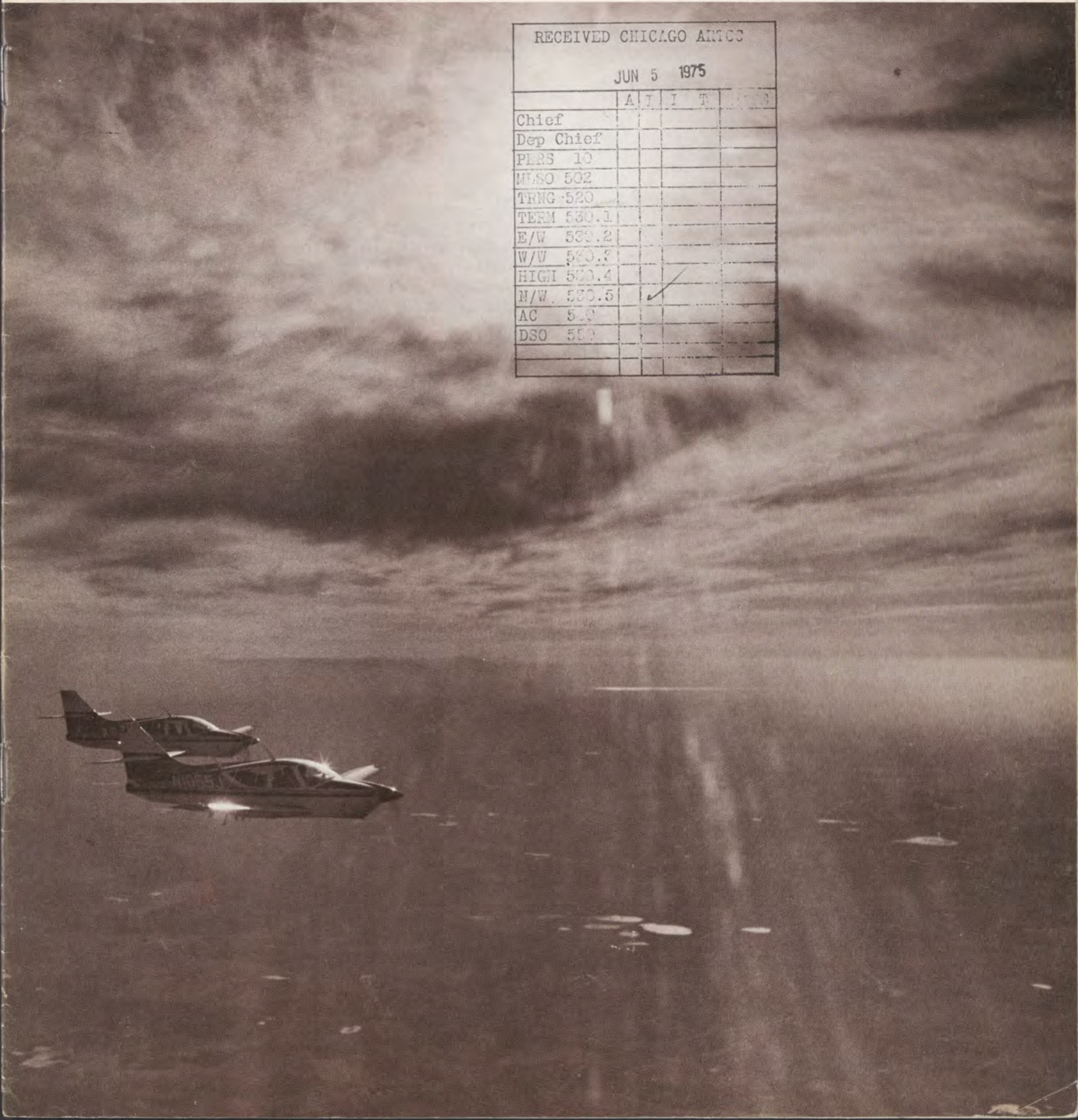
FAA AVIATION NEWS

APRIL 1975



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Extending your range.
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FAA AVIATION NEWS

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The Intruder

When carbon monoxide makes its unseen presence felt in the cabin, safety takes a holiday

At 1:00 a.m. a *Cherokee* 140B with a dead engine dropped out of a cloudless Kansas night and crash-landed near the small town of Hall's Summit, about 100 miles southwest of Kansas City. The airplane skimmed over the tops of a tree row at 50 feet above the ground, slammed through a clump of smaller trees and pancaked hard into the field. The landing gear was ripped away, the left wing torn loose and the right wing severely buckled.

But the two occupants, both young men in their twenties, survived. When the plane came to a halt they were both conscious, although bleeding from deep lacerations. The passenger, less seriously injured than the pilot, was able to unstrap himself from his seat, and at the direction of the pilot he turned off all electrical switches before extricating himself from the airplane. Then he set out to find help, leaving the pilot sitting in the cockpit in the chilly May night.

He had no idea where he was, and he could see no lights. The injured man walked for more than two hours in the darkness, frequently in circles, before he came to a trailer house in a field. He pounded on the door until lights began to flick on. The farmer took him inside and called police and an ambulance; both arrived within a few minutes of the call. But owing to the confused state of the survivor, it was difficult to establish the crash site. It took the rescue team nearly an hour to locate the airplane—only a few miles from the trailer. The pilot was still alive, although he had lost a good deal of blood, and both men were soon recuperating in the Coffey County Hospital.

The next day two investigators from FAA's Kansas City General Aviation District Office, which had been delegated authority by the National Transportation Safety Board to investigate the accident, were on the scene. They were puzzled by what they found. There seemed to be no doubt that the immediate cause of the crash was fuel exhaustion—both tanks were nearly bone dry. But how had the flyer managed to wander 100 miles away from their destination (and home town), Kansas City? There was no indication of mechanical or instrument failure, and the radios checked out perfectly. The investigators patiently reconstructed the flight of *Cherokee* N95152 from its departure point.

The pilot and his passenger had taken off from Kansas City, Mo., the day before for a one-day trip to Monmouth, just across the Illinois state line. The pilot, manager of a retail store in Kansas City, was not instrument-rated and had 124 total hours, with 11 in type. By all accounts he was a careful and prudent young man. He had rented the *Cherokee* from a flying club and was using it to fly himself and his friend to a religious meeting that evening at Monmouth College. They would fly home after the meeting.

The 250-mile flight to Monmouth was

uneventful, and when they were ready to return, the weather briefing indicated clear skies all the way. After topping the tanks, the pilot took off from Monmouth shortly after 10:30 p.m. Once aloft he radioed the Burlington, Iowa, flight service station and filed a flight plan for Kansas City. He proposed to cruise at 4,500 feet.

The flight proceeded southwest across northern Missouri utilizing the Kirksville VOR until within 35 miles of K.C., at which point the pilot tuned in the Riverside VOR. This was the last act he clearly remembered performing, until he found himself sitting in that bashed-in cockpit in a wheat field in Kansas, some 120 miles distant and at least an hour away in time. *Had he simply fallen asleep?* The hour was late and admittedly it had been a long day, physically and emotionally.

However, it did not seem likely to the investigators that both men would have fallen asleep at the same time. *Had they been drinking? What about medicines? Or maybe a drug "trip?"*

Negative on that too.

When the pilot's memory was jogged, he could vaguely recall seeing some lights below (apparently when they overflew Kansas City) . . . of hearing some distant voice (on the radio?) . . . and an abrupt sensation of dropping (when the engine, out of fuel, stopped?) . . . and of guiding the airplane down toward an open field. He recalled feeling as though he were in some kind of trance.

The investigators left the hospital after the first interview with the survivors, still puzzled.

But the pilot, as he lay in bed, began to recall other small details about the flight that fell into a pattern. On the first leg of the flight out from K.C. he remembered he had been troubled by a slight but persistent

headache, which he attributed to the vexing turbulence they were experiencing. But he had also felt a little drowsy. And on the return trip just before going into that trancelike state, again the headache and the slight drowsiness—in the complete absence of any turbulence. He compared notes with his friend, who admitted to similar feelings en route, which he had attributed to "air sickness."

