FAA AVIATION NEWS

DECEMBER 1973

COVER:
Kill Devil Hill—
where it all began.

FAA AVIATION NEWS

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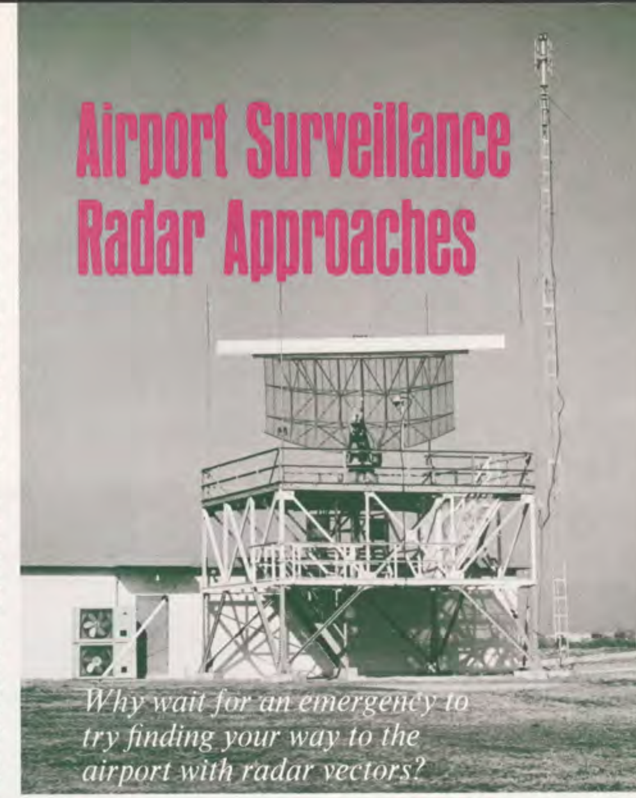
Airport Surveillance Radar Approaches



Why wait for an emergency to try finding your way to the airport with radar vectors?

Airport Surveillance Radar (ASR) approaches are a type of procedure almost every pilot has heard about. But responses to questions on FAA written examinations seem to indicate that very few pilots know exactly what the procedure consists of (it is not a precision approach, like a PAR). In the simplest of terms, an ASR approach consists of radar vectors to an airport or runway. In practice, this occurs commonly when any pilot, IFR, VFR or otherwise, gets lost and requires emergency assistance in reaching an airport. Also, when any airplane suffers an inflight emergency, such as equipment failure or fuel exhaustion, radar vectors are used, when available, to direct the pilot down in the shortest possible time.

Additionally, Airport Surveillance Radar approaches are also executed in non-emergency conditions, either (1) as a matter of convenience to the pilot, (2) as a useful exercise in aircraft control, or (3) as a means of maintaining controller currency in radar vectoring.

Suppose, for example, there is a failure of the ILS localizer at your destination airport, when the weather is IFR. If the ceiling and visibility are at or above the minimums for a nonprecision approach you would not, in all probability, be obliged to divert to your alternate airport if an ASR approach is available.

How do you know in advance whether an airport is equipped for ASR approaches? Most radar-equipped control towers offer these approaches—there are over 100 throughout the United States. Some airports in the vicinity of radar-equipped towers also receive this service, when the workload of the controller permits. Specific information about individual airports is found in the first part of each regional Instrument Approach Chart Booklet, in the Section titled "Civil Radar Instrument Approach Minimums." The same information is given in the NOS Enroute Low Altitude Charts, Area Charts, and Instrument Approach Procedure Charts.

Both VFR and IFR pilots are encouraged by the Air Traffic Service to request ASR approaches in VFR weather as a means of familiarizing themselves with, or sharpening their skill at, controlling their aircraft in response to precise radar vectors. They will be given course guidance (in azimuth only), and after passing the final approach fix, distance information at one mile intervals from the runway or airport down to the last mile. If requested by the pilot, recommended altitudes may be issued, also at one mile intervals. The recommended altitudes on final approach decrease by 300 feet each mile, and the pilot should adjust his rate of descent accordingly.

In the case of IFR pilots, if the Minimum Descent Altitude is reached before the Missed Approach Point (MAP), the pilot should maintain this altitude to the MAP. The controller will advise the pilot when he reaches the MAP or is one mile from the runway—whichever comes first—and if at this point the airport or its environs are not in sight a missed approach procedure should be commenced. Pilots are advised to be prepared to take over visually if, on final approach, communication with the tower is lost for more than 15 seconds.

VFR pilots on ASR approaches will simply be expected to execute vectors as requested, and to take over on their own if communications with the tower fail. All pilots must continue to rely on seeing and being seen as a precaution against the possibility of conflict with other aircraft or obstacles, and not to execute any vectored maneuver which their own judgment indicates could be hazardous.

ASR approaches in VFR weather are good practice for the controller as well as the pilot, particularly for controllers who may be relatively new to an area. They are offered only during periods of low traffic activity, since the service requires that a controller and a radarscope using a special overlay be devoted to handling a single airplane, instead of all the traffic in a given sector, as is normally the case. This should explain to pilots why the service can only be given on a workload-permitting basis.

Equipment needed on board the airplane for an ASR approach consists simply of a communications receiver and transmitter—and in a pinch the receiver alone can be used, after the pilot has indicated by the appropriate flight maneuver (triangular patterns) that he has lost his transmitting capability. Loss (or absence) of navigation radios would not affect the approach. It can even be conducted following a loss of gyro instruments.

No one has to wait for an emergency to try an ASR approach. As practice in good weather, it is an excellent means of testing your ability to stop a turn on command and maintain precise headings, while performing the other cockpit tasks required prior to landing an airplane. They also help to build up your confidence in your instruments in bringing you close to a runway, so that should you ever find yourself in an inflight emergency you will be well prepared to help others help you safely to the ground. ■

The Gas Chamber

Existence of crack prior to accident was proven by heat discoloration on the inner surface of the muffler shroud (above left) and on the metal of the muffler itself near the crack. CO fumes rendered the pilot incapable of landing the plane, which crashed near the runway (right).

The day after the crash there still was no clue as to why it had happened. Witnesses generally agreed that the Cessna 175 had stalled out of a tight turn near the approach end of Nashville's Runway 31—but no one could provide a reason. One thing was obvious: in the moments before the tragedy the pilot had exhibited a confusion inconsistent with his experience.

The incident had begun routinely at 10:48 on a cold, clear February morning when Nashville's control tower received the following initial call:

Nashville, Cessna six nine six five echo, landing Nashville.

A question from the tower revealed the plane's position as eight miles southeast of the airport. (Later reconstruction indicated the 46 year old pilot was making a planned fuel stop en route from Clearwater, Fla. to Muncie, Ind. He was the owner of the Cessna and during the past couple of years had logged nearly 500 hours in it.)

The tower acknowledged the call and told 65E to report left base for runway 31. Five minutes later the communications resumed.

65E: *Uh. . . . six five echo turning short left base.*

Tower: *Six five echo, roger. You're number three to follow a Douglas DC-3 on right base.* (Another Cessna was on final approach).

65E: *Six five echo, don't have him in sight.*

Tower: *Okay, he's just north of that rock pile.*

(There was a pause.)

Tower: *Six five . . . Six five echo, do you have the DC-3 now?*

65E: *Affirmative.*

Tower: *Okay, follow him, you're number three.*

Where's My Traffic?

At 10:55 the tower received a somewhat disturbed call from the pilot of 65E, which by then was nearing the final approach path for runway 31, almost above the DC-3 which was about to land.

