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Ground Deicing

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FAA Aviation News

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FEATURES

DEPARTMENTS

On the Cover: *Preserving a part of aviation's heritage. See page 22. Photo by Eric Presten*

Central Missouri State University's aviation partnership. See page 17.

Don't let your "well" run dry. See page 24.

Changing with the Times

Proposed FAR Parts 61 & 141 Rewrite

by Louise Oertly

The world of the 1990's has changed considerably from that of 20 years ago. In the 1970's the words "microwave" and "computer" invoked images far different from items that are commonplace in many households today. The same type of technological advances has taken place in aviation. For example, how many pilots in 1975 had heard of, much less thought they would be using, GPS 20 years later?

In an effort to make the Federal Aviation Regulations (FAR) reflect today's airspace and aviation technology, the Federal Aviation Administration (FAA) issued a notice of proposed rulemaking (NPRM) in the August 11, 1995, *Federal Register* revising FAR Parts 61, 141, and 143. These parts prescribe the certification and training requirements for pilots, flight instructors, and ground instructors and the operation of pilot schools approved by the FAA. The last time they had a major revision was in the 1970's.

To present a detailed discussion of these proposed revisions would be a lengthy process, especially as the NPRM contains 124 pages and 18 major proposals. In this article, we will try to highlight them. The NPRM proposes to:

1. ***Clarify and standardize terminology*** to ensure consistency throughout the text of FAR Part 61. This affects such terms as "Airman Certificate," "Cross-country Time," and "Supervised Pilot-in-Command."
2. ***Establish a new powered-lift category rating.*** In many respects the powered-lift aircraft resemble rotorcraft (vertical takeoff and landing and hovering) as well as airplanes, (flight at higher airspeeds) so it will require a new set of pilot knowledge, skills, and abilities.
3. ***Establish separate class ratings for nonpowered and powered gliders.*** Currently the FAR do not address powered gliders. The FAA proposes to convert the current glider pilot and flight instructor certificates to the new class rating over a two year period.
4. ***Establish a flight instructor certificate in the lighter-than-air category*** to ensure that those who perform flight training in all aircraft categories and classes are subject to flight instructor training and renewal requirements. The FAA has also determined that the present system of incorporating training privileges into the commercial certificate is a burden on commercial lighter-than-air pilots who do not instruct.
5. ***Establish instrument ratings for single-engine airplanes, multi-engine airplanes, airships, and powered-lifts.***
6. ***Revise the recency of experience requirements.*** The current requirement for three takeoffs and three landings within the preceding 90 days would be modified to allow night takeoffs and landings to also count for daytime currency. However, the takeoffs and landings would have to be to a complete stop, whether accomplished during

day or night or in an airplane with tailwheel landing gear or tricycle landing gear.

7. ***Revise recreational pilot certification, privileges, and authorization requirements*** to include:
   a. *Eligibility*—Must be able to read, speak, write, and understand the English language with no provisions or limitations to the contrary; would not be required to hold a medical certificate but would be required to provide a signed and dated statement certifying that there are no known medical defects that would prevent the person from operating the aircraft for the aircraft category and class rating sought; i.e., self-certification.
   b. *Aeronautical Experience*—Must accomplish and log at least 30 hours of flight time that includes at least 15 hours of flight training time from an authorized flight instructor and 3 hours of supervised pilot-in-command flight time.
   c. *Privileges and Limitations*—Would allow the recreational pilot to act as pilot-in-command of an aircraft on a flight that exceeds 50 nautical miles from the departure airport providing that the pilot has been trained and found proficient in cross-country flying and received a logbook endorsement for such from an authorized flight instructor.
8. ***Require human factors training and windshear training for all certificates and ratings.***
9. ***Replace flight proficiency requirements*** for training and certification with more general approved areas of operation.

The specific tasks for training and practical tests would be listed in the standards for each practical test for each certificate and rating.

10. ***Revise the training times for the aeronautical experience requirements*** to permit the student and instructor to tailor the training to the individual student's needs. The FAA recognizes that each person has his or her own pace for learning and retaining information.
11. ***Remove and reserve FAR Part 143 and establish a new subpart I in FAR Part 61 for ground instructors.*** This proposal revises the regulations on ground instructors to make the ground instructor certificate more compatible with the demands of current training requirements. The proposal would also establish a two year period for ground instructors to convert to the new system.
12. ***Require ground instructor certificates to be based on aircraft category.***
13. ***Require applicants for a ground instructor certificate to accomplish an oral test*** as currently only a written test is required. Also there are no provisions for renewal of ground instructor certificates, so a recency of experience requirement is proposed.
14. ***Revise the certification and test courses in FAR Part 141*** to accommodate all aircraft categories and new technology.
15. ***Establish a check instructor position to perform student and instructor checks and tests at FAR Part 141 pilot schools.*** The proposal would help FAA clarify to whom a chief instructor at a larger pilot school could designate the authority to conduct student stage checks, end-of-course tests, and instructor proficiency checks.
16. ***Delete exceptions that permit pilots to be certified without meeting the English language fluency requirements.*** The proposal will permit those already with these privileges to continue to operate with limitations, but they will not be able to seek a higher level pilot certificate or additional rating unless they meet the English language fluency requirement.
17. ***Revise the medical eligibility requirements for applying for all certificate levels and ratings by only requiring applicants to hold a third class medical certificate.*** Requirements for exercising the privileges of each certificate would remain as they are currently.
18. ***Delete the requirement for recreational pilots to hold a medical certificate,*** but those persons would be required to make a self-determination that they have no known medical condition or deficiencies that would prevent the person from operating the aircraft for the aircraft category and class rating sought. This proposal would also include higher rated pilots who elect only to exercise recreational pilot privileges.

Again, these are only the highlights of the proposed revisions to FAR Parts 61, 141, and 143. The NPRM covers much much more—such as clarifying the various aspects of logging time and windshear avoidance. The public is encouraged to study this proposal and send in comments by December 11, 1995.

To obtain a copy of this NPRM contact the FAA Public Inquiry Center, APA-220, at 800 Independence Ave., SW, Washington, DC 20591, or by calling (202) 267-3484, and ask for Docket No. 25910 or NPRM Number 95-11 which was published in the *Federal Register* on August 11, 1995.

Compuserve members may obtain a copy of this NPRM by contacting Library 15 of the AVSIG Forum by downloading the file called NOT_9511.ZIP. Also a copy may be obtained from FedWorld by dialing 703.321.3339, going to the FAA Data Library and downloading the file called NOT_9511.LZH.

Comments should be sent in triplicate and marked "Docket No. 25910" to FAA Office of the Chief Counsel, Attn: Rules Docket (AGC-10), Docket No. 25910, 800 Independence Ave., SW, Washington, DC 20591. Comments must be received on or before December 11.

Keep in mind that the last major revision of these FAR parts took place 20 years ago, and you now have an opportunity to affect the rules you will have to live with in the future. ■

H. Dean Chamberlain

The Clean Aircraft Concept

PART ONE

by Phyllis-Anne Duncan

A clean aircraft flies better, right? Is more aerodynamic, right? Pilots over the years have come to believe that regularly washing and waxing their aircraft somehow improves its performance. Every Spring you see lots of aircraft getting their post-winter baths. This may be a myth as far as performance is concerned, but that shiny, clean aircraft surely makes you feel good.

We need to make our mythology reality when it comes to cleaning the aircraft of ice, snow, or frost adhering to its control surfaces. The *clean aircraft concept* is actually supported by the FAR: FAR § 91.527 (as well as similar sections in FAR Parts 121, 125, and 135) prohibit takeoff when frost, snow, or ice is adhering to "any propeller, windshield, or powerplant installation or to an airspeed, altimeter, rate of climb, or flight attitude instrument system . . . ," when snow or ice is "adhering to the wings or stabilizing or control surfaces," or when any frost is "adhering to the wings or stabilizing or control surfaces, unless that frost has been polished to make it smooth." [FAR § 91.527(a)]

There are many aspects of the FAR peripherally tied into the clean aircraft concept—PIC responsibility, careless and reckless operation, preflight requirements, etc., but perhaps the most important is the fact that the pilot in command has the ultimate responsibility to assure that the aircraft can be operated safely. Recognizing that even small amounts of ice, snow, or frost can degrade aircraft performance *unpredictably* means you're beginning to accept that responsibility. Accepting the consensus of the aviation community that the best way to verify the condition of your aircraft before takeoff is to perform a *visual/hands on inspection* indicates that you are living up to your responsibilities. Not taking off with snow, ice, or frost on the aircraft means

you've fulfilled your clean aircraft concept responsibilities for that flight.

FAR § 91.527 is contained in FAR Part 91, Subpart F, which applies only to large and turbine-powered, multi-engine airplanes, but pilots of smaller aircraft under FAR Part 91 can use the definitions and prohibitions in FAR § 91.527 to enhance the safety of their winter aircraft operations. In this article—Part One of a three-part series—we'll outline the *clean aircraft concept* and encourage pilots of small aircraft to avail themselves of de-icing and anti-icing procedures when practical.

Understanding the Need

Before you can fulfill your PIC responsibilities, you must understand the need for a clean aircraft. This involves acquiring knowledge of the adverse effects of ice, snow, or frost on aircraft performance and flight characteristics. Degradation of performance is wide-ranging, unpredictable, and dependent upon make and model, but some of the typical problems are decreased thrust, increased drag, decreased lift (alteration of airflow over the airfoil), increased stall speed, trim changes, and altered stall characteristics and handling. All in all, nothing you want to mess with.

Additionally, the pilot committed to the clean aircraft concept needs to have knowledge of:

- Various and appropriate ground de-icing and anti-icing procedures, including the use and effectiveness of freezing point depressant (FPD) fluids
- Capabilities and limitations of these procedures in various weather conditions
- What the critical areas of the aircraft are, i.e., wings, props, and control surfaces, as well as airspeed, altimeter, rate of climb, and flight attitude instrument systems

Takeoff should not be attempted in any aircraft with contaminated surfaces, and the PIC is responsible for determining that the critical components listed in the FAR are free of frozen contamination. Operators under FAR Parts 121, 125, and 135 have to develop specific procedures for the PIC to follow to assure this. Those procedures could include qualified ground personnel and adequate equipment and supplies to remove frozen contamination. (Advisory Circular 135-17, "Pilot Guide: Small Aircraft Ground Deicing," contains information that will help pilots to understand aircraft ground deicing issues. It defines frozen contaminants and how they can affect performance and flight characteristics. What follows in this article is general information. For aircraft type specific procedures, consult aircraft flight manuals or other manufacturer documents for that particular type aircraft.)

Frozen Contaminants and Their Causes

Ice, snow, and frost are frozen contaminants, and they can form and accumulate on exterior aircraft surfaces on the ground. Weather causes this accumulation as do ground operational conditions conducive to icing. In either case, atmospheric conditions vary the type of accumulation, the amount, etc. Generally, icing conditions (during flight or ground operations) occur and ice protection systems or procedures should be activated when the outside air temperature (OAT) is below 50°F (10°C) and visible moisture is present or when there is standing water, ice, or snow on runways or taxiways.

Aircraft in flight experience a variety of atmospheric conditions which alone or together can produce ice formations on the aircraft and its components. These conditions include:

- ***Supercooled clouds.*** These are clouds containing water droplets that have remained in the liquid state even though the ambient temperature may be below 32°F. These droplets are very small (five to 100 microns), and they freeze on impact with another object. Water droplets have remained liquid even at temperatures as low as -40°F. Cloud liquid water content, ambient temperature, droplet size, and the aircraft's size, shape, and velocity all contribute to the rate of accretion and the shape of the ice formed. (One micrometer or micron is one millionth of one meter or .00003937 inches.)
- ***Ice Crystal Clouds***. These clouds exist at very cold temperatures where their moisture has frozen to the solid or crystal state.
- ***Mixed Conditions***. These clouds have an ambient temperature below 32°F and contain a mixture of ice crystals and supercooled water droplets.
- ***Freezing Rain and Drizzle***. These are precipitation that exist within or below clouds at ambient temperatures below 32°F. Rain droplets remain in a supercooled liquid state. Freezing rain is different from freezing drizzle only by virtue of droplet size. (Rain droplets range from 500 to 2,000 microns, and freezing drizzle droplets are less than 500 microns in size.)