They related these symptoms to the investigators on their next visit. It sounded suspiciously like carbon monoxide poisoning. Another check was made of the airplane, with particular attention given to the exhaust system. When the metal shroud of the heat exchanger which envelopes the muffler was dismantled, clear evidence of gas discoloration was present. There were also three distinct breaks in the shell of the muffler itself. Any inflight use of the cabin heater would have drawn carbon monoxide into the cabin. The heater control was in the "On" position in the wreckage. The mystery was solved.

Carbon monoxide, being colorless and odorless, gives no warning. As carbon monoxide is breathed in, the CO molecule replaces the oxygen in the blood, resulting in oxygen starvation. The brain is the first bodily organ to be affected, particularly as regards the ability to reason and make decisions. Once an individual's system becomes poisoned by carbon monoxide he quickly loses the ability to understand what is happening to him, and he soon sinks into a senseless stupor. In the case of the young pilot from Kansas City, apparently the amount of carbon monoxide entering the cabin from the engine was just enough to keep him on the borderline of consciousness, in a kind of "twilight zone" of semi-reality. The interruption of the CO flow, following engine stoppage, allowed enough fresh air to clear his mind sufficiently for him to guide the airplane to a survivable landing. He and his friend were very, very lucky.

In the course of the accident investigation, the *Cherokee's* logbooks were inspected for compliance with the Airworthiness Directive (70-16-5) which required that this particular type of muffler be inspected by an authorized mechanic at intervals of 50 hours after the first 950 hours of use. The Tach time on the aircraft on impact read 2223.7 hours; the last logged muffler inspection was at 1999.5 hours—some 224 hours previously. A violation was filed against the owners of the aircraft.

Carbon monoxide poisoning is always a possibility with aircooled engines, such as aircraft engines, which derive heat for the cabin from the hot air surrounding the exhaust muffler. Mufflers always contain some amount of carbon monoxide, the product of incomplete combustion of carbonaceous materials in the fuel, and any slight crack in the muffler will allow poisonous fumes to enter the cabin heating system. CO can also enter the cabin through other defects, such as openings in the firewall, or from worn or defective exhaust stack joints, but the danger is greatest from the exhaust heater system, which is used in cold weather when fresh air vents are generally closed.

Although the problem has been minimized in recent years, by improvements in cabin heater systems and by FAA surveillance and airworthiness directives, cold weather flyers should make certain that exhaust pipes and mufflers are frequently inspected by qualified mechanics. If you are renting, check the aircraft log of the airplane yourself. The owner may be the one to receive the violation, when inspections have not been carried out as directed, but you the pilot may be the one who winds up sitting in the wreckage of the airplane, like the young gentlemen from Kansas City.

And you may not be as lucky. Another recent accident involved a veteran 40-year-old pilot (over 2000 hours, commercial certificate) flying solo from Birmingham, Ala., to Nashville, also in a single-engine aircraft. He radioed the FSS at Muscle Shoals, Ala., to say that he was not feeling well and that he intended to make a precautionary landing at nearby Roundtree Field. Two miles north of the airport the plane was seen to go into a steep dive, crash into the ground and burst into flames. The pilot had no chance to survive. The subsequent autopsy showed a 21.8 percent saturation level of carbon monoxide in his blood—more than enough to drug him into a heavy stupor. In fact, concentrations of carbon monoxide which exceed one part in 20,000 parts of air can be extremely hazardous, if inhaled continuously. A little goes a long way—down.

The number of aircraft accidents attributed to CO poisoning is not alarming, but it is suspected that there are many other accidents or incidents where the causal contribution of this toxic gas goes undetected. If an aircraft is destroyed by fire, and no autopsy of the crash victims is possible, there is no certain trail leading back to leakage of muffler fumes. In non-serious accidents blood samples of the pilot are rarely taken, and even if there is some suspicion that CO was a factor, the evidence may not be conclusive. It is quite possible, for example, that the questionable judgment that has often led VFR pilots to fly into weather beyond their capability to handle, may have been impaired by CO inhalation. And of course there are countless *incidents* —where serious accidents were barely avoided—which are never reported but which may be related to contaminated air in the cabin.

A recent review of "Malfunction and Defect" reports received by FAA in general aviation for the year 1969 to 1973 lists 213 instances of defective heater systems which could have led to CO accidents. This represents only a portion of the total number of defective systems, since all defects are not reported.

Preventive Maintenance. Inspection of the exhaust and heater systems is best left for the eyes and hands of a certificated engine mechanic; minute cracks and metal discolorations may go unnoticed by even the most concerned pilot. The place where the pilot can be most effective is in the cabin of the airplane. Here he should be at all times alert for the onset of any physical symptoms, in himself or his passengers, which could be attributed to the presence of carbon monoxide, such as head pain, ear ringing, dizziness, nausea, vision problems, etc.

He should also be alert to any odors present. Although CO is itself odorless, it is frequently combined, in engine exhaust, with other gases that are quite pungent. If you have any reason to suspect that the air in your cabin has become contaminated in flight, take the following steps immediately:

1. Close the air heater intake and any other openings to the engine compartment.
2. Open a fresh air source.
3. Extinguish all cigarets.
4. Inhale 100 percent oxygen if available.
5. Make a precautionary landing at the first opportunity.

Detection devices. There are a number of CO detectors available for general aviation aircraft. The most reliable types are the "sniffers," which are used on the ground. A sample of cabin air is drawn into a transparent tube, coated with a chemical which changes color if carbon monoxide is present. The sniffer test should be performed by a qualified mechanic, first with the engine off, and then with the engine running.

There are simple and inexpensive inflight checks for CO leakage, the most popular of which is the "bull's eye" type, a small card with a plastic disc about the size of a dime. The disc contains a chemical which changes color when a certain level of carbon monoxide is present. The disc is not as accurate as the sniffer type of test, but it does have the advantage of being continually present and on guard in the airplane. On the other hand, it is only of use if the pilot is in the habit of consulting it, and servicing it (30 days is the normal lifespan of the chemical).

Stay out of the twilight zone. ■

For a copy of FAA Advisory Circular AC 20-32B "Carbon Monoxide Contamination in Aircraft—Detection and Prevention," write DOT/FAA Distribution Unit, TAD 443.1, Washington, D.C. 20590.

A Standard Pattern for Uncontrolled Airports

For the first time FAA has published an Advisory Circular recommending a standard flight pattern for aircraft approaching or departing uncontrolled airports. Compliance with the standard pattern, which is voluntary, is expected to reduce the possibility of conflicts at general aviation airports where traffic is not being controlled by an FAA control tower. While accident statistics for 1974 show a satisfying improvement over previous years, it is known that the majority of midair collisions occur in the vicinity of uncontrolled airports, under VFR conditions.

In familiarizing themselves with the pattern recommendations, pilots are asked to review the Federal Aviation Regulations (Part 91 and 93) which relate to airport traffic. It is recognized, for example, that jets or heavy aircraft will frequently be executing broader and/or higher patterns than lighter aircraft. If two aircraft at different altitudes approach to land at the same time, the pilots should be governed by FAR 91.67, which states (in part):

"When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right of way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land, or to overtake the aircraft."

Many pilots will find the newly recommended procedures comfortably similar, in most respects, to what they have been doing all along at uncontrolled airports. The recommended pattern altitude is 1,000 feet above the ground. The departure path is straight-out, or by means of a 45 degree turn from a straight-out course. Traffic flow, in accordance with FAR Part 91, is to the left, unless right turns are indicated by approved light signals or visual markings.

Accompanying diagrams illustrate the recommended standard patterns, which include the following procedures:

Pattern entry. The pattern should be entered via a 45 degree turn onto downwind leg, at about the midpoint of the runway to be used. Arriving airplanes should be at traffic pattern altitude before entering the pattern, and should stay clear of the traffic flow until established on the entry.

Attitude. A traffic pattern altitude of 1,000 feet above the ground is recommended. Use of a common altitude will be a key factor in minimizing the risk of collisions at uncontrolled airports. The pattern altitude should be maintained until abeam the approach end of the runway to be used, on downwind leg.