65E: *Six five echo, I don't know what happened to my traffic. . . that was a Cessna ahead that. . . I was following it.*

Tower: *Naw, I told you to follow the DC-3 and you told me you had him in sight, Sir. You can . . . he's on the ground. The DC-3. . . you can come right in now toward runway three-one.*

65E: *Six five echo.*

The runway was clear and 65E was in a position to land, but the pilot seemed confused and he had apparently still not spotted his traffic (which was by now safely on the ground). Instead of proceeding with the landing, the pilot suddenly pulled the nose up and started a left turn. The controller, who had glanced away briefly, did not see the wing dip and the plane plunge to the ground. Visually searching the sky across the airport he spoke into his mike:

Six five echo, Nashville tower. . . Do you read me?

There was no answer. The pilot was killed in the crash, and wheels were set in motion for an investigation.

A preliminary examination of the wreckage yielded no clues. From all indications the apparently well-maintained airplane and engine had been operating normally before the accident. There was ample fuel; weight and balance were within limits; the pilot was well-qualified. The investigators continued their search for a cause.

The first of the puzzle pieces fell into place when the toxicology report was completed: The pilot's blood showed 30 volume percent of carbon monoxide—far more than danger level. Investigators quickly focused attention on the airplane exhaust system, which earlier had shown only impact distortion.

Now the right muffler shroud was removed, disclosing a 1¼ inch crack, with heat discoloration on the metal around the crack as well as on the inner surface of the shroud—telltale evidence that the crack was not a new one. Carbon monoxide (CO) fumes had evidently been feeding into the cabin through the heater outlet. The mystery of the pilot's erratic behavior was solved. It was a classic example of CO poisoning, an often-ignored hazard that causes a number of accidents and incidents to small aircraft every year.

Carbon monoxide, the product of incomplete combustion of carbonaceous material, is found in varying amounts in the smoke and fumes of aircraft (and other) engine fuels and lubricants. You cannot see, smell, hear, taste or feel CO. However, it is often mixed with other gases and fumes which can be detected by sight or smell. When carbon monoxide is breathed and enters the blood it combines with hemoglobin, the oxygen-carrying agent in the blood. The affinity of hemoglobin for CO is, unfortunately, much greater than for oxygen, so the CO "squeezes out" the oxygen—and oxygen starvation results. Sufficient exposure to carbon monoxide in itself is fatal, but of equal importance to pilots is the fact that *long before that fatal point is reached a person's reasoning ability may become so impaired that he can not function as a pilot*, and may make a fatal error in judgment or aircraft control, as in the above accident.

Many light plane cabins are warmed by air that has been circulated around the engine exhaust muffler. A defect in the exhaust or cabin heat system may allow carbon monoxide to enter the cockpit. Naturally the danger is greatest during the winter months, when cabin heat is in use and vents are closed, but it is not limited to cold weather. CO can also enter the cabin through openings in the firewall and around fairings of the exhaust system, doing its deadly damage in any season.

It takes a surprisingly small amount of CO fumes to create a hazard. Volume of a small aircraft cabin may total no more than 50 or 60 cubic feet; a concentration of CO exceeding one part in 20,000 parts is hazardous. A good airplane engine, running on a rich fuel mixture, will have about 7% carbon monoxide in its exhaust. (A lean mixture results in a smaller percentage, but human susceptibility to CO poisons increases with altitude.) Other factors, too, can hasten the effects of CO: Alcohol in the blood decreases the body's CO tolerance. Tobacco smoke also introduces CO into the body, and although smoking by itself is not sufficient to cause CO poisoning to a dangerous level, a person who smokes does have a head start toward CO poisoning.

During the past few years the CO accident rate has shown some improvement—probably because of improved manufacturing and maintenance techniques coupled with pilot education. Still, there are numerous aircraft owners and operators who ignore the potential danger of this sneaky killer. Unless the 100-hour or annual inspection happens to coincide with the oncoming of cold weather, no seasonal inspection of critical parts is performed. Some pilots will slip on their mittens, warm up their engines, turn on the cabin heater—and take off. Even conscientious pilots, who religiously change to winter-weight oil and check the cold-weather inflation of their tires, may neglect to have their exhaust and cabin-heat system inspected at the beginning of the winter.

The only way a pilot can be positive there is no CO leakage into his aircraft cabin is to have a detector used. These are available at most maintenance shops. Most accurate is the "sniffer" type, which is operated by drawing a sample of air into a transparent tube which contains material that changes color according to the amount of CO present. Reading is made by comparing the color in the tube to a color standard provided with the instrument. Inexpensive do-it-yourself indicators are of some help, but are generally less accurate than the sniffer type. In any case, cabin air should be tested with heater both "off" and "on". However, do not assume that having your exhaust system checked once (during a periodic inspection or at the beginning of winter) will protect you forever. Cracks and holes in exhaust systems sometimes occur in a relatively short time. In fact, some manufacturers recommend inspection of the exhaust and heater system every 25 hours of flight time.

Unlike hypoxia symptoms, which usually are accompanied by a happy-go-lucky feeling of euphoria, the effects of carbon monoxide poisoning generally begin with sluggishness. The victim may feel overly warm and have a tightness across the forehead. Next he may have a headache, throbbing or pressure in the temples and ringing in the ears. With no relief the headache will become severe, and there will be general weakness, dizziness and a gradual dimming of vision, and of course all during this time the reasoning ability of the individual will be increasingly impaired. If the CO exposure continues without relief there will be loss of muscular power, vomiting, convulsions and coma, and eventually, death.

Because carbon monoxide effects "sneak up" on its victims, pilots should memorize the symptoms so that they can recognize them, and take action promptly. If you ever suspect that you smell exhaust odors while flying, or begin to experience any of the above symptoms, assume the presence of carbon monoxide and head for the nearest suitable airport *at once*. Meantime, turn off the cabin heat and (unless the manufacturer recommends against it) open all available fresh air sources including air vents and windows—although you may have to slow down for the latter. (In certain aircraft opening vents could allow excessive drawing in of CO from the engine; if you have any doubt about your model, check with the manufacturer). Breathe emergency oxygen if you have it.

Nil Reasoning Power

However, an emergency of this kind is no time for research or for reading the airplane handbook. Before it arises under critical circumstances you should, as part of your aircraft checkout, familiarize yourself with every plane you fly, with respect to fresh-air sources and the heating and exhaust system—and their controls. If you are exposed to CO fumes your thinking and reasoning ability may be nil, so these procedures should be well-rehearsed, along with those for other emergencies.

Recognizing the problem quickly, and reacting with the proper emergency actions, enabled two pilots to live to tell of just such an incident. An instrument instructor was accompanying a *Bonanza* pilot/owner on a dual IFR cross-country flight in actual instrument conditions over Pennsylvania when the student became ill. The instructor took over, and although he too was beginning to feel sick, he managed to slow down, open a window, declare an emergency and complete a successful instrument approach and landing. Both men were treated for CO effects at a local hospital. A leak was subsequently located in the cabin heat system. Oddly enough, although neither pilot was able to shut off the cabin heater during the episode in the air, once they were on the ground and exposed to fresh air, each could do it easily. Such are the effects of CO poisoning; this incident provides a convincing argument for knowing the emergency actions to cope with it promptly.

One last word of warning: it is possible to experience the effects of carbon monoxide poisoning even if there are no defects in your airplane. If you are following a jet aircraft on takeoff, or are stopped on the ground downwind of a jet that is "ground holding" prior to takeoff, you could get enough fumes to be affected. Whenever possible, position your airplane out of the exhaust area of preceding aircraft.

