FAA AVIATION NEWS

MARCH 1970

COVER

Flying over 45 sometimes means rapid escalation from cub to jet. Are you up to it physically? See page 6.

FAA AVIATION NEWS

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New Transponder Codes

Changes in beacon code assignments provide added flexibility in air traffic control

A new schedule of beacon code assignments for transponder-equipped aircraft has been announced by the Federal Aviation Administration of the Department of Transportation.

Major changes in code assignments include the substitution of three altitude-stratified codes for visual flight rule flights in place of the previous two codes, and the formal employment of a code for the loss of radio communications.

The following schedule went into effect on February 1, 1970:

VFR under 10,000 feet—code 3300

VFR at or over 10,000 feet up to the floor of positive control airspace (18,000 feet over northeastern and northcentral U.S., and 24,000 feet over most of the remaining 48 adjacent states)—code 3400.

VFR at or above 24,000 feet, in areas where positive control is not in effect, such as off the coast of the United States and in Alaska—code 3500.

The three new standard VFR codes (replacing 0600 and 0700) will provide greater flexibility during the period when the air traffic control system is being automated and both 64-code and 4096-code transponders are in use. Also, additional IFR codes have been assigned for further stratification of sectors, and to assist high density terminal control areas in sorting out traffic and speeding up aircraft movements.

Emergency code 7700 and radio failure code 7600 remain unchanged. However, a standard procedure for the use of the latter has now been published.

Code 7600 is used whenever a pilot has reason to believe that he is not receiving a radio ground station, or that his radio transmitter is not functioning properly. When the pilot switches to 7600, the radar blip representing his normal en route code disappears from the scope (at the radar facilities where an automatic alerting signal for code 7600 has not yet been installed.) The controller monitoring his flight will then interrogate the missing aircraft on code 7600.

If the missing blip reappears on code 7600, the controller will assume that the problem is radio failure, partial or complete. He will then transmit by radio, instructing the pilot to return to his en route code. If the target fades out on code 7600 and reappears on the en route code, the controller will assume that the pilot is receiving by radio but unable to transmit If the target remains on code 7600, complete radio failure will be assumed.

In either case, the pilot will be expected to follow the standard procedure for radio failure, and the controller will endeavor to protect his airspace, in accordance with available flight data. ■

Above—VFR transponder codes enable the controller to "stratify" VFR traffic, for more efficient monitoring. Area enclosed by broken line approximates heavily trafficked airspace where positive control (IFR only) floor begins at 18,000 above ground.

Left—By dialing one of three new VFR transponder codes—3300, 3400, or 3500—his aircraft is identified by altitude. For example, code 3300 is assigned to planes flying under 10,000 feet. The new codes provide greater flexibility while air traffic control system is being automated.

Somewhere, Over the Rainbow . . .

Trying to poke a hole in cloud tops with a single engine aircraft is tempting fate—even when Cupid is on your side

To the daring young man with the flying machine and romantic ideas, a thousand mile cross-country flight in a Cessna 172 looked like a simple one-day jaunt. So naturally he took his fianceé along to help while away the hours.

From Sam Williams' hometown starting point, Florence, S.C., to Fort Wayne, Ind., where he was to pick up some mechanical equipment for a local business firm, it is only a matter of 558 statute miles, a four to five hour hop in his Cessna 172, in which he had already logged over 100 hours on his private pilot's certificate. But the normally routine journey was turned into a lengthy near-nightmare by the intrusion of sudden thunderstorms and violent turbulence that tested the nerves of all concerned.

At 2:36 p.m. local time last August, the Huntington, W. Va., flight service station received a radio call from Cessna N35326, VFR from Florence to Fort Wayne, with no flight plan. The pilot was calling to check on the weather at his destination airport.

The weather at Fort Wayne was reported as clear with visibility unrestricted. Huntington FSS cautioned the pilot, however, that forecasts called for scattered thunderstorms and possible pre-frontal conditions just west and north of Huntington, presumably directly along his intended flight path.

The report understandably gave the pilot cause for concern. In South Carolina the weather that morning had been fair and warm, seemingly a lovely day for a flight. Since he had just made application for a wedding license, he was loath to be parted from his intended for an entire day, so when sweet Miriam sighed, "Take me along," he said, "Yes, indeed."

Clouds Begin to Form

It was important for him to reach Fort Wayne and pick up the equipment needed as soon as possible, and he was already over Ohio, only an hour or so flying time away from the airport, according to his calculations. He could see clouds beginning to form on the horizon, and of course he was not yet instrument rated. There was a chance that nothing serious would build up until he had passed out of the pre-frontal area. And of course the young lady at his side, his bride-to-be, might not be overly impressed by a show of prudence and a 180 degree turn at this stage of the flight. He decided to press on. It was a near-fatal decision.

Twenty minutes later he called Huntington FSS again. He was now experiencing the predicted weather deterioration, with dark, threatening clouds closing in on all sides. (endeavoring to climb over the storm, he had pushed the aircraft up to 13,000 feet (service ceiling 13,100). He could see a hole in the cloud ceiling overhead, but he was not able to climb any higher. He requested air traffic control assistance.

A coordinated effort on the part of Huntington FSS and Cleveland Center, using both direction finding equipment and radar, established the position of the aircraft as being in the vicinity of York, Ohio, about 60 miles northwest of Huntington. The pilot was advised of a heavy cloud buildup showing on the Center's radar between York VOR and Huntington's Tri-State Airport, indicating solid IFR conditions all the way. The back door was now shut tight. He decided to continue on a heading of 300 degrees.

At 3:15 the pilot radioed that he was completely engulfed by clouds and in an active thunderstorm with violent turbulence and hail. He had given up trying to climb over the weather, and his last known position was over Portsmouth, Ohio.

At this point Huntington's Tri-State Airport was reporting 7,000 feet overcast and a broken 4,000 foot ceiling. The FSS decided that there was no alternative but to descend the Cessna inbound to Huntington on DF vectors and endeavor to bring him down below the cloud cover at the airport for a VFR landing.

The next 15 minutes produced an ordeal for the occupants of the Cessna 172 that seemed like hours. Extreme turbulence tossed the light aircraft about like a leaf in a windstorm, as updrafts and downdrafts added to the control problems induced by the absence of visual references. Nevertheless, the descent was effected in accordance with the DF guidance given by Huntington FSS. Instead of giving way to panic, the bride and groom-to-be teamed up with admirable fortitude—the young lady handling the radio transmissions as her fiance struggled with the flight controls. Although she was not familiar enough with the panel to change frequencies, she was able to relay information from the FSS specialists and to report heading and altitude.

