, suitable, we hope, for framing. Also, Brig. General R. J. O'Keefe, Director of Flight Safety Research, has indicated that he desires to write a personal letter of congratulations to each "Well Done" subject. No doubt a copy of such a letter would find its way into the recipients' official records.

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CORRECTION

In an editor's note in conjunction with a letter from Captain C. C. Posey which appeared in the Crossfeed section of FLYING SAFETY for February, we stated: "It would seem safe enough to take CAA's word for it that a VFR flight below 4,000 feet above the terrain in ADIZ's should not be considered a controlled flight." This is not so. A subsequent ruling from the Office of the Deputy Chief of Staff for Operations states that for Air Force pilots such flights are to be considered controlled and will be indicated as DVFR. Clearances for such flights will be processed by CAA according to CAA Circular Letter FA-218, dated 10 May 1951.

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COVER

USAF's F-89 banks sharply for rocket firing test run. Plane is also equipped with 20 mm. cannon. Radar equipment insures all-weather operation.

Flying Safety

DEPARTMENT OF THE AIR FORCE
THE INSPECTOR GENERAL, USAF

Major General Victor E. Bertrandias
Deputy Inspector General

DIRECTORATE OF
FLIGHT SAFETY RESEARCH
Norton Air Force Base, California

Brigadier General Richard J. O'Keefe, Director
Lt. Col. John R. Dahlstrom, Supervisor of
Flight Safety Publications

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Editor
Lt. Col. L. G. Taylor

Art Editor
Capt. F. M. Edwards

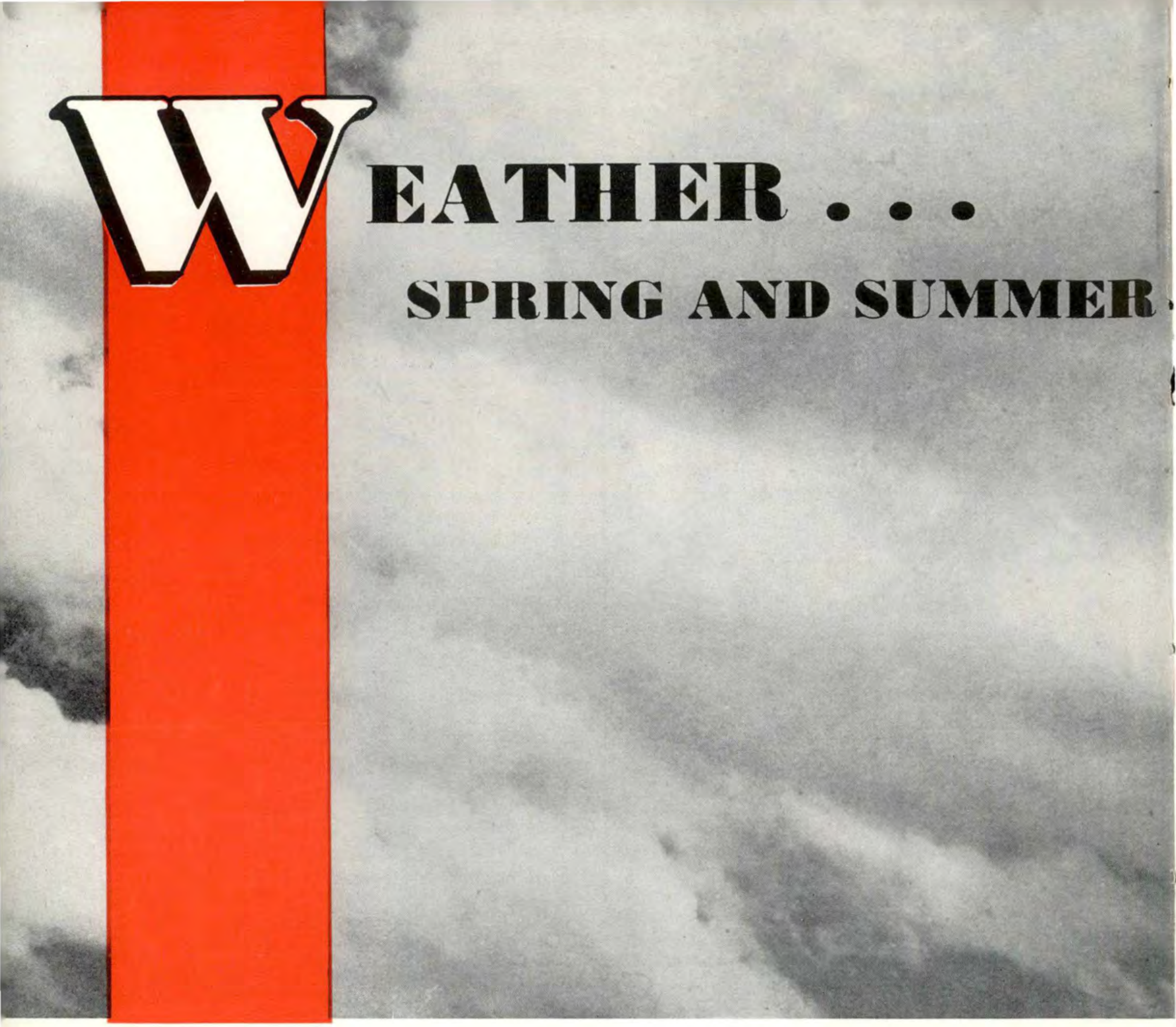
Associate Editors
Capt. Ben H. Newby
1st Lt. Edmund F. Hogan
1st Lt. John H. Moore

Circulation Manager: M/Sgt. William C. Hautz

The printing of this publication has been approved by the Director of the Bureau of the Budget.

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 FLYING SAFETY magazine. Contributions are welcome as are comments and criticisms. Address all correspondence to the 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.



WEATHER . . .
SPRING AND SUMMER

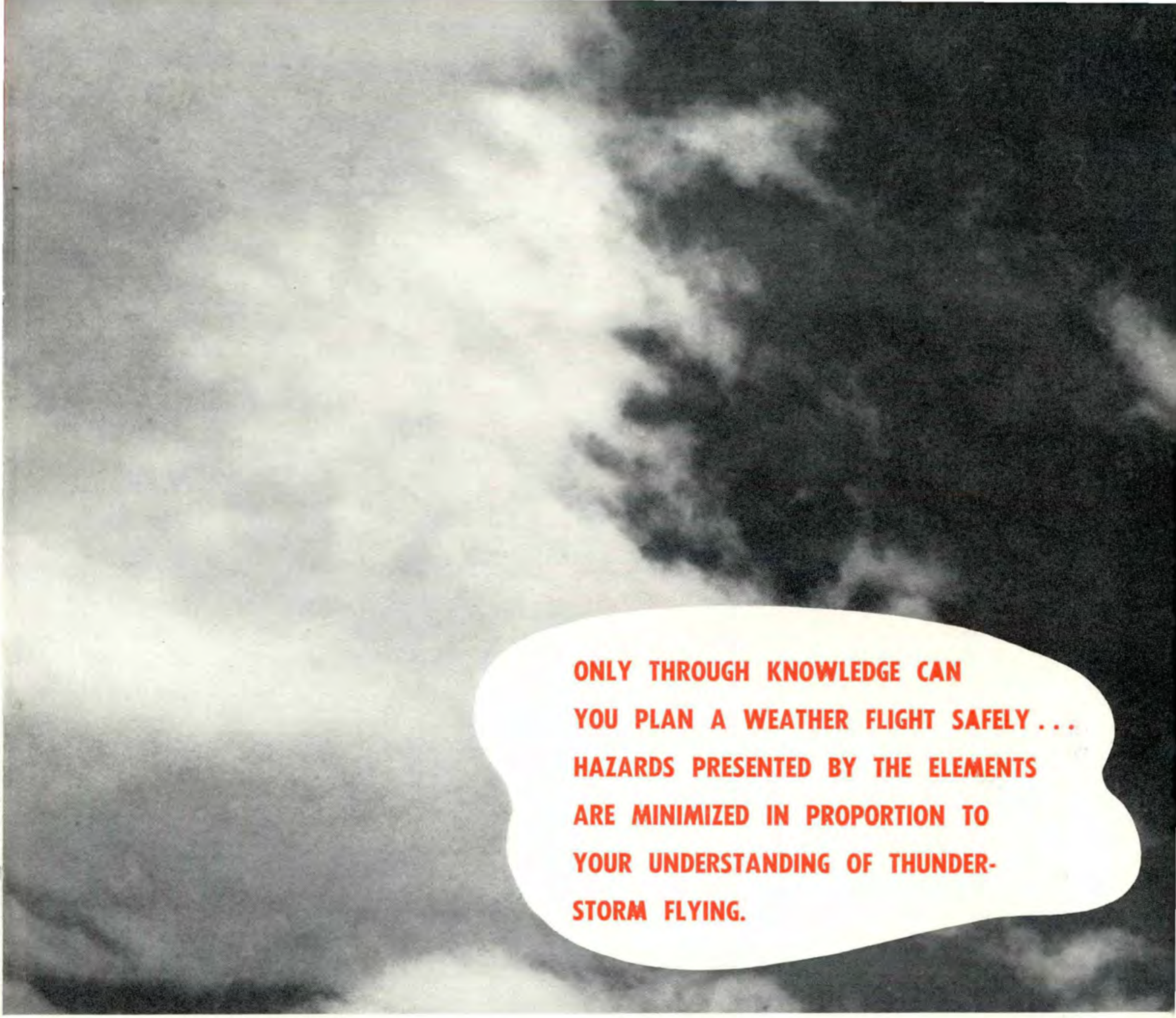
SOONER OR LATER IN THE COURSE of a pilot's flying career he will either be required to fly through a thunderstorm because of the importance of a mission, or when there is no other possible route of flight.

If it's his first flight experience it's going to be rough, primarily because he apparently will not be able to find any altitude or cockpit technique that seems smooth. But, if he keeps cool and avoids getting perspiration in his eyes, he soon finds that his fears do not result from any actual predicament at the moment. The fact is, he's afraid of imaginary dangers that lie ahead; of things unseen, and things that could happen.

Flying through most thunderstorms is rugged; the rain is heavy, there is lightning, turbulence is moderate to severe, and the dangers of ice and hail can be expected. These conditions, plus the possibility of structural damage to the aircraft in heavy turbulence and through over-controlling, call for a constant strain on the pilot himself.

However, with all things considered, spring and summer flying pose considerably fewer weather hazards to the cautious, weatherwise pilot than may be expected during the winter months. Fog is one of these hazards, but good flight planning technique will counter it as it will most of the other summer weather problems. The greatest summer hazard is the thunderstorm and it is with the thunderstorm that we are concerned in this discussion.

Quite a few hundreds of thousands of words have been written on the subject of thunderstorms—how they're



formed, what to do when you're face to face with one, what the storm is like and SOP's to follow. Before getting into the meat of the thunderstorm, it might not be out of order at this point to review generally just where and under what conditions the summer bugaboo is usually found.

TWO TYPES OF STORMS

Broadly speaking, there are two types of thunderstorms —frontal and air mass. This brings us to a condensed review of the types of weather to look forward to in various sections of the ZI during the summer season and the relationships of these air masses to thunderstorms and fogs.

Northeast coast area: This is an area of storm track convergence and cyclonic storm activity during the late winter and early spring. Also, this is an area in which storms are intensified by heating and addition of moisture over the Great Lakes. But generally good weather prevails in the summertime due to the dominating influence of the Bermuda high.

Southeast and Gulf States area: Weather forecasting for this area is difficult due to the stagnation of the southward moving front, the rapidly moving squall line, and associated thunderstorms. Frontal passages may be expected in early spring. South winds in the summer cause warm, moist air to be heated from below and convective thunderstorms occur daily. These storms are generally quite severe.

Central plains section: In this area the main summer weather hazard is presented with the formation of convective air mass thunderstorms which are quite prevalent throughout the summer. The storms usually form convectively and are very violent.

West Central and Great Plains region: The climate in this section is generally warm and dry in summer. The western mountain range, which acts as a climate barrier, has an extreme drying effect on air in the westerly circulation pattern. Maximum rainfall occurs in the spring and the chief flying dangers are found in the area of west-to-east moving frontal zones.

Southwest desert and mountain sections: This area covers lower California, Arizona, New Mexico and the western section of Texas. Here, flying troubles result from the predominance of summer and spring thunderstorms caused by air entering this area with the expansion of the Bermuda high in summer and being forced aloft at the mountains. Nearly all the mountains have thunder showers building up over them in spring and summer. The storms are scattered, but are always severe.