Landing. The downwind leg should be extended far enough to assure that you have a final approach leg of at least one quarter mile. Landing and takeoff should normally be made on the operating runway most nearly aligned into the wind. If it is necessary to use a crosswind runway for some reason—such as in training or when more runway length is needed—the pilot using the crosswind runway should avoid the flow of traffic to the operating runway.

Departure. On takeoff or go-around, you should continue straight ahead until beyond the end of the runway, and within 300 feet of traffic pattern altitude, before starting the first turn. Plan to be at pattern altitude when you turn onto downwind. If you are leaving the area, continue straight out, or exit with a 45 degree left turn (right turn for right pattern). If using the 45 degree turnout, it should not be made until you have passed the end of the runway *and* have reached pattern altitude.

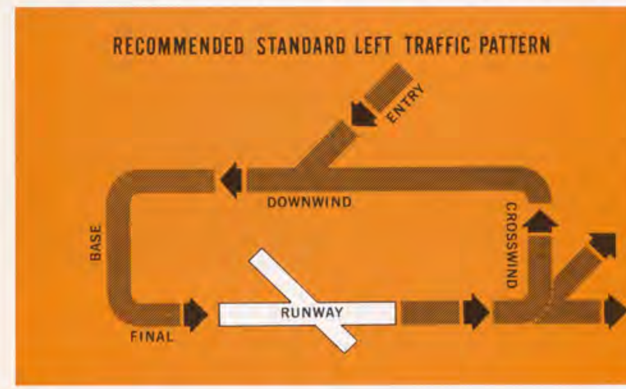
Speed limits. Recommended traffic pattern airspeed limits are the same as those required at controlled airports: 156 knots (180 mph) for reciprocating engines or 200 knots (230 mph) for jets.

The standard traffic pattern is the result of many requests from pilots and others concerned with safety near uncontrolled airports. Using the standardized procedures in no way relieves the pilot-in-command of the need to familiarize himself, before beginning a flight, with all available information on the destination airport or any other landing point. Aside from weather information, the always important preflight preparation may turn up closed runways, airport construction, inoperative lights or landing aids, or other circumstances that might affect the safety of the flight. For example, special conditions may exist which prevent use of the recommended standard traffic pattern, such as at "one-way" airports in mountainous areas; sites where wires or other obstacles would interfere with a standard pattern; landing strips where a pattern has been deliberately planned to avoid flight over a school or hospital; or airports which co-exist with other nearby airfields.

Changes should not be made in existing patterns for the purpose of standardization alone, at any location where adoption of the new standard pattern would not provide for a safe and efficient operation.

The use of any traffic pattern procedure does not alter the responsibility of each pilot to see and avoid other aircraft. At uncontrolled airports with air carrier operations, pilots should be particularly alert for air carriers executing straight-in approaches. Where such operations are permitted, the air carrier pilot must be in radio communication with a flight service station providing airport advisory service or with a "ramp-mike" operator. This operator or the FSS specialist will advise the pilot if there is observed or reported traffic in the pattern so that the pilot can make his approach in such a manner as to avoid disrupting or endangering the movements of other airplanes.

Voluntary cooperation is essential to the successful working of a standard traffic pattern. All pilots are asked to look carefully at the need for straight-in approaches or other deviations from the standard pattern. Under normal circumstances, the standard pattern is expected to increase safety, especially during peak hours of operation, or in marginal weather. Straight-in instrument approaches are best practiced during hours of low traffic density. Likewise, pilots utilizing intersecting or opposing runways to practice crosswind landings, should select hours of low activity at the airport.



Along with using the new standard traffic pattern, wherever practical, pilots are also urged to follow existing recommendations (Advisory Circular 90-42A) for using the radio to announce position and intentions to a ground station or, if none is functioning, to broadcast "in the blind" when approaching or departing uncontrolled airports. FAA has over 180 flight service stations which offer advisory information concerning the airport at which they are located, including wind speed and direction, airport conditions and reported traffic —as well as *the kind of traffic pattern followed locally.*

Where there is no FAA facility on the field, UNICOM can also be very useful to the pilot. The presence of UNICOM at an airport is indicated in the Airmans Information Manual and on sectional charts; there are approximately 4,000 airports with UNICOM in the United States. UNICOM is an informal, voluntary advisory service provided by the airport for the convenience of users. UNICOM will relay information on reported traffic in the area, and on field conditions. UNICOM provides convenient air/ground communication, but bear in mind that the person talking to you may or may not be an experienced observor of air traffic. He may be a veteran pilot, and again he may have no flying experience at all.

As standard operating practice, all traffic inbound to an uncontrolled airport should continuously monitor the appropriate field frequency as indicated in the Airmans Information Manual (Part I, Chapter 4) and in AC 90-42A. To avoid radio interference with traffic from adjacent airports you should delay your initial call to UNICOM on 122.8 (or your "blind" call on 122.9 if there is no UNICOM on the field) until five miles from your airport.

Departing aircraft should monitor the proper frequency, broadcasting position and intentions, when ready to taxi, and before taking the runway for takeoff. To minimize congestion on the airwaves, make all radio broadcasts as brief and concise as possible.

Advisory Circular 90-66, "Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports" and AC 90-42A, "Traffic Advisory Practices at Non-tower Airports" are available free from DOT/FAA Distribution Section, TAD 443.1, Washington, D. C. 20590. ■

As a general aviation airplane owner would you rather:

- ☐ Save $200 per year in fuel costs?
- ☐ Increase your airplane range up to 25%?
- ☐ Cut your down-time/maintenance costs?
- ☐ Decrease your chances of having an accident?

A hard choice to make? Never mind; you do not have to make a choice. You may be able to do *all* of the above *if* you put an average of 150 hours yearly on your airplane and *if you have not been using proper leaning techniques.* (If you happen to be one of those pilots who has mastered the technique of efficient leaning, you may already be getting all that your engine has to give you.)

This article is for the pilot who seldom bothers with the mixture control except to shut off the engine when the flying is over. If this is your category, it may come as a surprise for you to find that if you lean your airplane engine's fuel mixture precisely (according to manufacturer's recommendations) there will be a noticeable saving in fuel for a given flight—with no sacrifice in airspeed. In fact, under some conditions, you might even show an airspeed gain.

Suppose you have a 145 hp engine, and are flying at 4,500 feet, mixture full rich, power set at 2,500 rpm. In a given airplane, you may use up to 9.5 gallons per hour while you true out at slightly over 120 mph. Leave everything the same but lean the mixture out and your gas consumption goes down to 7.9 gph with perhaps a slight gain in speed. What does this put in your pocket? Well, for a 480 mile flight with properly lean mixture you should use 31 gallons; without leaning, about 38. If you pay 60 cents a gallon for your fuel, you saved yourself $4.20 on that trip—one way. If you fly 150 hours a year, that could amount to over $150—more if you fly at higher altitudes and can thus lean the mixture even more.

A second benefit from using less fuel through leaning is that you increase your airplane range. Without leaning, the above trip would be a risky operation non-stop, because your airplane could only fly about 515 miles without refueling, and you need a safety margin. Properly leaned, your fuel could take you 630 miles non-stop (in each case without wind). If you value your time at all, and you can safely avoid a fuel stop, you are well ahead of the game.

Meanwhile, even as you are saving fuel, dollars and time, and adding range, you are being kind to your engine. Engines are healthiest when they are fed the right mixture of fuel and air. Flying with an over-rich mixture may induce spark plug fouling, which may shorten the life of the plugs. Proper leaning also results in a smoother running engine, and in a cleaner combustion chamber with less likelihood of the pre-ignition that sometimes results from accumulated carbon deposits.

But the most important reason for careful leaning is that by broadening the range of your aircraft you may decrease your chance of turning up on the accident statistic list. Every year hundreds of accidents—and an unrecorded number of incidents—occur because airplanes run out of gasoline. National Transportation Safety Board records show that in 1971 there were 224 fuel exhaustion accidents (17 of them fatal) and in 1972 there were 190 (with 17 fatal in that year, too). While the causes of fuel exhaustion were varied, a significant number of tragedies occurred because the pilot was not able to fly the airplane as far as the handbook said was possible on a full tank of fuel.