Her role as a makeshift radio operator and her prayerful support were sorely needed by the pilot, who had his hands full trying to keep the aircraft in a controllable attitude and descending in the direction indicated by the FSS. At times the violence of the thunderstorm threatened to wrench the wheel from his hands, to pitch the plane on its back, or to tear it apart. Freezing rain and ice particles blasted into the cockpit through the air vent, obscuring his vision. He was unable to take his hands off the wheel, even momentarily, for fear of losing control. As his fianceé could not reach the vent from her seat, she had to brush away the ice as best she could. Icing of control surfaces apparently added to his problems; at times he could not push the wheel past the neutral position. Hail pellets as large as quarters bombarded the aircraft with such terrifying clamor that the pilot tried to reduce his airspeed, for fear of having the aircraft shattered in mid air.

NO EXIT! Trying to climb a light aircraft over cloud tops of a thunderstorm near Huntington, W.Va., left VFR pilot Sam Williams and his frightened fiancee engulfed in clouds, hail and turbulence. DF steers transmitted by FSS specialists Richard G. Mebus (foreground) and Robert McKinney, were relayed by young lady in the righthand seat, and led to safe landing.

Fiancee Keeps Her Cool

The eve of one's wedding is not the most desirable time to learn instrument flying, but the FAA air traffic specialists whose calm, steadying voices guided the pilot safely down to earth reported that Sam did a remarkable job of controlling the aircraft under conditions that could easily have led to disorientation and disaster. The ability of his fianceé to remain calm and to be helpful under circumstances beyond her understanding probably made the difference between a tragic and a happy conclusion to the "routine" flight.

Fortunately, the terrain below was fairly level. Coordination between Cleveland Center and Huntington Tower effected an airspace reservation from 7,500 feet on down to the airport. At 3:36 p.m. the excited feminine voice on Cessna N35326's radio reported the ground in sight some seven miles northeast of the airport. Three minutes later the aircraft made an erratic landing at Huntington's Tri-State Airport, flattening a tire in the process. A weary young couple emerged from the cockpit and counted their blessings as they stood on solid ground.

Their nuptials were postponed, as poor weather stranded them in Huntington for two days (their wedding license was not valid in West Virginia). But no storm is big or long enough to outlast true love, and 11 days later the Huntington FSS received a postcard datelined Niagara Falls, Canada:

"Because of you we are able to be enjoying our honeymoon here. Thanks again for everything." Sam and Miriam Williams.

Of all the many reasons non-IFR pilots can give for not turning back when a thunderstorm crosses their path, an impending nuptial is perhaps the most compelling. Nevertheless, the consequences could have been fatal. One happy pair in South Carolina is lucky enough to have learned their lesson in time: "Couples who fly together had better respect the weather."

Lewis Gelfan

Runway at Tri-State Airport, Huntington, W.Va., a welcome sight to the storm-weary couple whose aircraft was nearly disabled by ice while trying to fly over a thunderstorm.

Accident statistics do not support the assumption that general aviation pilots become less capable as they pass their physical prime. Experience and judgment help compensate for slower reflexes and weakened vision, but transition from low speed aircraft to jets should be made gradually.

Jets & Geriatrics

Bold pilots seldom become old pilots, so the saying goes, but just how good is an old pilot anyway? Do flyers over 45, say, have more or fewer accidents than younger men in general aviation?

The only statistical evidence comes from independent studies of the Federal Aviation Administration and the National Transportation Safety Board, based on a special, one-time compilation and analysis of accidents and the pilot population—by age and rating—for the year 1965. Conclusive evidence is lacking, but the studies indicate that there is no correlation between advancing years and higher accident rates.

In the FAA study the general aviation population was arrived at by adding year-end figures for 1964 and 1965 and dividing by two to produce an average total of 450,494 pilots in all categories as of mid-1965. This mid-year average included 129,958 students; 185,984 private; 112,546 commercial; and 22,000 air transport pilots.

(The year-end total for 1968—last year for which full data is available—was 680,731, with increases in all categories.)

The statistical tables broke the pilots down by rating—student, private, commercial, and air transport; and by age—16-29; 30-44; 45-59; 60-and-over. Accident frequency was analyzed by rating and age grouping per 10,000 pilots.

Commercial pilots younger than 45 had far more accidents per 10,000 pilots than those 45-59, and 60-and-above. In the 16-29 age bracket, there were 254 accidents per 10,000 pilots.

In the 30-44 bracket the rate was 146 mishaps. This rate dropped to 109 for pilots between 45 and 59, and rose to 123 for those 60 and above.

However, consideration must be given to two factors: (1) The study admittedly did not separate high-risk agriculture pilots by age group. (2) The studies did not reveal the comparable flight time logged in each group. A study showing the accident rate per 10,000 *hours* in each group might be more helpful.

In the private pilot category the difference in numbers of accidents per 10,000 pilots was not pronounced but was lower for pilots 30 and above than the investigators had anticipated. The 16-29 private pilot group had 126 accidents per 10,000 pilots. Those in the 30-44 bracket had 118; in the 45-59 group the rate was 120 accidents; and for those 60 and over the rate was 113 accidents.

When the student pilot category is excluded from the FAA study, the 60-and-over age group appears to be slightly more hazardous than the 45-59, but considerably safer than the 16-29, and about on a par with the 30-44 year age group.

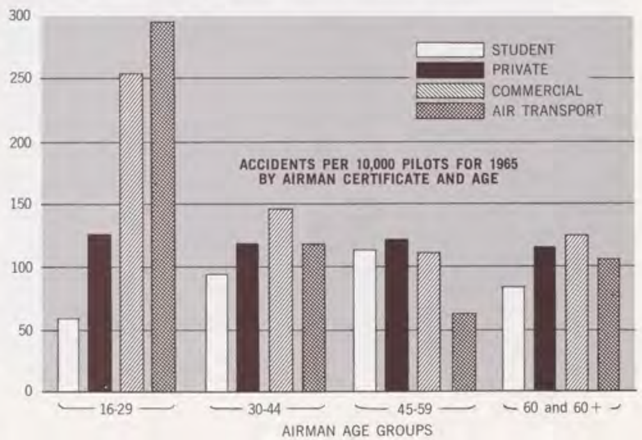
Pilots who have passed the half century mark can take comfort from these statistics, but it would be foolish to disregard the inexorable fact that *physically* they are far past their peak, and steadily declining. In particular, reflexive actions slow down perceptibly after the third decade of life, and visual acuity suffers noticeably after age 40.

Near vision begins to deteriorate with the inability to focus on a near object. This is a direct result of a gradual hardening of the eye's lens, and the trend is not reversible. Night vision also deteriorates.

Charts and digits become more difficult to read, and even though the pilot is conscientious he may not focus fast enough to effectively scan the horizon and the sky around him and monitor his flight and engine instruments without glasses. The mini-second lag in adjusting vision from instrument panel to horizon and back again—repeatedly—could significantly shorten the time available to him for evasive action, when imperative. ■

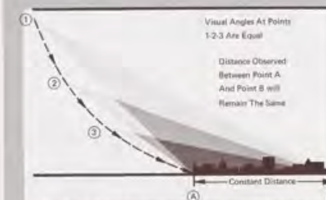
(A concluding article in the next issue will discuss some of the economic factors that affect the safety of older pilots.)