Now let's look briefly into the formation of a thunderstorm. First, there's moisture, which must be present in sufficient quantities. The second necessity is instability, which in combination with the moisture, contains the energy for storm development. The third ingredient is "trigger action" to start the development and this action simply consists of the lifting or heating from below.

Past research has shown that thunderstorms are composed of giant cells. There may be one or several cells in the same cloud. These cells cover a lopsided circle or ellipse horizontally over the ground. The largest dimension of the cells is approximately seven miles, and they range in height from a few thousand feet for those just starting, to more than 50,000 feet for those that have reached their peak.

Hundreds of "thunderstorm project" flights not only brought out these facts but enough data to more or less solve the mystery of thunderstorms for meteorologists and pilots.

Basically, the recommended flight procedures were to (1) get the plane ready before hitting the storm, and (2) once in the storm, fly attitude.

It's always possible to get the plane ready to fly through a storm before it is reached, since the pilot is warned of the storm's proximity by lightning and radio static. This "getting ready" means slowing down to the best penetration speed, instruments checked, lights, pitot, carburetor heat, de-icing and oxygen equipment, etc.

REMEMBER THE 180

In the light of more recent research have come more complete procedures for flying the thunderstorm. And

the first of these is to turn around before you enter the storm—unless you have to go through. The rule of 180 is still the wisest for all pilots.

Don't try to fly over the top without oxygen equipment. Before they knew better, it used to be commonly accepted among pilots that if they had the planes and equipment (pressurization-oxygen) to fly over 20,000 feet, they could usually get over any thunderstorm. They're wrong. The average thunderstorm goes above 35,000 feet. Over the top is not feasible.

However, pilots of pressurized planes flying at 20,000 feet can fly between saddlebacks and avoid any thunderstorms they see, even remaining contact most of the time. There are almost always clear pathways around the high-towering convective storm clouds.

Don't fly through the middle of a thunderstorm, if it can be helped. The updrafts and turbulence in a thunderstorm cell probably increase with height up to a level of about 10,000 feet below the maximum height of the particular cells. And of course the pilot cannot tell just how high the cell is in which he is flying.

In the average storm it is found that the greatest turbulence is around 15,000 feet, with the maximum updraft and downdraft around 26,000 feet. Generally, the updrafts are greater at all altitudes except the 6,000 feet level.

If you have to keep going, and you have any choice about altitudes, then fly through the lower portion of the thunderstorm. In both Florida and Ohio, for instance, fewer large velocity gusts per mile were found at the 5,000 and 6,000 feet levels. The maximum gust measured had a lower speed than at any other level. This is

confirmed through pilot reports which have listed a minimum of moderate and heavy turbulence at these altitudes.

Drafts, as distinguished from gusts which are short-lived upward or downward movements of air, cause systematic altitude changes even though the airspeed remains fairly constant. The strongest of these up and down drafts are, like the gusts, found in the middle and upper levels of the storm. At 5,000-6,000 feet the maximum updrafts encountered in any storms were 30 to 39 feet per second and there were only two of these. At 15,000-16,000 feet, however, 60 updrafts of that speed or higher were encountered. The same tendency is apparent with downdrafts.

This evidence indicates that instrument flights should clear for low levels if thunderstorms are expected. Over level country, if they can get 3,000-4,000 feet altitude and stay below the storm, they can usually see the worst of the storm areas.

Don't try to hold altitude in a storm. Let the gusts or drafts carry you up or down as the case may be. Be prepared to increase power if loss of altitude continues, but avoid the power increase if at all possible. More power will give more speed and turbulence will increase the stresses upon the plane.

In a downdraft you may have to put the plane into a slightly nose-dive attitude for a partial climb, but the downdrafts are unlikely to carry the plane into the ground. Although there is the danger, depending on the terrain, that they will carry the plane low enough to fly into an obstacle. Usually, the loss or gain of altitude amounts to around 500 to 1,000 feet.

AIRSPEED IMPORTANT

Proper airspeed is one of the primary safety factors in thunderstorm flying. The choice of airspeed depends upon the type of aircraft. Other factors of secondary importance are the weight and balance condition of the plane and pilot technique.

At the lower airspeed ranges, also, controllability is more difficult. An airspeed well above stalling speed should be maintained. If excessive control movements are necessary to keep level flight attitude, the airspeed must be increased.

Never turn around and go back once you're inside a storm. Most thunderstorms are small enough to go through in a few minutes. Many are less than ten miles across. An exception to this is a squall line which a pilot might hit lengthwise—it could easily be several hundred miles long.

Turning around has other disadvantages. It's a control maneuver which adds its own load to the gust load and thus increases the stress on the wings. Don't change headings in a storm or you may get lost. By the time you make up your mind to turn around, the chances will be that you're just about through the worst of the storm and it's shorter to go on through.

Fly around rain areas. If you can see rain at low altitudes when you are flying underneath, fly around it. Rain not only indicates downdrafts but also the areas of heaviest turbulence. Pilots avoiding the rain keep the advantage of visual contact. Remember, too, that heavy rain may slow down the IAS reading up to 70 mhp because of partial blocking of the pitot tube entrance.

Other general rules for flying the storm include letting the plane ride out the turbulence with a minimum of control, easing it over the rough spots. When a wing kicks up, don't overcontrol. Leave it up so long as it doesn't become dangerous; it'll roll back.

When hail is encountered, it may be at any altitude but it will be more in the middle levels of a storm. Even then the duration of the hail will be relatively small. Storms farther west, particularly in the Great Plains areas, have considerably more hail than eastern sections of the country.

In flying through thunderstorms there is rarely an occasion in which ice will accumulate enough to make safe flight impossible for a plane equipped with good anti-icing equipment. Also another reason for the lack of serious icing trouble is apparently due to the short time planes flying in storms are subject to the icing conditions. Carburetor heat usually takes care of carburetor icing in storm flying.

Lightning causes damage when it strikes, but this is no outstanding danger as yet reported. Most of the time the damage caused is confined to small holes burned in the skin of the plane, although there have been isolated cases where lightning caused major damage.

One other peculiarity of a thunderstorm appears to be the rapid surface pressure variations which can occur. Pressure may rise, stay high for several minutes, then return to its previous value. Sometimes it falls and then rises. Special studies showed in 22 per cent of the cases, if a pilot had landed during the maximum pressure with the altimeter setting given him a short time earlier, his altimeter would have indicated that he was 60 feet or more below the true altitude. If a pilot used an altimeter setting given him during the maximum pressure and landed after the pressure had fallen, in 26 percent of the cases he would have found that his altimeter still read 60 feet or more above the true altitude after he was on the ground. On two occasions the instrument would have read over 140 feet above the true altitude when he landed.

USE RADAR EYES

A new technique, the use of radar to see what's ahead in a storm, is doing a lot to eliminate any fear of the unknown. The psychological effect of knowing when an area of turbulence is coming up aids in better control of the plane. Aircraft equipped with radar can go around the radar echoes caused by thunderstorms. Although you *can't* "see" every detail of a storm on the radar scope, weak spots can be detected.

A considerable difference exists in the average magnitude and spacing of gusts within and adjacent to the "echoes." The gusts encountered within the radar echo are approximately four or five times greater than the gust velocity outside of the two-mile range of the echoes. Consequently, the area of the radar echo should be avoided. Radar shows the orientation of the storm in the case of fronts or line squalls, making it possible to "see" the smoothest way through.

There is no doubt that proficiency in instrument flying techniques following through to good flight procedures will do away with the burden of fear and uncertainty so often encountered by the pilot who has never had to fly through a storm. The use of proper flight planning, plus the full use of weather facilities, is the answer to better weather flying.

Where fog is anticipated in Spring and Summer flying, it's a wise pilot who chooses some good alternates —selecting a field where GCA is available.

Icing will be minimized if you use the anti-icing and de-icing equipment as recommended for the plane you're flying. Thunderstorms will always be a hazard to avoid or treat with respect. In flying through most storms, it's easy to control the plane and keep a reasonable altitude and heading. Any pilot who can fly well on basic instruments and does not become overly excited by lightning flashes and turbulence can fly safely through a thunderstorm with tactical military planes.

PIREPS

Don't keep it a secret—the weather, that is. Forecasters can depend only upon a few scattered upper air sounding stations for weather information at flight levels. For a complete picture, the weatherman must depend upon pilot weather reports.

Right here is where you enter the picture. Certain key USAF installations have direct VHF facilities for communication between the forecaster and pilot on Channel C which can be used for important weather data.

Anyway, you give the weather poop during flight and you may even profit from your own reports. The information you provide may affect the forecasts made for the route, and terminal of your own flight. Your reports will enable forecasters to provide more accurate weather information to fellow airmen traveling in the same area.

Rumormongers are slandering the "old reliable" T-6. They say it's dangerous...

IN A SPIN

FOR YEARS VARIOUS AIR FORCE AIRCRAFT have had labels slapped on them describing real or fancied flight characteristics that pilots disliked or distrusted. Occasionally these labels were true and corrective action was taken to eliminate the condition. Usually, however, the faults are attributable to poor flying technique on the part of the name callers. Any unfavorable reaction of the aircraft to this lack of flying ability was magnified beyond all proportion by the countless hours of hangar flying and professional gossip exchanged by pilots. Gradually the aircraft built a reputation for having certain features that demanded super flying skill as it was unsafe for the average pilots to perform some standard maneuvers in it.

The latest on the list seems to be Old Reliable, the T-6. Singled out for special attention by Dame Rumor is the T-6G model.

The story making the rounds is that the G model won't recover from spins properly and that there is some mysterious difference between this and earlier models of T-6. Research discloses that the only basic differences in the G and other models are that some additional fuel has been added and a radio compass installed in the G series. The total weight of the added gas and the compass amounts to 250 pounds and changes the CG approximately 2 per cent MAC.

The possibility that the extra fuel and compass weight might have had some effect on the spin characteristics was disproved by tests conducted by experienced ATRC pilots at James Connally and Goodfellow Air Force Bases.

These tests, a series of spins with the extra fuel added to and left out of the tanks and with one tank full and one empty alternately on both sides, were made with the compass and loop both installed and removed. They demonstrated that there was no appreciable difference in the spin characteristics of the T-6G from other models. All recoveries were made using a standard spin recovery technique.

T-6s, like all aircraft, display certain individual flight characteristics such as minor rigging differences and small changes in alignment due to normal wear and tear. These differences, which might cause one plane to take 1½ turns for a complete spin recovery while another will recover in 1¾ turns, are certainly not noticeable enough to cause apprehension to any pilot or student pilot. The additional weight of the T-6G will produce a slightly lower rate of climb at climb power settings.

Investigation of recent fatal accidents caused by spinning in has shown that many students and pilots are starting spin practice and acrobatic maneuvers that can develop into accidental spins at altitudes below prescribed minimums. Accident investigation boards recommend that entry into spins be made from a minimum altitude of 8000 feet *above the ground*. Students and pilots should be familiar with the terrain elevation in all practice areas to insure against starting spins from below a safe altitude. Board findings also show that faulty recovery technique, panic and impatience in waiting for control reactions have contributed to spin fatalities.

Several pilots witnessed one accident in which the student pilot recovered from the spin but came out in a steep vertical dive. He pulled up sharply, causing a secondary high-speed stall and hit the ground before he could get the aircraft under control. His mistakes, which culminated in a fatal accident, were made in allowing the plane to spin too low (regulations called for him to bail out if recovery was not effected at 3000 feet above the ground), overcontrol on the recovery thereby entering a steep dive and an abrupt pull-up resulting in a secondary stall.

A spin is just another flight maneuver and should be regarded as such and not as some complicated or dangerous operation demanding super flying techniques. Plenty of practice is necessary to attain proficiency in spin recoveries, just as practice is necessary to learn the proper execution of lazy eights, slow rolls, barrel rolls or Immelmann turns.