Leaning Right

Some of these accidents could certainly have been prevented had proper leaning techniques been used.

Why is the use of the mixture control one of the most neglected—and perhaps least understood—of piloting techniques? Partly because most operators of airplane engines were first operators of automobile engines where there is little concern for fuel mixtures. Also, most pilot training is done on relatively short hops at low altitudes that do not lend themselves to much leaning (except, of course for those operations conducted in high elevations). Even though a student is taught the theory of leaning through lectures and book study, unless he has had it clearly demonstrated, and practiced it himself, he may not absorb the importance of proper leaning.

A pilot may even have been unintentionally frightened early in his flying career when another pilot operated the mixture control with a heavy hand, brusquely pulling out the red mixture knob until the engine coughed and nearly quit, then casually shoving it back in to the point of a smooth operation. As a result, the pilot may shy away from leaning on his own, uneasy about hearing the engine cough inflight, and convincing himself (erroneously) that he is pampering it. If the student is the least bit uncertain or disturbed by the leaning operation, his fear may be dispelled by a demonstration on the part of the instructor that even when the mixture is leaned to the gasping stage the engine normally comes roaring back to life as the mixture is richened.

In the past, leaning information in many airplane handbooks has been sketchy, if included at all. Because of the many variables involved, it is not an easy subject to present, and its importance is not immediately apparent. Any harm that results from poor leaning habits may not show up for days or weeks (when the plugs need to be changed) or until the engine begins to run rough. Even when the results start to appear, the pilot may not be aware that he has contributed to the problem. So he sees no reason to change his leaning habits. Another part of the problem is a general lack of understanding about how a liquid fuel burns to produce power.

Gasoline *will not burn at all* unless it is first mixed with air in the proper proportion. Actually it is only the *oxygen* portion of the air that burns, and oxygen accounts for only 21% of the air's volume. The remainder of the air, largely inert nitrogen, does not burn, even though it does play a part in helping produce power. When the gasoline-oxygen mixture burns, generating heat, the heat expands the nitrogen and other gaseous byproducts of the combustion, and it is this expansion that produces the power for propulsion.

For the mixture to burn efficiently the ratio of fuel to air must be maintained within a specified range. These mixtures are described either by ratio expressions or by decimal figures. Thus 12 pounds of air and one pound of fuel may be described as an air/fuel ratio of 12:1.

Mixtures as rich as 8:1 and as lean as 16:1 will burn in the cylinder of an engine that develops *maximum* power with about a 12:1 ratio. Why not preset this mixture and do away with manual controls? Because as altitude increases, the air becomes less dense. At 18,000 feet the air is only half as dense as at sea level; at that level a cubic foot of space contains only half as many molecules of air. Similarly, an engine cylinder full of air at 18,000 feet contains only half as much oxygen as the same cylinder full at sea level. Meanwhile, the fuel is being metered at the same rate (by volume) as at lower altitudes. As a result, as you ascend at a fixed power setting you are getting progressively less oxygen with the same amount of fuel: i.e., a richer mixture. The mixture control provides a way for the pilot to introduce more air (and oxygen) to compensate for this imbalance.

With all those variables, what is the "right" mixture for a given flight? The quantities cannot be predetermined. The leaning procedure is always one of trial and error, whether you do it by "feel" or have instrumentation to aid you.

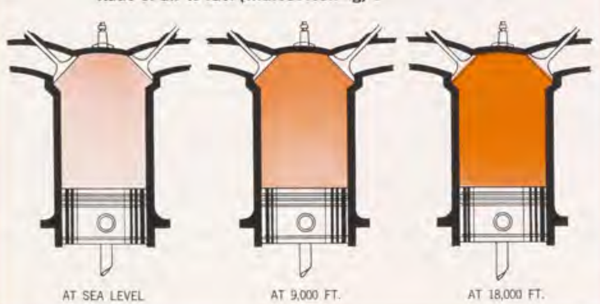
The most generally used aid to leaning is the exhaust gas temperature gauge (EGT). Exhaust gas temperature provides the most immediate indication of the kind of burn that is taking place in the cylinders: the higher the temperature, the stronger the burn. As the mixture gets leaner, the temperature will "peak"—rise steadily up to a point and then begin to fall. The generally recommended method for leaning at normal cruise speeds up to 75% power is to lean until the temperature peaks, then *richen* the mixture until the temperature falls back to about 50 degrees below the peak. (This is called the "rich side of peak.") At lower power settings you can safely operate closer to the peak temperatures than 50 degrees; on the other hand if you are more interested in prolonging the life of your engine than you are in economy and range, you might want to operate just a little cooler (richer). (NOTE: Some engine manufacturers permit running certain engines on the *lean* side of peak; check your model to be sure, never use this technique unless the manufacturer recommends it, and then only according to his instructions.)

As an aid to precise leaning the EGT is especially useful with the fuel injected engine. This engine has a more even distribution of fuel to the cylinders than a carbureted engine, and gives you a more pronounced "peak" on the temperature gauge. In either type of engine some cylinders will run leaner than others, so when the EGT is installed the probe should be located on the exhaust of the leanest cylinder. If located on a rich cylinder you could end up with an excessively lean—and harmful—operation in one or more of the leaner cylinders.

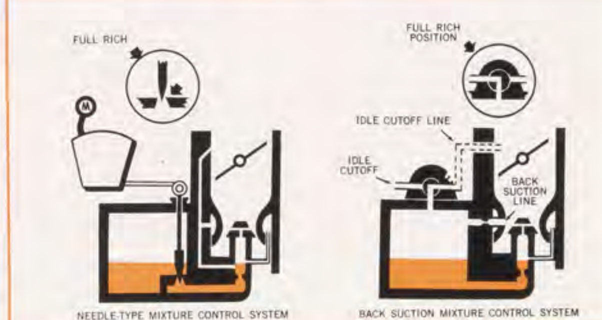
A more sophisticated—and more expensive—instrument is the "multiple point EGT," or "engine analyzer." Where the

Without leaning, the mixture would get progressively richer at higher altitudes where the air gets less dense, while the volume of fuel being drawn into the carburetor remains unchanged.

Ratio of air to fuel (without leaning) at various levels



Mixture control systems used on float-type carburetors: one uses a needle valve to control fuel flow; a back-suction type uses controlled air pressure into the float chamber.



simple (single-point) EGT registers the exhaust gas temperature from one cylinder, the analyzer registers the gas temperatures from each cylinder in turn. This instrument not only assists you in leaning, but will also tell you when one cylinder has a different temperature pattern from the others or when one suddenly becomes cold, which may alert you to impending engine problems before you would have noticed them otherwise.

If you have a carburetor engine without an EGT gauge, you can use a similar technique—not as precise but satisfactory if it is done with care. This is the old-fashioned *look, listen and feel* method. Lean until the engine begins to run rough, then richen until it smooths out. When you use this system with a fixed-pitch prop, at a given throttle setting in level flight, you will note an increase in RPMs at the point of roughness; as you richen to smoothness the RPMs will drop slightly. With a controllable prop, fixed power settings and at level flight, you will note an increase in airspeed as you reach a point of roughness, with a slight drop as you richen to smoothness.

Fuel injected engines have fuel flow gauges on the panel. On these engines, if you have no EGT, you adjust the mixture by setting the fuel flow according to the instructions in the owner's handbook or on the fuel flow indicator on the panel.

Are there dangers from over-leaning? Indeed there are. Running with a too-lean mixture can result in serious and expensive engine damage, although such damage rarely occurs at normal cruise power. It is much more apt to result from high power settings (above 75% of power for most engines) combining with too-lean mixtures to damage the engine by overheating. In point of fact, it may be harmful to over-lean at any power setting; besides, maximum engine efficiency comes only with the *proper* fuel mixture. If you fly at higher than normal power settings, it is still permissable to lean, but this needs to be done scientifically. You need sophisticated instrumentation and precise instructions, to avoid engine damage.

General guidelines for leaning.