Chart indicates that pilots in 45-59 age group have more accidents as students than other age groups but become increasingly safer pilots as they acquire private, commercial and ATR ratings. Statistics are from 1965 FAA Office of Aviation Medicine study.

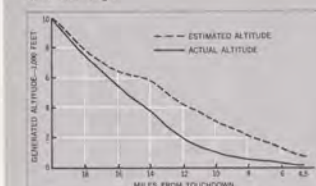


BLIND SPOTS IV

To the pilot making a night VFR approach, city lights give no accurate indication of the terrain below. When the terrain is sloping, flying the null can result in null altitude.

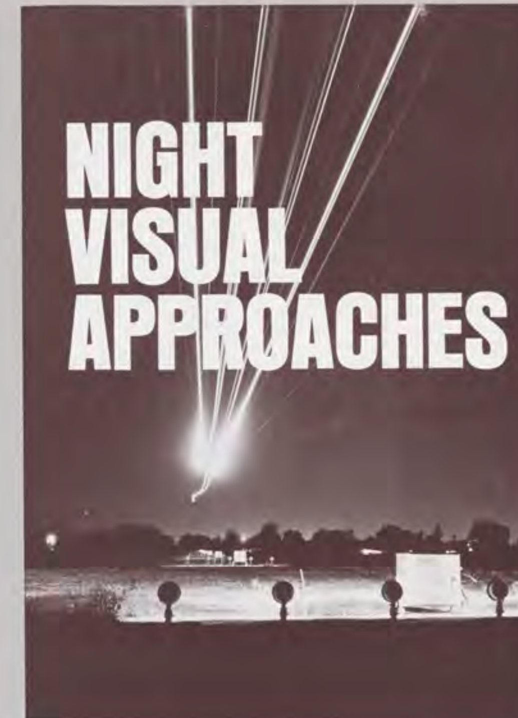


When the angle formed by the pilot's eye and the boundaries of the city (Points A-B) remains constant, the glide path is not a straight line as commonly believed, but part of a circle whose center is directly over the city.



When darkness hides the fact that terrain adjoining the airport is on a slope, the glide path may be dangerously lower than the path the pilot believes he is taking.

NIGHT VISUAL APPROACHES



Flying by night often involves approaches over darkness and landing at an airport located near a brightly lighted city. Pilots whose training and experience in night landings may be confined to airports surrounded by level terrain may not realize that a city background of sloping, illuminated terrain will affect the angle of their glide path significantly.

To understand this phenomenon, consider the following: Assume you are in a helicopter making a vertical VFR descent to an airport at the edge of a lighted city which extends from point A to point B. As you descend, the distance between these points will appear to diminish, as the angle of the viewer's eye becomes more and more acute.

Now assume that you are flying toward the city at a constant altitude. As you approach, the angle of your eye in viewing points A to B will increase, and the apparent extension of the city will increase until you are directly over it.

Now, assume you are making a final VFR approach at a normal constant glide angle. To do so, you endeavor to keep the line of sight angle constant. However, if you do so, your glide path will not be a straight line, but will actually follow the arc of a circle centered above the pattern of city lights, with its circumference contacting the terrain. The diameter of this circle is usually large enough to give the pilot the impression of a straight-line descent.

This type of approach is known as maintaining a visual null (no change in the subject angle). Pilots who fly the null regularly may encounter difficulty when approaching an airport located near a city lying on rising terrain. Tilting the lighted area upward will in effect lower the arc of the circle along which he will make his approach, and consequently he may be much too low before reaching the runway threshold.

In simulated test studies, pilots were informed that they were making a VFR approach to a hillside city; nevertheless, many flew too low, some *well below zero altitude.*

As a safety precaution, use of the instrument approach plate is recommended for all VFR night approaches at unfamiliar airports. Where full ILS is available, the pilot may also wish to make a practice instrument approach, to protect himself against any confusion which the landscape may produce. Irregular lighting, as well as sloping terrain, can be a deceptive landmark at night. ■

(Based on studies by The Boeing Company. Photographs provided by AEROSPACE SAFETY Magazine, USAF.)

The Whirling Dervishes

Wing tip vortices are an increasing menace to unsuspecting pilots.

Friday the 13th is usually considered to be an unlucky day, but for a 35 year-old attorney-pilot from Sherman Oaks, Calif., one such Friday turned out to be one of the luckiest days in his life. The pilot, with his wife and two friends, had gone up for an aerial tour of Los Angeles in his Cessna 172. It was a beautiful August day, with visibility 20 miles plus; temperature 80 degrees; and ceiling unlimited. The flight was enjoyable and uneventful until they encountered an invisible hazard in the final approach phase of their flight.

In his "Pilot/Operator Aircraft Accident Report," the pilot stated that after approximately 20 minutes of local flight, he entered the normal traffic pattern for Runway 15 (at Lockheed Airport, Burbank, Calif.), called the tower and turned downwind. The tower was clearing a Constellation number one on straight-in approach, and advised the Cessna 172 to extend downwind. His altitude was approximately 1600 to 1400 feet downwind and on wide base. On final the pilot noted that even though he was in a wide pattern he was high, so he put down 30 degrees of flaps. As the Constellation taxied off the runway, the Cessna was cleared to land and was cautioned about wake turbulence.

Passing over the San Fernando Road (major traffic artery passing close to runway threshold), the Cessna pilot encountered violent turbulence—wing tip vortices from the landing Constellation. His aircraft was turned approximately 45 degrees from the runway heading to 105 degrees, and entered a sharp descent. The pilot applied full power and righted the aircraft, but struck a tree with his left wing tip. He raised the flaps slowly, made a clockwise circle of the field and landed on Runway 15 without further incident.

The pilot paid $460 in aircraft repairs for his encounter with wake turbulence, and could thank his lucky stars that no one was hurt. He was lucky indeed. Between 1966 and 1968, 62 persons were killed or injured in accidents where wake turbulence was a primary, if not sole, cause. Some of these tragic incidents might have been avoided if the pilots had realized that "cleared to land" means only that the runway is no longer in use by other aircraft. It is not an assurance that no other hazards, visible or invisible, are present.

Aircraft Weight is Decisive

One invisible hazard is the turbulence found in the wake of aircraft. Also known as wing tip vortices, it is produced when an air foil (such as a wing) passes through a mass of air, creating lift and transmitting energy to the air mass. The air spills laterally over the wings and forms a horizontal vortex at each wing tip. The twin vortices settle downward and spread out to either side of the aircraft, whirling in opposite directions from each wing tip. Generally, the greater the lift, the greater the energy transmitted to the air mass in the form of turbulence. The intensity of the turbulence is *directly* proportional to the weight of the aircraft and inversely proportional to the wing span and speed of the aircraft.

Except where vortices are entwined with the contrails of high flying aircraft or the smoke trails from large jets, they cannot be observed. It is the "unknown" about this phenomenon that presents most of the problems to general aviation pilots. No one can tell you exactly where the vortices will be, how long they will last, or what effect they will have. Wind velocity, weather, temperature, the direction of the wind and other environmental factors make it impossible to predict the exact course of the dual vortices at any given moment.