The subject of carbon monoxide poisoning and detection is discussed thoroughly in FAA Advisory Circular AC 20-32B "Carbon Monoxide (CO) Contamination in Aircraft—Detection and Prevention," available free from DOT/FAA Distribution Unit, TAD 484.3, Washington, D.C. 20591.

R. T. Benedict

FAR's are grouped into volumes, as listed below. FAR's may be ordered, by volume only, from the Superintendent of Documents, Washington, D.C. 20402 or purchased from any Government Printing Office Bookstore. Prices include transmittals (amendments), which are sent automatically to subscribers.

Beside each FAR volume number below are listed all transmittals for all Parts in that volume, to date. Number in parentheses after each Part indicates the latest transmittal, if any, to that Part.

(Note: For upcoming changes in FAR sales, see page 14.)

FARs

STATUS of the FEDERAL AVIATION REGULATIONS

(As of December 1, 1973)

FAA VOLUME/PART	TITLE	PRICE
Vol. I: (Transmittals 1-5)		$2.50 + 75¢ foreign mailing
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* Changes to individual airspace designations and airways descriptions, individual restricted areas and individual jet route descriptions are not included in the basic Parts 71, 73 and 75, respectively, because of their length and complexity. Such changes are published in the Federal Register and are included on appropriate aeronautical charts.

** Due to the complexity, length, and frequency of issuance, airworthiness directives, enroute IFR altitudes and standard instrument approach procedures are published in the Federal Register and are not included in basic Parts 39, 95 and 97. In addition, enroute IFR altitudes and instrument approach procedures are depicted on aeronautical charts.

Standard instrument approach procedures are published in the Federal Register by reference to FAA documents which are available for examination at the Rules Docket (AGC-24) and the National Flight Data Center, in FAA Headquarters, Washington, D. C. and at FAA Regional offices and Flight Inspection District Offices.

Sorry, No Gas

It was not until after they had been left at the airport with their fishing gear, ice chest and luggage, that the pilot and his fishing buddy noticed the "closed" sign in the window of the line shack: the building, with telephone inside was locked up tight. When they had arrived the previous weekend, they had been impatient to start their holiday. The lineman was busy servicing a couple of other planes so they had decided to wait until their departure to fill their tanks. This was an unexpected—and unfortunate—turn of events. They probably had no more than half an hour's gasoline in the tanks, and no way to tell whether there would be fuel available at other airports within that range. Too risky to start out under those circumstances . . .

When they walked down the road to the farmhouse, they were seeking only a telephone, but they were in luck (they thought). They found that the farmer had, out by his barn, a gasoline pump with which he fueled his farm equipment, and the octane rating seemed all right for their 150 hp engine. The farmer also had a pickup truck, some empty five-gallon cans, and a strong sense of neighborliness. Before long they were in the air, rocking their wings in a gesture of thanks and farewell, and congratulating themselves on their good fortune.

In the next half-hour—after the airplane engine suddenly quit and they made a semi-successful forced landing in a wheat field—they suspected they might not have been as lucky as they first had thought. Next day, a multitude of embarrassing questions by local authorities and FAA confirmed their suspicions. *Airplanes were not designed to run on automobile gasoline.*

Recently announced fuel allocations may result in spot fuel shortages which might tempt a pilot to use automobile gasoline, or a lower grade of avgas than recommended by the engine manufacturer. Both temptations should be rigorously resisted.

The arguments against using auto fuel in an aircraft (or even a different grade of avgas) are many and well documented. The results can include everything from engine damage or engine failure to an increased susceptibility to fire. In addition an increased octane requirement may result from deposits and coatings on valves and combustion chambers.

- Engine failures can occur because automobile fuel has a higher vapor pressure than avgas (8 to 14 lbs. as compared with 5 to 7 lbs.). In high temperatures and/or altitudes bubbles may form in the fuel lines, preventing fuel flow and resulting in vapor lock and engine failure. The low vapor pressure of aviation gas is designed to assure against such stoppage.
- Pre-ignition, detonation and perhaps engine damage can result because of the considerable difference in actual anti-knock rating of auto fuel and avgas. *This difference exists even though the octane rating (or anti-knock quality) of an auto fuel is similar to what you normally use in your aircraft engine, because different methods are used to rate aviation fuels.* Auto fuels also have wider distillation ratios than avgas, which allows for less effective distribution of the anti-knock components.
- Automobile gas additives are not compatible with aircraft engines. The anti-knock additives, or tetraethyl lead (TEL), in auto fuels contain a considerable amount of chlorine and bromine; in aviation fuels only the chemically correct amount of bromine is added. Chlorine is extremely corrosive and under severe conditions can lead to exhaust valve failures. On the other hand, lead-free auto fuels should not be used in aircraft engines because, among other reasons, they lack the valve-seat lubricating qualities of leaded aircraft fuels. Lead-free auto fuels would still be subject to vapor lock and volatility problems if used in aircraft.
- Automobile gasoline tends to have less storage stability. Airplanes are generally not operated as regularly as automobiles, and auto gas left in fuel tanks for any length of time may suffer loss of octane rating and become gummy after evaporation. Automobile engines are built with limits and clearances to accommodate this instability, but airplane engines are not.

Another temptation, for pilots who are unable to obtain the fuel octane they need, is to use an alternate grade of avgas. With many aircraft this can be done within reasonable limits, but before you resort to this course you should *always* check the manufacturer's recommendations. If your grade of fuel is not availbale, and the engine *must* be operated, there are a few general guidelines to follow:

- Use the next higher (never lower) octane fuel.
- Be aware of the possible consequences if your engine is designed for 80/87 octane and you must use the new "reduced lead" 100/130 avgas. This new fuel is still of a higher lead content than 80/87 (though lower than the original 100/130). The increased lead will create more deposits in the cumbustion chamber and could lead to various maintenance difficulties. Its effect may vary from negligible to critical, depending on the vintage of the engine and other factors. Some manufacturers permit the unrestricted use of the new "low-lead" 100/130 octane fuel in engines approved for 80/87. Others allow its use 25% of the time.
- Whenever running with higher leaded fuel than recommended, keep the mixture on the rich side of normal lean to counteract the effects of increased combustion chamber deposits. Avoid extremely lean operation.

If the fuel you use is not compatible with your original engine handbook specifications you may have to take your problem to your maintenance facility. Necessary steps may include more frequent inspections of plugs and compression; increased maintenance in the form of oil changes or even a top overhaul; approved engine modifications; or combinations of the above.

Understanding the fuel requirements and tolerances of your airplane engine is important to your flying pleasure, your pocketbook and your safety. If you have a problem, get expert help. Aircraft engines were not meant to run on substitute fuels. Some are outright dangerous and against the law—their use may result in cancellation of your insurance, warranty . . . and your life.

A leaflet, "Danger, Automotive Gasoline at Work," is available from FAA Accident Prevention Specialists at Flight Standards or General Aviation District Offices. Also, an FAA Advisory Circular, AC 91-33, "Use of Alternate Grades 80/87," may be obtained free of charge from DOT/FAA Distribution Unit, TAD-484.3, Washington, D.C. 20591.

Spin-In

A spin is usually defined as "an aggravated stall resulting in autorotation." Before you can spin an airplane you must stall it, and if you are able to prevent it from stalling or recover from a stall promptly and effectively—no spin. Since stall prevention and/or recovery procedures are well known and widely practiced (see FAA AVIATION NEWS, October 1973), why do we still have so many fatal or serious accidents in which the aircraft spins into the ground?

The primary reason appears to be that when an unintentional stall occurs at low altitude, the inexperienced pilot is apt to panic.