Aircraft on the ground are susceptible to many of the same conditions as in flight even when they are parked or when they are operating on the ground. There are also conditions specific to ground operations. On the ground, the aircraft is exposed to:

- Frozen precipitation—snow or sleet
- Residual ice from a previous flight—usually on the leading edges of wings, the empennage, trailing edge flaps, etc.
- Moisture, slush, or snow on ramps, taxiways, and runways—which can remain in place on the aircraft if the temperature is low enough; particularly susceptible to this kind of frozen contamination are wheel wells, landing gear components, flaps, undersurfaces of wings, horizontal stabilizers, etc.
- Supercooled ground fog and ice fog—much like supercooled clouds and caused by advection or nighttime cooling
- Snow blown by ambient winds, other aircraft, or ground support equipment; the source can be snow drifts, other aircraft, buildings, etc.
- Recirculated snow—whipped up into the air by engine, propeller, or rotor wash
- High relative humidity with temperatures below the dew or frost point can cause frost; this is common during overnight storage after descending from higher altitudes, especially on lower wing surfaces in the vicinity of fuel cells
- Frost—a crystallized deposit formed from water vapor on surfaces at or below 32°F
- Polished frost—Takeoff is allowed by FAR Part 135 and other rules for small aircraft if the frost has been polished smooth; FAA recommends removing frost, but if you choose to polish it, use the aircraft manufacturer's procedures
- Clear ice—usually around integral fuel tanks, difficult to see, and usually detectable only by touch or ice detector

Other Locations of Frozen Contamination

There are areas of the aircraft other than the ones we've mentioned where frozen contamination can accumulate and not be detected except by careful, visual inspection. Some of these areas are not found in smaller, general aviation aircraft, but pilots of those aircraft can get an idea of how extensive a visual examination has to be.

Anti-icing fluids may not reach areas under leading edge slats and portions of trailing edge flaps. Without a protective film of anti-icing fluid, these areas may be exposed to icing during precipitation or high relative humidity when taxiing, waiting for takeoff, or when in a takeoff configuration.

Residual ice, in particular, from previous flights can "hide" on the leading edges of wings, on the empennage, in slotted flaps, engine air inlets, etc., of arriving aircraft. If not discovered and removed, residual ice can then affect aircraft performance and handling characteristics on takeoff after turnaround.

During ground operations, propellers and other rotating components are exposed to icing-forming conditions similar to those in forward flight. Some aircraft require operation of inflight ice protection equipment when operating on the ground.

Effects of Contamination

Ice, snow, or frost, with the thickness and surface roughness of medium or coarse sandpaper, on the leading edge and upper surfaces of wings can reduce wing lift by as much as 30%! Drag can increase by 40%! (Figure 1)

As surface roughness increases so, too, do these values. (Figure 2)

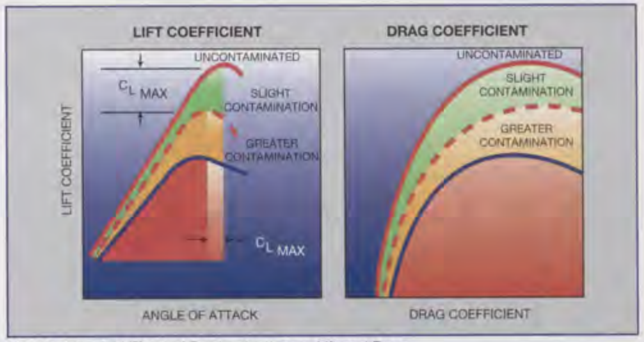

Figure 1. Typical Effect of Contamination on Lift and Drag

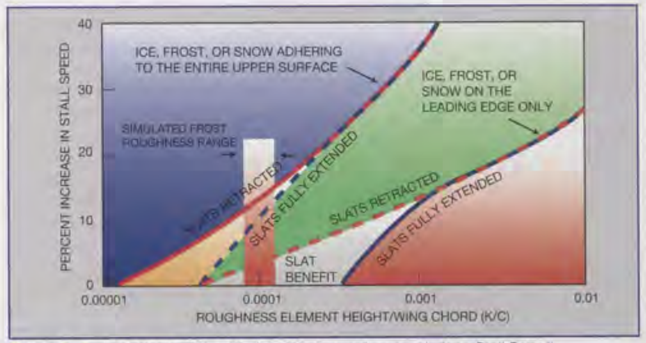

Figure 2. Typical Effect of Wing Surface Contamination on Airplane Stall Speed
As illustrated above in Figure 2, greater surface roughness can increase these values. Some aircraft are more susceptible to the effects of surface roughness than others.

Such changes in lift and drag can greatly increase stall speed, reduce controllability, and can even alter flight handling characteristics. As the frozen contamination gets thicker and rougher, the adverse effects also increase, and, in addition to the stated effects on lift, drag, stall speed, and performance, the aircraft's inherent stability and control can be lost. Without warning, the aircraft can depart from the commanded flight path. Consequently, it is essential that the pilot not attempt takeoff unless the PIC has made certain these critical surfaces and components are free of frozen contaminants.

Snow, frost, slush, and other ice formations can cause undesirable air flow disturbances or can restrict air and fluid vents. Mechanical interference can also occur, resulting in restricted movement of flight controls, flap and slat operation, landing gear mechanisms, etc. Ice formation on turbine engine and carburetor air intakes can cause power loss. If the ice dislodges a turbine engine may ingest it, and engine damage or failure can occur. Ice on external instrumentation sensors (pitot/static ports, angle of attack sensors) can result in improper indications on cockpit instrumentation or improper operations of certain systems.

H. Dean Chamberlain

Summary—Cold Weather Preflight Inspection Procedures

No one looks forward to preflighting in the cold, and sometimes pilots will cut the preflight short for the sake of saving fingers and toes from frostbite. When it comes to icing, abbreviating your preflight could be deadly. Conducting the complete, normal preflight inspection offers the opportunity to detect ice, snow, frost, slush, etc., which has accumulated on your aircraft from any of the ways we've already discussed.

A thorough preflight is actually more critical in extremely low temperatures because of the degradation of performance that can occur from frozen contamination on critical surfaces. Even though the preflight may make you physically uncomfortable, wintertime is the time to do your most thorough preflight.

The areas requiring special attention during a cold-weather preflight depend on the aircraft's design. FAR Part 135 and 125 certificate holders will identify these areas in the training program they are required to develop. Borrowing from what's required for that training program, general aviation pilots should pay particular attention to:

- Wing leading edges, upper and lower surfaces
- Vertical and horizontal stabilizing devices, leading edges, upper surfaces, lower surfaces, and side panels
- Lift/drag devices (e.g., flaps)
- Spoilers and speed brakes
- All control surfaces and control balance bays
- Propellers, spinners
- Engine inlets, particle separators, and screens
- Windshields and other windows necessary for visibility
- Antennas
- Fuselage
- Exposed instrumentation devices, e.g., angle-of-attack vanes, pitot-static pressure probes, static ports
- Fuel tanks and fuel cap vents
- Cooling and APU air intakes and exhausts
- Landing gear

If you know or suspect that the aircraft has been subjected to blowing snow, check any openings where snow can enter and freeze. In addition to and including the above, check:

- Pitot tubes and static system sensing ports
- Wheel wells/wheel pants
- Heater intakes
- Engine air intakes and carburetor intakes
- Elevator and rudder controls
- Fuel vents

Now, what to do if you discover frozen contamination on your preflight? Remove it. But how?

Tune in next issue. ■

Part Two in the next issue will discuss anti-icing and deicing fluids, post-deicing/anti-icing checks, deicing/anti-icing equipment for small airplanes, FPD fluids, temperature buffer, and holdover times.

Safety First:

Common Sense and Pilot Judgement

by Patricia Mattison

As we all know there are many times each day that we are called upon to make decisions. Some are simple, such as, should I salt my eggs this morning? Some are more difficult, like, do I want to spend $40,000 on a new car? Situations arise in which a simple correct decision can be the difference between delight and disaster.

As private pilots we are tested for our decision making ability when we take our private pilot checkride. The Practical Test Standards refers to testing for sound judgement in decision making.

Webster's Dictionary defines judgement as the process of forming an opinion or evaluation by discerning and comparing known information. As student pilots we are given instruction on evaluating the constantly changing situations that arise in the course of a flight and given direction on how to make appropriate corrections. Unfortunately, an instructor pilot is not always with us in time of need, so we have to be able to handle things that come up and which require good decision making on our own.

Why? We pilots are on our own most of the time as far as decision making is concerned. As a relatively new commercial pilot I took a trip to Mexico to a small town called Baja de Los Angeles. The strip was really a road that went between a row of houses which comprised the town. The approach was over the town cantina and the departure over a row of homes and directly towards a mountain that surrounded the town. To the east was a lagoon and a small islet. Arrival was not a problem, but when I took off in my *Cherokee* the engine sputtered and began to lose power. I knew that I might have to make an emergency landing. That's when my instructor took over.

Mind you, my instructor was back in San Diego, but he was there in my memory telling me every step of the procedures I needed to follow to execute the approach safely. I recalled his lectures on emergency landings, especially ditching, because it seemed I might have to land in the lagoon. The final outcome was that I returned over the cantina to the runway that I'd left only moments before, landing safely. The judgement calls that I had learned as a student pilot held me in good stead.

How does an instructor teach good judgement? Further, how does an examiner test for it? A student pilot relies on the expertise of the flight instructor—as well as the example the flight instructor sets—to impart to him or her the causes of potentially harmful situations and the measures needed to recover from those situations. These are learned responses. The ability to apply the measures taught appropriately is where judgement comes in. Judgement itself cannot be taught, but is acquired through practicing learned responses, coupled with the pilot's ability to perceive the situation and the ability to evaluate that situation with a positive outcome. The result can be referred to as using good judgement.

The checkride is a good place to get a feel for a pilot's ability to cope with emergencies, weather, and general flight situations that require the weighing of known facts and premises. When the examiner sees a real problem in the applicant's ability to make what the examiner thinks is a good judgement call during the checkride, the applicant can fail. This is an area of subjectivity where examiners have to rely on their own background to make their own judgement calls.

The decisions we make as pilots determine the outcome of each flight. We are tasked to assure that we have done everything possible to have a safe flight. This is a big responsibility, but if we use our common sense and good judgement, we will arrive at our destination safely. ■

Ms. Mattison is the Safety Program Manager at FAA's Juneau, AK FSDO.

LOST COM

by Charles Drew, Andrew Scott, and Bob Matchette

The key to any good relationship, whether in marriage, at the office, or between pilot and controller, is communication. Pilots and air traffic controllers know that the safe and efficient movement of air traffic requires good voice communication between air traffic control facilities and aircraft; yet, most pilots and controllers have experienced a loss of communication at least one time or another for a variety of reasons.

A Near Thing

The following event, reported to ASRS by several participants, illustrates the problems that can arise when communication is not possible. A Center facility had jurisdiction over two air carrier aircraft, both at flight level 350 and on a nearly head-on converging course. The Captain of air carrier X writes:

> *". . . We were given a routine radio frequency change . . . We tried to check-in on the new frequency several times but were blocked by other transmissions. The Controller on this frequency was extremely busy . . . While waiting for a break to check-in, my First Officer called out traffic to me at the 2 o'clock position. The traffic, a wide body [jet], was in my blind spot (behind a windscreen post). When I saw the aircraft I watched for approximately 10 seconds and determined were on a collision course. I initiated an immediate descent out of 35,000 feet."*

The First Officer of air carrier X adds:

> *". . . I figure we missed by 800 feet vertical separation. He went directly over us. I'm sure we would have collided had I not seen this aircraft."*

Several communications-related problems occurred here, including the flight crew of air carrier Y not maintaining a listening watch on frequency, and aircraft X being sent to the wrong frequency by ATC—perhaps with insufficient time for a recovery.

How many ways can you lose your com (and your calm)? Well . . .

There Must be 50 Ways . . .

There must be at least 50 ways to lose communication, and here are just a few:

- misset the aircraft audio selector panel
- set the aircraft radio volume too low
- assign an incorrect frequency to an aircraft
- experience an electrical system failure
- forget to turn on the aircraft alternator
- have a "stuck mike"
- tune the wrong frequency on the aircraft radio
- have an ATC facility radio failure
- get frequency blockage because of radio congestion
- fall asleep
- forget to switch to a new frequency
- try to communicate on the wrong radio

Sound familiar? Perhaps you can think of 38 more. Given the potential hazards, a review of the causes and effects of interruptions to communication sounds like a pretty good idea. An initial investigation, using ASRS records, examined the causes and effects of loss of communication events. A follow-up study looked at the principal human factors issues involved in delayed lost communication recognition on the part of pilots who experienced this problem. Here are the six most interesting findings of these two studies.