But certain characteristics of wake turbulence are fairly well known. The windmilling air settles below and away from the path of the aircraft, whirling in opposite directions. Avoiding an encounter with wake turbulence calls for trailing aircraft to make a good path *above and well behind the flightpath of the leader.* (Turbulence may persist for five minutes or longer after the passage of a large aircraft).

However, it must be borne in mind that local turbulence or cross winds may alter the ideal dispersion picture, so that the light plane pilot must be always alert and ready to counter the effects of disturbed air whenever flying in the vicinity of similar or larger aircraft.

Wing tip vortices are present from the moment the weight of the aircraft is transferred from wheel support to wing lift. Since aircraft at altitude are usually not in close proximity, wing tip vortices normally

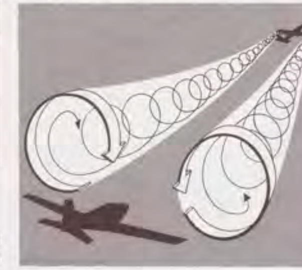
When large aircraft are taking off at X, small aircraft may land or take off at A, B, C, or D, but should avoid taking off or landing at E. The prevailing cross wind could push turbulent air to this point. When large aircraft are landing at Y, small aircraft may land at A, B, or E (but not at C or D) and may take off at A, B, C or E (but not a D) because of the proximity of wing tip vortices.

The smaller the trailing airplane, the greater the danger from wake turbulence. Between 1966-1968, 62 people were injured or died in accidents caused by this "invisible hazard."

are a problem only at airports. Nevertheless, light plane pilots should be wary of crossing the visible wake of jets (i.e. the trailing smoke particles) aloft since the *invisible* turbulence they create may be encountered—especially if a crossing is made at a right angle. When wake turbulence is still present, the greater the angle of crossing, the more severe will be the jolt received. When the telltale jet smoke is in the area, it is a good precaution to reduce speed and be alert for corrective action, since it is impossible to guess where the invisible vortices may have drifted.

Jets or large transports are by no means the only source of hazardous wake turbulence. If you are flying a single-engine aircraft, virtually any other light aircraft can, under some circumstances, generate enough turbulence to upset you if you follow too closely in its wake. Quick takeoffs

Dual wing tip vortices are generated when an air foil, such as a wing, passes through a mass of air. The whirling motion is inward, but the path of the vortices is downward and in opposite lateral directions.



Small aircraft caught in wing tip vortices of departing aircraft is flung up and then down by violently whirling turbulence.

behind aircraft flying touch-and-go practice can provide you with unpleasant surprises.

Airports constitute an environment where wake turbulence is always a potential and sometimes an unavoidable problem. However, solving the problem calls for pilot judgement, not mere reliance on airport or tower authorities.

When in Doubt, Ask

If a tower controller cautions you about wake turbulence, he is warning you that it may exist because of another aircraft that has recently made a takeoff or landing. He cannot tell you *where* it is, or if you will actually encounter it during your operation. When you receive such an advisory, don't hesitate to ask for more information if you think it will help you to analyze the situation and determine your course of action.

Even though a takeoff or landing clearance has been issued, if you believe it would be safer to wait to use a different runway, or to change your intended operation in some other way, ask the controller to approve a revised clearance.

Sometimes clearances include the word "immediate," such as "cleared for immediate takeoff." Such communications are to be interpreted as meaning that if the pilot takes off at once he will have adequate separation from other aircraft. *It is not an "order" to go.* If you have any reason to believe you cannot proceed safely, it is your responsibility to decline the clearance. The controller's primary job is to aid in preventing collisions between aircraft, not to advise pilots on flight procedures.

It is up to the pilot to recognize potential wake turbulence at an airport, and to know what he can do about it. At least five options are open to him:

(1) For takeoffs on the same or parallel runway behind a large, heavy aircraft, plan to take off *before* the point where the larger aircraft left the ground. Remember that even in a "no wind" condition, a vortex from a departing aircraft on a nearby parallel runway could descend on your proposed takeoff route, so check out the takeoff point of that 707 on the runway next to you as well as the one that took off ahead of you.

(2) For takeoffs on intersecting runways, remember the basic rule is to *stay above the flightpath of other departing aircraft.* If the departing aircraft on the other runway was still on the ground well past your intersection, and your takeoff will permit you to climb approximately 100 feet or more before you reach the intersection, you should have clear air.

(3) When taking off after a larger aircraft has landed on an intersecting runway, make sure that it touched down before it crossed your intersection. If this is not the case, you may request a delay or an alternate runway.

(4) When landing behind a large, heavy aircraft, it is essential to *remain above the flightpath* of the aircraft you are following and to touch down well beyond the point where he landed. In this way, you will avoid encountering the turbulence which is settling behind and to either side of the larger aircraft.

(5) When landing after the takeoff of a larger aircraft, make a normal touchdown well within the approach end of the runway. Plan to set your aircraft solidly on the ground before the larger aircraft's point of lift off.

In this age of increasingly crowded airports, and with the introduction of new, heavier aircraft into the system, the responsibility daily grows greater for the pilot of the private aircraft to understand wake turbulence potential and to cope with it under varying conditions. ■

Child's gyroscopic toy illustrates basic stability of a spinning mass, the principle underlying function of aircraft gyroscopic instruments. Whether the rotor is set spinning in a horizontal plane (above) or at an angle (below) the gyroscope will tend to hold its position until the rotor slows down. Aircraft instrument gyros are precision devices driven either by air pressure or electricity.

When the natural horizon is obscured by fog or clouds, a pilot unfamiliar with the use of his attitude indicator may lose his sense of stability and aircraft control.

FLYING RIGHT

Gyroscopic action enables the attitude indicator to show your aircraft's relationship to the horizon even when there is none

Maintaining a proper attitude is more than a figure of speech when the subject is flying, especially when you are on instruments. When the cabin is wreathed with a gray mantle of fog and the horizon has disappeared, maintaining the right *attitude* of the airplane can be a matter of life and death.

Complete or partial loss of visual reference can quickly lead to disorientation, panic, and loss of control of the airplane—particularly if the pilot is not instrument rated and current.

Fortunately, it has long been a simple matter to create an accurate, dependable airborne artificial horizon on the instrument panel. Called by various names—attitude indicator, gyro-horizon, artificial horizon—the instrument is based on the principle that a spinning mass tends to remain stable in its plane of motion. (See "Rigid Rotation," FAA AVIATION NEWS, December 1969).

The heart of the attitude indicator is a gyroscope with a spinning rotor about the size of a golf ball. Energy to spin the gyro is provided either by air pressure or an electric motor.

The attitude indicator provides the pilot with two vital pieces of information: pitch and roll. Moreover, it provides this data in calibrated degrees. It tells the pilot how high or low his aircraft's nose is in relation to the horizon; and what angle, if any, his wings form in relation to the horizon (angle of bank).