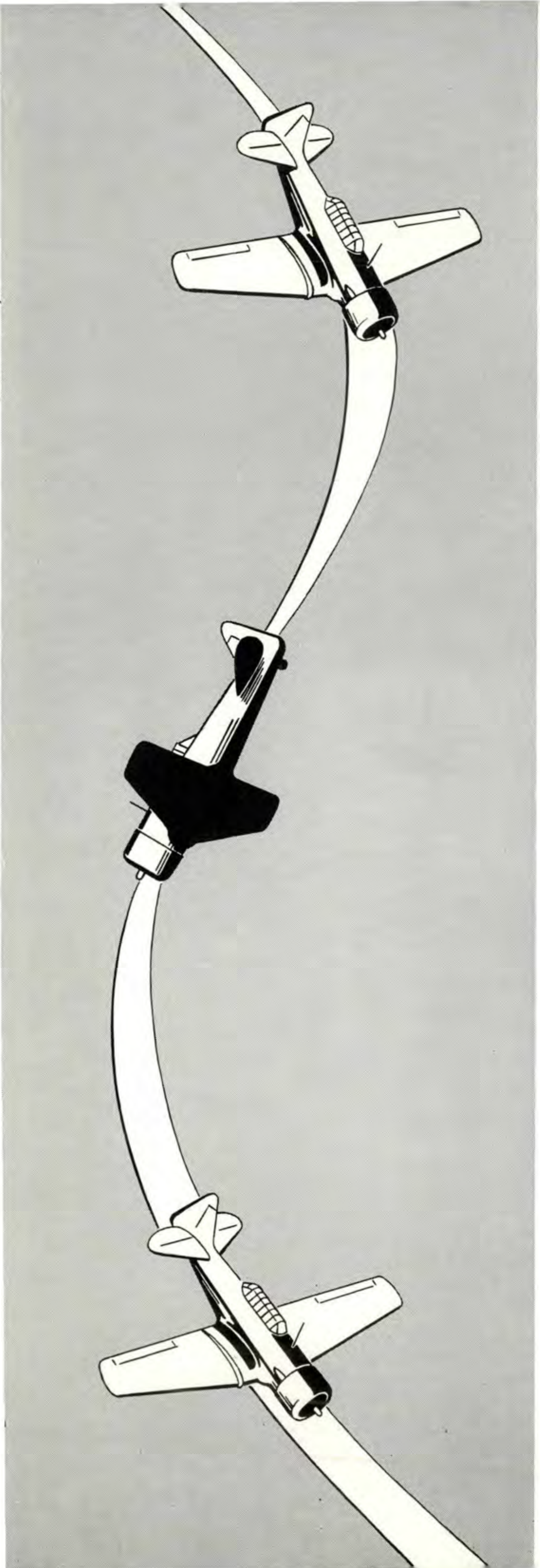
Some of the more common errors made by students and pilots in spins include:

- Starting the spin at too low an altitude;
- A poor entry resulting in a sloppy or aggravated spin;
- Failing to hold the controls full in with the spin;
- Negligence in keeping the ailerons in neutral during the entry and spin;
- Forgetting to wait a half turn after applying opposite rudder before bringing the stick forward;
- Failing to neutralize the rudder after the spin has stopped;
- Overcontrolling the forward motion of the stick in the recovery;
- Indefinite or weak control movements instead of brisk, positive control motion, and,
- Abrupt pull-ups causing secondary stalls and mushing.

The entry into an intentional spin is made with the mixture rich, 1850 RPM, 15″ Hg., and the nose approximately 30 degrees above the horizon. As the airspeed falls off and nears the stalling point, the controls will become loose and the plane will feel mushy. Upon getting the feel of the stall approach, rudder should be led in on the side of the desired direction of the spin. When the aircraft is completely stalled, use full rudder and bring the stick straight back all the way and hold it there.

For recovery from any T-6 spin, apply full opposite rudder and after another half turn, move the stick briskly forward, keeping the ailerons neutral, to a point slightly beyond neutral. With the application of the controls, the spin will accelerate for approximately one full turn and the nose may drop slightly. The spin will stop abruptly at between 1¼ and 1¾ turns after recovery action. Hold the controls in recovery position until the spin stops, then immediately return the rudder to neutral. Slowly and smoothly apply back pressure on the stick to round out and resume level flight, then bring the throttle forward smoothly to cruise setting.

Too violent and too weak control pressures are to be avoided equally. Overcontrol can easily result in a secondary stall and possibly another spin. Abrupt pullouts caused by bringing the stick back too strongly and rapidly can result in a high-speed stall and spin, while failing to remember to neutralize the rudder when the spin



rotation stops can cause the aircraft to snap over into a spin in the opposite direction.

Weak or overly cautious movements on the controls may be insufficient to break the spin and it is then necessary to put the controls back with the spin and start the recovery all over again.

Impatience can also be a contributing factor to spin accidents. It is vital to remember that after opposite rudder and forward stick have been applied, the spin will actually *accelerate* for one full turn before it is broken. Neutralizing the rudder too soon and prematurely attempting to pull out and apply throttle will keep the plane in a spin and very likely aggravate it to greater severity.

Undue panic must be avoided when an aircraft is put into an accidental spin. Accidental spins can occur from almost any type of basic flying maneuver but especially from acrobatics, lazy eight or demonstration stalls where the airspeed is allowed to become too low and stall recognition and recovery is too slow.

Recovery from an accidental spin is made in exactly the same way as from an intentional spin with one addition. Start the recovery by putting the controls full in *with* the spin and then proceed to make a standard spin recovery.

Many students and pilots who make excellent recoveries from practice spins show poor technique when faced with an accidental spin, due primarily to the panic caused by a spin starting in an unusual position. Most important to remember when thrown into an accidental spin is, don't panic and don't hurry—think what you want to do and do it.

Most accidental spins can be eliminated if a full knowledge of the common stall warnings is developed. The T-6 has excellent stall warnings. The controls loosen up so that greater movement is necessary to get the desired flight reaction and the engine will begin to labor. As the stalling point nears, a sinking or mushing feeling develops. When the aircraft is finally stalled, a slight buffeting is noticeable and the fuselage may vibrate as the nose or a wing drops.

Ability to recognize stall warnings that foretell the imminence of a stall, coupled with proficiency in all kinds of stall recoveries, are prerequisites necessary to avoiding an accidental spin.

The T-6 has been used by the Air Force as a trainer since early 1940. During that time literally hundreds of spins have been performed in the Training Command each day. The percentage of spin accidents to the total number of spins performed in any given year has been gratifyingly small. Even so, it seems to have been sufficient to start the reputation of the airplane going downhill. Actually, of course, it's not the airplane, but pilot procedure and technique which is at fault.

Before laying the T-6 rumors away with the other hoary old Air Force legends, it might be advisable to add one pertinent fact to the discussion.

Too few pilots are attempting to get out of the aircraft when the spin has gone below the minimum safe altitudes. The obvious conclusion is that if it gets below 3000 feet—jump, brother, jump.

A combat training program at Nellis AFB insures that we get Q

A LEADING AIR FORCE TEACHER once observed that the United States won aerial supremacy in World War II not so much through preponderance of numbers as through superiority of pilots.

Insistence upon superior quality is responsible in considerable degree for the fact that our side is out in front in the race for control of the skies over Korea. Sheer accident had nothing to do with the matter of record. Producing quality in the cockpit is a deliberate undertaking, as witness Air Training Command's Jet Combat Crew Training School at Nellis Air Force Base.

Nellis, eight miles north of Las Vegas, proclaims in an official press release that its primary mission is "the training of fighter pilots for combat in jet fighter aircraft." Its success is measured by the deeds of its graduates in Korea.

The school lasts eight weeks—just two short months to finish preparing the student for the payoff in his flying career—battle. For every pilot who completes the course moves in one direction only—West to Camp Stoneman and to FEAF for assignment as a replacement to a unit in action.

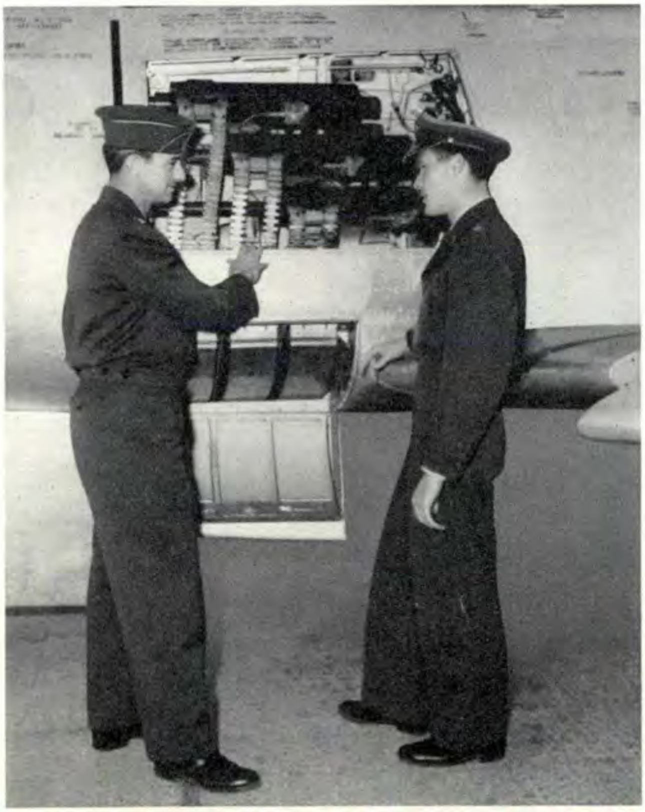
The combat crew training school opened in July of 1950, directly following the incident of the 38th Parallel. Nellis seemed the logical location for such an undertaking since it then was the site of the Air Force Gunnery School and top-drawer gunnery instructors were on hand to form the all-important cadre.

Administratively, the task of producing the best fighter pilots possible rests with the 3595th Training Wing, whose commanding officer, Col. Avelin P. Tacon, Jr., himself has a long fighter background. The 36-year-old Alabama native led the 67th Fighter Wing in England during War II and flew 89 missions in F-47s and F-51s in 300 combat hours. In tactical outline, the organization breaks down into the 3595th Training Group and five training squadrons—3597th, 3598th, 3599th, 3596th and the newest member of the family, 3594th.

Students get approximately 160 hours of instruction in the eight weeks they make their home at Nellis, divided roughly down the middle between academic and flying training. Upon reporting, they are assigned for aerial schooling to the 97th, 98th or 99th Squadrons. These are, in effect, "feeder" squadrons which give training in both F-80s and F-86s. Students move from these units into the 94th or 96th for final schooling.

Training is as realistic as any can be, short of actual combat. "The mission of combat crew training conducted by this Wing," says Colonel Tacon, "is to receive a pilot and teach him to use the jet fighter as a combat weapon in order that he might take his place in an operational fighter unit in a combat theater." And he adds:

UALITY IN THE COCKPIT



These experts discuss gunnery. Maj. Vermont Garrison, left, and Capt. John Roberts, 1950 Air Force champion.

"We are trying to turn out the best qualified pilots we can in the time allotted for this course. Our course is as realistic as we can make it and is primarily designed to teach the student to perform missions and functions that he will be called upon to perform in combat."

Since realism keynotes the training, safety considerations are of prime importance. Consider, for example, that there is a takeoff or landing every 36 seconds in an eight-hour period at Nellis and the reason underlying rigid traffic control becomes obvious.

All SOPs have been set up with safety in mind, according to Maj. Aubrey C. Moulton, flight safety project officer for the training wing. Particular heed is paid to armament safety. Guns are charged on the runway and cooled after landing. Gunnery patterns are under strict surveillance. This is particularly true on the air-to-ground range at Indian Springs, 40 miles northwest of Las Vegas. Here, a left-hand pattern is used for firing on the right range, and right-hand pattern for the left range. As a result, a pilot never points the nose of his aircraft at the control tower. The foul line has been established at 850 feet. The pilot draws a warning for the first infraction; on the second he is sent home. The rule applies equally as well to instructors. An instructor who chisels on the foul line twice is sent home and he takes his entire flight with him. For with few exceptions, such as early transition, all flying is instructor-supervised.

Pilots are required to use oxygen from the time they taxi out until they are back on the ground. There is no option, just as there is no option to play with gun switches on the range. A controller tells when the switches will be turned on and off. Drilled into pilots, too, is the need to keep their heads out of the cockpit. Because every flight is subject to being bounced by another flight at any time, students must be able to activate anything in the cockpit by feel. A blindfold check is the proof.

It may sound strange but food plays an important part in the safety program. Investigation of accidents that had occurred in the morning, Major Moulton says, disclosed that 60 per cent involved pilots who had failed to eat breakfast. The traditional morning meal of coffee, doughnut and cigarette having been found wanting, pilots now are urged to eat a substantial breakfast. In addition to this, each squadron has a small refrigerator where pilots may store lunches for the noon meal.