1. Causes for Communication Interruption

Misset Radios

As can be seen in Figure 1, pilots' inadvertent missetting of aircraft radio or audio selectors accounted for over half of all interruptions to communication. Notes a pilot:

> *"We were experiencing loud noise over the radio, and so we tried switching radios while getting the ATIS at the destination airport . . . and in turn left Approach [Control] on the radio, but on the wrong side (plane is equipped with flip/flop radios). After several minutes of radio silence, we noticed what had happened and switched Approach back on and called them. The Controller was upset and announced we had delayed 7 other aircraft due to our mistake."*

Radio Problems

An aircraft radio problem or failure was the next most commonly noted cause for loss of communication, but pilots of general aviation aircraft (specifically light single-engine types) were more likely to experience loss of communication through aircraft radio failure than were operators of other aircraft types. The following report from a general aviation pilot illustrates not only the potential problems with general aviation aircraft electrical system failure but also a reasoned response by the reporter and the invaluable employment of a handheld, portable transceiver:

> *". . . In a single instant, the electrical system failed. The off flags on the navigation receivers dropped, all LCD displays disappeared, and there was no reply light on the transponder. I attempted radio contact anyway, but there was no sidetone in my headset so I doubted I was transmitting. I heard no other radio traffic. I was IMC at the time and squawked 7700. I knew that the destination area was VFR. However, I was transient and therefore unfamiliar with the area. It took me a moment to realize that I carry a portable transceiver for this very situation. I pulled it out, connected the headset, and attached it [the radio] to the external antenna cable. Unfortunately, I could not monitor the primary Center frequency. That information was locked in the memory of the now inoperative radio panel. I had fallen in to the trap of not manually logging on paper the assigned frequency . . . I attempted contact on 121.5 but got no response.*
>
> *"I navigated as best as possible, and soon broke out into VMC. I headed for the first airport I saw. Some quick dead-reckoning and the VFR chart I had been using to monitor the flight progress led me to believe, correctly, that it was Scottsdale. I changed the handheld frequency to Scottsdale Tower and was able to make contact." And after a safe landing, "Maintenance examined the aircraft the next day and determined that [aircraft] battery had shorted; at least one cell was dry."*

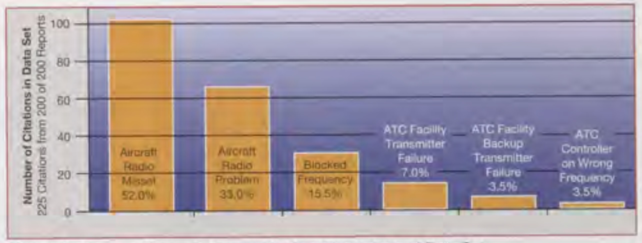

Figure 1. *Causes of Loss of Communication, Percentage of Data Set*

Blocked Frequency

A "stuck mike" (in which a microphone, radio transmitter, or audio selector panel failed in the transmit mode) was known to be the cause in about 60% of blocked frequency incidents. ATC facility transmitters and combined weather conditions/frequency overlap each accounted for less than 10% of occurrences. The following report is typical of stuck mike incidents:

> *"Shortly after switching to Washington's final Approach Controller, an aircraft began broadcasting on the frequency with a stuck mike. The aircrew maintained a steady stream of conversation not pertinent to their flying duties . . . effectively jamming the frequency while we were awaiting further vectors for sequencing into Washington National during the afternoon rush. Fortunately the alert Controller managed to announce an alternate frequency and regained control of the situation."*

An in another classic stuck mike event:

> *". . . After three minutes of radio silence I had begun to wonder if I had lost communications with the Radar Controller. My instincts were right—we had lost radio contact . . . In the cockpit I had a few choice words to say about my aircraft and radios which should not have been said at any time."*

And later, when asked to contact the Facility Supervisor on the telephone:

> *"He [the Supervisor] said 'Now how are your blank-blank radios doing? . . . We have everything on tape, everything! We had to go to a backup frequency because of your language. You apparently had a hot mike.'"*

2. Duration of Lost Com

Figure 2 shows the average (mean) duration of the loss of communication, which ranged from a low of 30 seconds to a high of one hour. When various causes for loss of communication were combined, the average duration was 7.6 minutes.

3. Phase of Flight

In what phase of flight are pilot most likely to experience a loss of communication? The answer differs depending on whether the operator is an air carrier or general aviation.

Figure 2. *Range and Mean Duration of Communication Interruption*

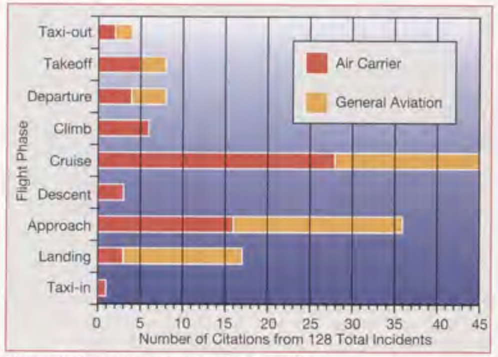

Figure 3. Flight Phase and Type of Operation

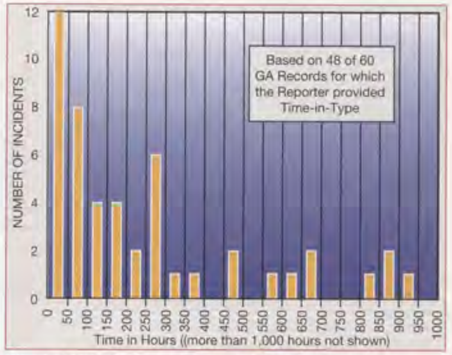

Figure 4. GA Pilot Time in Type vs. Event Frequency

Air Carrier = Cruise

According to the McDonnell Douglas 1992 Commercial Jet Transport Safety Statistics review, air carrier aircraft spend an average of 64% of total flight time in cruise, thus it is not surprising that air carrier pilots experience the majority of event occurrences in the cruise phase, but we found that there may be additional factors. On long distance routes, and while in cruise, it is generally accepted that air carrier flight crews will experience lowered levels of attention due to reduced stimulation from cockpit management duties, which may lead to a reduction in pilot monitoring of radio traffic. From an air carrier pilot:

". . . either we missed a frequency change call, or Center failed to pass us to the next sector. Although all three flight crew members were eating, I am reluctant to believe we all missed the repeated calls ATC states they made to us directly and through other aircraft . . . But, through inattention or subconscious reliance on a call from Center to start descent, we continued on at flight level 350. We were nearly at ATL [destination] when we recognized the problem. After a rush to re-establish communication, I made contact with ATL Center and reported over ATL at 35,000 feet . . ."

GA = Approach and Landing

Combined approach and landing phases provided the greatest number of events for pilots of light single and twin GA aircraft. Why? well, for one thing GA pilots, when all types of operations are considered, probably spend less time in cruise than do air carrier flight crew. For another, they usually have significantly less cockpit automation and often [are] a single-pilot operation, therefore, a general aviation pilot may be required to devote greater attention to positional and situational awareness while in cruise, which may result in heightened levels of awareness. However, a general aviation pilot on an instrument approach and landing in a small aircraft usually has fewer and less sophisticated systems and navigational devices, less total and recent experience, and less opportunity for task sharing when operating single-pilot. He or she often has to cope with a higher individual workload than their airline counterpart, and the opportunity for task overload is enhanced. Of course, sometimes a pilot makes his or her own problems, as in the following report by a flight instructor:

"While we were landing at SJC in a light aircraft (X) . . . the Tower advised us of light aircraft Y making a right cross-wind departure. I reported looking for him . . . then continued looking for [other] reported traffic. No sighting. Many calls at the same time to other aircraft by Tower. Turned off speaker switch to tell student to descend to pattern altitude . . ."

And after the reporter had spent some time in the now quiet environment . . .

"What's wrong? No speaker! Darn. Switch on! . . . Tower called . . . ' Where have you been? We've been calling you for the last five minutes.'"

Figure 3 shows the flight phases in which air carrier and general aviation pilots experience their communications problems.

4. Low Experience = More Loss of Com Events

There is a significantly increased opportunity for lost com occurrences when one or more of the flight crew is low time on the aircraft type—this is particularly true for general aviation pilots. Figure 4 provides the frequency of lost communication events versus time-in-type for GA pilots. (A similar, but less pronounced pattern was revealed for air carrier pilots.)

Times in Figure 4 are in 50-hour segments from one hour to 50, 51 to 100, and so on. The "spike" noted in the 251 to 300 hour segment is probably a result of "rounding" by reporters. (A reporter with 276 hours or 310 hours, for example, may tend to round his experience to 300 hours.)

5. Delay in Recognition

Preoccupation or distraction with tasks in high workload situations was commonly noted in delayed recognition of loss of communication. Note the following report:

"Upon change over from approach to tower frequency, new F/O failed to move COM selector head switch to new frequency; we called on wrong frequency for landing and call was covered by another aircraft transmission. I thought we had called on tower frequency and were cleared to land, but we were distracted at this time by performing the final landing checklist . . ."

At the opposite end of the causal spectrum, loss of awareness or lowered levels of awareness was also a significant contributor to delayed recognition of com loss:

"While in cruise, the captain, acting as pilot-not-flying, was given a frequency change to Chicago Center, I believe. I do not remember a reply to his call on frequency. Sometime thereafter I noticed there was no one on frequency talking. I said it sure is quiet. He said 'Yeah,' so I called center for a radio check—no reply. So I switched back to previous frequency. Controller stated he had been trying to reach us, gave us a new frequency. I feel it was due to fatigue that we had not caught the apparent wrong selection of a new frequency . . ."

6. Recognition of Com Loss

Most commonly, flight crews discover their communication loss when they made a normal attempt to communicate with ATC:

". . . Had a . . . mike switch which stuck in the transmission mode. ATC said that had been that way for 15 miles. I had not heard from ATC for some time and it was about time for a frequency change. I attempted to call ATC and then discovered the sticking switch . . ."

The next most common reason for communications recovery was intervention by the controlling facility on another frequency or through company or [other] channels as illustrated in the follow report:

". . . Center read a clearance so fast that neither my FO nor I had a chance to copy it, nor were we sure if that clearance was for us. I called Center back and said that if that clearance was for us, we did not copy it . . . I called again and still no response . . . About 5 minutes later an air carrier flight called us on 118.15 (our ATC frequency) and advised us that Center wanted us to immediately climb to 31,000 and turn to 180 degrees . . ."

Observations and Recommendations

Let's see if there may be some useful recommendations for reducing the frequency, duration, and severity in lost communications events.

General Considerations

- As noted, the most common reason for a misset radio is inadvertent pilot mis-selection of a frequency. The best solution to this problem is the old solution—proper *attention* to detail and good cockpit management and monitoring on the part of the flight crew.
- Pilots should be aware that there is a significantly increased opportunity for a lost communication event when pilot experience in the aircraft type is low. Continued emphasis on the value of situational awareness will help.
- Pilots often experienced difficulty in returning to an original frequency if there was an error in selection or clearance to a new frequency. A simple and effective aid for pilots is to write down assigned frequencies; should a loss of communication occur at the point of a frequency change, the pilot may easily return to the previous frequency.

General Aviation Pilots

Loss of situational awareness in high workload situations and problems with aircraft radios or electrical systems were commonly noted problems for GA pilots. Thorough pre-flight planning can help reduce the impact in high workload situations. GA pilots should know their electrical system and should constantly monitor the electrical system in flight and should consider terminating the flight at the first signs of system problems.

Where high cockpit workloads contribute to loss of communication such as during approach and landing, adherence to cockpit disciplines (such as

the sterile cockpit), and maintenance of positional awareness should serve to reduce delays in event recognition.

A number of ASRS reports from general aviation operators note the use of hand-held portable aviation radio transceivers—as backup to aircraft mounted radio equipment. In four incidents the "handheld" can be credited with a communications "save," and there are additional reports among those reviewed for this study that cite effective use of these portable communications radios.

Air Carrier Pilots

Review of pertinent records indicates that pilot recognition of interrupted communication in the cruise phase (notable for a low workload environment and a point where ATC communication and chatter are minimal) may be facilitated by the motherhood and apple pie solution of constant situational and positional awareness.

For high altitude flight, noting the location of ARTCC boundaries as marked on charts should serve to alert pilots to required hand-offs.

Controllers

Controller intervention through use of company or [other] frequencies is effective when [employed].

Those incidents wherein an ATC facility used an alternate communications process to "recover" an interrupted-communication aircraft showed good success.

It is suggested that ATC facilities review alternate communications possibilities in the event of frequency blockages. ■

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"EXERCISE-LITE" Enables Aviators to Reap the Benefits of Physical Activity

by Stanley R. Mohler, *M.D.*

Regular sessions of aerobic exercise are still strongly recommended, but when such a program is impractical, considerable benefit can be derived from everyday activities such as bicycling, stretching, walking, and even climbing stairs.

Short periods each day of moderate physical activity will reduce significantly the risks of contracting leading chronic diseases, according to recent reports by the U.S. Centers for Disease Control. The findings, widely distributed by the U.S. Public Health Service, are good news for aviators disinclined to practice regular aerobic and other exercises.