A typical serious spin accident occurs on takeoff following a mechanical failure. The inexperienced pilot, forgetting all he has been taught on this subject, yanks the plane around in a panicky effort to get back to the airport. Going into a steep bank with the nose still high, the aircraft stalls and drops into a spin as the desperate pilot pulls back futilely on the wheel in an effort to escape impact with the ground. *A spinning airplane is a stalled airplane.* It will not climb until the stall factors have been overcome—i.e. insufficient airspeed and excessive angle of attack.

Some of the most common causes of unintentional spins are:

- An *improperly* performed steep turn.
- Too steep a climb
- A skidding turn.
- Insufficient airspeed

It is apparent that these maneuvers most commonly take place during the takeoff or landing phase of flight, when altitude is a critical factor. A badly performed steep turn or an excessively steep climb may follow an ill-planned takeoff, when terrain obstacles present a hazard—or they may be part of a deliberate act of showing off. The third source of trouble, skidding turns, are sometimes the result of overshooting the turn to final approach and attempting to tighten the radius of the turn with rudder.

Another common circumstance which leads to serious stall/spin accidents is slow flight at low levels—when sightseeing, for example, patrolling woodlands or cattle ranges, engaging in search and rescue, geological or real estate surveys, aerial photography, etc. The pilot who allows his attention to be diverted too long away from his airplane may not notice a further decrease in the airspeed, or he may not be prepared to handle a sudden wind shift or gust. Close proximity to the ground may upset him to the point where he overcontrols the airplane. Abrupt control movements are very conducive to stalls or spins. The inevitable loss of altitude (a light plane may drop 400 to 500 feet in a single revolution during a spin) may be more than he has to spare.

Several years ago, before hunting from aircraft had been banned federally, two airborne coyote hunters took off in an Aeronca on a winter afternoon from a ranch near Presho, S. Dak. The pilot in command, 33, had 1,272 total hours, 162 in type, and held a commercial certificate. They succeeded in shooting two coyotes and were circling a third, at about 300 feet above the surface, when the airplane went into a spin and crashed. Snow on the ground may have cushioned the impact; both hunters survived, although seriously injured. The pilot said later that he had recovered the aircraft just prior to its striking the ground. Apparently he *could* have recovered without incident if he had maintained a safer altitude.

Almost all aircraft will spin, and in fact the spinning process itself does not place a great stress upon it structurally. It is during the pull-out phase of spin recovery that additional gravity forces may be felt—usually no more than about 3.5 "G"s, although in a pull-out from a 70 degree dive a force of more than 6.0 "G"s may be experienced for one or more seconds. (One "G" is the gravitational force felt during straight and level flight.) Aircraft in the "Normal" category are certificated by FAA to withstand stresses up to 3.8 "G"s only. Aerobatic aircraft are certificated to withstand 6.0 "G"s.

In addition to stress limitations, certain aircraft have flight characteristics which make them difficult to recover from a spin, especially if there is considerable aft loading. In general, the flatter the spin (the more nearly horizontal) the more difficult it is to recover.

What exactly happens when an airplane spins? When we say that it is an aggravated stall, we mean that the stall is worsened by continued back pressure and application of rudder. If we release the back pressure the aircraft may move from a spin into a spiral. Some, but not all aircraft will recover to level flight if all controls are released, given sufficient altitude. There was a period in aviation history (1945-1948) when federally certificated light aircraft had to be capable of recovering from a spin "hands off" within one and a half turns, and pilot applicants were tested in spin recovery.

Supervised aerobatic training can help you master control of the aircraft but nothing will assure your safety if you fail to maintain a minimum safe altitude above the ground.

But in 1949 the spin testing of airmen, and the "hands off" spin recovery requirement (although not spin tests) of aircraft were eliminated in the expectation that greater safety would result from more emphasis being placed on the prevention of and recovery from stalls; and in anticipation that general aviation aircraft manufacturers would build spin-resistant or spin-proof airplanes. The first expectation appears to be justified by a reduction in stall/spin accidents over the ensuing years, but hopes for spin-proof aircraft have not been generally realized.

When we speak of a spinning aircraft having autorotation, we are not referring to the propeller, of course, but to the wing, which is whirling around somewhat in the manner of a helicopter blade. However, the blades of a helicopter have fairly equal lift during autorotation, whereas the spinning airplane has partial lift on the upraised wing and virtually no lift on the lowered wing: this is what actually causes the spin.

The flight path of a spinning airplane is virtually a plumb line to the ground. The nose is not pointing directly at the ground, although it may seem so to a frightened pilot in his first spin; rather, the airplane revolves around its center of gravity. Airspeed is relatively low, somewhat less than stall speed, but the airplane will be dropping earthward at something like a mile a minute, which is cause for concern. The relative wind is straight up, and the angle of attack of the wings is excessive. Hence, the nose must be pushed further down to overcome the stall—once the rotation has been halted by opposite rudder.

The spinning motion may lead to disorientation, especially in an inadvertent spin near the ground. When the airplane spins to the left, the earth appears to be spinning to the right, and a confused pilot may jam on left rudder, frantically and, of course, futilely. In most aircraft struggling to regain control by means of the ailerons is also useless, and may even produce a more severe spin, or lead to a flat spin. Prompt, brisk application of opposite rudder, followed by positive forward elevator control movement is the only means of recovery. (Manufacturer's spin recovery recommendations should always be followed.)

Incidentally, mis-loading or overloading an airplane, or externally loading it with such objects as skis, sleds, toboggans, game trophies, etc. may effect the spin or stall characteristics and airspeed, and may also create a serious flutter problem. Overall performance of the airplane becomes an unknown commodity and may be dangerously reduced.

What effect does spinning have on the pilot? During a prolonged spin he may become dizzy and possibly nauseated, especially if he attempts to stare at one point on the ground. The safest practice is to let your gaze flow easily from one object to another. You will not feel any pronounced gravitational effects until you begin your pull-out, which, in an inadvertent spin at low altitude, must be started the instant the rotation stops. In a normal category aircraft the healthy pilot can assume that his body will be able to withstand (for short periods) about as much stress as the airplane—i.e., the airplane will start to separate before he passes out. He should not become alarmed at the tugging sensation on his upper body, or some "graying out" of vision, but continue the pull-out. (Tensing the abdomen will tend to stave off "graying-out.") Positive "G" sensations lasting a few seconds are not harmful; indeed, some pilots have found them exhilarating. Speed Holman, for example, in 1928 set a still existing world record for consecutive inside loops when he performed 1,453 in a row, experiencing 3.5 "G"s during two distinct phases of each loop.

Medical investigations have shown that the average skilled aerobatic pilot can function effectively for up to three seconds under a stress as high as 12.0 "G"s—an enormous load that would disintegrate the average light plane. This is because the brain can operate on the oxygen diffused in its tissues for about three seconds.

Some sectors of general aviation have called for a return to spin recovery training for private pilots. FAA is giving consideration to the pros and cons of such training under revised Part 61. However, many accidents involving spins occur because the spin was entered at an altitude too low to permit recovery before impact, regardless of the pilot's familiarity, or lack of it, with this maneuver.

If you feel that some experience in spin recoveries will give you greater confidence in the cockpit, you are encouraged to take some dual instruction from a qualified instructor in a properly certificated aircraft. Chances are you will find that one of the greatest safety benefits of such experience is that it will teach you how to avoid losing control of the aircraft under any circumstances. That is the real key to safe flying. ■

Unequal lift at the wings gives the plane its rotational motion: wing with most lift chases the other wing like a dog after its tail.