In order to get the three-way freedom of motion needed to maintain its plane of rotation, the gyro in an attitude indicator is mounted within two gimbal rings, with the instrument case itself forming a third gimbal. Thus, regardless of which way the aircraft turns, the spinning rotor maintains a horizontal reference plane. The horizon bar displayed in the attitude indicator instrument case is attached to the gyro by a linkage which synchronizes the bar to it.

A miniature airplane symbol, representing the actual aircraft, is a part of the instrument case and in some models can be adjusted up and down by a knob to match the actual horizon with the indicated horizon line shown by the instrument.

Instrument Lag

During sharp and violent maneuvering, such as that encountered in the turbulent weather which normally accompanies instrument conditions, the attitude indicator may develop an error of up to 5°. Also, in a normal turn, centrifugal force may induce a similar momentary erroneous reading in pitch or bank after return to straight and level flying. Following sudden acceleration, the true pitch attitude will be lower than the instrument indication. An opposite error may occur after sudden deceleration. The instrument will correct itself automatically within a few seconds.

Many gyro instruments include a manual caging device, used to align the display with the true attitude of the aircraft. As a general rule, *the instrument should not be left caged, except when deliberate aerobatics are undertaken.* (For shipping, the instrument should be caged or otherwise prepared according to manufacturer's instructions.)

When the attitude indicator is to be uncaged, the aircraft attitude should be straight-and-level, so that the instrument indication and the aircraft attitude are the same. Otherwise the instrument will give an incorrect indication until the automatic correcting mechanism makes the necessary adjustment. Correction devices develop torque around the deflected axis of the gyro, and use the torque to restore it to its normal position. During intentional aerobatics the pilot should keep the attitude indicator caged in order to avoid possible damage to the instrument.

The value of the attitude indicator depends heavily upon the readability of the instrument—the ease and speed with which you can use it to determine exact aircraft attitude. Although the older types of instruments are not difficult to interpret in normal flight attitudes, their limitations and errors require rapid reference to other instruments for precise flying.

Moreover, under conditions of stress during abnormal flight attitudes, rapid and positive interpretation of conventionally designed attitude indicators can be difficult, if not impossible, even for experienced and professional pilots. The display usually consists of a kidney-shaped section of a sphere with a horizon line or bar and a vertical position mark. Bank index markings, usually at 10°, 20°, 30°, 60° and 90°, are scribed on either side of the vertical mark.

With some models of this type of display, the operation of a bank index can be confusing. When the aircraft banks to the right, the display index "moves" to the left, and vice versa. Students and other pilots under stress commonly misinterpret this bank index and apply aileron control in the wrong direction—a mistake that can lead to disorientation and tragedy. Frequent and regular practice is required for safe flying with this type of instrument.

Improved modern attitude indicator designs now on the market remove some of the confusion and allow for swifter, surer readings. One such design eliminates the horizon bar and divides the sphere horizontally by using two distinct colors, representing earth and sky. Bank index degrees are shown by lines painted on the "ground" and shown converging dead center on the horizon. Horizontal ground lines show degree of dive, and a dot above the horizon shows a climb reference.

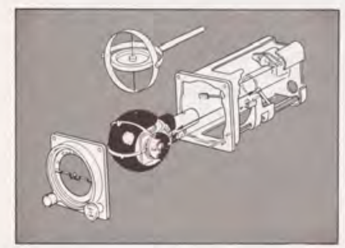
Red Flag for Danger

With this arrangement, there is no mistaking the attitude of the aircraft as shown on the display. When the aircraft goes into a left bank, the aircraft symbol clearly is seen as turning in that direction, regardless of whether the plane is climbing, descending or flying straight and level. Degrees of pitch can be read quickly, and excessive climb or dive attitudes are signalled by the appearance of a red warning flag.

In recent years the attitude indicator has grown much more versatile through the addition of new symbols and functions. Computed steering commands may be provided by a "flight director" system to control the aircraft along pre-selected courses and conclude with a full instrument landing.

Future aircraft will have access to an electronic presentation in which most essential flight information is given to the pilot on a cathode ray tube, much like a television screen. The television picture will be a symbolic presentation of the outside world, reconstructed from the gyros and various radio signals. This type of instrumentation will have the advantages of greater versatility and instantaneous action, but it may be some time until they are considered economical by the average pilot. ■

Above—Electrically driven attitude indicator shows aircraft in a right turn. **Above, right**—modern attitude indicator face features simplified design. Banking scale and horizon bar have been removed from upper part of instrument face. **Below, right**—Uncluttered, clean face of modern attitude indicator provides pilot with instant, accurate picture of his aircraft's position relative to horizon. **Below**—Electrically driven attitude indicator with gyroscope motor in the instrument case with indicator assembly.



Famous

FLYERS

The

FOUR HORSE-MEN

They Tamed the Western Sky

In the early 1920s, when the shadow of the airplane was first making its appearance over the land with some regularity and purpose, a group of southern California businessmen gathered together to complain. Why, they asked, did transcontinental air service terminate in San Francisco, while the City of the Angels received its mail by old fashioned train or ship?

A determination to change all this resulted in the filing of incorporation papers, on July 13, 1925, for "Western Air Express," a pioneer American aviation venture. Of the many early pilots whose courage and dash etched their names onto the pages of aviation history, four outstanding men flew the mail for Western.

First on the payroll was Fred Kelly, a WW I Army pilot and winner of an Olympic games gold medal in the high hurdles at Stockholm in 1912. He was joined by Charles N. "Jimmy" James, Alva R. DeGarmo, and Maurice F. Graham—dubbed the "Four Horsemen" by the press.

The fleet of aircraft originally acquired by Western consisted of six Douglas M-2s—a wood and fabric, single-engine biplane that seated two passengers, face to face, ahead of the pilot's cockpit. Each pilot had his "personal" plane, and there were two in reserve.

The route Western Air Express had mapped out for itself, as a result of a successful airmail bid, lay between Salt Lake City and Los Angeles, with one stopover at Las Vegas. The course they laid down essentially followed the path of the Union Pacific railway tracks, with the gleaming rails serving as visible beacons from the air. In bad weather, it was agreed that east-bound pilots would fly on the south side of the track bed, to avoid collisions with west-bound planes on the north side. Arrangements were made with ranchers, railroad clerks and others to phone in weather information. Canvas markers were staked out to indicate emergency landing strips.

Early in the morning of April 17, 1926, Maurice Graham took off in his red and silver biplane from Los Angeles, while Jimmy James departed from Salt Lake City to inaugurate the new air service. (The honor of flying the first trip had been decided by a toss of a coin; losers Kelly and DeGarmo stood by in their airplanes as alternates). James and Graham passed in flight within saluting distance, each carrying about 250 pounds of mail.

The first flights over the 750 mile course were scheduled for 8½ hours, at a cruising speed of 90 mph, in deference to the strain on the engines. But the impatient pilots soon raised the airspeed to 115 mph and cut the flying time to 6½ hours, apparently with no ill mechanical effects.