Short exercise periods during the day, for a cumulative total of 30 minutes of moderately vigorous activity, have been shown to lower the risks of heart disease, high blood pressure, noninsulin-dependent diabetes mellitus, obesity, colon cancer, arthritis, and bone loss. Regular 30-minute session of continuous aerobic exercise three of four times a week are still strongly encouraged, but for those who do not maintain that schedule, the short periods of "exercise-lite" distributed throughout the day can yield outstanding results.

An exercise-lite program can be employed in everyday activities. For example, you can park in a shopping mall lot farther from the store that is the objective and walk briskly to the destination. You can also, weather permitting, make daily energetic strolls in the home and work neighborhoods. Avoiding elevators and using the stairs is another approach. Getting from one gate to another at airports can be accomplished by walking, rather than using moving sidewalks and shuttle buses, if there is time. Carrying items burns some additional calories (at a rate depending on their weight) and contributes to the total conditioning response.

Many common and even enjoyable activities provide considerable exercise benefits. Some of these are shown in Table 1.

A calorie is a measurement of energy; it is not a discrete component of food. Foods—carbohydrates, fats, and proteins—are burned (metabolized) by the body to generate energy. The energy is measured in a unit: one kcalorie = 1,000 calories. (One kcalorie is defined as the amount of energy (heat) required to raise 2.2 pounds (one kilogram) of water 1.8 degrees F (one degree C).)

A small, elderly woman may only require about 1,000 calories (one kcalorie) a day, while a large, physically active young man may require as much as 4,000 calories (4 kcalories) a day. Thus, everyone requires calories, but the number of calories required varies based on individual energy needs.

Although the figures will vary somewhat from person to person, running 10 minutes will burn 64 calories in a 176-pound man, while running 10 minutes will burn 44 calories in a 121-pound woman (Table 1); walking 10 minutes for pleasure burns 28 and 19 calories, respectively for the man and the woman. More people can incorporate walking, rather than running, into their workdays, which is one way to burn calories.

Many people associate exercise with weight reduction or for maintaining appropriate weight. From a caloric standpoint, exercise results in calories being burned. Thus, if a person adds exercise to a daily routine, while maintaining the same level of caloric intake, a reduction in weight is likely. The more vigorous the exercise, the more time spent exercising, and the more frequent the exercise, the more calories will be burned. Nevertheless, if the daily intake of calories is equal to the calories burned daily, a healthy person's weight will remain stable.

When caloric intake is less than calories burned, stored fat is burned; when caloric intake is greater than calories burned, the energy from the excess calories is stored as fat.

Consider that during the course of one year if a person's caloric burn rate remained stable, but the daily intake of calories increased by just 80 calories—a slice of bread—the person would add some 29,200 calories (8.3 pounds) by the end of the year.

On the other hand, based on Table 1, a man who adds 30 minutes of pleasure walking, three times a week to his normal activities, without increasing his calorie intake, will burn approximately 252 calories a week or 13,104 calories per year. Thus, by the end of one year, he will have lost 3.7 pounds.

The stair-treadmill exerciser caloric burns (Table 1) are 48 and 33 for men and women respectively, indicating that using a building's stairs helps burn calories. When walking more and using the stairs more, comfortable shoes with robber soles and heels are highly recommended because any foot pain or other discomfort will discourage walking.

Various household activities noted in Table 1, including gardening and leaf raking, contribute to reducing calories. Those who find these activities boring can wear a portable cassette player. If, besides these activities, an aviator maintains an exercise program, no problems with excessive fat can be expected if there is a reasonable daily intake—and intelligent selection—of food and the consumption of minimum alcohol, if any. A high level of conditioning should result.

In maintaining fitness and controlling weight, it helps to adopt hobbies that

Table 1: Energy Costs of Selected Physical Activities

Activity	*Calories Burned in 10 Minutes* Men*	Women**
Sleeping	7	5
Driving a car	16	11
Housecleaning, light to moderate	20	14
Sitting, playing with children	20	14
Automobile repair	24	17
Throwing frisbee	24	17
Walking for pleasure	28	19
Bicycling to work or pleasure (<10 mph)	32	22
Raking leaves	32	22
Swimming (moderate effort)	32	22
Dancing (on average	36	25
Golf	36	25
Stationary bicycling (on average)	40	28
House painting	40	28
Gardening	40	28
Stair-treadmill (on average)	48	33
Ice skating	56	39
Running	64	44

* Standardized to 176 lb. male
** Standardized to 121 lb. female

Source: Stanley R. Mohler

Driving a high-powered car may be exhilerating, but it burns only slightly more calories than sleeping.

burn calories. One useful activity is swimming. Tennis and other aerobic activities contribute significantly to maintaining fitness. (Aerobic is derived from the Greek *aer*, air, and *bios*, life. Thus, aerobic suggests "life in air.")

Anyone who has not exercised regularly for a period of years should be cautious about moving from an exercise-lite program to a vigorous aerobic exercise regimen. Your physician should be included in the development of an exercise program that best fits your physical condition. A stress electrocardiogram may be suggested if:

- Your age is more than 35 years
- Your family history includes coronary heart disease for those under the age of 55 years
- You are male and have another coronary heart disease risk factor such as high cholesterol, high blood pressure, or cigarette smoking or
- You are female and have two risk factors for coronary heart disease

The human skeleton comprises 212 bones that support the internal organs and the engines of motion, the muscles. These bones are joined precisely, many surfaces meeting in a near-exact fit. This is particularly true for the 26 bones of the foot and ankle. Upon arising in the morning, the lubricating fluid in the joints between these many bones of the foot will be less evenly distributed as a result of loading pressures and the diminished activity during sleep. Accordingly, when you awaken each day, you will benefit by moving the feet around and by giving them a brief massage.

In the morning and the evening, perform leg stretches. A couple of minutes of stretching brings blood into the muscles, toughens the tendons and ligaments, and benefits overall health. Of course, stretching while driving and while flying when a cruising period allows for it promotes alertness.

Do the same for the Achilles tendon and the calf muscles. Also flex each knee several times. Some leg raises will help warm up the hips and distribute lubricating fluid. A few sit-ups will help put the spine in shape and better prepare it for the load bearing required by daily activities. Swing the shoulders; massage and move the elbows and hands. Next, flex the neck right and left, fore and aft, and move the head around a few times. These minimal exercises and a bit of subsequent stretching will prepare the body machinery for the day's activities.

You can do a variety of small tasks throughout the day to enhance conditioning. One helpful measure is to keep in your flight bag a small hand exerciser, of the type found in sport and exercise equipment stores. Periodically using this hand exerciser while in cruise flight, at home, or at layovers is a superb way to develop and maintain conditioning of the hands, the wrists, and forearm muscles. You can obtain immense benefits by this simple method over months and years.

Another useful adjunct to brief periods of exercise is to have handy a bungee or rubber stretcher. A bicycle inner tube will do as well. The stretcher need not require a great deal of strength, but it will help limber the arms and shoulders, lessen fatigue, and promote conditioning. Such a stretcher is light and can be carried in an overnight bag.

You can alleviate the sedentary behavior that has evolved along with televisions and VCR's by intermingling stretching, sit-ups, and push-up while watching programs. Cumulatively, this practice will contribute to daily conditioning, while developing feelings of comfortable relaxation and diminishing feelings of agitation resulting from disturbing news programs and other shows. These exercises should also result in faster, deeper, and more refreshing sleep.

More good news comes from a recent study, which shows that recreational exercise over a period of years results in a markedly lower risk of a heart attack. Accordingly, viewing exercise-lite as a form of recreation that yields mental enjoyment encourages an activity that diminishes heart attack risk. This attitude provides for miniature recreations throughout the day.

The key is how exercise-lite is perceived. For example, if climbing stairs to attend a meeting is viewed as a mini-recreational session that yields satisfaction, the cumulative effects will be similar to those of a dedicated recreational exercise period of one hour or so. ■

Dr. Mohler is a professor and vice chairman at Wright State University School of Medicine in Dayton, OH. He is director of aerospace medicine at the university, an ATP and CFI, former director of FAA's CAMI, and a former chief of the FAA's Aeromedical Applications Division. This article is reprinted from the Flight Safety Foundation publication, Human Factors & Aviation Medicine, *May-June 1995.*

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G. S. Livack

Taxi into Position and Hold (TIPH)

by FAA's Air Traffic Terminal Procedures Branch

The TIPH procedure was developed to enhance the ability of the air traffic controller to expedite traffic and increase capacity. Controllers have to be extremely careful to place safety first when applying or using TIPH procedures.

The air traffic control system operates on a team concept between controllers and pilots. This team concept relies on an exchange of information and situational awareness in the control facility and in the cockpit. During TIPH operations, pilots holding in position have their backs to traffic and potential danger, thereby reducing their situational awareness. Therefore, we must exercise constant vigilance, especially during night time operations, low visibility, and light traffic periods. During TIPH operations, pilot and controller team work is crucial. This team work can be fostered through pilot reminders to the controller when aircraft are in position and holding on the runway and through controller exchange of traffic information between arrival and departure aircraft.

When aircraft are authorized to taxi into position or holding in position on the runway, the controller informs the pilot of the closest traffic that is cleared to land or any other traffic that in the controller's judgement is pertinent. The controller also informs the pilot that the aircraft cleared to land or for the option, touch-and-go, stop-and-go, or unrestricted low approaches when there is traffic authorized to taxi into position or is holding on the same runway. Controllers have the flexibility to either issue or withhold a landing clearance during TIPH operations. If a landing clearance is issued, traffic information shall be exchanged. If a landing clearance is not issued, traffic information may be exchanged.

No one can become complacent; the potential for incidents is there every day. Knowing this, we must maintain the strictest form of professionalism to avoid any occurrence. Controllers need to be aware of the following:

- ***Alertness:*** It is extremely important that controllers be alert to pilot readbacks/reminders, to adherence to control instructions, and to time on the runway during TIPH operations. Awareness is the key to the prevention of operational deviation, runway incursions, and operational errors. Be aware of increased demands upon the system and external factors such as individual limitations, darkness, and weather.
- ***Non-operational Conversation***: Avoidance of non-operational conversations while on control positions will help increase the attention of everyone to their duties. This also promotes team work during busy as well as light periods of traffic. The combination of light traffic and non-operational conversations can create distractions and foster vulnerability to errors. A good operational practice is to discourage distracting non-ATC activities while on position. When controllers are engaging in non-ATC activities, they may not be scanning the airport surface areas. They may also be distracted from reviewing previous control instructions and actions (e.g., aircraft holding on an active runway with another approaching with a landing clearance or other possible runway incursions).
- ***Development***: Skill development is an ongoing process throughout a controller's career. Regardless of the time and effort, there must be a personal commitment from each controller to apply self-discipline to perform up to his or her true potential.

Managers, supervisors, and controllers-in-charge (CIC) should play a more significant role in addressing TIPH problems. Managers shall ensure that appropriate memory aids are used to identify aircraft taxiing into or holding in position on the runway (e.g., strip board management, coordination procedures, etc.). Supervisors and CIC's should maintain a special degree of alertness to the controller workload, time on position, and pending traffic requirements. They should also take appropriate actions to maintain accountability through internal evaluations, required training, and over-the-shoulder evaluations to assist the workforce to increase efficiency and proficiency that strengthen good work habits and operating practices.

Recent statistical data from TIPH incidents/accidents revealed that aircraft were holding in position on the runway unnecessarily. In some instances, aircraft were held in position in excess of 10 minutes and subsequently forgotten. In many of those instances aircraft were put into position without a need to expedite because traffic conditions were extremely light. Many incidents occurred with three aircraft or fewer on the frequency. In concert with safety and good operating practices, the following should apply:

Aircraft should not be taxied into position:

- for EDCT (expected departure clearance time) or flow restriction delays for more than one minute
- during light traffic when no capacity increase is to be realized
- when not visible from the tower

Aircraft SHALL NOT be taxied into position:

- at intersection between sunset and sunrise or at any time when intersection is not visible from the tower. ■

Don't Touch that Propeller

by Paul D. Adler

How many of you are familiar with the dangers surrounding hand rotation of your propeller especially if the sole purpose is other than an intended startup? My propeller inadvertently started spinning one cold morning from hand rotation, with nearly catastrophic results. Most of us have been told, or have read, to hand rotate the propeller before normal startup or after shutdown for the following suggested reasons:

1. When the outside temperature is below 20°F, to loosen and limber the oil before startup, which will make normal starting easier, distribute oil on bearing surfaces, and conserve battery life.
2. If your aircraft is stored longer than 10 days to lubricate the internal engine components.
3. To align the prop in a vertical position for outside storage so as to allow rain and ice to evacuate the spinner area.
4. To move the propeller out of the way for attaching a tow bar.