All pilots are required to wear G suits but the point is emphasized that this attire does not constitute license to tear the aircraft apart. Still, because aircraft used in this type of training inevitably are subjected to heavy G loads, every airplane is inspected thoroughly after each mission for evidence of over-stress.

Proficiency in recovering from unusual attitudes must be demonstrated to an instructor's satisfaction in a T-33

Check and double-check are by-words. Here, Sgt. Harry Bodington and T/Sgt. Jack Malone go over F-86 tiptank.

Korea vets—Capt. Little, Lt. Sweatman, Lt. Schneider—and fourth instructor—Capt. Luksic, 18½-victory WW II Ace.

before the student is permitted to make a night cross-country. And each student undergoes an instrument check while he is in school. Every instrument check pilot is a graduate of the jet instrument school at Tyndall AFB, but, says Major Moulton, "we could use more quotas."

About half of the instructors are Korea returnees. Besides their flying duties, instructors must take their turns as range officers, mobile control officers, tower officers, members of faculty and investigating boards and as crews for tow target planes.

To assure that training stays current, the school has a policy of sending instructors to FEAF on temporary duty to fly with combat units and acquire first-hand knowledge of tactics employed in the air war over Korea. Their reports are invaluable assets to training.

Maj. Robert H. Knapp, currently inspector of training and operations for the Wing, was among the first to go out under this program. He spent 60 days in Korea and Japan studying combat crew training methods and in the process covered the 8th, 18th, 49th and 51st Fighter Wings. He returned with recommendations for the kind of realistic training students receive now. The Knapp proposals were incorporated, or were in the process of being incorporated into the program within a month of his return.

He proposed first that the training include ground attacks of tactical targets under direction of an airborne or ground forward controller, simulating frontline troops and installations in close proximity to friendly troops. He urged tactical air-to-air camera attacks against bombers and fighters under direction of a controller; bomber escort and tactical reconnaissance; maximum fuel and armament load missions, and other aims designed to produce the qualified replacement in the fighting zone. Effects of the Knapp report can be found throughout the eight weeks' course, which is divided into four phases of two weeks each.

Generally speaking, students come from two sources: young pilots who have won their wings recently, and World War II pilots who are being brought up to date in jet combat. All students arrive at Nellis from Williams AFB in Arizona, where they are given a minimum of 20 hours in jet transition. The first phase at Nellis, flown in F-80s, consists of familiarization, instruments and formation. In the next two weeks the student flies air-to-air and air-to-ground gunnery missions.

At the halfway point in the course the future of the student is determined. Those who show aptitude for close support work are moved into the 94th Squadron for their final four weeks in F-80s. Those whose talents lie in the direction of air-to-air engagements are given two weeks of training in F-86s in the squadron to which they are assigned, then are moved up to the 96th Squadron, where they spend the final two weeks brushing up on Applied Tactics.

Experience level of instructors is extremely high. A case in point is Maj. Vermont Garrison, Commanding Officer of the 3596th Squadron, whose 2852 hours include 1184 hours of jet time. A World War II ace who scored 11 victories, Major Garrison served with the famed RAF "Eagle Squadron" before shifting to the 4th Fighter Group after the United States entered the war. Following the war he organized the 4th's widely-known jet acrobatic team which performed throughout the nation. In 1949 he was a member of the championship gunnery

Academic training is thorough. Capt. William F. McCrystal, Jr., teaches course covering operations orders and briefings.

Realism keynotes the program in the Combat Crew Training School. The lessons learned here are put to use in Korea.

team in the Air Force-wide competition at Las Vegas. Another example is Capt. Carl Luksic, who flew with the 352nd Group in the ETO and is credited with 18½ victories. The instructors in the 3596th Squadron have flown 1791 combat missions, totaling 4787 hours, and destroyed 49½ enemy aircraft. Almost half of them are Korea returnees.

Major Garrison terms the instructor corps the "key to the program." Their experience and knowledge, plus their ability to transmit these to the students, are producing better pilots progressively.

"In my opinion," Garrison says, "when a pilot leaves here he is qualified to go into a fighter squadron. He is getting the tactical training that all too often a pilot did not get in World War II."

His opinion is shared by another instructor, Capt. Harry H. Hermann, a World War II Thunderbolt pilot, who was in action in Korea in the early days of that conflict. "After this school was set up," Hermann recalls, "we began to get fine replacements. The school also eliminated the need for each unit setting up its own RTU, which saved men and equipment needed for the fighting. I'd say," he adds, "that when a pilot leaves here he's well up on fighter tactics and has the necessary flying ability."

Dovetailed into the flying schedule is the academic training. The ground school director, Maj. Bryce McIntyre, flew 28 missions in Korea with the 18th Fighter-Bomber Group before he was shot down and rescued by Marine helicopter. Of his nine instructors, five flew in Korea.

Students receive approximately 75 hours of academic training. And of the large number who have studied in the classrooms, there has not been a single failure. Even the instructors go to school. Special courses for them have been devised by Vernon L. Stradling, a civil service employee and former school superintendent. A Reserve pilot, Stradling also set up the testing system being used.

Students: Lt. Col. Keyes and Lt. Bateman, left, flew in World War II; Lts. Mayo and Hochhalter won their wings in 1951.

Because the training program is designed for maximum realism with combat as the eventual goal, it cannot be accident-proof. They have had accidents at Nellis, possibly too many. But accident prevention is no lightly regarded matter. Their one aim is to produce quality in the cockpit—combat quality. And there are no shortcuts in the procedures which are utilized in reaching that aim. For example, each mission is briefed as a combat mission and the instructor-flight leader's checklist covers 18 separate items, each of which is given more than passing mention.

It makes sense that a pilot thoroughly familiar with himself, his equipment and his mission will, in the long pull, be relatively accident free. This is fully realized in the Combat Crew Training School at Nellis AFB, and every effort is bent toward making lasting team mates of Safety and Proficiency.

THE PARA

ANYBODY CAN PUT ON A 'CHUTE YELLS EDDIE BRACKEN, WHO SHOWS HOW SOME PEOPLE MAY DO IT.

"Just start off this way . . ."

"an' keep goin' . . ."

"What's this about inspections?"

"OWWWWWWwwwww!!"

"Easy . . . only took me twenty minutes . . ."

CHUTE PUZZLE

BRACKEN needs a briefing and the chances are that any passenger who gets a hop in a military plane could also absorb plenty of advice on how to get a proper fit with a parachute. What with all of the different type chutes in use throughout the USAF, even rated men who are checked out and familiar with their personal equipment run into trouble when an emergency allows too little time to get into and adjust a parachute. Obviously every eventuality cannot be covered in a short briefing for passengers but the main points can. And it is necessary to show men how to put parachutes on—to have their chutes at least prefitted—and to brief them on how and where to operate the emergency escape exits. The pilot and crew cannot jump for a passenger but they can be sure that everyone on a flight knows how to use a chute if an emergency does arise.

"This can't be right . . ."

"Where did this come from?"

"Pull to adjust it . . ."

"If ya hadda bail out ya pull this ring . . ."

"Oops! How dumb can a guy get?"

"DOC" Forecas

By Maj. CLARENCE P. TALBOT, Jr.
20th Weather Squadron, AWS

The weatherman has his limitations, too, and cooperation between pilot and forecaster should be more like the relationship between patient and doctor.

AT FIRST GLANCE, ANY SIMILARITY between a weatherman and a physician seems too obscure to mention. Since relatively few people understand the limitations which confront the modern weather forecaster, the tendency is to give too little credit or to expect too much where the weatherman is concerned. The medical profession, on the other hand, is well established and, for the most part, very highly regarded. Where, then, is the similarity?

When the average person goes to a physician, he is usually satisfied to learn that he will improve within the next few days and to accept the doctor's advice about his condition. After receiving treatment and listening to the doctor's advice, he goes home and follows it. The patient is usually much too miserable to try to pin the physician down about trifling matters in connection with his complaint or treatment, such as "What's in the medicine?"

For the weatherman, however, this type of questioning by his "clients" is commonplace. Weather "clients" frequently demand that the forecaster specify exactly the time rain will start, or exactly the height of the top of an overcast. If the weatherman attempts to keep his forecasts within the range of reliability, he is accused of hedging. Lack of adequate weather reports and unsettled conditions often make a positive, exact statement impossible. Moreover, many pilots let the forecaster know that they have had wrong forecasts before (probably after goading a neophyte weatherman into an unwise positive statement) and regard their trip to the weather station as a burdensome formality.

A man can ignore a nagging pain in his abdomen, but a physician will see him sooner or later—if only to perform an autopsy. With the weatherman, the outcome may very well be an accident report.

Most people would no more think of being their own ter

The Weatherman Can't Cure The Weather But He Can Ease The Pain

medical diagnosticians than they would of contradicting Einstein on higher mathematics. But everyone is an amateur weatherman, if only to the extent of predicting rain when there are dark clouds overhead.

Considering the large number of guesses which are made about the weather, it would be strange if there were not occasional instances when—from the standpoint of the amateur weatherman—the experts have been "outguessed." There are times when too much information can be just as misleading as not enough. Frequently the weatherman's charts and maps indicate that the weather should go contrary to all outward appearances. In some of these cases, however, the weather refuses to cooperate with the forecaster and things happen just as would be expected from a casual observation. These are the cases that are remembered, for everyone likes to recall the time he "beat the experts." On the other hand, it is easy for the amateur weatherman to forget the times he was wrong for, after all, he makes no claim to being a forecaster.

If you catch your physician at the ballpark and tell him you have spots before your eyes, you are told to see him in his office for an examination. In a similar situation, the forecaster is invariably asked the most searching of questions about the weather at any time or place. Contrary to persistent rumor, weathermen are not a selected tribe of rheumatics with highly educated corns. Their maps and charts, confusing though they may be to the layman, were not designed for the creation of confusion. Take the weatherman away from his weather station and any remarks he may make about the state of the weather are observations—not forecasts.

All too often he is accused of "sequence forecasting," a system by which a forecaster looks at the latest weather sequence and assumes that the weather will remain the same. But the general opinion seems to be that the weatherman should get firmly oriented from his weather maps and proclaim in a resounding voice his final verdict, thereafter sticking to his meteorological guns.

Take a parallel case with a physician where the patient is reasonably presumed to have pneumonia. Would the patient insist that his doctor never examine him again, but continue to rely on the original diagnosis throughout the entire period of illness? Could the patient be so sure of his doctor's opinion as to ask the physician to leave the medicine and not bother to return? The weatherman, too, must keep checking for "complications" and revise his diagnosis accordingly. No pilot in his right mind should ask the weatherman to be so opinionated as to bet the pilot's life without checking his opinions. For the weatherman, in certain weather situations, may be very well betting the pilot's life on the accuracy of his forecasts.

In other ways, too, the physician is luckier than the weatherman. When a patient visits a doctor, he is usually under a stress and not too likely to be critical. When a pilot enters a weather station, however, he is normally in the pink and raring to get into the blue. Naturally, he will be critical of any weather information which runs contrary to his desires.

As a final touch to the uneven comparison, there is the old story: while the physician can usually help his patient, the weatherman cannot do very much about the weather.

It should not be supposed that research into methods of improving weather forecasting is being neglected. Almost without exception, forecasters are constantly devising new and promising theories and discarding disproven ones. Forecasters devote much off-duty time to attendance at seminars for the interchange of ideas and the discussion of weather problems for the purpose of improving weather service to their "customers."

Although weather forecasting is one of the newer sciences and its operations must often be carried on with equipment designed for other purposes, it has been said that if meteorologists cannot give the service demanded by the using agencies they should close up shop and go home. If the weatherman can state honestly that he has much the same limitations as the physician, is there any more justification for labeling weather service useless than there is for declaring the medical profession obsolete?

Cooperation between pilot and weatherman should be much the same as that between patient and doctor. Through such cooperation both will benefit. Recognizing the limitations encircling the forecaster, the pilot should expect no more than the weatherman is equipped to give. After a forecast is received, the pilot should follow it as he would a physician's advice, expecting it to be reviewed and perhaps changed in the light of later developments. The weatherman, in turn, profits from the pilot's experience with weather in actual flight.