During spin the airplane nose seems to be pointed straight down, but is not. Aircraft path is, however, virtually straight to the ground.

Illustrations based on drawings from "The Student Pilot's Flight Manual" by William K. Kershner, Iowa State University Press

Weather Whys:

From the turn of the century until the 1930's kites carried instruments high into the air to measure temperature, pressure and humidity.

Aviation Forecasts

This is the ninth article in a series on aviation weather prepared by meteorologists of the National Weather Service.

Nearly all human activities are influenced by weather, especially those conducted when man leaves the ground and subjects himself to the whims of the atmosphere.

Even the Wright Brothers, before their first flight, foresaw the need for weather information. In 1902, at the Wrights' request, the Weather Bureau prepared a study of surface winds at Kitty Hawk. Continued association with aviation throughout the years has shaped the entire structure of the Bureau.

During the period of aviation development before World War I, the Weather Bureau assisted many individual flights. Daily weather forecasts, principally for military aviation, began in 1918. The service expanded in 1919 when the Post Office started regular air mail flights. All flight forecasts were prepared in Washington and broadcast over special Post Office radio stations. These early aviation forecasts included current and expected weather conditions—cloudiness, visibility, wind direction and speed—and in many cases suggested the best altitude for flying. No night forecasts for aviation were issued until 1924.

Weathermen in those early days had little information on conditions above the surface. Pilot balloons were used in a few places, and upper-air observations were made with kites at six stations scattered throughout the United States. Incredibly, six to eight kites strung on steel wire could carry recording instruments as high as four miles, but the effort to reach such heights took four to five hours.

Early aviation weather service also was hampered by inadequate communications. Until 1928, the Weather Bureau depended on telephone and telegraph to collect and distribute weather information. Moreover, there were no briefers to assist the pilots, nor were there any airport weather stations.

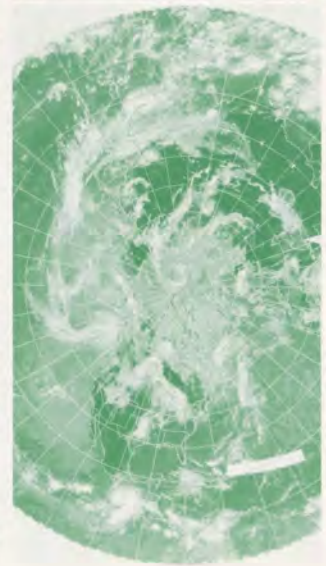
The turning point came in 1926, with the recognition that flight safety demanded better weather information. Congress, in passing the Air Commerce Act, authorized the Weather Bureau to expand its services to aviation. Within two years, 18 Weather Bureau Airport Stations were opened.

Today, most weather offices are located at airports. Extensive weather observing networks, high-speed communications systems and a special forecasting organization serve the needs of aviation. Modern instruments have capabilities undreamed of by the kite-flying weather observers. Radiosondes, lifted by balloons to heights of 100,000 feet, measure temperature, barometric pressure and humidity. Radar detects storms and precipitation up to 250 miles away. New modifications enable radar measurement of precipitation falling at distant points. Automatic observing stations in remote areas on land and sea can make weather observations and transmit them to manned stations. Other instruments provide automatic, instantaneous reports of weather conditions as nearly as possible as the pilot himself would see and experience them.

The weather satellites launched since 1960 have given meteorologists a new view of weather around the world. Cloud photographs taken by these satellites provide vital information, unobtainable from other sources, to improve analyses, forecasts and warnings. The photographs themselves have proved valuable in briefing pilots for intercontinental flights.

Weather reports from all over the world flow by radio and high-speed teletypewriter to the National Weather Service's National Meteorological Center near Washington, D.C. Swiftly, analyses and forecasts are prepared with the aid of electronic computers. This centralized facility saves countless hours of plotting and analyzing at field stations. The processed information is transmitted to National Weather Service, FAA and military stations through the United States by facsimile and teletypewriter.

Still, there are definite limits to what the forecaster can do for the pilot. Compared to other sciences, meteorology is still in its infancy. A chemist can mix ingredients in his test tube and observe the results. As yet, the meteorologist cannot study and observe the entire atmosphere. He can, by various means, simulate the atmosphere. Or he can observe parts of it in great detail. Though knowledge of the atmosphere continues to increase, much more research is needed before its behavior can be predicted accurately over long periods of time.



Above—weather briefer's information comes from various sources. Antennas at National Meteorological Center at Suitland, Md. (above right) receive satellite data such as that in lower photo which shows warm, low clouds.

The weatherwise pilot regards the forecast as professional advice, not clairvoyance. He knows that certain weather conditions can be predicted with more accuracy than others.

Aviation forecasters can predict, 12 hours in advance, with an accuracy of at least 75 per cent:

- Passage of fast-moving cold fronts or squall lines, within plus or minus two hours;
- Passage of warm fronts or slow-moving cold fronts, within plus or minus five hours;
- Rapid lowering of ceiling in pre-warm front conditions within plus or minus 200 feet and a time of plus or minus four hours;
- Rapid deepening of a low-pressure center;
- The onset of a thunderstorm, if radar is available;
- The time of clearing or rapid lifting of fog, within plus or minus two hours;
- The time rain will begin, within plus or minus five hours;
- The time snow will begin, within plus or minus five hours.

Even experienced aviation forecasters cannot predict, 12 hours in advance, with an accuracy of better than 50 percent:

- The time freezing rain will begin;
- The location and occurrence of severe or extreme turbulence;
- The location and occurrence of heavy icing;
- Ceilings of 100 feet or zero before they exist;
- The onset of a thunderstorm which has not yet formed;
- The position of a hurricane center to nearer than 100 miles;
- The occurrence of ice fog.

Some hours in advance, the forecaster can tell you when—and the general area where— thunderstorms are likely to occur. He cannot tell you exactly where the individual thunderstorms will be, the exact time they will occur, or their precise intensity.

The forecaster often can suggest an alternate route, in case your weather should turn out worse than expected. Of course, he can't do this if the weather is doubtful in all areas.

For periods of a day or two in advance, the forecaster can give you a general outlook of flying weather conditions. Outlooks cannot be as specific as short-term forecasts and must be accepted as guides for planning only. Pilots should seek the latest weather information shortly before takeoff, even if they have made earlier weather checks.

The National Weather Service constantly strives to improve the weather services available to pilots. For example, the Service is cooperating with FAA and the Public Broadcasting System to bring pilots a weekly half-hour television report of aviation weather on a nationwide basis. Details will appear in the January issue of FAA AVIATION NEWS. ■

Miracle at Kitty Hawk

Seventy years ago Wilbur and Orville put it all together

Although virtually inseparable companions most of their life, the Wright brothers—the Gemini of powered flight—were born four years apart—Wilbur on April 18, 1867, on a farm in Millville, Ind., and Orville on August 19, 1871, at Dayton where the family home was established.

The relationship between the two boys was unique, in that from an early age they shared their toys, their games, their feelings, their thoughts, and virtually all their aspirations. On later reflection, they felt that their ability to solve difficult problems owed much to their constant opportunity to bandy ideas back and forth in an atmosphere of mutual interest. Although both boys attended high school long enough to acquire a diploma, neither formally graduated or gave any thought to attending college.

Wilbur has been described as "a large man, of the big-bone Scotch-Highlander type, with gray eyes and a long, aquiline nose." Orville was slight and dapper, with blue eyes and small features. Both were gentle in manner and unassuming—but extremely persistent when it came to solving problems or matters of business.