Have you ever been properly trained or made aware of all the precautions to implement before touching that propeller? Most pilot instructors and examiners provide little guidance relative to propeller safety, apparently assuming the aircraft manual provides this information.

I have come to the conclusion that there are no compelling reasons to ever hand rotate the propeller. With the advent of multi-viscosity oils, which most of us now use, it is not necessary for anyone to pre-rotate the propeller for oil limbering as Cessna still suggests (though Lycoming does not). If your aircraft is in storage, I would not rotate the propeller unless I knew the spark plugs were removed and/or the magneto ignition completely disconnected. (Unless the mag has an internal grounding spring, a disconnected "P" lead leaves the mag hot.) As far as rotating your prop to place it in a vertical position for ice and water drainage or to attach your tow bar, is it worth risking your life? Propellers are most likely to start spinning when the engine is warm with residual fuel in the carburetor! Some mechanics suggest rotating the propeller in the reverse direction which will prevent an inadvertent start as the impulse coupling is not activated with reverse propeller rotation. However, I have read that possible damage to the vacuum pump blades may result by reverse propping. Obviously, more research is needed regarding this procedure.

If you are one of those adventurous pilots who still ignores all these warnings, at least be mindful of the following. There have been several thousand recalls of faulty ignition switches, starting capacitors, starters, and magnetos in all types of aircraft, that will allow a propeller to start spinning inadvertently when rotated, even if the keys are out of the ignition. Even with a properly working ignition switch, if the wire known as a "P" lead, running from the ignition to the magnetos, becomes disconnected or cut (from vibration or whatever), once again you have what is known as a "hot mag" situation. This "P" lead wire can come loose at any time without notice. All of the above scenarios may be intermittent, making it difficult, if not impossible, to locate the problem.

One very simple check for a potential "hot mag" situation is to carefully watch your RPM drop either during your initial run up or before a shutdown, assuming your tachometer is working properly to report this RPM change. If, when alternating from left to right magneto by switching with your ignition, you do not notice a magneto drop, this may indicate a "hot mag" situation, which could be caused by a disconnected "P" lead. Or, before shutdown, while the engine is running and you are stationary and secure, you can briefly switch the ignition key to an off position and listen if the engine wants to stop. If it does, your ignition system is most likely working correctly at that moment. Also, make sure your ignition key can not exit the ignition with the ignition switched in the on position!

Following my propeller incident, I wrote letters to the FAA and NASA concerning inadvertent propeller starts. On March 9, 1994, the FAA issued "Priority Letter Airworthiness Directive 96-06-09," followed by "Owner Advisory SEB94-5A" issued on March 18, 1994, alerting every registered pilot concerning a potential defective capacitor within the magneto that could cause an inadvertent propeller start. Following this directive, I contacted Tim Davis (expert from Teledyne Continental Motors) regarding Bendix magnetos, and discovered several other reasons that supported my belief to never trust your ignition system.

Assuming you have a working ignition system, and you still feel that hand rotation of the propeller is essential, here are some additional precautions to implement. First, always assume that the propeller may start and then implement the following safety precautions:

1. The ignition key should be out of the ignition and the switch in the "off" position.
2. The mixture control should be in the mixture shutoff position. (Beware—even if this control is in the off position, the engine can start if there is residual fuel in the carburetors from priming or whatever.)
3. Make sure the aircraft is secured by wheel chocks and/or tiedowns.
4. Engage the emergency brake.
5. If a pilot is available, place him or her in the front seat for added safety to shut down the aircraft if it inadvertently starts.

Continued on page 21

Central Missouri State University: Haven For Aviation Education

Courtesy of CMSU

by J. D. Lewis

The Year was 1968, the United States was in Vietnam and Central Missouri State University (CMSU) had just purchased its first four airplanes for a mere $33,000 . . . flight fees were set at $11 an hour, and there were 25 aviation students enrolled. . . . Thus were the humble beginnings of the aviation program at Central.

Back then, the university only offered a two-year associate in science degree for its aviation students. A bachelor's degree in aviation technology was offered in 1970, followed by a master's degree program in aviation safety in 1975—the first and only one of its kind in the United States.

Located some 50 miles southeast of Kansas City, Missouri, Central and its Max B. Swisher Skyhaven Airport is home to an average of nearly 650 aviation students a semester—500 of whom are enrolled in the FAR Part 141 flight program and fly out of the university-owned airport.

Central Missouri State University is a four-year university with about 11,500 enrolled students. Although the University has many degrees to choose from, ranging from associate's degree to master's degree programs, Central has been nationally recognized for superiority in three: aviation, graphic art, and criminal justice. As a state university, Central receives a variety of grants thereby offering its students many scholarships, student loans, and government financial assistance.

Within the College of Applied Sciences and Technology, the Aviation Technology Program is part of the Power and Transportation Department (PR&T) and offers its students many pathways to graduation: professional pilot, maintenance management, aviation management, avionics management, agricultural aviation, and systems design technology. In addition, Central's master's degree program in aviation safety is very popular with graduate students. "You get a really broad knowledge of aviation safety as well as the entire field of aviation," said Mattias Swedenklef, a Swedish student who is earning his master's degree in aviation safety.

Chair of the PR&T Department, Dr. Tim Brady, says that Central, in addition to its aviation curriculum, provides a well-rounded education because of the internships offered to its students. Currently, the University has internship programs with Trans World Airlines, Trans World Express, United Airlines, and the law office of Kent Jackson (aviation lawyer and author). Programs with United Parcel Service, Federal Express, and NorthWest Airlines are still in the works. According to Brady, Bobby Bonham, who interviews internship candidates for United, calls the program the *million-dollar internship* because it gets the prospective pilot in the workforce sooner, which equates to about $1 million more income over a career. Brady estimates a 60-percent chance of interns getting hired after completing the three-month program; whereas a pilot off the street, and possibly with more flight experience, has only about a 15-percent chance. "It's the best screening process for the company because it gives them a three-month, full-time look at the intern before a possible hire," Brady said.

J. D. Lewis

Two CMSU students with one of the school's Cessna trainers.

Central graduate John Ball, who completed an internship under the Director of Safety and Engineering at TWA's headquarters in Mt. Kisco, NY, said, "It's worth it because now I know what it takes to become an airline captain. I've got a valuable insight on what's going on in cockpits and the bigger world of airlines." Some of the projects that Ball worked on while there included aircraft crash investigation, putting on check airmen seminars, designing a safety poster for terrain avoidance, and a project dealing with extended range operations (ETOPS). "We were trying to get it certified so that we could go 150 minutes across the ocean without fire suppression capabilities in the cargo hull. I compiled a list of what TWA was doing to meet FAA requirements and put it in a book for future certification," said Ball. "They also put me in aircraft jump seats to learn the different types of aircraft they had. I've been in everything from a DC-9 to a 747."

The agricultural aviation option is one of the newest additions to the aviation degree program at Central. Brady says that CMSU's ag program is more than just how to dust crops. The program is designed to prepare the student for managerial positions within the industry as well as owning one's own crop dusting business. To keep an eye on industry trends, the University has John O'Connell, President of the National Agricultural Aviation Association, as its industry advisor. O'Connell also donated the spray equipment that will be used on the Central's Piper *Super Cub*. Brady, however, mentioned that he would be more than happy to talk with anyone interested in donating a purpose-built ag plane for the program. And because the ag program is so new, the University is still tailoring the program, which in addition to locating a purpose-built ag plane includes finding suitable fields to spray. "You can't just use any field," said Dave Card, Central's Airport Director and Chief Flight Instructor who also flew crop dusters earlier in his career. "The first field you take a student into must be flat with nothing on it. Next you'll start bringing them into fields with high lines on one end . . . then one with high lines on both ends . . . and then throw in a few trees here and there—we want a variety of fields for our students," explained Card.

J. D. Lewis

As Region VI Champs, CMSU's flight team hones its landing skills during a precision landing practice in which they aim for a 6-inch-wide chalked line.

Another recent program addition at Central is the FAA-approved FAR Part 147 Maintenance Management option, which allows students to earn their airframe and powerplant (A&P) certificates. Students can also earn their A&P's through an apprenticeship at the airport's maintenance facility since the University performs all of its own aircraft maintenance with full-time A&P's. "I think the apprenticeship is much better than classroom education because you get hands-on experience, and you actually get to see the stuff you've worked on take flight. Because of that, there's much more responsibility demanded of us—no room for error," said Brett Friederich, a soon-to-be A&P and graduate of the Aviation Safety master's degree program. Friederich plans to use his education and experience to get a job as both a pilot and A&P with one of the many companies that demand both qualifications.

Besides the courses that are required in Central's Aviation Technology degree, which includes aerodynamics, college trig., aviation law, and technical report writing, there are many electives to choose from. For example, one of the more recent additions to the aviation elective potpourri is turboprop familiarization, due to the recent purchase of a Beechcraft *King Air*. "Once you complete the '*King Air* course' you get to fly along on FAR Part 91 trips that the University does—and we get a fair amount of those—and the students are getting a good amount of flight time at no additional cost," said Card. In addition to high-altitude and second-in-command (SIC) endorsements, the student receives good hands-on training says Card. "We fly just like the airlines—one leg the student acts as PIC and the other as SIC, checking after the captain. It really prepares them for that first job," Card explained.

Central's training fleet includes nearly 40 aircraft: Cessna 150's, 152's, 172's, and 172RG; Beechcraft *Sierras* and *Duchesses;* a Piper *Super Cub;* Porterfield; Schweizer gliders; and a Beechcraft *King Air*. Student flight fees range from $15 per hour (Schweizer glider) to $280 per hour (*King Air*). These are in addition to the $72 credit-hour fee (on-campus, in-state resident) required for classes. The training aircraft used for primary student instruction are mostly the Cessna 150's and 152's. Although some 152's are IFR equipped, most of the instrument training is done in the University's 172's. Central uses its *Sierras* and 172RG for high-performance/complex training and its *Duchesses* for multi-engine training. The tailwheel aircraft are used for obtaining a tailwheel endorsement and for the crop dusting program, while the gliders and hot air balloon are used mostly for fun.

On the Horizon

According to Card, there are many improvements underway at Central's Max B. Swisher Skyhaven Airport. One such improvement is the reconstruction of the airport's Runway 13/31. "It's not going to be an overlay, they're going to tear out the old runway and put in a completely new, expanded and lighted runway," said Card. Currently, the primary runway is Runway 18/36, which is lighted and 4,206 feet long. "Having Runway 13/31 fully-operational will mean more flight training days for the student," said Card noting that some days strong crosswinds halt operations. With the $1,242,000 FAA grant already approved, the University expects the runway project to begin soon.

Another recent FAA grant of $291,000 was used to improve the avionics program by refurbishing a building at the airport to provide appropriate lab facilities. Currently, all avionics have to be sent away for repair. Another project in the works would allow for navigational aids on the field, so that the airport would be able to include precision approaches. Presently only non-precision approaches are now available at Skyhaven, including a temporary GPS approach that's under FAA review.

Courtesy of CMSU

Members of Central's flight team receive a preflight briefing from a NIFA Safety Judge Wally Funk before a precision landing event.

The most noteworthy item on the University's horizon, however, is the purchase of a new training fleet. The most recent addition to Central's fleet of training aircraft is the Diamond (formerly Dimona) DA 20 *Katana*. The all-composite *Katana* is a two-place VFR-only aircraft (IFR-certification is pending) powered by an 80-hp, liquid-cooled, four-stroke Rotax 912 engine that burns approximately 3.2 gph and cruises at 128 knots. For a price of $98,800, Central's recently purchased *Katana* came with modern instruments and avionics such as King dual nav/coms, HSI, RMI, VOR/ILS, and an integrated Garmin GPS system.

"We wanted an airplane that reflected current technology," said Brady. Central's senior flight instructor, Bill Runyon, commented on the *Katana*, "I do like the composite construction. I'm also in favor of the liquid-cooled Rotax engine because it's a technology we should have had on airplane engines a long time ago."

Brady said the Katana will cost flight students $50 per hour to fly ($59 dual). "Traditionally, if you bought an airplane for $90,000, as a rule, you would rent it for $90 an hour. But because this airplane is so fuel efficient, we are going to start it out at $50 an hour," said Brady. According to Brady, the Katana is the University's first step towards achieving a complete "training system," which will eventually include 19 new aircraft (not necessarily Katanas) and four instrument ground trainers identical to the new aircraft. Brady said the University plans to replace its current fleet of Cessna 150's/152's with new trainers over the next five years.