Just beyond the horizon may loom vastly improved weather techniques, electronic computing devices and other inventions of which the present-day weatherman does not even dream. Meanwhile, weather is here to stay. The accuracy of the weather information which pilots receive will continue to depend largely upon what they ask of the weatherman and how they use the information he gives them.

THE G VERSUS YOU AND YOUR AIRPLANE

Jets and their pilots are built to withstand stresses; but there is a limit to everything. Men and machines are no exceptions.

THE OLD ROMAN POET, HORACE, once observed that the man who makes the experiment deservedly claims the honor and the reward. But were the ancient bard penning his sage commentary with the modern jet pilot in mind, very likely he would qualify the premise. He would note perhaps that today's Lochinvar of the blue might better waive experimentation until he was thoroughly familiar with the characteristics of the two agents required for jet flight—Man and the Machine. Else the toiler in the laboratory of near-sonic flight might discover his honor and reward to be of posthumous nature.

Admittedly, the old saw about repetition being the mother of learning is more than slightly shopworn. But nonetheless, it is pertinent to the continued carping that jet pilots can live longer and reduce contributions to scrap metal heaps if they know and observe the endurance limits of their machines—and themselves.

Webster defines limit as "that which confines, ends or bounds." Two principal considerations confine the jet machine. One is compressibility; the other, G forces. And this latter consideration is the wall that restrains operation of the jet man.

In the good, old days of aviation, the red line on the airspeed—if there was one—was fixed solely by structural limitations. The speed of modern jets, however, is limited both by structural limitations and compressibility effects. The approach of compressibility is easily measured by the Mach number which, briefly, represents the ratio between the speed of the aircraft and the speed of sound. As the airplane reaches toward the speed of sound, the airflow at some point on the aircraft's surface arrives at that point first. This is not as complicated as it seems at first glance. What happens is this:

The aircraft's thickness forces the air to flow around it in something other than a straight line. This air travels farther than the straight line between leading edge and trailing edge of the wing. Consequently, it moves faster with respect to the wing than the straight line between the two points. Thus, when the aircraft gets quite close to the speed of sound, the speed of the air flowing around the airfoil has, in fact, already reached sonic velocity. In modern jet fighters this usually occurs at Mach .8 or .9 for the aircraft. This means that when the machine is flying at eight-tenths or nine-tenths of the speed of sound, the air is flowing over some part of the plane's surface at Mach 1. It is then that the effects of compressibility become noticeable.

Aircraft with thin, swept-back wings are capable of generating much higher airspeeds before the local airflows over the wings reach sonic velocity. Very modern models, such as the F-86E, have appreciably reduced compressibility effects as compared with their straight-wing forerunners. But design features for straight wing types—and this discussion is concerned primarily with these—merely delay the effect of compressibility, causing it to occur more gradually. They are not the cure-all.

Wartime conventional fighters tended to pitch down when they reached compressibility. Modern jets do just the opposite; they pitch up—again, with the exception of the very high speed, very thin wing type. At altitudes above 25,000 feet, the pitch-up is less severe than that which occurs upon reaching compressibility at a point below 15,000 feet. Further, the pitch-up at altitude is overcome more handily, normally with forward stick pressure. This fact could lull pilots into a sense of false security. Compressibility below 15,000 feet can be accompanied by a pitch-up so violent it will tear off the wings.

In the final analysis, compressibility occurs or does not occur as the jet man wills. For this reason, flight technique is of utmost importance. Two instruments are invaluable aids to the pilot—his airspeed indicator and Mach meter. A third vital instrument, the accelerometer, is concerned primarily with G forces, which will be discussed subsequently.

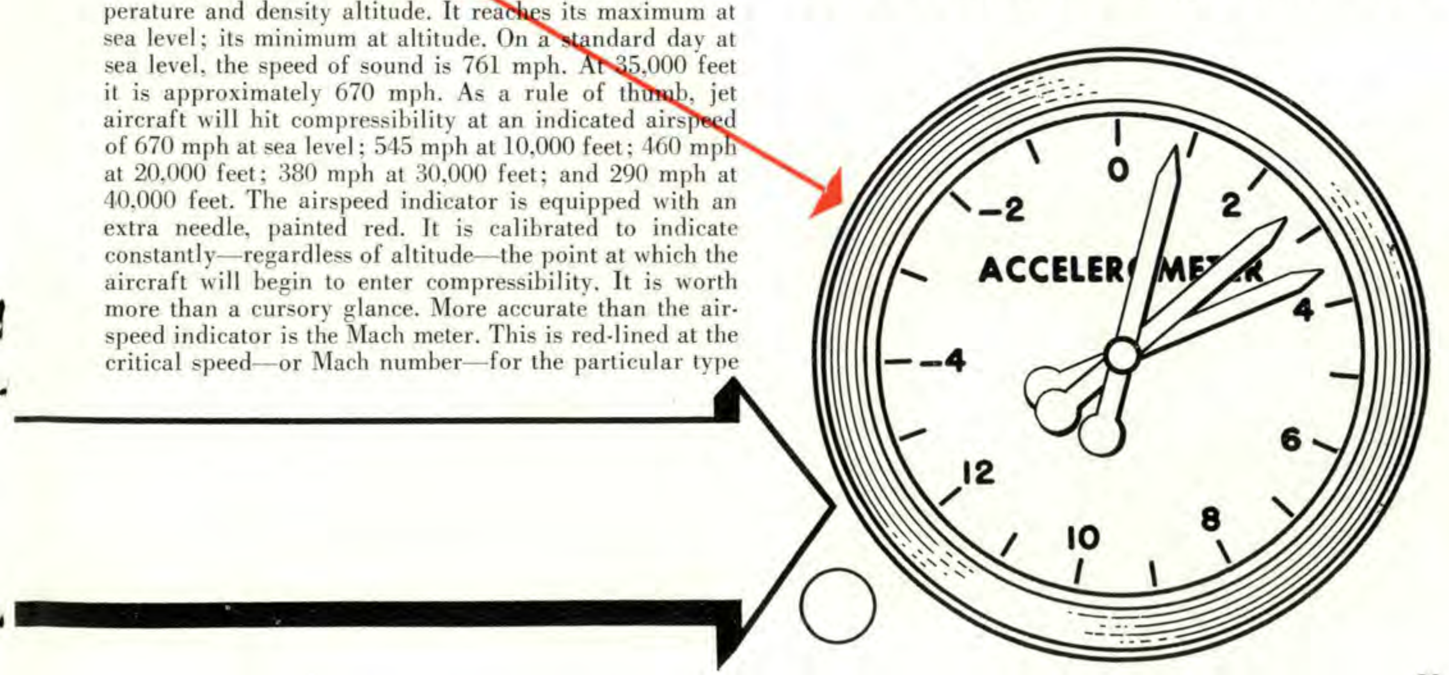
The speed of sound is not constant. It varies with temperature and density altitude. It reaches its maximum at sea level; its minimum at altitude. On a standard day at sea level, the speed of sound is 761 mph. At 35,000 feet it is approximately 670 mph. As a rule of thumb, jet aircraft will hit compressibility at an indicated airspeed of 670 mph at sea level; 545 mph at 10,000 feet; 460 mph at 20,000 feet; 380 mph at 30,000 feet; and 290 mph at 40,000 feet. The airspeed indicator is equipped with an extra needle, painted red. It is calibrated to indicate constantly—regardless of altitude—the point at which the aircraft will begin to enter compressibility. It is worth more than a cursory glance. More accurate than the airspeed indicator is the Mach meter. This is red-lined at the critical speed—or Mach number—for the particular type of aircraft. It relates airspeed in terms of Mach value and serves as an excellent cross-check on speed.

The accelerometer tells the story of G forces—that second limiting factor in the operation of the jet machine—being imposed upon the aircraft. It is red-lined at the various critical G forces by a red needle.

The force of gravity equal to the weight of the aircraft is expressed as G. This is a 1 G force. At 4 G's the force of gravity is four times the weight of the aircraft. Jet aircraft are built to withstand great stress loads. Generally speaking, except for shock loads jet aircraft can handle a limit load of 7.33 positive G's in their clean configuration. But design specifications provide a safety factor of 50 per cent, which means that the load could go as high as 11 (positive) G's. A limit load of 7.33 (positive) G's is considered sufficient for the modern aircraft to do its job.

The manner and direction in which forces are applied in relation to the aircraft and the body are of prime importance. When the force is directed from the head to the feet, the G is said to be positive. When the force is directed from feet to head, the G becomes negative.

If an aircraft is designed for a limit load of 7.33 positive G's, it should permit this number to be pulled as often as desired without damaging the aircraft. Wrinkles and popped rivets result when the limit load factor is exceeded. Beyond 11 positive G's lies only trouble, commencing usually when a structural member fails completely. In this respect, accelerometers do not give true readings for shock-type loads such as are encountered in hard landings. Such an authority as R. G. Bowman, assistant chief engineer for Republic Aviation Corp., has pointed out that measuring dynamic loads is a tricky business. "If an instrument were designed to read shock load correctly," he has said, "it would not give a true reading for the G's encountered in normal maneuvers. Conversely, if the instrument reads correctly for normal maneuvers, it would read too high for shock type of loads." The con-



clusion is clear that 11 positive G landings, which have been reported by some pilots, are considerably less.

Still, the jet pilot who looks forward to the luxury of puttering around a house financed from retirement annuity funds, might inspect closely this area of G forces. For instance, it is possible to pull positive G's safely, starting at the red line airspeed, provided the aircraft is in a very shallow dive. In such a maneuver, the aircraft slows up as the G's are applied. By the time the load has built up to 7.33 positive G's, the aircraft has lost from 35 to 50 mph because the aircraft automatically loses speed with the application of the G's and it does this rapidly enough to avoid effects of compressibility.

On the other hand, if the aircraft is in a steep dive and has been picking up speed, it will not slow down as the G's are applied. In this instance, the speed of the aircraft is increasing during the application of the G's and could easily exceed the limiting Mach number at the time that 7.33 and over positive G's were being applied. Stability of the aircraft will change—usually at the time when it is approaching the ground rapidly. More often than not, in such an instance, the aircraft simply runs out of altitude before it can be pulled out.

Speed and G forces can be considered separately but in the actual practice of jet flight, they march hand in glove. So present-day designs require that the pilot be familiar with the VG diagram. The "V" stands for speed or velocity and the "G", obviously for G load. The diagram is an essential part of the basic design of each aircraft. As soon as the designer determines the wing loading, power loading and intended performance, he plots the VG diagram. This diagram is included in the Tech Order for each type of jet aircraft. If thoroughly understood, it eliminates experiments of the trial and error kind; for it tells the jet pilot the limitations of his aircraft before he ever leaves the ground.

The VG diagram shows how stall and compressibility limit maneuverability at various altitudes. It proves the point that maximum attainable G's and the airspeed at which they are reached change with altitude. The curved line on the left of the diagram represents the stall boundary, indicating at what combination of G's and speed it is possible to stall the aircraft. One section covers the complete speed range of the airplane and extends from the negative to positive G load limit. This area constitutes the legitimate maneuvering range pilots can use.

The diagram will prove that modern jet fighters can fly at speeds sufficiently high in level flight for structural failure to occur if the airplane gets out of control. It proves, too, that whenever a modern jet fighter operates at low altitude it is flying in a region where indicated speeds build up tremendous dynamic pressures on the aircraft. Considering the fact that the VG diagram contains so much valuable information, it is strange indeed that so few checkout questionnaires refer to it.

With the development of high-speed aircraft much attention has been directed toward the pilot's ability to withstand the G forces associated with acceleration. The sense of urgency has been greater in the last few years because designs for speed have progressed so far in such a relatively short time. But, in fact, the study has been continuing since World War I when extensive experiments concerning the effect of centrifugal force on the brain were conducted.

Many jet aircraft have been damaged badly because a pilot pulled positive G's in excess of the designed strength. Damage has ranged from minor wrinkling of the wing skin to tearing off the wings and disintegration.

An Air Force study of human factors in major accidents of jet aircraft notes that the average pilot has a tolerance to positive G forces of approximately 6 G's for 15 seconds, 7.5 G's for five seconds and 9 G's for three seconds (providing the 9 G's is reached in one second), without the use of the G Suit. But this was found to be true only if the individual was in good mental and physical condition and was actively resisting the effects of positive G forces by straining both leg and abdominal muscles. Straining these muscles helps the blood return to the heart. If the pilot relaxes his muscles, virtually all of the blood will pool in the lower portion of the body, insufficient blood will return to the heart, and the heart will be unable to maintain circulation in the head. And when circulation through the brain stops, unconsciousness follows in three to four seconds. Recovery from unconsciousness produced by high G forces is slow and is accompanied by convulsions followed by a state of mental confusion. The average pilot would not be able, the survey states, to control an aircraft for at least 20 seconds after losing consciousness under high G even if the G was lowered immediately.