After a brief excursion into the newspaper business, (they had assembled a printing press from old parts found in junk heaps), Wilbur and Orville formed the Wright Cycle Co. in 1892 to sell and later to build bicycles.

Their bicycle venture was moderately successful, and the seasonal ebb and flow of business gave them periods of leisure to devote to what had begun as a boyhood interest and become a consuming passion: aviation. They read everything they could get their hands on concerning experiments in flight, and spent pleasureful hours working up data and calculations on various forms of airfoils. When their hero, Lilienthal, was killed in a glider crash in 1896, followed by Pilcher's similar end two years later, the Wright brothers felt that the fateful baton had been passed into their hands. On May 13, 1900, Wilbur wrote to Octave Chanute, indicating a serious dedication to penetrating the mystery of flight:

". . . it is possible to fly without motors, but not without knowledge and skill. This I conceive to be fortunate, for man, by reason of his greater intellect, can more reasonably hope to equal birds in knowledge than to equal nature in the perfection of his machinery."

The Wrights had already moved beyond the first phase of study, speculation and discussion. Not wishing to follow Pilcher and Lilienthal's fatal footsteps, they determined first of all to solve the problem of equilibrium: how to keep the wings level in the presence of turbulent air. They understood, as indeed others had perceived before them, that if you simultaneously decrease the lift on the wing that rose, and increase lift on the wing that dropped, you could return the wings to level balance. They rejected the much tried concept of "automatic" balancing, and sought a means of control for the "operator" (pilot).

Their solution was the celebrated technique of "wing-warping", or twisting the ends of the wings in opposite directions, so that the angle of attack was increased at one wingtip as much as it was lessened at the other. Leverage was applied by means of control cables and pulley blocks attached to a "cradle" fitted about the hips of the operator as he lay prone on the wing. If the right wing were to drop, the operator would simply roll his hips to the left, twisting the right wingtip upward until the increased angle of attack raised the wing to level.

Wing-warping was later succeeded, of course, by ailerons [sections of the trailing edge of the wings which moved up and down in opposition; a more satisfactory technique] but the Wright method was probably the most important breakthrough in the long, elusive pursuit of learning how to balance an aircraft in flight. After testing their idea on a five foot glider/kite at Dayton, Wilbur and Orville set out for the sand dunes of Kitty Hawk, N.C., where they would build a full scale glider and begin flying.

The brothers had selected Kitty Hawk in part because of the abundant soft beach sand which would cushion their landings (they depended on wooden skids instead of wheels) but also because they had learned from the Weather Bureau that this tiny village on the Outer Banks had an average wind velocity that appeared to be ideal for gliders. However, soon after their arrival they discovered that the variation in wind conditions was enormous, ranging from dead calms to gale or hurricane winds which frequently necessitated their springing up in the dead of night to hang on to their tent for dear life.

Persistence, however, was their middle name, and in October of 1900 their first glider took the air. It was a biplane with a 17 foot wingspan and a lifting surface of 165 square feet. Total cost: $15. It had no tail, but a "horizontal rudder" (elevator) placed forward of the wings and capable of flexing up and down, for pitch control. The glider was launched by racing down Kill Devil Hill, a sand dune about 100 feet high. In this contraption Orville and Wilbur made repeated flights of 300 to 400 feet, close to the ground, landing at about 20 mph without damage or injury.

"The machine seemed a rather docile thing," Orville wrote to his sister, "and we taught it to behave fairly well."

Back at Dayton over the ensuing months, while attending to their bicycle business, the Wright brothers pondered the results of their first flight experience and planned the next one. They returned to Kitty Hawk again in 1901 and in 1902 with improved gliders which set world records for distance and exhibited remarkable stability. And in the fall of 1903 they brought with them not only a new glider design (Wright *Flyer* I), but an engine as well.

The *Flyer* showed many design improvements resulting from the Wrights patient checking and rechecking of aerodynamic data. They had even built their own small wind tunnel to test airfoil structures. Their craft now had a steerable tail rudder, greater wing camber, a wingspan of 40 ft. 4 in., a wing area of 510 sq. ft., and weighed 605 lbs. without a pilot. What is more, it had twin propellers, revolving in opposite directions to eliminate torque, chain driven by a 12 hp gasoline engine built in their own shop. The meticulous Wright brothers had worked out every detail of propeller and drive design to achieve maximum engine power, and they were confident that the machine would fly.

For takeoff, a small dolly or truck was fashioned to run along a wooden track laid on level ground at the base of Kill Devil Hill. By a toss of a coin Wilbur won first honors as pilot, and on December 14, the engine was cranked up and the *Flyer* launched. Like many a pilot after him, Wilbur pulled the nose up too soon and stalled out after being airborne for 3½ seconds. This trial was not considered a success.

A few days later, on December 17, Orville had his chance. The first official flight lasted 12 seconds, covered 120 feet at 6.8 mph groundspeed. Then Wilbur flew, and Orville again, and Wilbur once more. The last flight covered 852 feet, and lasted 59 seconds. There was no question in their minds but that their goal was achieved: they had flown at last!

A brief telegram to their father announcing their success was passed on to the Dayton press, but the newspapers found little to be excited about in a 59 second flight. It was not until years later, after hundreds of persons had seen the Wright *Flyers* sailing gracefully through the air with their own eyes, that the public began to appreciate the miracle of Kitty Hawk, and what it might mean to future generations in terms of mobility and exploration, war and peace, research and rescue—the possibilities were endless. Those 59 seconds over the Carolina sands were the first stages in the incredible human trek to the clouds, to the moon, the planets, and the stars beyond.

David Gelfan

Wilbur and Orville Wright, inseparable sons of an Ohio clergyman, worked as one mind to unlock the secret of flight.

The Wrights mastered aircraft control with their gliders (1902 model above) then added propulsion. Below—1909 *Military Wright Flyer*. Ribbon on front spar served as drift indicator.

■ **TAXI TESTS.** A two-month test has begun at Atlanta International Airport to determine whether jet exhaust emissions can be cut down by a change in taxiing procedures. During November aircraft taxied in their normal manner; in December they are taxiing with one or two engines shut down. Research contractors are measuring emissions and keeping track of weather conditions, numbers of airplanes, engines shut down, taxi operations, etc. Tests are being conducted by FAA and the Environmental Protection Agency with the cooperation of Air Transport Association.

■ **DISTANCE-FROM-CLOUDS.** A proposed rule that would have increased the distance-from-clouds requirement for VFR flight in uncontrolled airspace 1,200 feet or less above the ground has been withdrawn. The proposal would have required the same clearance as in controlled airspace (500 feet below clouds, 2,000 feet laterally and 1,000 feet above). The existing rule, which will remain in effect, provides that aircraft operating under those conditions remain clear of clouds. Most of the 1,300 comments received saw no reason to anticipate that an increase in these minimums would result in a corresponding increase in safety. Some commentators felt the rule would work a hardship on certain operations, such as agricultural and flight training.

■ **TALKING ELTs.** Recent clarification of Part 87 of the FCC rule regarding emergency locator transmitters (ELTs) indicates that although voice capability is not recommended in ELTs, the rules do not prohibit it. (Earlier reports indicated that such voice-capable ELTs would not meet requirements of the rule). Any ELT that meets the standards of TSO-C91, regardless of extraneous features such as voice capability, will satisfy the requirement of the Public Law which makes ELTs mandatory for most general aviation airplanes after December 30, 1973.