With the new addition of the *Katana* as well as the University's *King Air*, one has to wonder what's next for Central . . . a jet? "I wouldn't rule a jet out," said Brady. "A jet would be the normal evolution from our *King Air* to a jet," said Brady when asked to look a decade into the flight program's future.

Although Central has a lot on the horizon, Brady says that it's important that the University never loses sight of its aim: "Our goal is to turn out the best pilots, mechanics—all of our specialties—in the world. And at the best price to the student."

For additional information on degree programs, contact Central Missouri State University, Department of Power and Transportation, Warrensburg, MO 64093; telephone (816) 543-4975. ■

Mr. Lewis is a freelance writer and flight instructor—ASEL, instrument—based in Warrensburg, MO, where he is in his final semester at Central.

H. Dean Chamberlain

GPS Functional Flight Evaluation

by Richard Davis

Global Positioning System (GPS) follow-on field approvals for en-route and approach operations have been a learning experience for both the FAA and those repair stations and mechanics installing them. Typically, the applicant submits an FAA Form 337 and data package to their local aviation safety inspector-avionics for review and field approval. Included in that package is a completed proposed flight manual supplement and plan for conducting the "functional flight evaluation" required by FAA Advisory Circular AC 20-138 for IFR GPS systems. The verbiage recorded on the FAA Form 337 and the text required in the aircraft flight manual supplement are fast becoming routine. However, there are still lessons to be learned concerning operation of the unit and the functional flight evaluation.

The purpose of the functional flight evaluation is normally to assure that the system as installed operates properly and that the system accuracy was not degraded because of something done during the installation. The flight test report/outline is normally referenced on the 337 as part of the data package and is evaluated and approved by the FAA inspector. As the principal avionics inspector at the Portland, OR Flight Standards District Office (FSDO), I wanted to understand what this "functional flight evaluation" was all about before requiring installers and pilots to venture out and conduct these evaluations on their own. To accomplish this goal, I participated in the first A–1 approach flight evaluation in the Portland area. The flight was conducted in a Beechcraft *Baron* equipped with a Bendix/King KLN-90B GPS interfaced into a King HSI and KFC–200 autopilot. Our two-hour flight evaluation was exciting to say the least and taught us many valuable lessons!

Traffic, Traffic!

Our flight was conducted by two qualified pilots and myself acting as an observer. It quickly became very apparent that this was not a single-pilot operation. The flight test outline required us to conduct five low altitude overflights of one or more surveyed locations and three GPS approaches. With the weather VFR and "severe clear" we found ourselves sharing the airspace with gliders, parachute jumpers, and one other aircraft practicing approaches. To make things more difficult, the prevailing wind dictated approaches "against the grain" heading us right into outbound traffic! Then there was the question of how to record our position once over the surveyed waypoint. Some units will allow you to freeze the position by pressing the hold (HLD) button. With our unit you have to be set up to create a user-defined waypoint. At the instant you cross over the waypoint, you push the "enter" button and create a new waypoint. We found that the accuracy recorded was usually directly proportional to one's ability to push the enter button at the correct time. The combination of operating the box, recording aircraft position, talking on the radio, and keeping good vigilance on traffic and terrain outside the aircraft demands at least two qualified pilots. And it wouldn't hurt to have even a third set of eyes.

On Approach

A review of the GPS flight manual supplement and pilot's guide will reveal the complexity of the GPS receiver operation and approach procedures. It's not as simple as just flying to the initial approach fix (IAF), flying outbound to the procedure turn, and finally turning inbound on a previously set-up course to the missed approach point. With GPS there is some "switchology" and mode annunciation that takes place as well. If the pilot is unaware of how to access, arm, and initiate an approach correctly from the database and does not understand the appropriate mode/warning enunciators, things can go sour in a real hurry. During our flight we initiated a GPS-overlay at McMinnville, OR for the NDB or GPS RWY 22 approach. Unfortunately, we did not properly retrieve an IAF transition for the approach from the database. Consequently, the GPS would not sequence through the approach nor arm as we expected. Understanding how and when the OBS [?] and LEG [?] modes are used in an approach and the meaning of ARM (arm) and ACTV (active) enunciators is critical.

Like all aircraft systems, GPS has its limitations, both physically and legally. Some approaches are not published for GPS because they are not suited for this type of operation. For this reason they are not included in the GPS database. It is important to assure that the database reflects all approaches to be flown on any given flight.

One could go out and conduct three perfect GPS approaches without any problem. Yet because electronics do fail and installations don't always work the first time around, we need to check the failure modes. During the NDB or GPS-B approach to Hillsboro, OR, we chose not to arm the GPS to see what would happen. As advertised, the MSG (message) light enunciated, "ARM GPS APPROACH." We continued our approach "unarmed" to see what would happen. Upon crossing the final approach fix, we did not get the ACTV light as expected; yet, we were still able to continue to navigate to the missed approach point, *even though a missed approach was required*. The legal limitations for the GPS are found in the flight manual supplement. These limitations must be followed to stay in compliance with the FAR. Some of the limitations for the unit we tested are as follows:

- Instrument approaches must be accomplished in accordance with approved instrument procedures that are retrieved from a current database for the unit.
- APR ACTV mode must be enunciated at the final approach fix.
- Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.
- When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or LORAN-C navigation.
- The aircraft must have other approved navigation equipment appropriate to the route of the flight installed and operational.

The last limitation of the GPS is that its accuracy is phenomenal! This is only a limitation in that a pilot could become spoiled. Remember a pilot needs to be current and knowledgeable in any approach he or she may be requested to fly.

GPS functional flight evaluations should be carefully planned. The pilot should know what, how, when, and the expected results for each step in the flight evaluation outline. The pilot should also review the flight manual supplement to assure it contains no misleading or false information. Operating at low altitudes demands extra attention to traffic, terrain, and noise abatement procedures. Remember, regulations are still in effect, and safety must always take precedence over any part of the flight evaluation. Decisions must be predicated on what is safe not on what needs to be accomplished to gain an IFR certification.

School's not out when it comes to GPS and IFR approach field approvals, but I'm sure we'll continue to learn together! ■

Richard Davis is a Principle Avionics Inspector at the Portland (OR) FSDO.

H. Dean Chamberlain

This is a typical Bendix/King IFR approved GPS installation. All the photos accompanying this article were taken during a demonstration flight for FAA HQ's Flight Standards personnel.

Don't Touch that Propeller

Continued from page 16

6. Make sure you have been taught the proper way to evacuate the propeller area from an inadvertent start. Your survival rate is minimal without proper training, especially when you're not prepared for the propeller to start spinning.

Older pilots seem to be fully well aware, from experience, of the dangers surrounding propellers, but we newer pilots, taught by new instructors, may not be fully aware of this scenario. If this information reaches just one pilot and saves his life, I am thankful. Meanwhile, happy flying and be proud of the fact that we are still part of the most well organized aviation community in the world, and we shall stay that way if we continue to communicate. ■

Paul D. Adler is an aircraft owner and pilot based at Martha's Vineyard. This article originally appeared in the Boston FSDO Communicator.

Eric Presten

LUSCOMBE

Preservation of an American Aviation Heritage

by Douglas Combs, *President, DLAHF*

This Famous Flight is slightly different. It not only recounts an aircraft's past history, but also recounts an effort to preserve an aircraft's future.—Editor

Most of us in aviation have precious little knowledge of the history rooted in the aviation manufacturing field after the Wright brothers. There were many turns and technological advances in aviation through the 1920's, '30's, and '40's that created the production light planes of today. One such visionary and promoter whose dreams paved the way for many of these technological changes to become a reality was Don Luscombe.

Don Luscombe was an ambulance driver in France during World War I. He ingratiated himself with the French pilots, bartered a few rides, and was hooked on aviation for many years thereafter. His operation of open cockpit biplanes during the post World War I years convinced him that a closed, comfortable cabin was preferable to the winter weather he was forced to endure while exposed to the elements. Don dreamed of flying in comfort year-round. This brought on the development of the *Monocoupe* aircraft, a very strong, one-piece wing, fully enclosed cabin craft that grew from a lightweight flivver in the mid-1920's to a real speedster of almost 200 mph in the air races of the late 1920's and early 1930's.

The *Monocoupe* was a break from the traditional biplane. Unfortunately, it was disdained in its day because the pilot could not feel the wind in his or her face! Approximately 500 *Monocoupes* of many different models were produced.

During the Depression, *Monocoupe* lost a major financial backer and most of the marketplace because of slow sales and the general economic condition of the country. Like other businessmen of the era, Don was forced to leave *Monocoupe* and witness its demise. However, he wasn't through yet with aviation. He had a better concept in mind.

Luscombe assembled a small team which included Ivan Driggs, his chief engineer from *Monocoupe*, and developed a radical new design in private air transportation. That concept used the emerging technology of aluminum, monocoque-skinned airplanes where the structural loads were to be carried by the skin itself rather than in underlying tubes or wood as had been done in conventional aircraft structures. That monocoque structure is common now, but when the Luscombe *Phantom* was born in 1933 the Luscombe Aircraft Development Corporation had to go to great lengths to convince the CAA (later FAA) and the flying public of the strength of this construction method. The Luscombe *Phantom*, Model 1 certification tests were completed in August 1934.

The Luscombe *Phantom* was tested to over 10 "G's" and seated two in leather upholstered elegance. Though a very fast and efficient airplane, the *Phantom* had some unruly landing characteristics that made it a challenge on the ground and a marketing failure.

In a follow-up design, the Luscombe Model 4 was scaled down and redesigned lighter, simpler, and hopefully cheaper. A serious effort was made to build an inexpensive metal airplane that could be produced on an assembly line (such as Ford was using for autos), bought at a competitive price, and flown by the masses. Luscombe's education in marketing and skills in promotion kept the company afloat.

To survive in his aviation pursuit Don Luscombe opened a school to train young aspiring aviation mechanics at the Luscombe factory. Some classroom training and real shop experience on metal fabrication of aircraft made these young men assets to the World War II war effort in later years. The cheap labor was also essential to the company's survival.

This school developed a project airplane which became the Luscombe Model 8. It was designed to carry two people on 50 horsepower at almost 100 mph. The *Silvaire*, as it became known, was light, efficient, durable, and, best of all, a relatively inexpensive airplane.

Truly, Don Luscombe was a pioneer in the mass production of the metal, monococque personal airplanes. The dream was complete.

The introduction of the Luscombe Model 8 design in 1937 was well received by the aviation media and the Wall Street financiers. The advanced design concept of a government certified, factory-built metal monococque airplane for personal use was quickly realized and many of the aircraft were sold from 1938 through 1940. Don Luscombe capitalized the company and sold stock. The airplane was selling so well that the company was wrenched from Don Luscombe's control by an investor who knew the value of the concept of production-line produced monococque metal airplanes. Don Luscombe would be disillusioned after this and go into other enterprises. However, he did design one more airplane before his death in 1965, but it was never put into production.

The competition took notice also. Cessna, seeing the market for an airplane of this sort, procured a Luscombe and had a design team reverse engineer it as a less expensive copy. This was certified at the end of World War II as the Cessna 120. This humble Cessna duplication of a Luscombe Model 8 is the corner stone and basis of the 120, 140, 150, 152, and apparently most of the post-war, high-wing, metal, light-plane designs now flying. The Cessna 120/140 were less expensive, offering a cost advantage to the consumer, but the expected post-war airplane demand was never realized. Luscombe closed its doors in 1949 and again in 1961 under bankruptcy reorganization.

Under the stewardship of several corporate entities, Luscombe Aircraft produced over 6,500 airplanes which included some 75 Model 11 Sedan airplanes (a 4 place) and almost 100 tandem seating T8F Luscombes. The rest were all two-place, side by side seating aircraft with control sticks, responsive controls, and horsepower ranging from 50 HP to 150 HP. Over 2,300 of these aircraft are still flying today. An additional 2,000 are available and in need of restoration by enterprising and resourceful individuals or groups, which brings us to the next part of our story.

The concept of owner self-help is not new. The Swift owners did it many years ago, and the EAA as well as smaller groups have collected data to help owners and restorers get good information for their aircraft maintenance or restoration work. Organized as a non-profit charitable organization, the Don Luscombe Aviation History Foundation (DLAHF) was formed in 1989 as an outgrowth of two Luscombe clubs and owner concerns about Luscombe historical preservation and the inability to get reliable or accurate factory engineering information on the Luscombe *Silvaire* aircraft that are still flying.