Despite the primitive NAVAIDs, all four pilots maintained their schedules with remarkable regularity, day and night, in good weather and bad, in spite of exposure in the open cockpit to winter frost and summer heat (flying clad in shorts only was the informal uniform over the desert).

Night flying, as required by mail contracts, was particularly risky, involving flight over long, uninhabited stretches of country where a forced landing in the dark would have been almost inevitably fatal. The courage and daring of the Four Horsemen, dramatized by the press, gradually built up public confidence in the airline pilot as a virtual superman, offsetting the early fear of air travel.

Informality was the keynote of the early flights. Fred Kelly was a fine pilot (and later became chief pilot for Western Air) but he also had an irrepressible prankish nature. Jimmy James was almost his match in both respects. Not infrequently when Kelly and James passed each other in flight, they landed in the nearest pasture or open field to gossip or introduce the celebrity in their passenger seat—movie stars and other VIPs were among the first regular air travelers. On more than one occasion Western Air's operations office received a report of late flight arrivals from the Salt Lake and Los Angeles offices, both delays blamed on head winds!

Kelly never overlooked an opportunity for a prank that left junior pilots agape with surprise. For example: tired of the heckling from Kelly and the other pilots in the cabin, the crew up front locked the cockpit door. Kelly deftly removed the door pins, which were on the cabin side, and, via intercom, told the pilots in the cockpit that there was some trouble in the cabin. When they swung the door open, it came off in their hands and they were convinced the plane was falling apart.

DeGarmo, a chunky individualist with a resourceful mind, was flying a Boeing 40-B-4, a four-place cabin biplane with the pilot controlling the plane from an open cockpit immediately aft of the cabin. Shortly after takeoff, DeGarmo was startled to see his lone passenger attempt to emerge from the cabin. After a bout with the bottle, the traveler decided it was time to take up wingwalking. DeGarmo, leaning half out of his cockpit (and flying the plane with his knees only), used his long-handled flashlight like a club and persuaded the passenger to return to the cabin.

Maurice Graham, a handsome, likeable perfectionist and a man of strong will, was the first of the Horsemen to be struck down. On January 11, 1930, Graham was reported overdue on the Las Vegas to Salt Lake leg of the eastbound flight. A massive search by air and land was organized by Graham's fellow pilots in the desolate, rugged mountain country of southern Utah—a situation made all the more dramatic by the fact that he was carrying negotiable securities reputedly worth over a million dollars.

Nearly six months later, the airplane, a Boeing 95, was located in the Kanarra Mountains south of Cedar City (Utah); the mail sacks and securities untouched. Searchers finally found the body by the discovery of a solitary clump of wheat, growing from the pocketful of raw wheat seeds Graham had carried to munch on as an aid to resisting cigarettes.

With the aid of courageous colorful flyers like Graham, James, DeGarmo and Kelly, Western Air gained favor with the public and press. Soon it had established a "model airway" between Los Angeles and San Francisco, a route that since has developed into the most heavily traveled airway in the world (over five million passengers a year now travel between these two cities on half a dozen airlines).

Pioneering in air to ground radio communications and other safety improvements, Western Air survived the Depression, and as Western Air Lines eventually acquired routes from Anchorage to Acapulco and from Minneapolis-St. Paul to Honolulu.

The Four Horsemen gradually passed out of the picture. Shortly before Graham's death, DeGarmo left Western to continue his career with Boeing Air Transport (later to become United Air Lines) where he retired as a captain in the late 30s. Now in his 70s, he raises cattle in western Oregon.

Jimmy James, who stayed with Western until his retirement in 1950, became a vice president in charge of operations. He died in 1964.

Of the four, only the indomitable Fred Kelly is still actively associated with Western Air Lines. In 1946, after logging 17,000 hours in the cockpit, Kelly grounded himself, after developing a minor heart condition. Kelly was contacted by Western in 1964 and invited to be associated again with the airline in a public relations capacity. He accepted happily, and once again the first of the Four Horsemen is helping to stir the imagination of the public to the romance and excitement he has known as a pioneer of flight. ■

Above—Pilots Jimmy James (left) and Fred W. Kelly, with Herbert Hoover, Jr., who developed the first practical two-way airborne radio for Western Air Express. **Right**—"The Four Horsemen" with Maj. Corliss C. Moseley, Western's operations chief, center. L-R, Fred W. Kelly, "Jimmy" James, Alva R. DeGarmo, and Maurice F. Graham. The aircraft is a Liberty-powered Douglas M-2, one of six in Western's original fleet.

The Four Horsemen marked scores of emergency fields in the western desert.

Pilot

BRIEFS

■ A WEALTH OF WEATHER LORE is now available free from FAA flight service stations and Weather Bureau facilities. ESSA's "A Pilot's Guide to Aviation Weather Services", an envelope-sized publication, contains tables for converting temperatures (F to C), time from standard to Greenwich Mean Time, wind-speed from knots to mph, and pressure from millibars to inches. Also included are weather abbreviations, a key for decoding teletyped weather reports, effect of barometric pressure on altimeter readings, turbulence reporting, and conditions conductive to icing. The pamphlet lists frequencies of transcribed weather broadcasts (TWEB) and pilot's automatic telephone weather answering service (PATWAS) phone numbers. A valuable addition to any pilot's flight bag.

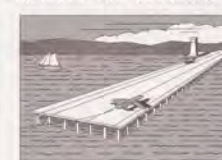
■ THE QUIET AIRPLANE. Lockheed has developed a sail plane into a nearly noiseless military observation aircraft for the U.S. Army by powering it with a 210 hp engine turning a six-blade wooden propeller. A 57 foot wingspread on a 30 foot fuselage gives impressive lift. The aircraft is designed to ghost its way over enemy lines for low level intelligence work.

■ NEW ILS INSTALLATIONS BEGUN. The first of 110 new full or partial instrument landing systems ordered by FAA early this year was commissioned at Orange County Airport, Santa Ana, Calif., last month.

The ILS at Santa Ana is low-cost, solid state, "turn-key" (contractor installed) equipment, consisting of a localizer transmitter, a glide slope transmitter, and two marker beacons. A medium intensity approach light system (MALS) with runway alignment indicator lights is also being installed at Santa Ana to provide the airport with a system capable of meeting ICAO and FAA Category I performance standards.

■ FROM THE TOP. "For the pilot not IFR-qualified or equipped with two-way radio, navigating in busy terminal areas today entails some risk—and the degree of risk will grow with the increase of traffic," FAA Administrator John H. Shaffer told a recent meeting of the Northeast Ohio Pilots Association in Canton, Ohio. "I do not seek to ban any segment of aviation from operating within the terminal area, but certain operating and equipment requirements have to be met."

■ WATER-SURROUNDED AIRPORTS AND HOW TO BUILD THEM is the subject of a two-volume FAA/DOT report on offshore airport planning and construction methods: Offshore Airport Planning (AD 693 172) and Evaluation of Construction Methods for Offshore Airports (AD 693 185).