■ **NON-DRAIN HOLES.** Each winter numerous general aviation aircraft suffer substantial damage from water that accumulates and freezes in confined areas of the airframe because drain holes are clogged. Ice trapped within the aircraft can jam the controls, throw the weight and balance off, crack the structure or interfere with proper venting. Source of such water may be the wash rack where the conscientious owner has the craft cleaned for safety reasons, or rain or snow that gets inside the airplane when tied down outside. In any case the problem may be avoided if drain holes are kept open by regular inspection, especially in winter.

FLYING DOCTOR'S WEIGHT LOSS THEORY. Sidney White, a 51-year-old doctor from Los Angeles, has his own technique for slimming. He calculates the additional airspeed he will need to get from his diminutive racer before each race, in order to win, and converts the figure into terms of reduced weight. The incentive is enough to help him shed pounds—he lost 20 pounds before winning at Reno with an airspeed of 194.9 mph over the course.

FAR Parts to be Taken Out of Volumes, Sold Separately

In response to widespread user dissatisfaction with the current system of selling Federal Aviation Regulations by the volume only, FAA has arranged with the Superintendent of Documents to make FARs available as individual parts. The most commonly used FAR parts (and amendments thereto) will be available on a subscription basis. Lesser used parts, because of their small number of pages and/or infrequent amendments, will be sold as single sales items.

Neither prices of parts nor starting dates of changeover has been determined, but it is anticipated that a gradual phasing out of the old system will begin early in 1974 and require 12 to 18 months to complete.

The Superintendent of Documents will notify all current subscribers regarding publication dates and prices for the various parts. Details will also appear in FAA AVIATION NEWS as they become available.

First Part of Cost Allocation Study Sent to Congress

The first of two parts of a report on the Aviation Cost Allocation Study was sent to Congress recently by Secretary of Transportation Claude S. Brinegar. Under the terms of the Airport and Airway Development and Revenue Act of 1970, the Department was required to review the costs of operating the Federal Airport and Airway System and to determine realistically what percentage of these costs are returned by taxes.

Part one outlines DOT conclusions on how the airlines, general aviation and the public should help pay for the System:

- Costs should be allocated 50 percent to air carriers; 30 percent to general aviation; and 20 percent to the public.
- The present tax structure recovers only about 55 percent of the total Federal costs from non-public users; a more realistic amount should be 80 percent.
- Only about 20 percent of the costs allocated to general aviation are now being recovered by user taxes.
- Long term taxpayer subsidy of the airport and airway system is not warranted. A high percentage of costs should be recovered through gradually phased-in user charges.
- The tax structure should be shifted toward user charges that more nearly reflect actual costs imposed by users on the system.

Part II of the study is scheduled to go to Congress in February and will provide specific recommendations to change the tax structure along with proposals for legislative action. Copies of the report can be obtained by writing to Airport and Airway Cost Allocation Study, DOT Buzzard Point Building, Room 6604, Washington, D.C. 20590.

New Flight Guides Published Conforming to Revised Part 61

Several new FAA flight test guides have been issued to conform with the provisions of Part 61 (Revised). The pocket-sized guides contain information and guidance concerning the pilot operations, procedures and maneuvers relevant to the flight tests required for the various certificates, and include suggested flight test checklists.

Although Part 61 (Revised) became effective November 1, 1973, applicants for pilot certificates and ratings have a choice, for one year after that date, of meeting either the previous requirements or those of the revised rule.

The booklets are available by mail from Superintendent of Documents, GPO, Washington, D.C. 20402. Titles, AC numbers and prices are:

- Flight Test Guide (Part 61 Revised) Private Pilot, Airplane, AC 61-54, 45 cents.
- Flight Test Guide (Part 61 Revised) Commercial Pilot, Airplane, AC 61-55, 45 cents.
- Flight Test Guide (Part 61 Revised) Private and Commercial, Glider, AC 61-61, 50 cents.
- Flight Test Guide (Part 61 Revised) Instrument Pilot, Airplane, AC 61-56, 35 cents.

Above flight test guides are also available at reduced prices from government bookstores.

Technical Aviation Reports Listed

A new listing of recent scientific and technical reports on aviation and related subjects has been made available to the public by the Federal Aviation Administration of the Department of Transportation. The reports are sold for $3 by the National Technical Information Service.

For a free copy of the latest list, write to FAA, AIS-300, 800 Independence Ave., S.W., Washington, D.C. 20591.

1974 FAA FLIGHT INSTRUCTOR REFRESHER COURSES

DATE	LOCATION	SPONSOR
1/8-10	Chicago	Illinois Dept. of Avia
1/8-10	Cleveland	AOPA & Cuyahoga Comm. Col.
1/15-17	Farmingdale, L.I., N.Y.	Civil Air Patrol
1/15-17	Knoxville	University of Tenn.
1/22-24	Corpus Christi	Texas Aero. Comm.
1/22-24	Rochester, N.Y.	AOPA & NAFI
1/29-31	Hot Springs, Ark.	Arkansas Div. of Aero.
1/29-31	Detroit	AOPA & Mich. Aero. Comm.
2/5-7	Seattle	Wash. State Aero. Comm.
2/5-7	Louisville	AOPA & Ky. Dept. of Aero.
2/12-14	Santa Monica, Cal.	Los Angeles Chapter 99's
2/12-14	Ruston, La.	La. Tech. University
2/26-28	Pierre, S.D.	S.D. Aero. Comm.
2/26-28	Las Vegas	AOPA & Nev. Safety Council

NOTE: All above are Flight Instructor Refresher Courses, designed for airplane and/or instrument-airplane instructors.

Flight FORUM

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.

• Pass the Ammunition

After many years of reading FAA AVIATION NEWS, a thought occurred to me that might be of value to you in your efforts toward pilot safety education. Our airport receives a great quantity of printed material from your office—most of which is promptly posted or made available to pilots. However, we notice that pilots do not read this material as readily as you might desire—or with as much interest as I find in your magazine.

I have noticed extra copies of FAA AVIATION NEWS in many of your District and Regional Offices. Why not send a copy to each airport, for placement in the pilot lounge or reading room? It would cost you very little in additional printing costs.

L. L. Baumgartner
Newberry, S.C.

We are presently considering several means of broadening our readership, and will certainly keep your suggestion in mind. Thank you.

• ELT Alarm

Your article "False Alarm", September 1973, is an admission of the fallacy of making any addition to aircraft safety *mandatory*.

I have been associated with flying since 1920 when I crashed my first home-built glider at the age of 10! The last 50 years have convinced me that people who fly accept and use every device that proves to be an aid to safety or convenience to flying.

FAA and DOT have taken the course of dictating mandatory actions dreamed up by people who have not proven their qualifications to promote such actions. It's my opinion at this time that mandatory ELTs will be one of the biggest ego-breakers FAA has come up with to date!

A. R. Brunette
Columbia, Cal.

The mandatory action to which you refer was passed by Congress, as Public Law 91-596, Section 31. In this law Congress amended the Federal Aviation Act of 1958 to require Emergency Locator Transmitters in most general aviation aircraft. Responsibilities of FAA with respect to the ELT law have included amending the Federal Aviation Regulations to carry out the requirements of the Public Law and setting up Technical Standard Orders (TSO's) which prescribe the minimum standards for the manufacture of ELT units to meet the requirements of the law.

• Setting the DG

Aligning an aircraft's directional gyroscope using a runway heading for reference can result in an error of 0-5 degrees, because runways are numbered according to the nearest 10 degrees of heading. To advocate the practice ("Fly By Night", September 1973) is irresponsible. Alternately, using the magnetic compass with its deviation card results in no significant error and should be recommended instead.