- Always enrich mixture *before* increasing power.
- Reset mixture after any change in power or altitude.
- Use full rich mixture for takeoff and climb unless, at high elevations, it is necessary to lean to eliminate roughness and loss of power.

An old pilot's tale has it that you should never lean below 5,000 feet MSL, but this is not necessarily true. Most fuel metering devices are set on the rich side, which means that prudent leaning is permitted—in fact advisable—at almost any altitude at the recommended cruise powers.

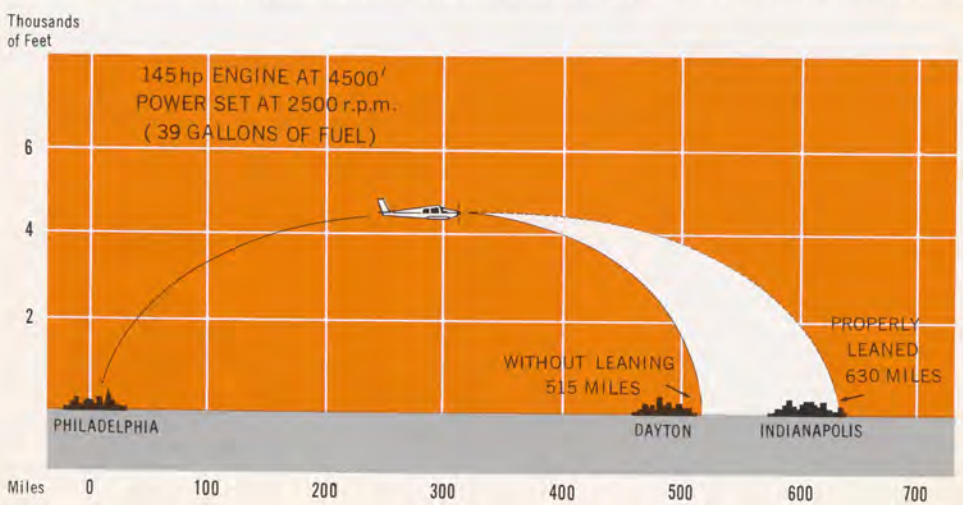
If you are attempting to take off from a high elevation airport you may have to lean on the ground to prevent roughness in the engine, and a lack of power that could keep you from getting safely into the air and over the trees. Leaning on the ground is usually not necessary until you get above 5,000 foot elevation but—and this is a very important *but*—remember that it is *density altitude* that counts: on a hot day you might need to lean at a 3,500 foot elevation airport. To lean on the ground, just before takeoff apply full throttle (with brakes on) and lean until maximum RPMs are achieved. (Keep full throttle operation on the ground to a minimum to avoid overheating the engine.) Important: with a turbocharged or supercharged engine, make *all* takeoffs full rich.

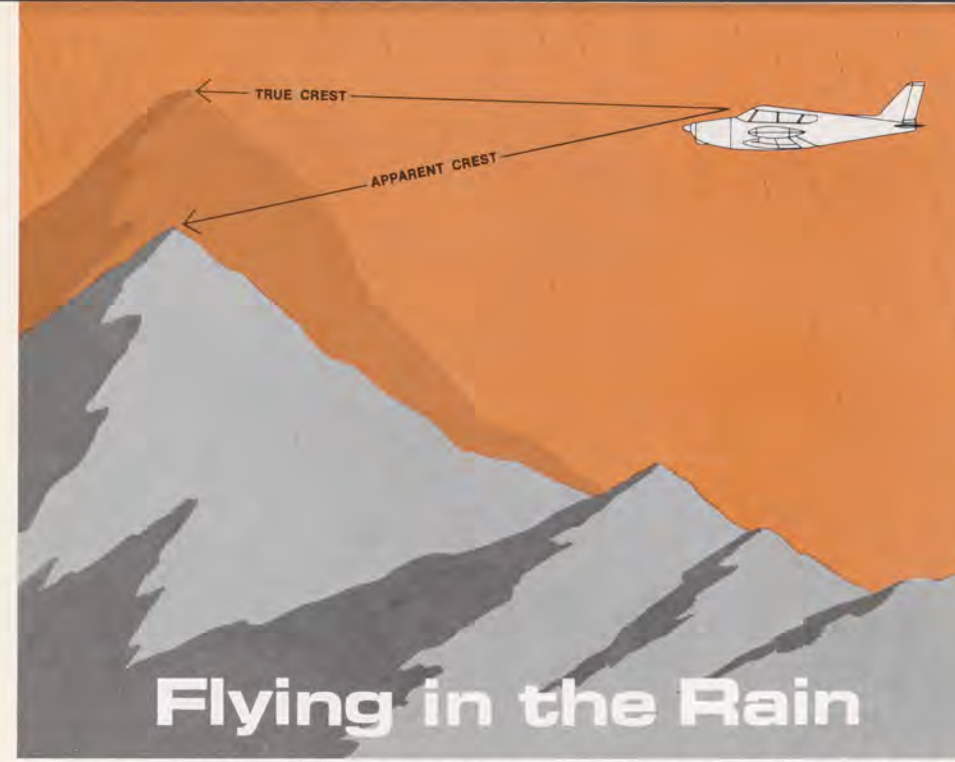
If saving fuel is your goal, once you have mastered proper leaning techniques you might want to explore other ways to reduce your gasoline consumption without sacrificing much of your aircraft utility; in fact, in some cases you can actually increase your flying enjoyment. Some economy tips:

- Keep your airplane, especially the engine, in first class condition. A well-maintained engine with a well-rigged, clean airplane flies faster, uses less fuel.
- Try using reduced power settings; sometimes you can save as much as 30% of fuel by just cutting your speed 10%. You can determine this from your airplane handbook charts; pick the power setting that gives you the most miles of range. (Do NOT use economy power for takeoff and climb, or with new or overhauled engines until piston rings have seated.)
- Choose altitudes that allow efficient fuel use (handbooks explain this) in conjunction with favoring winds.

Every little bit helps. Saving a couple of gallons of gas on two-hour trips may not sound like much—until you add it up for the year. In these times of energy shortages, the fuel you save today may be the fuel you fly on tomorrow. ■

At 4,500 feet a properly leaned engine will take you considerably farther between refueling stops than one running full rich.





Flying in the Rain

A dangerous misapprehension may result when heavy rain on the windshield causes terrain contours to appear lower than they actually are.

How the refraction of light through a wet windscreen can distort your vision.

Raindrops falling on your windshield and on the approaching terrain can cause visual distortions which may lead to mismanaged approaches to land. Several kinds of distortion errors are possible, including those due to refraction and diffusion.

Refraction here means the change of direction of light beams as they pass from one type of medium to another, as from air to water. Water slows up the passage of light and causes it to "bend," as in the familiar example of placing a stick in water. Also familiar is the experience of visualizing objects at the bottom of a pool as being at a shallower depth than their true depth, because of the refraction of light by the water.

In heavy rain, even though visibility may appear fairly good to the pilot, terrain contours or lights may seem lower than their actual elevation relative to the airplane. *Diffusion* (or "halo-ing") refers to the tendency of lights seen through moisture to spread apart and appear less intense—and therefore farther away than their actual distance. Conversely, diffusion, under other circumstances, may cause approach lights to appear larger, and hence nearer, than they are.

Light passes through water more slowly than through air. Example: half-submerged, a straight stick appears bent in the middle.

The National Transportation Safety Board has cited such visual distortions during instrument approaches made at night during rainfall as factors contributing to air crashes—including the recent 707 crash in Samoa which took the lives of 97 persons. The critical point is the moment when the pilot-in-command transitions from instruments to visual reference, mistakenly concludes that he is higher than normal, and permits a too-rapid descent to take place. The degree of distortion which can take place will vary in accordance with weather and terrain conditions, so that it is not possible to arrive at any rule of thumb for compensating for rain distortion. But awareness of the phenomenon should be enough to enable the alert pilot to avoid mishandling the approach.