Four general methods of constructing airports in bodies of water are discussed. These are filled embankment, dike and polder, decked pilings and buoyed decking. The two volumes are sold for $3 each by the Clearinghouse for Federal Scientific and Technical Information (make out checks to CFSTI), Springfield, Va. 22151.

Amphibious Sikorsky S-61N is typical of multi-engine helicopters now active in air carrier service. S-61N can carry crew of two and 28 passengers at 140 mph over 248 miles.

New Rules Affect Maintenance Manuals, 'Copter Pilots

An FAA rule change on Feb. 5, 1970, requires aircraft manufacturers to provide owners with maintenance manuals. The rule applies to aircraft certificated under FAR 23 (normal, utility, and aerobatic category) and FAR 25 (transports).

Multi-engine helicopter pilots engaged in air carrier service will have to perform proficiency landings every 90 days in the type of helicopter that the pilot usually flies, in accordance with another rule change which became effective February 7, 1970. The requirement for two one-engine-inoperative proficiency landings in each 90-day period has been eliminated. However, this particular maneuver will still be required during the pilot's regular six-month proficiency check.

Pilots Respond Quickly to FAA Administrator's Letter

The aviation community was quick to respond to FAA Administrator John H. Shaffer's year-end letter to all licensed pilots recounting the tragic weekend of November 7-10, 1969, when 13 general aviation accidents claimed 30 lives.

The Administrator's letter contained a brief description of each accident and a plea that pilots review their capability to deal with similar circumstances.

Of some 250 replies received, all but 17 expressed appreciation for Mr. Shaffer's concern. Most letters contained the general sentiment that directing pilots' attention periodically to details of accidents could reduce the annual toll. Many thought the Administrator's letter should be enlarged upon to show an object lesson.

The few unfavorable responses generally expressed concern that accident publicity could lead to restrictions on general aviation.

Typical pilot reaction to the Shaffer letter follows:

"In my opinion, your plain and unfettered report stating the bare facts drives home the need for exercise of care and good judgement far more than articles on safety."

"I do consider your comments well taken . . . and perhaps could save the lives of future pilots."

"Now I know that someone at the top of the FAA is interested in me."

"I commend your efforts to bring these accidents to the attention of all pilots . . . each of us should analyze our own faults and bad habits. . ."

". . . a periodic letter of this type will help all of us to stop and think before we take shortcuts."

"Is it possible for you to continue supplying me and my fellow pilots with whatever accident reports might be available as a constant reminder from month-to-month?"

Handbook on Heliport Design

The new edition of FAA's "Heliport Design Guide", the first revision since its initial appearance in 1964, contains complete information on the planning, design and construction for helicopter landing sites.

New additions to the 76-page booklet are separate chapters on public and private heliports, and information on instrument flight rule operations.

Also covered in the publication is information on terminology, the role of the Federal and local governments in heliport development, elevated heliports, visual aids, pavement, safety considerations, and types of helicopter operations. The booklet is illustrated and has a bibliography pertaining to helicopter operations.

The "Heliport Design Guide," AC 150/5390-1A, may be obtained for 75 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

Proposed Rules Would Affect Preflighting, Radio Repairs

Two proposed rules would affect preflight procedures and radio calibration. Notice 70-1 (Docket 10052) would require pilots as part of preflight procedures to be familiar with runway length at the airport of destination, and with takeoff and landing distance at that airport.

Notice 70-2 (Docket 10054) would amend FAR 43 to eliminate the adjusting of all radio equipment, including ILS, VOR and DME equipment, from the category of "major repair." As proposed, the amendment would leave calibration of radio gear in this category.

Comments on both rules proposals should be sent in duplicate to Federal Aviation Administration, Office of General Counsel, Rules Docket, GC-24, 800 Independence Ave., S. W., 20590, no later than April 10, 1970.

TALL TAILS—Boeing 747 tail feathers (left) tower over Boeing 707, itself a heavyweight among airliners. The 747 can carry 374 passengers plus 40,000 pounds of freight, compared with the 707's 141 passengers. As a freighter, the 747 can airlift 260,000 pounds of cargo and fly it more than 5,000 statute miles.

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Sunset Onset

While flying I listen to the regular scheduled weather broadcasts but lately it has occurred to me that sunset time should also be included in the last broadcast before sunset actually occurs.

Mrs. W. E. Bedinger, Jr.
Sioux City, Iowa

Scheduled weather broadcasts are restricted in content to the most essential weather and flight information in order to keep the broadcast within a reasonable time span. If the time of official sunset becomes a critical factor in flight, this information can be obtained by an individual radio request to the nearest FSS.

• Pattern Altitude

While flying into an uncontrolled airfield in New Jersey recently, I provoked the anger of a flight instructor who threatened to report me to FAA for causing a "near miss," as he was landing with a student at the same time. We both got down without difficulty.

I had called the Unicom at the field before entering the pattern at 800 feet AGL but got no response, so I proceeded with my landing approach. The instructor was very unpleasant because I didn't know the pattern altitude was 1,000 feet.

How does a strange pilot find out the pattern altitude of a field? It is not in the Airman's Information Manual or on the sectional.

J. H. Conner
Morgantown, W. Va.

Although many uncontrolled airports have developed a traffic pattern, their use—including the altitude—is not regulatory unless the traffic pattern is established by FAA. If this is the case, adherence to the pattern is required only by departing aircraft.

This requirement is covered in Part 91.89 of the Federal Aviation Regulations.

Given the limited facts supplied by your letter, 800 feet AGL for a light aircraft does not appear to be unreasonable. Of paramount importance, however, is the need to maintain a constant lookout for other aircraft.

• Locked Fuel Caps

Perhaps you or a *Forum* reader can answer this question: Why can't, or won't, aircraft manufacturers provide locks for fuel caps?

It seems that the key used to open and start the aircraft could be used. This might possibly prevent fatal results in acts of vandalism, such as one I read about where investigation revealed that five pounds of sugar had been poured into a fuel tank.

Ronald Leddy
Stratford, Conn.

Technically, there would be no problem in devising a fuel cap lock for aircraft; such locks have long been in use in automobiles. Such application to aircraft would have to show that no safety hazard resulted, such as blocking off a fuel tank vent.

As to why such innovations are not provided by aircraft manufacturers we know of no reason. Perhaps it is a matter of cost, weight, or insufficient demand.

• Unsolicited Proposals

Reference is to the item in "Pilot Briefs" in the January *FAA AVIATION NEWS* concerning FAA's awarding of a contract to develop a low-cost instrument system to warn pilots of the presence of other aircraft. We have designed a low-cost unit we believe will solve this problem. Who shall we contact to bring our product to the attention of the proper authorities?

Houston, Tex.

Unsolicited proposals should be directed to Federal Aviation Administration, DOT Procurement Information Office (LG-280), 800 Independence Ave., S. W., Washington, D. C. 20590.