G. G. Kunz
Ft. Atkinson, Wis.

Either method is acceptable for VFR flying. The important thing, particularly at night, is to be positive before you leave the ground that you have not overlooked the setting of the directional gyro (DG), or inadvertently left the instrument caged.

Using the runway heading to set the DG can result in a small error. However, sometimes setting the DG by the magnetic compass can also be subject to error if insufficient time is allowed for the gyro rotor to get up to speed, if the engine rpm's are too low, or if the airplane is not sitting level. If the airplane is moving the magnetic compass may be subject to other small errors. Whichever method you use, upon reaching straight and level cruise you should recheck the gyro, and repeat the check about every 15 minutes.

Recommended procedure for instrument flying is to carefully set the directional gyro with the magnetic compass before taxi, applying correction and allowing plenty of time for the gyro rotor to reach normal speed (about five minutes). Before takeoff, when lined up on the runway, recheck. Heading indicator should be within five degrees.

• Cover Photo

Could you please tell me where the picture on the cover of the August 1973 FAA AVIATION NEWS was taken?

D. K. Bahr
Phoenix, Ariz.

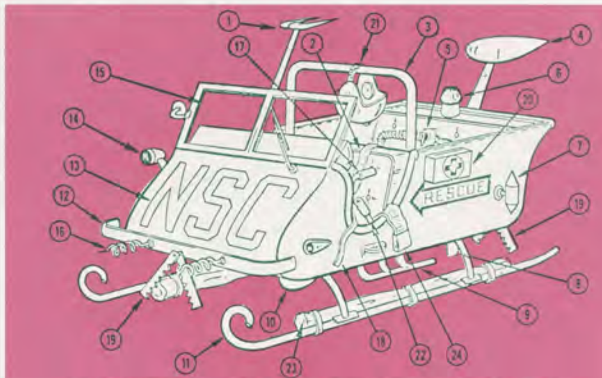
Photograph was taken at Toms River, N.J.

• VOT Checks

According to the Airman's Information Manual (AIM), a pilot wishing to check his VOR receiver with the VOT (VOR test signal) must do it on the ground. In the Houston area there are many airports but the only VOT is at Hobby Airport. What about airborne VOR checks using the VOT?

A. Cameron Mitchell
Houston, Tex.

The VOT was intended to be used on the ground at the airport where it is located. Although seemingly accurate signals can be received in the vicinity in the air, VOT facilities have a very low power output (2 watts) and their frequencies are not protected against VOR frequency interference. Also, since they are not tested for airborne use their accuracy can not be guaranteed.



Santa's Sleigh After FAA & OSHA Requirements Have Been Met

1. VOR Antenna
2. Shoulder Harness
3. Roll-Over Bar
4. Weather Radar
5. Oxygen Mask
6. Strobe Anticollision Light
7. Emergency Crash Locator Beacon
8. Transponder Antenna
9. Glideslope Antenna
10. ADF Antenna
11. SAE 1020 Steel Skids replaced by SAE 4130 Steel Skids
12. Reindeer Bumper
13. FAA Registration Number
14. Landing Light
15. Shatterproof Windscreen with Wipers
16. Redundant, Stainless Steel Thrust Absorber to Harness
17. Automatic Reins
18. Nonslip, Redundant, Anti-Feedback Control Reins
19. Padded-Roof Gripper
20. First-Aid Kit
21. Crash Helmet (Military Bases Only)
22. Rocket Extraction Seat
23. Flotation Bags for Ditching

• New Model

I thought you might be interested in this humorously exaggerated drawing from the National Safety Council. It shows how Santa's Sleigh might be designed by today's aircraft designers, considering the FAA regulations as well as provisions of the Occupational Safety Health Act.

E. A. "Jerry" Jerome
Annandale, Va.

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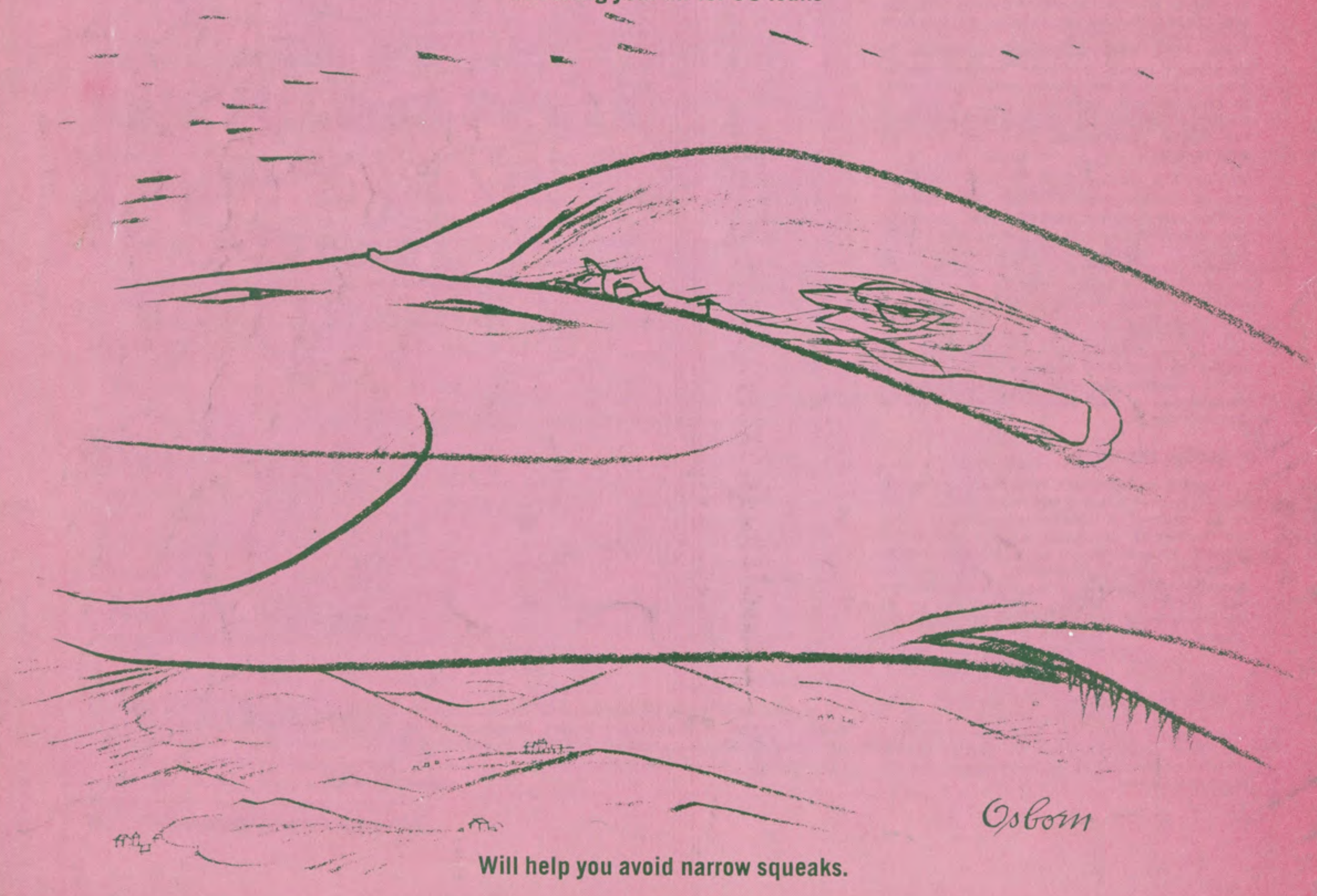
BDC

Checking your air for CO leaks



Will help you avoid narrow squeaks.