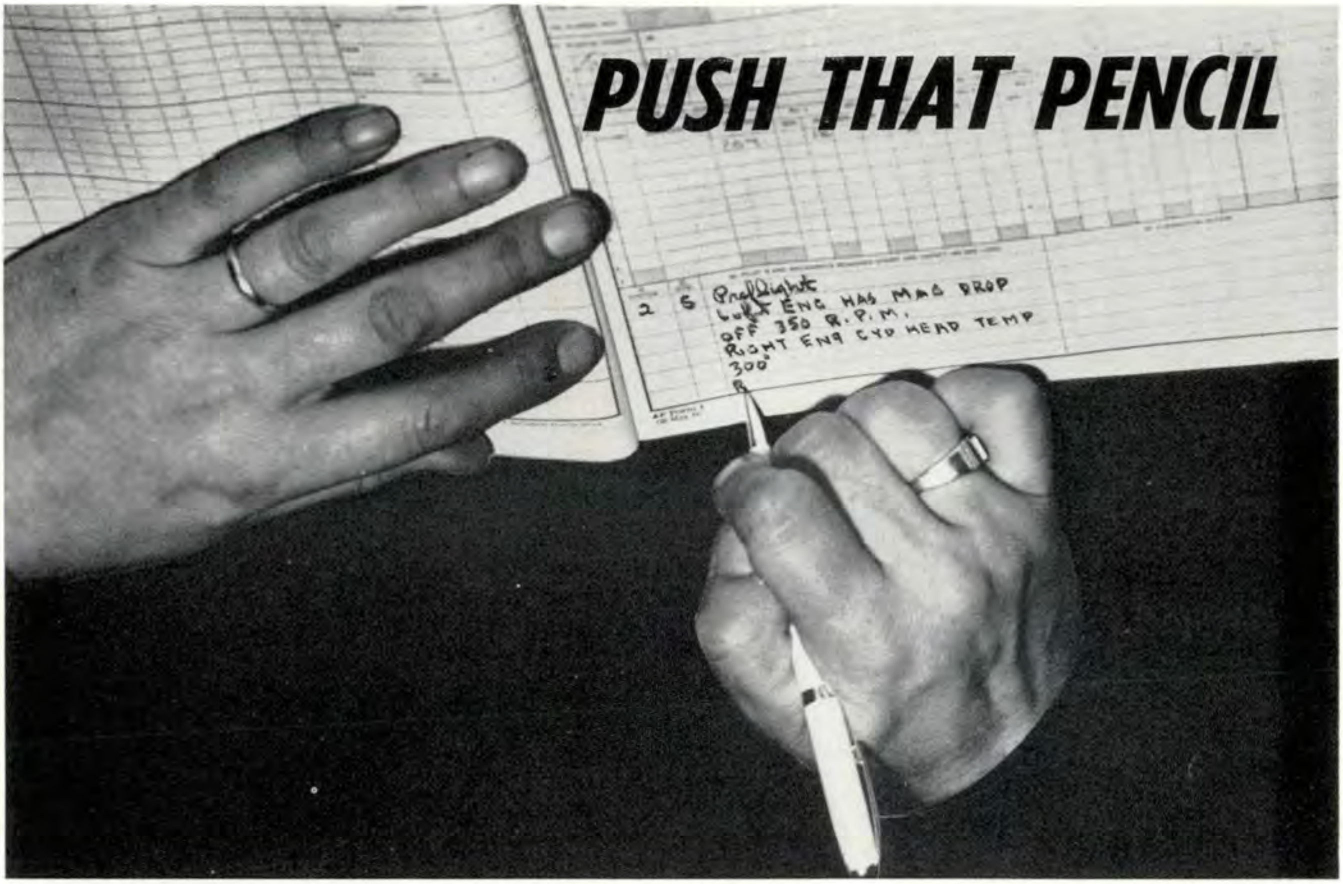
A number of physiological and psychological stresses alter the tolerance to G's. Worry can cause a pilot to forget to tighten his leg and abdominal muscles. So can lack of sufficient oxygen, carbon monoxide in the blood stream, upset stomach, gas pains, and so forth. Additionally, there are definite stresses which directly lower tolerance to G forces by decreasing elasticity of blood vessels. If the blood vessels relax completely, the volume of the blood vessel system of the body increases so much that there is not one-half enough blood to fill it, and even 1 positive G cannot be tolerated. There can be various degrees of relaxation of the blood vessels which would produce various degrees of tolerance to G forces. An individual can and does vary from day to day, depending upon his state of health and well-being.

Nausea from any cause is accompanied by a relaxation of central blood vessels, a slowing of the heart's rate of beating, a lowering of blood pressure, and a very marked decrease in tolerance to positive G forces. A nauseated individual may not even be able to tolerate 1 G. For this reason, factors which cause nausea might well be considered by operations officers.

Always present in aerial maneuvers is the possibility of vertigo. Further, there is the possibility of upset stomach, excessive heat, hypoxia, high G forces, and emotional disturbances. Physiologists and others concerned with a pilot's ability to withstand G forces encountered in high speed flight advise that a pilot should break off a mission and return to his base whenever he feels "bushed." Bravado, they observe, is a poor excuse for loss of life and expensive equipment.

The jet pilot, they note, would be well advised to keep in mind that he—and his machine—have limits beyond which it is not safe to experiment.

PUSH THAT PENCIL



THAT SAME OLD OUNCE OF PREVENTION is still worth a couple pounds of cure. Especially when it concerns the Form 1.

Imagine yourself halfway down the runway in the midst of taking off an F-86. All of a sudden your wingman speaks over the radio, "Hey, Joe, watch your tailpipe temperature." Checking the gage, you find that it is fluctuating dangerously. It falls to 450 degrees; rises back to over 600, and almost immediately starts to decline again.

Your reaction might be to cut the power and abort the takeoff. Then you might hit the brakes and go into a screaming skid that could take you off the runway, set fire to the plane and force you to abandon it while it is still moving.

If all this happened (and it did), you might ask yourself, "If he knew the tailpipe temperature warranted watching, why didn't he mark it in the Form 1 instead of waiting until a critical moment in my takeoff to inform me about it?" And if you were the calm type of individual, it is possible that you would try to analyze the reason for this oversight. But it isn't likely that you would find the answer. Because there is no reason for it.

This particular accident cost thousands of dollars in man hours and equipment. The pilot, luckily, sustained only a slight sprain at his knee. It could have been a lot worse. Certainly the little time that it takes to make a Form 1 entry is justified when you think of the expenditure and risk of injury involved.

The takeoff started in a routine manner. After receiving the belated warning, the pilot cut his power and applied the brakes. The brakes locked, sending the plane into a skid. It caught fire as it slid off the runway but the pilot managed to jump clear after it had slowed to about 10 miles per hour.

The investigating board found that the primary cause for this accident was the negligence on the part of the wingman in not writing up the fluctuating tailpipe temperature on the maintenance form, coupled with his poor judgment in informing the pilot of an alarming condition during the takeoff run. A secondary cause was found to be the failure of the rotor link assembly in the brake which caused it to lock and thus produce the skid.

The wingman had flown the plane himself on several previous occasions and had noted the fluctuating tailpipe temperature. His intentions were undoubtedly good in issuing the last minute warning but a great deal of expense and trouble could have been saved had he merely entered the discrepancy on the Form 1 of the aircraft. It is one of those things that pays off. Too many times materiel failures or other irregularities are not noted by the pilot after he has landed safely.

The same pilot may fly the plane on its next flight. But if he doesn't, the pilot who does has every right to expect the aircraft to be in its best possible condition.

The Form 1 is supposed to provide insurance that all the ills of a plane have been cured before a pilot takes it into the blue. It's up to pilots to make certain that that insurance pays off. Who can do it better?

THE PILOT ON INSTRUMENTS

THE SEAT-OF-THE-PANTS PILOT is on his way out. Decisive testing is proving more and more that sensations and "feels" that pilots experience in flight are not the true characteristics of the attitudes of their planes. This proven hypothesis places even more importance on instruments and instrument proficiency.

First, let's look at sensations. For the purpose of this study we can divide them into three categories: visual, vestibular and postural.

Vision is the only dependable sensation in instrument flying. The instruments are the "eyes" of the airplane in flight. Practice and experience are required to see effectively through these eyes but the visual sensations are always reliable. The decision to use direct vision (contact) or indirect vision (instruments) at precisely the right time depends upon all the factors involved in the conditions of the flight. This demands judgment which is achieved only by training the brain to believe what the eyes see in the instruments.

The vestibular sense originates in the hairlike filaments of the vestibular nerve which are stimulated by pressure alterations resulting from motion. However, this organ cannot distinguish between centrifugal force and gravity, and since in flight these are often fused, the separate forces cannot be recognized as such. Also, this nerve senses only changes in speed and misses the normal or constant velocities. It is not stimulated at all if the acceleration is less than two degrees per. sec. per. sec. When activated by deceleration, the vestibular organ senses rotation in reverse which is held responsible generally as the main contributing factor to confusion in instrument flying.

The postural sensations are derived from the stretching and contracting of muscles, touch and pressure and the shifting of the abdominal muscles. This sense is not reliable in flight because the postural system cannot detact continued velocity without acceleration and deceleration. If equilibrium and orientation are to be maintained, however, accurate postural interpretation is necessary. In instrument flight this must be accomplished by visual impressions from the instruments.

And then there are sensory illusions (vertigo). They include visual, vestibular and postural sensory cues in a conflicting manner, sometimes associated with emotional and mental confusion. These conflicting sensory cues arise from the fact that these different sense organs give inharmonious information to the brain at the same time. This causes postural reflexes and eye movements to be actuated in the wrong manner. These illusions give the pilots the feeling that they are in turns, banks, dives and other types of flight attitudes when they are actually straight and level. Some pilots become so convinced of the feeling that they do not believe their instruments. Others upon checking their instruments manage to shake off the illogical illusion.

A conclusive testing program brought out the following facts about pilot errors in judging attitude without the aid of their instruments or their vision. When attempting to judge whether a plane was climbing, level or diving, pilots made an average of 39 per cent errors. In judging if a plane was banked to the right, level or banked to the left, pilots made an average of 37 per cent errors and when the climb-dive and bank judgments were made together, they were wrong 60 per cent of the time. One more reason why you should depend on your instruments rather than your "feel."

This brings up the matter of instrument proficiency. In accidents caused primarily by pilots becoming lost or

losing control of their planes while on instruments, lack of instrument proficiency was found to be the outstanding contributing factor. Records reveal that many of the pilots involved in such accidents had either never attained a high degree of instrument proficiency or had not maintained this skill once attained.

Habit interference, another basic cause for instrument accidents, occurs when the pilot is transitioning from one type or model of aircraft to another. Many of the habits learned in flying a certain type or model plane will not apply to the new model or type because of changes in the control arrangement, instrument panel or flight characteristics. Thus, emphasis must be placed on the importance of being completely proficient in the instruments of the plane being flown at the time it is being flown.

But pilots who are proficient in their instruments still have accidents. Why? One reason is that many reading errors are made. Instrument reading errors are not confined to any single group or class of pilots or to any one experience level. They are more likely to occur during real or simulated instrument conditions and happen more often at night than in the day time. Following are nine major categories of these errors and their percentage of occurrence in relation to each other:

- Errors in interpreting multi-revolution instrument indications—18 per cent.
- Reversal errors—17 per cent.
- Signal interpretation errors—14 per cent.
- Legibility errors—14 per cent.
- Substitution errors—13 per cent.
- Using an instrument that is inoperative—9 per cent.
- Scale interpretation errors—6 per cent.
- Errors due to illusions—5 per cent.
- Forgetting errors—4 per cent.

Apparently a lot of these errors can be eliminated by better display and design of instruments. Extensive research is being carried on to find out human requirements in order to ascertain the most easily readable presentations. Some conclusions have already been reached on the matter.