The Luscombe Foundation effort is unique in that *Silvaires* had been unsupported "officially" for more than 30 years with the engineering data locked away and unavailable. Moreover during this period, the Luscombe fleet had been disserved with untrue rumors of superior acrobatic capability and critical maintenance issues related to corrosion and AD notes which denigrate a good airplane. This all changed for Luscombe in July 1993, when DLAHF took possession of the 13 file cabinets, three flat files, and reams of factory paper that contain the history of the original American metal production airplane. The Luscombe Foundation has yet to organize all of the 10,000+ Luscombe drawings procured. But it has assembled many of the original tools from the factories in Dallas, TX, and Fort Collins, CO. Some historical Luscombe tools still remain in outside storage in Michigan. Nevertheless, DLAHF has essentially created a factory support network for an out of production airplane.

Since its inception, DLAHF has undertaken several projects to revitalize the Luscombe. This includes substitution of current FAA-approved suppliers for those no longer in business and the development of shoulder restraints and new engine installation STC's for current production engines. In addition, DLAHF has developed a wide variety of approved parts for Luscombes under an FAA-PMA approval.

The Luscombe Foundation has no illusions about reentering the production aircraft marketplace. The DLAHF is organized as a historical preservation and educational group and has fulfilled that mission handsomely with annual forums at Sun 'N Fun, Oshkosh, and numerous other airshows and aviation gatherings throughout the USA. Eventually these efforts are hoped to culminate in the building of a dedicated public museum and technical facility in the Phoenix area.

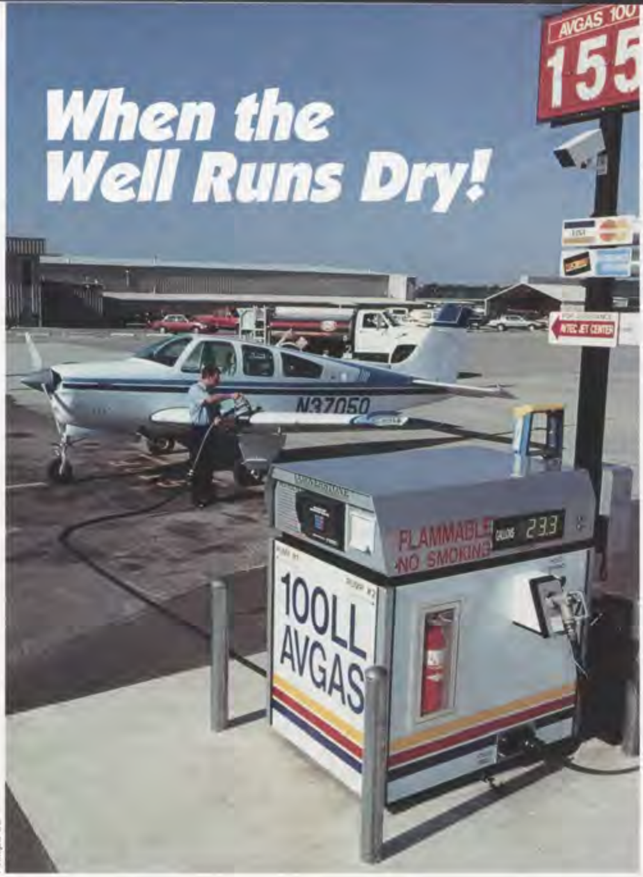
Showing the Luscombe "WIN ME" airplanes and Luscombe Phantom 272Y (Don Luscombe's original *Phantom*) throughout the U.S., the DLAHF has created a public interest in the rich Luscombe aviation heritage, while also selling tickets to win a freshly restored classic airplane. The proceeds are then used to make more support available to owners and Luscombe aficionados through preservation of archives in the museum.

Those interested in Luscombes, Luscombe history, aviation preservation, or support of a genuine grassroots effort to improve general aviation maintenance, can contact the Don Luscombe Aviation History Foundation for more details by telephoning (602) 917-0969 or by writing the DLAHF at Box 63581, Phoenix, AZ, 85082. ■

Eric Presten

Above is a Luscombe 8A. A Luscombe Model 4(90) is shown on page 22 and a Phantom Model #1 is on the cover.

When the Well Runs Dry!



Phillips 66

by Marlan J. Perhus

Imagine the sinking feeling that you could get when your airplane's engine quits after running out of fuel! Unfortunately, many pilots have gotten the chance to experience that feeling personally. For example, when I reviewed the 1994 accident/incident statistics for Minnesota and surrounding states, I noticed that many pilots had fuel problems—especially "lack of fuel" problems—which was the primary cause of the accident. Upon interviewing most of these pilots, I came to the determination that all of them had one thing in common. All of them thought they would have plenty of fuel to arrive at their destination and had no idea they had a problem until the engine let them know. In other words, it got really quiet, really quickly!!

Planning and Fueling

When planning a flight, review your pilot's operating handbook, owner's manual, or other data indicating your aircraft's correct *fuel capacity and fuel consumption* information for all phases of flight. Many pilots know their airplane burns around eight gallons per hour but do not compensate for fuel burned during start, taxi, takeoff, and climb. If you're thinking that this is minimal, most of the fuel starvation accidents in the 1994 in my district happened less than five miles from the destination airport—just the difference that "minimal" fuel could make.

During your briefing from flight service, pay close attention to the *winds aloft* for your area of operation. You must factor in the winds to your pre-flight planning, but use caution: Winds aloft are forecast, not measured. That's why it's important to update your flight planning calculations in flight, where you can get an accurate snapshot of conditions.

Preflighting and Fueling

During your pre-flight of the aircraft, *visually check* the fuel in the tanks—don't just look at the fuel gauge. When you look in the tank, make sure that the fuel level is really where you want it to be. Some aircraft fuel tanks may look full; however, you might be able to squeeze a few more gallons in each tank—taking into account your weight and balance, of course.

Also remember to *have the aircraft level* when fueling and to note where your fuel selector should be during fueling. For my Cessna 172, the manual suggests selecting the left or right tank to fuel the aircraft fully. If you do not use this procedure in a 172, fuel will drain from the left tank to the right tank (or right to left) while you are stepping off the ladder, automatically lessening the amount of fuel in the tank that you just filled. You'll go away thinking it's full.

Perhaps you don't do your own fueling. When I was an *aircraft line attendant*, I recall pilots watching me fuel their aircraft, so I absolutely did not want to spill a drop on their newly polished aircraft. Trying to fuel an aircraft too quickly can result in "Old Faithful," so remember that line attendants may leave the fuel level down a bit after you told them to "top it off."

Some *aircraft tanks* are designed to hold the majority of the fuel near the top of the tank (i.e., they are wider at the top), so even though the fuel is only a couple of inches from the top, you may be short several gallons. We've all heard that one of the most useless things in aviation is "the air in the tanks" and one of the most important is fuel, the "time in your tanks."

Leaky fuel systems, as indicated by fuel stains and puddles under your aircraft, also may lead to a fuel mismanagement accident. Fuel sumps, fuel lines, carburetors, and primer lines may only have a small leak—but one that may make a difference between landing at your destination airport or the street two miles from the landing strip.

Beware of aircraft with "*bladder tanks*." If the bladder in the tank is not properly installed or has decided to shrink or collapse, you may not have the quantity of fuel that the tank is supposed to hold, even though it appears to be plum full!

Flying and Fuel

Okay, now it's time to go flying!

Begin by noting your *engine start and takeoff times*. As you are flying, it is important to *check your ground speed periodically* and to determine revised ETA's so you are able to calculate your fuel required for the trip. If at any time during flight your fuel requirement exceeds what you have available for flight (not your reserve), plan a fuel stop before reaching your original destination—even if it's just 20 miles short of where you're headed!

Fuel reserves are not meant to be used in flight because of greater headwinds or other factors. Reserves are to be used in an emergency, such as an airport closure at your destination, a missed approach, a go-around, or an air traffic delay.

Winds aloft continually change, especially when flying near fronts. Keep in mind that just because surface winds are relatively light, winds aloft may be howling—and it's probably a headwind. Review your *range and endurance charts* en route, if your aircraft has that data. If not, calculate a range and endurance profile for your aircraft using data from your aircraft manual. If your endurance chart indicates that you have three hours and 10 minutes of fuel on board, subtract your reserve fuel time and simply do not overfly that time. Sounds basic, but pilots continually fly past their calculated maximum endurance time trying to stretch fuel to their destination.

Fuel and Gauges

Now, to really confuse the subject, as we alluded to before, don't trust your *fuel gauges*. I have talked to pilots who have flown a Cessna 152 for three and a half hours, and the gauges still said full, so they continued! Wrong move, because the gauges were obviously sticking.

If a pilot knows the fuel gauges are inaccurate, he or she may not even look at them—even if they are showing empty. Again, wrong move! Fuel gauges, even though they may be inaccurate, may still provide you with an idea of how much fuel you have. For example, you fuel your aircraft and forget to put the fuel cap on the tank (which does happen). As you're flying, fuel is leaving your tank, and even the most inaccurate of unstuck fuel gauges will reflect this. Consequently, in this situation, if you ignore your fuel gauges, you could run out of gas early into your flight. Use your fuel gauges as a reference or crosscheck, not a crutch.

Any discussion of fuel consumption must include the reminder to *operate your aircraft as you have planned* during your pre-flight preparation. If you planned to use 2450 rpm, then do so. It is important to remember that your aircraft's tachometer and/or manifold pressure instruments may be inaccurate. It is possible that you are actually running your engine at 2600 rpm instead of 2450. Just think what this will do to your fuel consumption! It doesn't hurt to have your tachometer checked periodically.

Proper leaning of the air/fuel mixture is also of extreme importance. Many cruise charts indicate fuel consumption rates for a mixture leaned to "best economy" condition, when you may have leaned your aircraft to "best power" and expected the charts to be correct. Please also remember that fuel consumption rates were calculated using a brand new aircraft with a test pilot doing the flying—and the leaning. Still, it is important to follow the manufacturer's recommendations on leaning the fuel/air mixture. Not leaning at all will significantly decrease your range and endurance, which may later increase your blood pressure!

Reserves

The FAR require you to have a *fuel reserve* (FAR §§ 91.151 and 91.167). Remember, these are minimums, and I recommend that a pilot add his or her own requirement for a "safety buffer."

There are a number of excellent publications, ideas, and stories about fuel management. The key is know your aircraft and your surroundings and not to exceed the limitations—not even by a minute. It could be the last minute you have! ■

Mr. Perhus is the Safety Program Manager at the Minneapolis Flight Standards District Office in Minnesota.

Flight**FORUM**

Airspace**CORNER**

• Airport Extensions

This letter concerns your response to the question about weather within an airport surface area in the September 1994 issue. Attached is a copy of the Miami sectional with Gwinn Airport and its non-Federal control tower (NFCT). It looks as if the new North Palm Beach Co. Airport (F45) is within the extension. If Gwinn has weather reporting capabilities, do I need SVFR if Gwinn is below VFR to get into F45? Is a NFCT in this instance the same as a Federal control tower?

What if Gwinn does not have weather reporting capabilities? How can I find out if F45 is definitely within the extension?

Howard G. Soloff
Boca Raton, FL

We called the Palm Beach Tower which provides approach control services for Gwinn. According to controllers Kevin Sullivan and DeWitt Ingram, who is also the tower's plans and procedures specialist, North Palm Beach Co. Airport (F45) is considered outside of the Gwinn Airport Class E extension. Since F45 is outside of Gwinn's controlled airspace, you do not need a SVFR to fly into F45 as long as you can maintain VFR and do not enter Gwinn's airspace if Gwinn is IFR.

NFCT's operate the same as Federal towers. Finally, to answer your question about how to figure out the airspace, the easiest way is to contact the air traffic control facility that has jurisdiction for the airspace. The facility is either listed on the chart or in the FAA *Airport/Facility Directory.* If in doubt, contact the Flight Service Station responsible for the area for help.

• AIM Pricing

Why is the price of the Aeronautical Information Manual(AIM) so expensive? It recently jumped in price from $58 to $75 a year. Outrageous prices are self-defeating as all but the most dedicated pilot subscribers will probably not renew.

Name withheld

Normally, the FAA is NOT responsible for the pricing of the AIM (or the *FAA Aviation News* for that matter). Prices are set by the U.S. Government Printing Office (GPO) using a cost formula. However, in this case, FAA was indirectly involved when an investigation into subscribers' delivery complaints discovered that GPO was mailing the AIM as fourth class bulk mail. This puts AIM into the same category as "junk" mail and translates into being delivered whenever. As the AIM is considered critical to flight safety, the FAA requested that the delivery of the AIM be upgraded to first class mail to ensure prompt and timely delivery by the effective date of the AIM change(s). This is what drove up the cost. The FAA believed that subscribers would want their AIM as soon as it was available.

• SVFR Clearance Revisited

I am writing in response to your article in the September 1994 Forum. The article is entitled "Special VFR Clearance." I feel the response given to Ms. Tulumello regarding the need for special VFR clearance in her scenario is incorrect.