Incidentally, the more effective your windshield wipers, the less distortion will occur, so a periodic check of wiper condition and performance is worth remembering—even if you are by habit a fair-weather flyer. You can never tell when those raindrops might start falling on your plane. ■

Famous
Flights

Conclusion of a two-part article on Amelia Earhart

The Last Flight

Billed as the "Lady Lindy" when in 1928, she became the first woman to cross the Atlantic in an airplane, Amelia soon established her own image as a Liberated Woman who followed her own path and refused to bow to convention. She cherished freedom of action above all things, and dreaded any commitment that went beyond her personal interests of the moment. She liked flying airplanes—as well as racing about in open cars—"simply for the fun of it," without regard to practical reward or social propriety. And now that she had won her place in the sky, the last thing she wanted was the traditional bounty of a rose-covered cottage, a rich and handsome husband and a brood of happy children . . . to chain her down.

Nevertheless, in 1931, after an avid courtship by her business mentor and publicist, the recently divorced George Putnam, Amelia agreed to marry him—on certain rather unusual conditions. Just before the marriage ceremony was to take place, the reluctant bride slipped a "contract" into the bridegroom's hand and asked him to sign it, "if he really wanted her." She asked, among other conditions:

". . . Please let us not interfere with the other's work or play, nor let the world see our private joys or disagreements. In this connection I may have to keep some place where I can go to be myself now and then, for I cannot guarantee to endure at all times the confinements of an attractive cage."

She also stated cryptically,

"I shall not hold you to any medieval code of faithfulness to me, nor shall I consider myself bound to you similarly. . . ."

Putnam agreed, and apparently kept to the bargain.

After her marriage Amelia did less of what she called stunt flying, but was very active as a lecturer, building herself a reputation as a champion of women's rights with an attitude that sounded like heresy in her day but which now has a very contemporary ring. She proclaimed that it would do men good to become acquainted with the drudgery of household routine, and she denounced the concept of marriage as "a cyclone cellar into which a woman retreats from failure in other spheres." But she also told a meeting of the Daughters of the American Revolution in Washington that "You really all ought to be drafted," and chided them for glorifying war and patriotism.

Above—plane and pilot, ready for the world flight. Right—En route Earhart and Fred Noonan confer with mechanic under the tail of the *Electra* at Caripito, Venezuela.

In 1936 the Purdue University Research Foundation presented Amelia with a new Lockheed *Electra*—and therewith the means of embarking on one last daring adventure: a flight around the world. She was now 38, and facing uneasily the approach of her middle years and the loss of that footloose freedom granted her so long. "One more stunt," she told her husband, "and I'll be willing to settle down." He made no effort to dissuade her.

The *Electra* was an all-metal monoplane with twin *Wasp* engines delivering 1,100 horsepower, giving the airplane a top speed of well over 200 mph and a cruising radius (with extra tanks) of 4,500 miles. It was regarded as a virtual "flying laboratory," equipped with a newly invented autopilot, a radio direction finder and the most advanced voice and code communication systems known. To man all this electronic equipment, Amelia signed on Fred Noonan, an expert navigator who had already flown the Pacific 18 times.

On June 1, 1937, nearly nine years to the day after her first endurance flight in the *Friendship* Amelia and Noonan departed from Miami, bound for Oakland, Calif., the longest possible way—29,000 miles via Puerto Rico, Venezuela, Brazil, across the Atlantic to Africa, Arabia, on to India, Singapore, Australia, New Guinea and finally north to Hawaii and home.

The flight proceeded as scheduled, and was followed with feverish excitement in the world press. Putnam telephoned his wife almost daily at her fueling stops, where she and Noonan were feted royally, transported on camels and elephants, and laden with gifts. For the starry-eyed girl from Kansas, the panorama of jungle and mountains and storied temples that lay beneath her flight path was almost unreal—she recalled the imaginary journeys she and her sister had taken as a child, curled up with maps in an old abandoned carriage on their Kansas farm.

Reality impinged on the dream as they prepared for the longest nonstop hop of their flight, from Lae on the coast of New Guinea, to Howland Island, 2,556 miles.

Howland is a tiny speck on the equator near the Marshalls, two miles long by half a mile wide, rising no more than two feet above water at high tide. The smallness of the island and the vastness of the Pacific ruled out pilotage or dead reckoning as reliable forms of navigation, leaving only celestial charting with radio aids. They would lose radio contact with Lae after about 500 miles and they would have to come within a few hundred miles of Howland before they could home in on the Navy's transmitter there. Because of mechanical difficulties, Noonan was not able to set his chronometers as accurately as he wished, but after two days of impatient delays the two travel-weary flyers took off at dusk.

The first contact at Howland from Amelia came at 2:45 a.m. and consisted of only three words: "Cloudy and overcast." Evidently Noonan had no visible stars to steer by. At 6:15 a.m. Amelia's voice was heard on the radio asking for a bearing. She thought she was "about 200 miles from Howland," but the Navy direction finder was unable to get a bearing. Half an hour later she repeated her request, saying she was about 100 miles out. Still no bearing, nor were any of Howland's signals being heard aboard the *Electra*. A last, tense plea for assistance came after the plane had been airborne for nearly 21 hours—long overdue—"listening on 6,210 kilocycles. We are running north and south."

Amelia Earhart, examining the newly developed automatic radio direction finding antenna employed on her round-the-world flight.

Amelia was never seen or heard from again. At least there is no certain evidence that she was. Her disappearance launched the most massive seahunt in history, involving dozens of U.S. Navy ships, including the air carrier *Lexington*, lasting weeks and covering over 200,000 square miles of ocean. *Not a trace*. Nothing that could be verified.

Almost immediately rumors spread that Amelia's "stunt" had been a cover for aerial espionage over Japanese-mandated islands in the south Pacific, and that she had been shot down or otherwise captured by the Japanese, imprisoned, tortured and executed. Numerous private investigators, some heavily backed commercially, have conducted lengthy, exhausting inquiries, and have produced many interesting theories and conjectures—but no real evidence to weaken the Navy's statement ". . . it is regrettably unreasonable to conclude otherwise than the unfortunate flyers were not above water at the conclusion of the search."

In her journal Amelia admitted to some misgivings about her last flight, but it would have been out of character for her to have held back, or regretted the attempt. "Courage," she wrote, "is the price life exacts for granting peace." She found hers in her own way. ■

Pilot
BRIEFS

■ ALTITUDES AND INSTRUMENT APPROACHES. FAA has amended regulations covering pilot procedures for altitude management after receiving an approach clearance when operating IFR on an unpublished route or on radar vectors provided by air traffic control. After receiving such a clearance the pilot must maintain his last assigned altitude unless a different altitude is assigned by air traffic control; or until the aircraft is established on a segment of a public route or instrument approach procedure. The pilot who does not fully understand his clearance must request clarification from the controller immediately.

■ UNAUTHORIZED ADDITIONS. Engine add-ons for the convenience of maintenance, which are not authorized by the manufacturer, have been reported responsible for engine failures and forced landings of general aviation aircraft. One owner added a magnetic pickup to the engine oil drain plug, which restricted oil flow to the engine oil suction screen, resulting in oil starvation and subsequent engine failure. Another owner installed an oil quick-drain in the engine sump, on an aircraft equipped with retractable landing gear. When the gear was retracted it broke the protruding plug, allowing oil to escape and the engine to overheat.

Approval from the manufacturer should always be obtained before having an engine modified—otherwise the warranty may be voided. Any addition or change of parts requires a careful ground run and inspection after shutdown; a test flight, with alert monitoring of instruments; and another inspection on the ground. Convenience parts can add up to a highly inconvenient repair bill.

■ CYCLE CHANGE FOR IFR CHARTS. To help keep prices down in the face of escalating paper and postage costs, the cycle for issuing IFR Enroute Charts has been changed to every 56 days instead of 28 days. (Instrument Approach Procedures are excepted from the change.) Normal changes to the National Airspace System (such as commissioning, decommissioning, and frequency changes of navigation and communication facilities or airway changes) will continue to be scheduled to coincide with the issuance of charts. The only changes to be issued between chart dates will be those of a critical and/or emergency nature, and these will be accomplished by using Notices to Airmen (NOTAMS) or by Chart Change Notices.