For instance: Moving pointer instruments are in general superior to moving scale instruments for ease of check and qualitative reading. For judging the direction of an instrument deviation in terms of increase or decrease the 9 o'clock and 12 o'clock positions are somewhat better than the 3 and 6 o'clock positions. A moving pointer on a circular dial appears to be slightly superior to a moving pointer on a linear scale for ease of check reading. For qualitative reading the moving pointer on a linear scale seems to have a general advantage over a rotating pointer since the former has the same direction of motion for all parts of the scale.

Also a direct reading counter with only three digits gives excellent results for ease of check and qualitative reading when only one instrument is being read at a time. And in measurements of qualitative reading which involve judging the direction of a deviation, the nature of the response of the subject is a significant factor in determining the speed and accuracy of the response.

Still in the stage of experimentation but looming in the future is the standard cockpit. Some estimates say that such a cockpit will mean a 30 per cent reduction in losses of pilots and planes. The big fallacies in present cockpits seem to be the absence of any logical association between the way an instrument depicts information and the original action of the occurrence depicted, and the absence of any logical association between the shape and movement of manual controls and the mechanisms activated.

It boils down to the fact that instruments, their design and display, are being improved. This leaves it squarely up to the pilot to make certain that he is proficient in instrument flight. For the instruments, if read accurately and used correctly, will tell the true story. The "feel" of the plane may not.

RESCUE BY *Radar*

NO INSTRUMENT LETDOWN PROCEDURES and a closed field plus two planes unable to proceed to another base equals a touchy, dangerous situation. But teamwork and ability were combined by an Air Force crew to effect a solution to such an emergency recently.

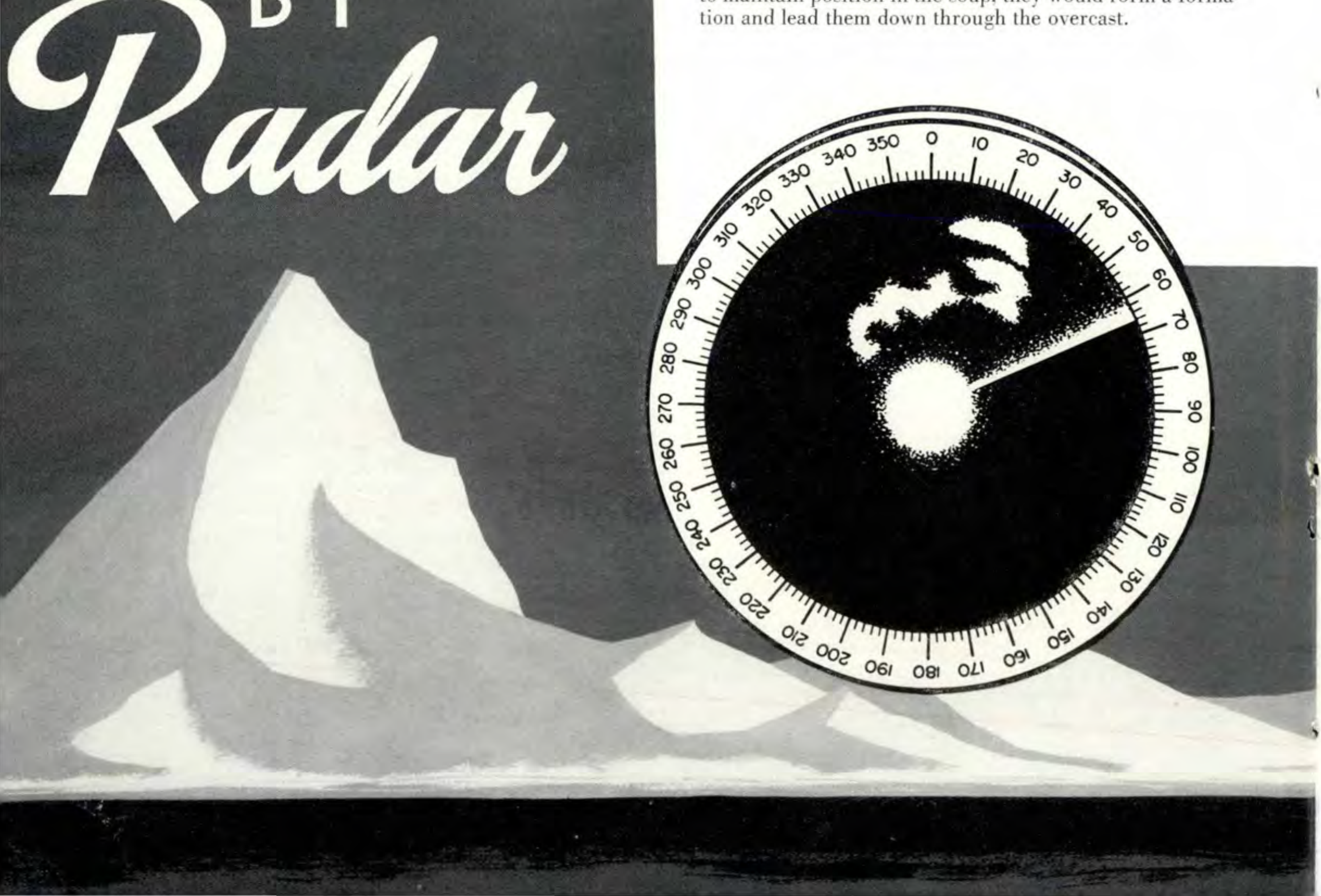
The place was Greenland AFB, known during the last war as Bluie West One, a far northern installation of the Northeast Air Command. Two civilian aircraft were over the field asking permission to land after a flight from Keflavik, Iceland, some 752 miles away. One, a C-46, had three persons aboard, and the other, a De-Havilland Dove, had a crew of two. Both were being ferried to North America by a commercial ferrying firm.

A communications blackout, common to the North Atlantic region, prevented all contact with the inbound aircraft until they passed the east coast of Greenland, 100 miles from the base. The Dove passed its point of no return two hours earlier and the C-46 had developed an oil leak which threatened to knock out the left engine at any time. GAB had been trying to reach both planes for three hours to advise them that the weather at the base was below minimums. By the time contact was established it was too late. Both planes were committed to land some place in Greenland and no field within 800 miles was open.

GAB is situated at the head of a fjord, 51 miles long, which twists its way inland from the coast between cliffs and mountains that ascend to more than 5,000 feet just two miles from the fjord. It is one of the few fields in the world having nothing resembling an instrument letdown procedure, as the approach up the fjord must be made contact. At the mouth of the fjord, 1,300 feet is the minimum approach altitude over an island named Simiutak, better known as Bluie West Three. A radio range there allows a letdown over the ocean before a plane enters the fjord. The procedure for this letdown calls for a missed approach if the plane is not VFR by the time it descends to 1,300 feet.

There is no approved letdown at the base if the fjord is closed and the ceiling at GAB is less than 7,000 feet, the minimum instrument altitude between the BW-3 range and the radio beacon at GAB. On the morning of the emergency, the weather at the base was reported as 1,000 feet overcast, visibility 10 miles; at BW-3, zero-zero with fjord closed.

A crew of Flight "A," 6th Air Rescue Service Squadron, with an SB-17, on temporary duty to provide rescue coverage for the Greenland area, rose to the occasion. The plan of the AR crew at the time of takeoff was to fly down the fjord under the ceiling as far as possible to check the weather conditions and find where the cloud deck lowered to the water. They then planned a climb out through the overcast, using the airborne radar set for guidance to avoid the mountains. Then if the pilots of the two planes demonstrated formation flying ability to maintain position in the soup, they would form a formation and lead them down through the overcast.



The rescue crew had been practicing radar directed approaches up the fjord the two preceding days and felt that such an approach was feasible if the other two pilots were able to follow their lead. The practiced procedure had the navigator interpreting the scope with the radar operator switching the ranges and tuning the set at the navigator's direction.

The SB-17 took off from the field and started down the fjord to the first turn, beyond which the only thing known about the weather was that 51 miles away the clouds were on the deck. At some place between GAB and BW-3 the 1,000-foot ceiling lowered to zero. Upon where this point was depended the success of the plan. From the base the fjord angles off at 90° from the end of the runway; four miles further it makes another 90-degree turn. Once around the second turn, the rescue crew saw that the fjord was open (if having around a 700 to 900-foot ceiling can be considered open) at least down Sugarloaf, a distinctive mountain checkpoint in the fjord about half way between the base and BW-3. Once around Sugarloaf, the ceiling lowered rapidly so that half way from that point to the village of Narsak it was down on the water.

The climb started there and the Fortress broke into the clear at approximately 4,000 feet. On the way up the cloud density seemed so intense that a formation flight did not appear to be practical. The planes joined in formation and made test runs through a few tops. It was obvious that they would be unable to hold the formation.

The rescue pilot then decided that it would be possible to lead the planes over the stretch of the fjord that goes past Sugarloaf and up to the "big basin" just prior to the two 90-degree turns that lead to the base. If the approach to the south edge of the fjord were made on the same heading as that of the comparatively straight stretch of the fjord, then a letdown could be made straight ahead once the radar indicated that the plane was over the exact point that led to the straightaway. Although the fjord narrows to about a mile in width in the vicinity of Sugarloaf, it was decided that this was the only procedure that could succeed. The entire success of the plan depended on the ability of the SB-17's navigator to interpret his radar scope and determine that the formation would come over the exact point that was selected for the start of the letdown and on the heading that would lead the planes between the narrow walls of the fjord.

The initial approach to the letdown was aborted as the navigator was not absolutely certain that he was oriented correctly. Time then became a vital factor as the Dove pilot had reported some 30 minutes before that he had less than an hour and a half of fuel remaining. The second time around, the navigator was certain. When he saw the spot on his scope that had been picked for the start of the descent, he told the pilot, who relayed it to the Dove. The Dove's pilot chopped the power and entered the overcast, maintaining the 86-degree heading being flown.

One minute and 30 seconds later, the aircraft broke into the clear at 700 feet and was on its way up the fjord to the base. The success of the first letdown increased confidence for repeating the procedure for the C-46.

One change was necessary for the second attempt. There being no direct contact between the rescue pilot and the C-46 pilot, all instructions had to be repeated through the radio operator aboard the SB-17. A couple of minutes later the C-46 landed safely. Taking the SB-17 in was simple as the radar operator was plotting the plane's position all the way in.

All three pilots agreed that they had held this particular heading closer than any other they had ever flown. And it was good that they did. A couple of careless degrees off could easily have made the difference between threading the fjord and winding up on the mountain side.

To the Crew of the SB-17

Capt. John H. Corcoran
1/Lt. George M. Huntley
2/Lt. Richard L. Kerr
S/Sgt. Edward B. Wester
Sgt. George R. Shirar
Cpl. Stephen M. Furman

Well Done!

CROSS FEED

ROOM OF HORRORS—In order to supplement the FLYING SAFETY Magazine, this base publishes bimonthly a Base Flying Safety Newsletter. The attached article, extracted from the 8 January issue of the Newsletter, is forwarded for any use you may be able to make of it. The article was written by 1st Lt. William C. Paynter, Assistant Wing Flying Safety Officer.

Capt. Joel C. Lee
Wing Flying Safety Officer.
3535th Bombardment Tng Wg
Mather AFB, California

Ed. Note: Here is the article (letter) which Captain Lee inclosed with his letter:

Lt. Firesquirt Blisterbottom, USAF,
P.O. Box 00050, Anyold Air Force Base,
U.S.A.

Dear Flash:

Since our graduation from cadets, I have progressed quite rapidly, and at this time I feel impelled to pass on to you a word of warning and advice.

Located in a particularly annoying spot on each Air Force Base is a small room, bedecked with charts, graphs, and teletype reports, infested with clacking machines, wind recorders and barometers, and presided over by a negative personality chosen for his "You-shouldn't-go-Lieutenant" attitude.

This torture chamber will be recognized by a sign reading: "Base Weather," and should (naturally) be avoided if at all possible.

If, however, one is forced (by unreasonable Clearing Officers) to subject oneself to its horrors, the best attitude to adopt is "Grin and bear it," or "Get it over quickly."

If the latter course is decided upon, clenching one's teeth, thinking of females, firewater, Saturday night and payday, will help. A hidden comic book in the flying suit, looking out of the window, or simply staring into space has also been found to be quite effective. At all costs, however, one must close one's mind and ears completely to the tales of terror being related by the weatherman in his ravings . . . of turbulence, hail, ice and freezing rain . . . and concentrate on life's lighter side.