First of all, the FAR with the answer to the question is FAR § 91.155 not § 91.157. The answer lies in §91.155(c) which states that: "Except as provided in FAR § 91.157, no person may operate an aircraft beneath the ceiling under VFR within the lateral boundaries of controlled airspace designated to the surface for an airport when the ceiling is less than 1,000 feet."

In the scenario in question the aircraft is not under a ceiling. The author of the response has arbitrarily interjected a reference to the primary airport. Since the prohibition is to not operate beneath the ceiling if less than a 1,000 feet, a ceiling must exist over your aircraft so as to know what not to operate under. The only mention of landing and taking off from an airport in a surface area has to do with visibility. This section [91.155(d)(2)] allows for pilot visibility if none is reported at the airport. I suggest the same would be true regarding ceiling.

Harold C. Hartzell
Tacoma, WA

No arbitrary injection was made. As explained in the May-June 1994 Airspace Corner, which was written by FAA's Air Traffic Rules and Procedures Service, the case in point involves operations within a Class E surface area designed to support a Class D airport with weather reporting. The Class D airport was reporting IMC conditions which required instrument flight rules to be in effect for the airport area which includes the Class E surface area. The Class E surface area is an extension of the Class D airspace designed to protect IFR operations into and out of the primary airport. As a result, the Class E surface area also requires IFR procedures when the primary Class D airport is IFR. The primary airport's weather controls the type of flight operation within the designated airspace. As the May-June 1994 Airspace Corner emphasized, "The Class D airport, may be IMC, but the Class E extension is not automatically IMC. Please don't confuse IMC with IFR!"

FAA AVIATION NEWS welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Send letters to Editor, FAA Aviation News, AFS-810, 800 Independence Ave., SW. Washington, DC 20591, or FAX them to (202) 267-9463. INTERNET address: Phyllis_Duncan@mail.hq.faa.gov

Av**NEWS/BRIEFS**

FAA Wake Turbulence Study—Keep Those Reports Coming!

Earlier this year NASA's Aviation Safety Reporting System (ASRS) and other aviation industry organizations jointly publicized a special FAA-funded study on wake turbulence. The study, which is being conducted by ASRS analyst and research staff, uses detailed telephone surveys to gather information on wake turbulence encounters reported to the ASRS. The FAA's purpose in supporting the study is to reduce the frequency and danger of wake turbulence events.

In response to announcements in *CALLBACK* and other industry publications, the ASRS has already received more than 58 reports of wake turbulence encounters. To date, 47 telephone interviews (structured callbacks) have been completed with reporting pilots.

Inspite of this strong response, ASRS in seeking additional wake turbulence reports from the pilot community through the end of 1995. Both air carrier and general aviation pilots are encouraged to continue reporting their wake turbulence encounters to ASRS. Here are some additional facts about the ASRS wake turbulence study:

- ASRS is seeking pilot reports of *recent* wake turbulence encounters—those that occurred *within the last six months.*
- Reporter participation is voluntary, and all personal identifying information (names, company affiliations, etc.) will be removed before the data are given to the FAA. Only aircraft make/model information will be retained in the ASRS data.
- ASRS will contact you for an interview appointment in one of two ways: by a telephone call to the phone number given on your reporting form ID strip or by letter the address on your ID strip (if you give no phone number).
- The interview itself will take approximately 45 minutes. If there are any questions you prefer not to answer for any reason, the interviewer will go on to the next question.
- You will receive your report ID strip back—with no record of your identity retained by ASRS—as soon as the interview is completed.

The collection of wake turbulence incident data by the ASRS is the first phase of an extended FAA effort to track and monitor wake turbulence incidents. Your report counts, so don't forget to tell your story to ASRS! Reporting forms are available on request from NASA's Aviation Safety Reporting System, P.O. Box 189, Moffett Field, CA 94035-0189.

(From the July 1995 issue of *CALLBACK*)

Reaching for the Stars, FAA's New "Line of Business"

The Office of Commercial Space Transportation (OCST) officially became part of the FAA on October 1. Established in 1984 as part of the DOT's Office of the Secretary, OCST's purpose is to license and regulate all U.S. commercial launch activities to ensure that they are conducted safely and responsibly and to promote, encourage, and facilitate commercial space transportation.

"The safety licensing activities of OCST for launches of launch vehicles and operation of spaceports share a common safety objective with FAA's aircraft, airspace, and airport safety regulatory activities," said DOT Secretary Federico Peña. "This move is consistent with the Clinton Administration's goals for the enhancement of the nation's high technology industries, including an international competitive U.S. commercial space transportation industry."

The U.S. commercial space transportation industry is comprised of aerospace companies and entrepreneurial businesses that provide launch services to foreign and domestic customers and the U.S. Government. Since 1989, the year of the first licensed commercial space launch, the industry has steadily expanded and OCST has issued licenses for more than 50 U.S. commercial launches, both orbital and suborbital.

According to FAA Administrator David Hinson, "the FAA is well positioned to advance OCST's goals of ensuring safety, promoting the development of new markets and customers for U.S. products, and maintaining U.S. technological leadership."

This year's agenda of 15 licensed U.S. commercial launches could, for the first time, exceed the number of government launches in a single year. "To meet the regulatory demands of new launch systems and a growing industry, combining the resources and skills of OCST with the FAA allows us to address those challenges," said OCST Director Frank Weaver. "I am delighted that we will be moving to the FAA and look forward to advancing the goals of commercial space launch industry to position it competitively for the next century."

From the Airworthiness Alerts

A *report* in the May 1995 issue stated that on several occasions the Beech Model 35-B33 *Bonanza's* elevator trim tab bolts at the trim tab and the actuator attachment have been found with excessive play. In some cases, the clevis forks at the actuator were found elongated and required replacement. It was stated that with the use of AN close tolerance bolts, the "play is minimized." It is possible that changing the hardware may cause control surface balance problems. The manufacturer should be contacted, or another form of approved data should be obtained prior to installing the AN bolts. This area should be closely checked during scheduled inspections and maintenance. Total part time was 3,634 hours.

A report in the September 1995 issue stated that during scheduled inspections frequent findings of cracked and/or broken ribs on the Cessna Model 152 *Aerobat's* horizontal stabilizer leading edge. The defective ribs (P/N's 0432001-6 and 0432001-46) were primarily found on the right side of the stabilizer. The submitter speculated the cause was the elevator trim assembly (located on the right side) exerting excessive loads on the ribs. The aircraft maintained by this operator are used in a training environment, which may have been a contributing factor. Improper ground handling may also have been the cause of these defects. Total part time was 7,804 hours.

Annual Airport Conference

The Federal Aviation Administration's Great Lakes Airports Division will hold its Eleventh Annual Airport Conference November 1st and 2nd. Registration to the event, taking place at the Holiday Inn in Rosemont, Illinois, costs $95.00 per person.

Organizers plan a two-day agenda that includes general presentations and break-out sessions in Planning, Engineering, Funding, Construction Quality, Operations, Safety, Capacity, and the Environment. More information is available from Carol Koenes at (708) 294-7013.

Wings of Warmth

On November 11 and 12 Reading Regional Airport will sponsor the sixth annual "Wings of Warmth" flight to help the homeless and poor. Fly or drive your donations of warm clothing, non-perishable food, or new, unwrapped toys to the Mid-Atlantic Air Museum, located at Pennsylvania's Reading Regional Airport—Carl A. Spaatz Field (RDG). Linger for flying fellowship, food and drink, and a look at the Museum's newly renovated facility, award-winning aircraft, and special displays while helping the less fortunate with your caring gifts. Certificates will be awarded to all participants. For more information call (610) 372-7333

AOPA's Project Pilot—Searching for Mentors and Students

Aircraft Owners and Pilots Association Project Pilot II, the Association's second program of CFI recognition and student pilot motivation, signed more than 1,200 flight instructors within three weeks into this year's program.

AOPA is inviting 55,000 CFI's to join Project Pilot that offers free educational and motivational resources for instructors and students.

Project Pilot is AOPA's move to help stem the decline of U.S. pilot population. AOPA says that research indicates that only 14 percent of current student pilots will be licensed by next year, while 31 percent will drop out by 1996.

Last year, the first for the program, the Association achieved its goal recruiting 10,017 prospective student pilots. Once identified, prospects are "mentored" individually by AOPA members through the process of becoming a pilot.

Project Pilot staff can be contacted at AOPA, 421 Aviation Way, Frederick, MD, telephone: (800)USA-AOPA.

GPS and LORAN, A Brief Guide

AOPA Air Safety Foundation has just released "GPS/LORAN—A Guide to Modern Navigation" booklet.

The new guide has key information on how to use GPS and LORAN, and how both systems work. It explains how to certify GPS and LORAN units for IFR, and why existing hand-held units cannot be certified and should not be used for IFR navigation.

Although it forecasts GPS as the major navigation system of the future, it assures that LORAN is still a viable system worth keeping in the panel. The 24-page guide reminds IFR pilots that alternates for stand-alone GPS approaches must be airports served by traditional ground-based navigation aids. The aircraft's traditional navigation equipment therefore must be operational.

This pamphlet is available from AOPA Air Safety Foundation, 421 Aviation Way, Frederick, MD 21701, telephone: 1-800-638-3101.

Safety Seminar Attendee Wins the "Jazzy J-3"

When pilot Phillip Kayman decided to attend an FAA Aviation Safety Program safety seminar last year, it wasn't because he expected to win an airplane. Along with other participants, he entered AVEMCO Insurance Company's "Jazzy J-3" Sweepstakes. In a partnership with the Aviation Safety Program, AVEMCO provided FAA Safety Program Managers with Sweepstakes entry forms and a tabletop display to encourage attendance at safety program seminars. The "Jazzy J-3" prize package consisted of the 1946 Piper J-3 *Cub*, plus travel and accommodations for three days and two nights at the 1995 EAA Oshkosh Convention.

AVEMCO President Bill Condon said, "The purpose of the sweepstakes is to promote awareness of general aviation and in particular flying safety. It's especially fitting that this year's winner entered the contest as part of his participation in an AVEMCO-sponsored FAA safety seminar." The "Jazzy J-3" Sweepstakes has proven highly successful in its dual roles of building traffic for the FAA Aviation Safety Program seminars and raising public awareness of general aviation.

The happy winner chose a cash equivalent instead of the "Jazzy J-3," and AVEMCO will award the aircraft in a new "Classy Classic" sweepstakes concluding at EAA Oshkosh 1997.

For information on how to enter the "Classy Classic" Sweepstakes, contact your Safety Program Manager at your local Flight Standards District Office for a schedule of safety seminars.

At Oshkosh '95 "Jazzy J-3" winner Phillip Kayman (left) accepts his award from AVEMCO President Bill Condon (right) while Christian Eagles pilot Charlie Hillard looks on. The "Jazzy J-3" in the background will be awarded as a "Classy Classic" at Oshkosh '97.

In the United States of America . . .

Number of Companies Operating Turbine-Powered Aircraft:	6,751
Number of Turbine-Powered Aircraft Operated by U.S. Companies:	9,715
Millions of Passengers Flow by U.S. Airlines:	83
Millions of Passengers Flown by General Aviation Aircraft:	130
Percentage of General Aviation Flights Flown for Business:	70
Number of Airports Served by Scheduled Airlines:	669
Number of Airport Serving Hubs about Three-Quarters of All Airline Passengers:	55
Number of Airports Served by Business Aircraft:	5,500
Billions of Air Miles Flown by All U.S. Aircraft:	9
Billions of Air Miles Flow by U.S. General Aviation Aircraft:	3
Percentage of U.S. Aviation Fuel Used by General Aviation Aircraft:	7
Percentage of *Fortune 500* "Honor Roll*" Which Operated Aircraft in 1994:	90
Percentage of *Fortune 500* "Honor Roll*" Which Operated Aircraft in 1993:	92
Percentage of *Fortune 500* "Honor Roll*" Which Operated Aircraft in 1992:	88
Percentage of the *Forbes* "Super 50" Which Own Aircraft:	92
Percentage of the *Forbes* "Top 50," Ranked by Market Value, Which Own Aircraft:	94
Percentage of the *Forbes* "Top 50," Ranked by Profits, Which Own Aircraft:	92
Forms of Transportation Offering Management More Control Over Security:	0

**The 50 Fortune 500 companies that returned the most to stockholders, including capital gains and dividends, over the last 10 years.*

From the General Aviation Manufacturers Association
Annual Industry Review, 1995 Outlook & Agenda

U.S. Department
of Transportation

**Federal Aviation
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800 Independence Ave., S.W.
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DO NOT DELAY—CRITICAL TO FLIGHT SAFETY!

G. S. Livack