■ WHO'S KEEPING THE BOOKS? A new advisory circular (AC 43-9) discusses the responsibilities of owners, operators and maintenance personnel for the upkeep of aircraft maintenance records, as required by the Federal Aviation Regulations (FAR 43 and 91). The circular explains the various kinds of records that must be kept, and by whom; and cautions pilots about purchasing aircraft with incomplete records which could delay indefinitely certification of the aircraft. The legal validity of tach time is also clarified. AC 43-9, "Maintenance Records: General Aviation Aircraft," is available free on request to the DOT/FAA Distribution Unit, TAD-484.3, Washington, D.C. 20590.

RETURN OF THE AIRSHIP. Presently undergoing tests in Sioux Falls, S.D., is the experimental *Enterprise*, first hot-air airship to be built in this country. Powered by a modified Revmaster VW engine, the craft is 120 feet long, 48 feet in diameter, carries a crew of two, and can travel from 5 to 25 miles per hour. Possible uses are traffic watch, crowd control, environmental observation (like checking oil spills), and advertising.

Safety-Minded Pilots Have Chance to Win Airplane

FAA's Accident Prevention Program has again been given the support of the General Aviation Manufacturers Association in the form of a "Safe Pilot Sweepstakes," which this year is offering a $40,000 new airplane to some lucky attendee of a flight safety seminar.

Some 1,600 safety seminars will be held throughout the country during the 12 month period beginning April 1, 1975, and any person attending will receive a free Sweepstakes ticket. Pilots will be notified of nearby meetings by their local Accident Prevention Specialist. The first Safe Pilot Sweepstakes, which ended in May 1973, was launched by GAMA as an incentive for pilots to attend FAA safety seminars, and drew more than 200,000 participants.

There is no limit to the number of times a person can enter the Sweepstakes—a sweepstakes chance is given each time you attend an FAA Safety Seminar and fill out an application. First prize will be a choice of aircraft models, retailing at $40,000. Other prizes include two $1,000 certificates for pilot training or advanced ratings, two 14-day "Rhine (Germany) Discovery Tours" and a trip for two at the AOPA 1976 Plantation Party in San Antonio, Texas.

Complete information is available from any FAA General Aviation District Office, or from GAMA, 1025 Connecticut Ave., N.W., Suite 1215, Washington, D.C. 20036.

Proposed Rule Changes From Airworthiness Review

As a scheduled part of the Biennial Airworthiness Review Program, FAA has published the second in its sequence of notices of proposed rule making dealing with certification procedures and airworthiness standards. Notice #75-10, which contains a wide range of proposed changes affecting FAR Parts 21, 23, 25, 27, 29, 31, 33, 35, 91, 121, 127, 133, 135, is aimed at updating existing regulations to the state of the art.

The Airworthiness Review is in the second half of its scheduled two-year cycle. The proposals now being published are based on suggestions selected from hundreds submitted by the government, industry and the public, which were subsequently compiled and commented upon by interested persons. Additional notices of proposed rule making will follow.

The latest proposals were published in the Federal Register on March 7, 1975. Comments should be sent before June 5, 1975 to FAA, AGC-24, Washington, D. C. 20591.

GAMA Drafts Guide for Standard "Pilot's Operating Handbook"

Purchasers of general aviation airplanes will find it easier in the future to understand and use the airplane handbook, once the new, standardized "Pilot's Operating Handbook" is phased into use by manufacturers.

Representatives of the General Aviation Manufacturer's Association, in coordination with FAA, have completed specifications for the standard handbook, and expect that it will begin to appear with some models within the next year. Until now, airplane handbooks have taken a variety of forms, some much more helpful than others, with various titles ("Owner's Manual," "Pilot's Handbook," etc.).

The GAMA specifications manual covers the preparation of handbooks for all types of general aviation airplanes (under 12,500 lbs) except jets; simple aircraft will have simpler handbooks than complex aircraft. Handbooks for all models, however, will be presented in a common format and order, for maximum in-flight utility. The arrangement of the handbook is intended to increase the in-flight usefulness of the book. For example, the Sections on "Emergency Procedures" and "Limitations" are placed ahead of "Normal Procedures," "Performance," "Weight and Balance," etc., to provide easier access to information that may be required in flight. A wide variety of emergency conditions are provided for, including failure of engine, prop, fuel, electrical or hydraulic systems, and flight controls.

Glider, Rotorcraft Test Guides

A new guidebook for applicants taking the written test for instructor ratings in gliders and in rotorcraft under FAR Part 61 (Revised) has been published by FAA. Included in the guides are study outlines, recommended study materials and sample test questions.

Books may be obtained from Superintendent of Documents, U.S. GPO, Washington, D.C. 20402. Flight Instructor, Glider, Test Guide (AC 61-75) is $1.10. Flight Instructor Rotorcraft-Helicopter Test Guide (AC 61-74) is $1.45.

General Aviation Activity Up

General aviation operations at controlled airports increased nearly five percent last year, while airline flights dropped by seven percent during the same period, (although the number of passengers carried by air carriers increased by three percent).

General aviation activities dropped during January but all other months in 1974 showed a gain. High point was in October, when a 10.1 percent increase was registered over the previous October.

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.

• Postscript from Ercoupe N99166

I read your February article "Coming In On a Road and a Prayer" with much interest. I am the current owner of that famous *Ercoupe* N99166, having purchased same from the unfortunate subject of your article. I have a few additions and corrections to your story. First of all the aircraft is an *Ercoupe*, not *Aircoupe*. The original *Ercoupe* was built by Engineering and Research Co. of College Park, Md. *Aircoupes* were later versions by successors to the design.

I discovered, after purchasing the aircraft, why the pilot was having some of his problems. The intermittent radio transmissions were due to an instrument panel brace which had come loose and was periodically shorting the microphone jack. The gyro horizon and directional gyro had worn out bearings and the DG had the air inlet plugged. The turn-and-bank instrument worked OK.

Worth noting was the lifesaving inherent stability of the aircraft which saved the pilot's life. The plane did not stall or spin, even though the pilot stated he was inverted at times. I don't know of any current production plane which would have been so forgiving.

Ercoupe N99166 and myself thank you for a very good and interesting article. Kudos to controller Richard Gardner (no relation) for giving calm, reassuring directions.

William R. Gardiner
Perry, Fla.

• Echoes of Tallahassee

As an avid reader of FAA AVIATION NEWS I derive a lot of helpful information from accounts of other pilots' problems. You learn from the errors of others. However, in "Coming in on a Road and a Prayer" the pilot showed more than poor judgment: he appeared almost catatonic. I wonder what makes an intelligent pilot turn into an incoherent mass when thrown into hazardous flying conditions. Can it happen to anyone? How does one avoid the problem—aside from avoiding the hazardous conditions themselves? I wonder if the old admonitions of, "Don't panic, keep your head, trust your instruments, etc." are sufficient to prevent disorientation and incoherence.

George F. Granger
Somerville, N.J.

It is difficult to say why some people panic, and others do not, in the face of an unexpected emergency. The best antidote for panic is to be as well-prepared as possible for every conceivable in-flight eventuality. This is why so much emphasis is placed on emergency procedures during flight training. Knowing what to do in an emergency—and how to do it, as the result of repeated practice—has a calming effect. The pilot who has not practiced emergency landing procedures regularly is the one most apt to panic if the engine quits. Similarly, recurrent instrument training for VFR pilots will help you take rational steps, rather than irrational ones, if the weather suddenly starts to deteriorate.

• No Birds on the Soup Dock

I found your February issue particularly interesting and hope you keep up the good work in 1975. With reference to "Bright Lights and Birds" in the Forum I would like to add some local research. The Campbell Soup Co. in Camden, N.J., uses rotating orange beacons over each truck-loading dock, similar to those used on emergency vehicles. This is the only practical method they found to keep birds away from the docks. Maybe you should check to see if it would work for airplanes.

On another subject, I recently requested and received the Advisory Circular Checklist and Status of FAR's and found it to be a goldmine of references to virtually all available literature. I was surprised to learn from several pilots that they were unaware of the contents of this Checklist. I think you would be making a worthwhile contribution to aviation safety if you informed pilots of this valuable resource.