• Aerospace Humor

I am writing a book on the humorous happenings in aviation and space flight. I would like to communicate with people who can contribute stories, anecdotes and colloquial sayings, such as "He bought the farm" etc. I am interested in true or allegedly true incidents, jokes and cartoons.

Duane Fiorini
3540 Ashwood Ave.
Los Angeles, Calif. 90066

• Spiral Ascension

I am thinking of building a Benson Gyrocopter and would like some information about its safety record. Can you direct me to the available sources?

Fr. Steven A. Katsaris
Belmont, Calif.

A letter to the National Transportation Safety Board (NTSB), 1626 K Street, N.W., Washington, D. C. 20591, should produce the information you seek. NTSB is responsible for investigating civil aircraft accidents and maintains statistics on safety records. NTSB publishes briefs of rotorcraft accidents, as well as briefs on other types of aircraft accidents.

• Safety Streets in the Sky

The FAA proposal for "Terminal Control Areas," (*FAA AVIATION NEWS*, November 1969) has been severely criticized by pilot organizations which have proposed their own alternative plans, which consist of some form of climb/descent corridors. So far, I have seen proposals for increasingly complex configurations of airspace.

Is FAA listening? Is FAA really interested in promoting safety, or is the objective merely to make the use of airspace so restrictive as to dissuade people from flying?

The corridor approach may not be the best, but it has proved itself—the military has used it for years. It is simple, easily charted, and well-defined. Pilots, commercial and others, prefer it. Why is it so offensive to FAA?

Frank Bates, III
San Jose, Calif.

FAA is listening, and FAA is not trying to dissuade people from flying, but the problem is more complex than commonly understood.

High-speed corridors as suggested by AOPA and ALPA will be designed for high density terminal areas, wherever suitable. FAA studies of traffic flow, however, plus experience with military restricted corridors, indicates that strict application of the corridor concept would not be operationally feasible at many busy terminals.

At terminals such as Chicago O'Hare, New York JFK, etc., an excessive number of corridors would be necessary to accommodate the many approach and departure procedures. The resulting tangle of corridors could be difficult to chart, and would make pilot identification of the area a serious safety problem.

FAA is considering a corridor configuration for some airports, a mushroom type configuration for others, and a combination of the two at still other locations.

• Author! Author!

I just finished reading with much interest "On Top of Old Snowbird" in the January *FAA AVIATION NEWS*. The author conveys a warm and sincere appreciation of the electronic technician which is very appealing to this reader.

Can you tell us something about Mr. Gelfan, and are there any other published works of his available?

Gerald Perlman
Oak Park, Mich.

Mr. Gelfan is the author of a novel, The Embroidered City *(Little, Brown, 1950) which may be available in your local library; also some short stories, see* **Readers Guide.**

• Accident Reports

Where can I obtain National Transportation Safety Board (NTSB) "Aircraft Accident Reports" over the past three years?

Joseph A. Esser
St. Petersburg, Fla.

These reports can be obtained by writing to the National Transportation Safety Board, Publications Service, 1626 K Street, N.W., Washington, D. C. 20591.

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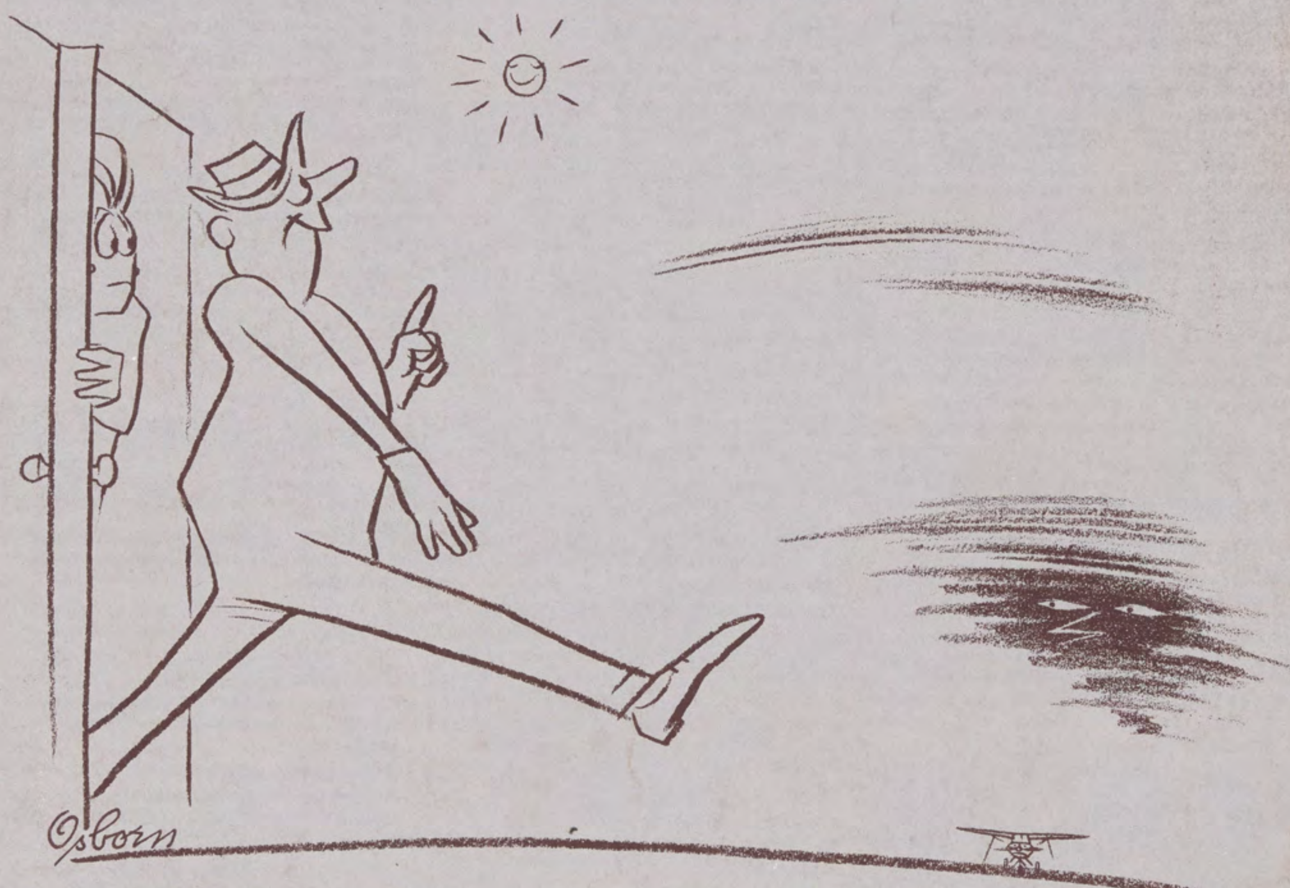

Call FSS for a complete weather scoop

Suggested by Larry Larkin,
Tulsa FSS, Oklahoma