Now, having prevented the weatherman from blowing hot and cold on your venture, set your cap at a jaunty angle, saunter through Operations (keeping an eye out for feminine hitch-hikers), carelessly toss your clearance to the AO, glare defiantly (unless, of course, he ranks you—in which case leer confidently) while receiving his signature, ignore the sad shaking of his head, proceed to your aircraft, clear the flight deck for action—i.e., throw the checklist into the radio operator's compartment, and you're up and away

Thus, and only thus, may one live a happy, carefree life, free from humdrum, everyday worries, and marred only by an occasional rending crash.

Affectionately,

Lt. H. P. Sizzlebritches
Errornaute Extraordinare

A "LI'L DEICER"—As snow and ice present a major flying safety hazard to a large number of Air Force bases, I believe some investigation should be made into any commercial products which may help alleviate this situation. While reading a Chicago paper the other day, I came across the enclosed article on a new product for removal of snow and ice. If found practical, it should do much to lessen the number of winter flying accidents.

Maj. William G. Ehart
Wing Flying Safety Officer
3310th TTW, Scott AFB.

The clipping concerned a solution which is supposed to remove ice and snow much more effectively than previously known products. Major Ehart's letter has been forwarded to the proper people for investigation of the ice "cure." Even if the product is found impracticable for Air Force use, the Major is to be congratulated for his interest and initiative.—Ed.

A POSY—I have noted with interest the article entitled "Ground Controlled Approach" in the November, 1951, edition of FLYING SAFETY. We of the Airways and Air Communications Service know only too well the importance of reaching the ultimate in Ground Controlled Approach to radar. . . .

Your GCA story is a great tribute to AACS, in that it thoroughly depicts the operation of GCA, the miracle of radar. I believe that after having read your story, users of GCA will have a finer appreciation of the technical aspects involved in landing aircraft under IFR conditions.

It might be interesting to note that the original CPN-4 unit, tested at Eglin AFB, Florida, is presently being used by AACS in Korea. Also one of the members of the original Eglin (AACS) testing team, M/Sgt. Robert H. Nelson, is presently working with this same unit.

Again, I express my appreciation for a well-defined story; please continue your fine work of attaining our mutual goal of FLYING SAFETY.

Lt. Col. Marion A. Ramsey
Commanding Officer
Hqs. 1818th AACS Group
APO 970, San Francisco

THE OTHER CORNER — The article "GCA Saves Lives," in the December, 1951, issue of FLYING SAFETY, although informative, was lacking in the spirit of "flying safety."

There are many airports, both here in the United States as well as overseas, which utilize ILS as a Low Approach System. I believe it would be well to advise all personnel of this fact so that all concerned may be aware that in cross-country emergencies many disasters might be averted by the use of "en route ILS" facilities as well as GCA at the destination. Both systems are fine and both have their limitations.

On the Airlift as a Group Check Pilot on C-54's, I used GCA to the fullest extent possible and also used VAR, which is airborne ILS. Both were needed and both were used to insure the success of the Airlift mission. As an airline pilot I have used both GCA and ILS with great success.

A few instances were quoted whereby GCA aided pilots in distress to reach the ground safely. Those instances made me think of a paragraph in our MATS Manual 55-2, which is as follows:

"A pilot's skill refers not so much to the excellence with which a difficult situation is overcome, as it does to sound foresight and judgment exhibited by the pilot in avoiding a difficult situation in the first place."

There are circumstances where ILS is better than GCA, and in other instances GCA is better than ILS. But both are a means to safety in an emergency. Neither should be overlooked.

To say that the GCA-ILS controversy is a closed issue may be the author's opinion. Both are here to stay in one form or the other, and to insure retirement at the age of 60, I, for one, intend to use both to promote flying safety for myself.

Capt. Perry Schreffler
1257th ATS (MATS)
Westover AFB, Miss.

Ed. Note—We feel properly chastised; now, we'll have to do an article on ILS. You're right, though, to insure that age 60 retirement, it's best to be proficient in both types of approaches.

OH - - OH! — Upon receiving the November issue of FLYING SAFETY and examining the cover picture "Flying the B-47," I noticed the Aero Maintenance stands nearby minus the guard rails. Realizing the magazine is dedicated to flying safety, I also believe ground safety should be stressed in your wonderful publication.

James H. Lint
Supt., Aircraft Shops
325th Maint. Sqdn.,
McChord AFB.

DECEMBER COVER — I would greatly appreciate the names of the pilots on the cover, and on pages 2 and 5 of the December issue of FLYING SAFETY. I might add that I enjoy your magazine immensely. Thank you.

2/Lt. John C. Miller
513th Bomb. Sqdn.
Barksdale AFB, La.

Ed. Note—The cover and photos accompanied the article, "Safety in the Nest," and all were taken at Williams AFB, Arizona. Some of the names requested are not available, but here are the ones we do have:

Cover (left to right), Captain D. L. McCance, Cadets N. D. Evans, W. G. Tuttle and L. E. Thomas.

P. 2, top photo—second from left, standing: Cadet James D. Carey, and instructor, 1st Lt. Elmer E. Colley. This is an old photo and we were unable to obtain identification of the other cadets.

Those appearing in the other photos on pages 2 and 5 were foreign cadets. Names will be furnished to anyone who is interested.

MOTHER of INVENTION

THE OLD SAYING THAT "necessity is the mother of invention," is only a partial truth. In most cases, necessity is not enough—there must also be a respectable amount of ingenuity, initiative and sometimes a fair amount of luck. In the case we are about to recount, it is the ingenuity and initiative which we salute.

The leader of a flight of F-86's noticed during takeoff that his nose gear steering was ineffective. When he raised his gear after becoming airborne, only the main gear retracted. The nose gear remained extended. All gear were again extended and this time all were successfully raised. To insure that he would not be involved in a gear emergency after completing his mission when he would be low on fuel, the pilot again extended the landing gear.

This time the nose did not straighten out after extending, but remained cocked 90° to the path of the airplane. The pilot was unable to remedy the situation. Now it was time to think of something.

First, the pilot tried a trick that had worked before when the nose gear of a jet was cocked at a smaller angle. He returned to the field and shot a number of touch-and-go landings, letting the nosewheel touch the runway momentarily each time in the hope that it would straighten out. This was unsuccessful and, in fact, one of the attempts almost ended in an accident when the pilot let his speed drop too low before the nosewheel tire touched. After this experience, he recommended that in future similar cases, at least 60 per cent power be maintained to avoid the lag in acceleration which is characteristic of jet engines near idling speeds.

After several unsuccessful attempts to straighten the nosewheel by touching it on the runway, the pilot's fuel supply became low. It was time to try something else.

The answer came from those on the ground who were watching and coaching the pilot. They held a quick pow-wow and decided to try wetting down a six-foot wide strip down the center of the runway, beginning at the point where the nose gear was expected to make contact. It had to work if an accident was to be prevented. The pilot of the F-86 had only enough fuel remaining for one more approach.

It did work, of course. The pilot touched down in normal landing attitude, and immediately cut off his power unit. He then retracted flaps to help hold off the nosewheel as long as possible. The main gear straddled the wet strip on the runway, and the pilot held the nose up until speed had dropped to about 50 knots. As the nosewheel made contact, full brake was applied on the side away from the direction in which the nosewheel was cocked. The plane was held straight until the nosewheel straightened around and the landing was completed without damage to the plane or injury to the pilot.

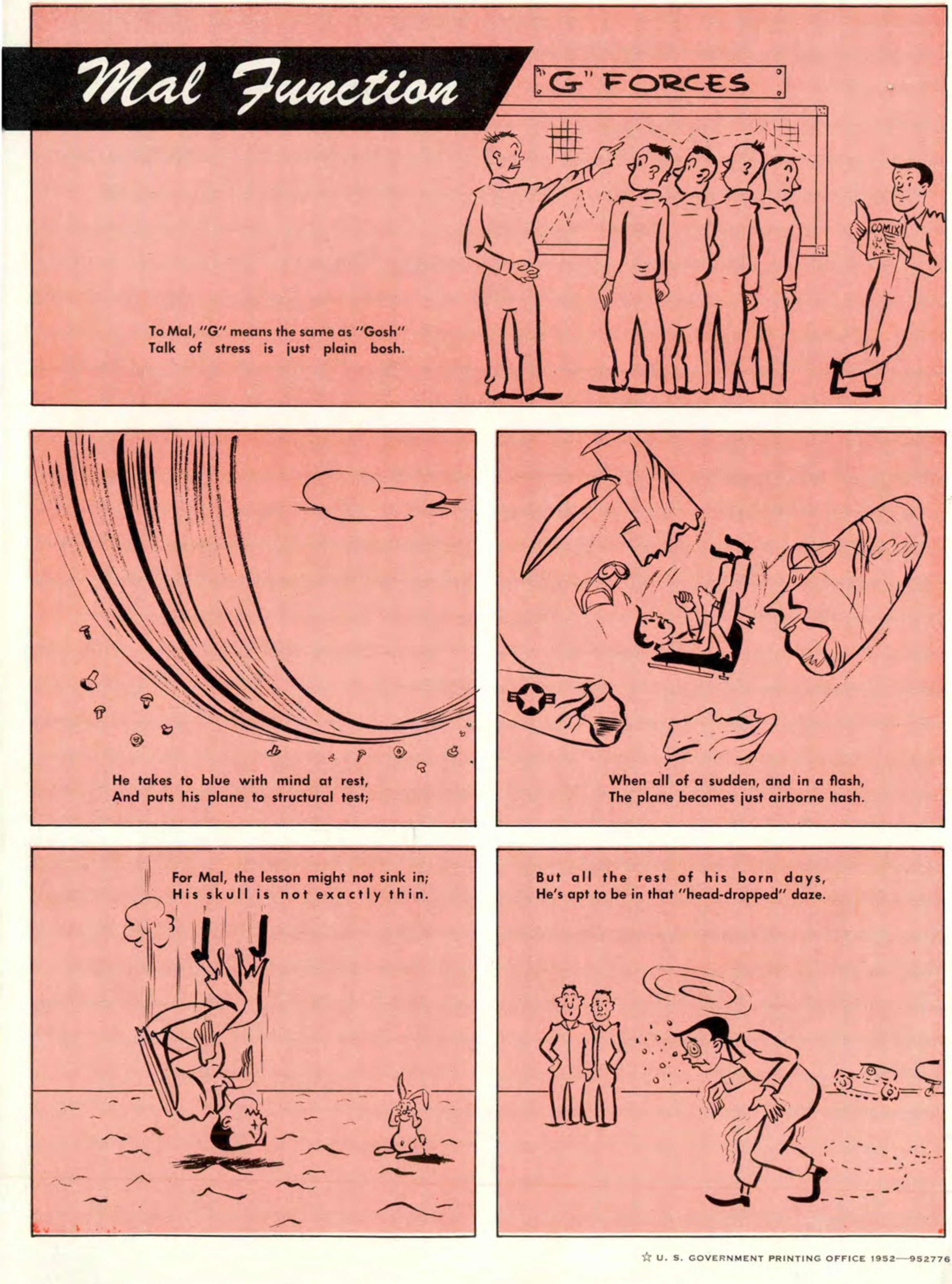
The procedure of wetting down a portion of the runway was not the idea of any one individual. It was arrived at more or less by mutual agreement after a discussion involving a number of persons standing by on the ground. The theory was not exactly new, either, although this may be the first time it has been used on a paved runway. It was previously used on PSP by another fighter outfit and the records show it was used by a commercial airliner. In that case, however, the temperature was so low that the wet down strip froze and provided an icy surface.

In the case of the F-86, the original difficulty was caused by failure of the nose gear rotating mechanism. Undoubtedly, if the final landing had been made on a dry surface, an accident would have occurred.

The cooperation and teamwork, the ingenuity and initiative displayed by the pilot and his advisors on the ground, all members of the 71st Fighter Interceptor Squadron at Greater Pittsburgh Airport, prevented what might have been a serious accident.

ROUND 'n ROUND

There are fancy names, like pirouette, for some kinds of spins; but they're not the same kind you do in airplanes. Actually, a spin in an airplane is not much more dangerous than the dancer's pirouette, provided, of course, the pilot knows the proper recovery procedures. Both spins, the pilot's and the dancer's, require the utmost in coordination and technique. The recoveries are different, though. The dancer's must be graceful; the pilot's recovery must be safe.



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