Jon R. Sank
Haddonfield, N.J.

The "Advisory Circular Checklist" contains the names of various FAA publications (some of which are for sale and some of which are free), and tells how to get them. The checklist which also details the status of the Federal Aviation Regulations, is issued three times a year, and is available free from DOT Publications Section, TAD 443.1, Washington, D.C. 20590. Advisory circulars are listed according to subject matter (Airmen, Aircraft, Airspace, Airports, Air Traffic Control, General Operations, etc.). After reviewing the checklist you can ask to be put on the mailing list for any series of ACs that interests you.

• Safety Pilot Time

FAR Part 91.21 states "no person may operate a civil aircraft in simulated instrument flight unless (1) an appropriately rated pilot occupies the other control seat as a safety pilot." FAR Part 61.51 states regarding second-in-command flight time: "A pilot may log as second-in-command time all flight time during which he acts as second-in-command of an aircraft on which more than one pilot is required under the type certification of the aircraft or the regulation under which the flight is conducted."

If I am qualified in the airplane, flying safety pilot for another pilot who is flying under simulated instrument conditions in a Cessna 150, can I log second-in-command time because we are operating under the above FAR Parts?

Tim McVey
Downey, Calif.

In the operation you describe, the safety pilot may log second-in-command time under the provisions of FAR Part 61 (Revised).

• A Scattered Ceiling?

This is a gripe. The article "Coming In On a Road and a Prayer" in the February issue was good and well-done except for a few mistakes in wording. Example: you refer to a "Ceiling scattered at 2,000 feet . . ." No way! Can't be a ceiling when it's scattered.

Allen Barco
Kendall Park, N.J.

The word "ceiling" should have been omitted, for technical accuracy.

• Hold the Foam

"Your son the pilot" committed more than one safety oversight in the "Home for the Holidays" article in the December issue. When queried by the tower as to whether crash-rescue equipment was required to stand by during his return to the field because of a failing engine, this brave pilot said "negative"! In such a fine article an attitude like this is to be abhorred. If the problem was bad enough to return to the field to land, then "your son the pilot" should have thanked the tower for their concern, had the trucks out, asked for a preacher and a direct line to the angel-in-charge of sky hooks, and anything else that was available.

A calm approach to an emergency is a great asset, but failure to utilize all available help is dumb. Besides his children would probably have gotten a kick out of seeing the fire engines. They're free!

James P. Gunter, Jr.
Virginia Division of Aeronautics
Richmond, Va.

"Our son" did tune in the Upstairs frequency, but perhaps he should have asked for a little more terrestrial help. The man in the cockpit is in the best position to judge how serious his situation is.

• What Price Survival

You have a great periodical in FAA AVIATION NEWS, but it has simply priced itself out of the budget of the average pilot. Yours in mutual sorrow.

Emmette T. Gatewood, Jr.
Los Gatos, Calif.

As you undoubtedly know, the price of this safety magazine is set by the Government Printing Office to cover the cost of publishing, and its recent increases ($6.20 per year now) reflect the inflationary trends in materials and services. The sorrow over losing readers on this account is indeed mutual.

But consider this. Active pilots fly a minimum of about five hours a month, or 60 hours a year. This means an annual cost of perhaps $1,200 annually, even if you are a rental pilot, and quite a bit more if you are an owner. Your subscription to FAA AVIATION NEWS costs you about one half of one percent of your annual outlay. Is that really an exhorbitant expense for information that could save your life or limbs, not to mention costly repairs?

• Grandaddy of the C-119

The FAA AVIATION NEWS is widely read here at Lawson Field, and it is usually factual and accurate. However the photo caption on page 14 of the February edition which identifies a low flying twin as a C-119 should be examined more closely. It is actually a C-82, the grandaddy of the C-119. Note that outer extension of the horizontal stabilizer—the C-119 does not have that protrusion. Otherwise the photo tells a good story of an old military aircraft in non-war use. Both aircraft used Lawson Field for years.

J. V. Warren, Jr.
Fort Benning, Ga.

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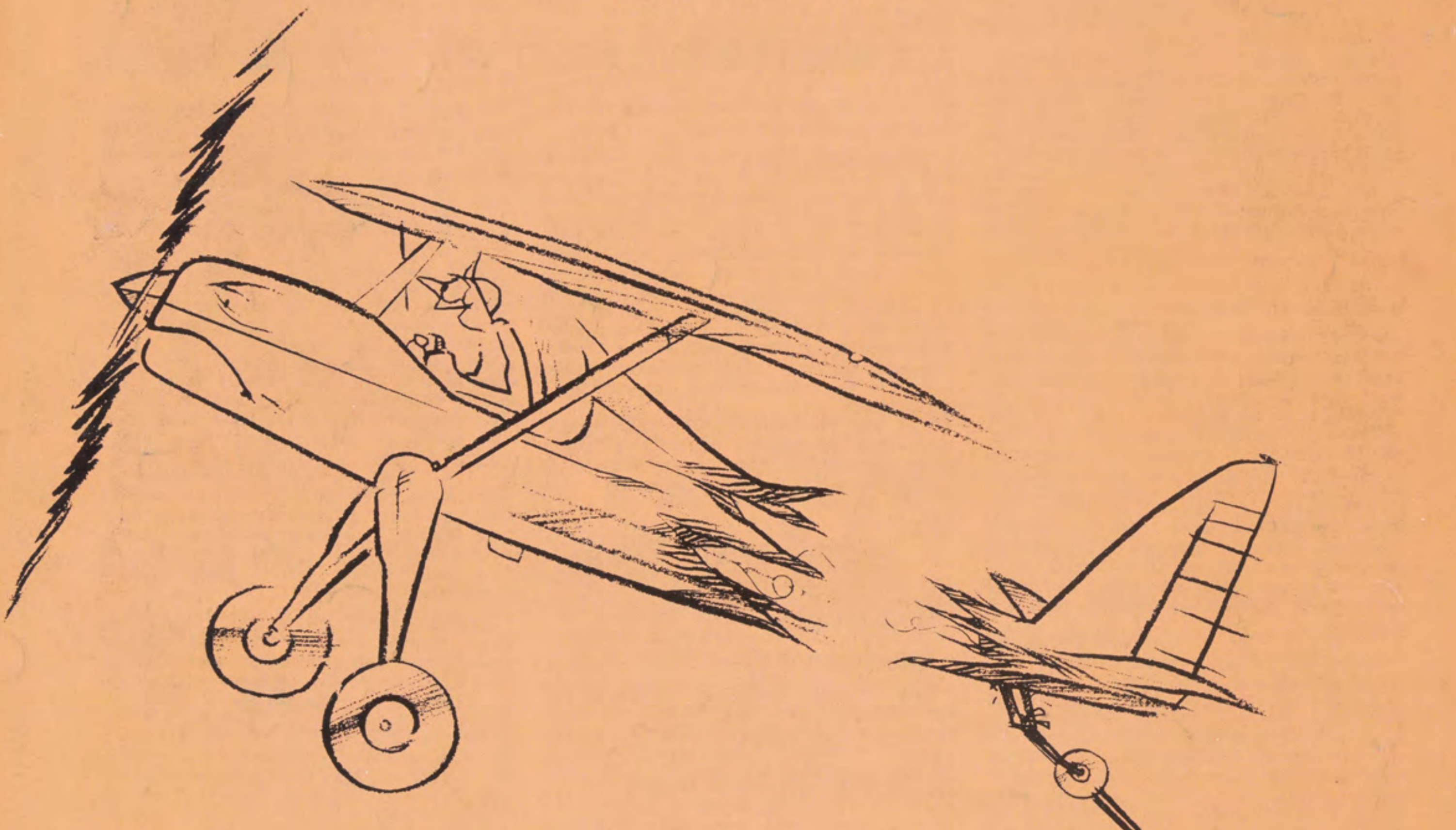
Hell-for-leather starts



May result in extra parts

Idea suggested by Arthur Eickenberg,
ACTC, Tampa, Florida