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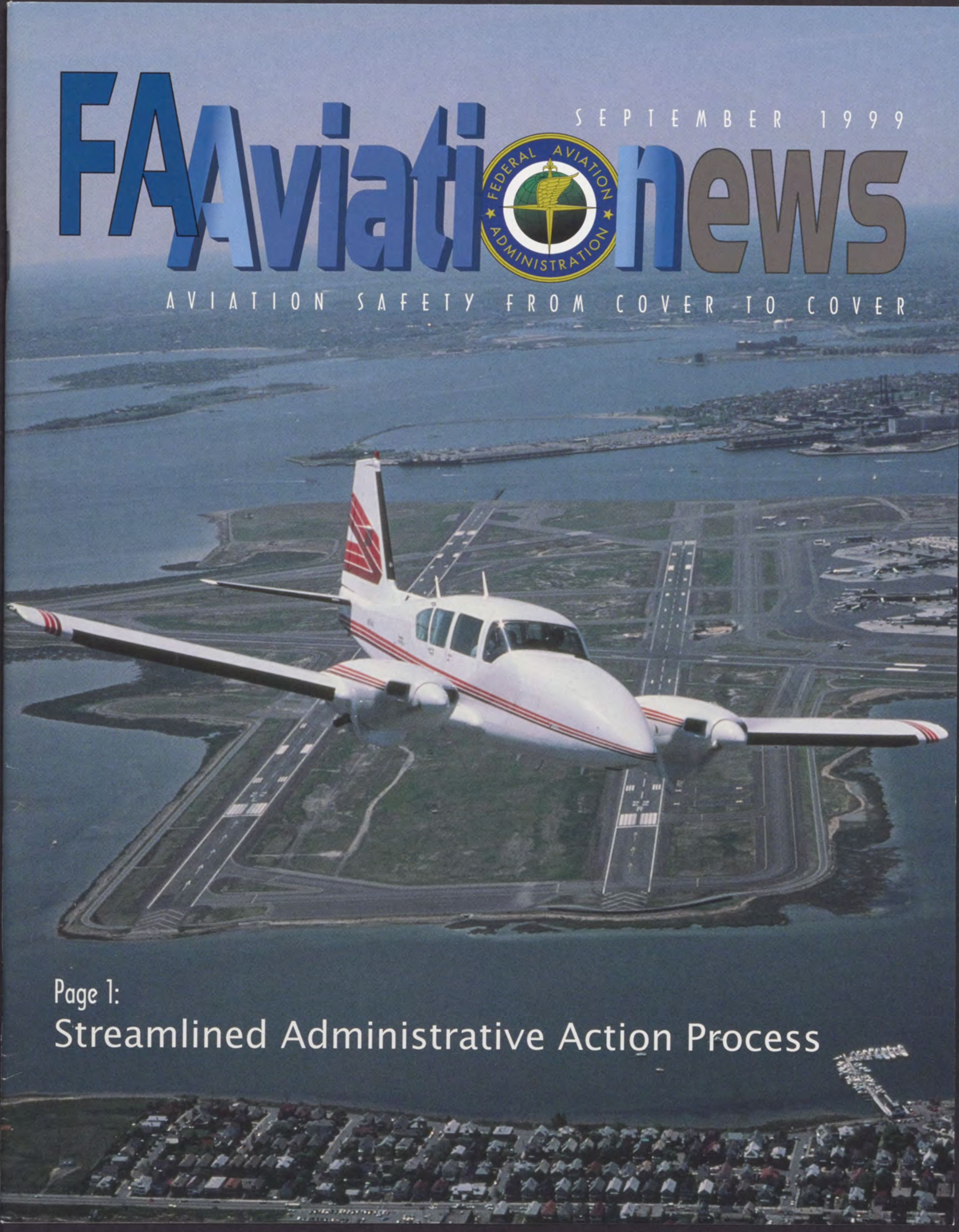

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Streamlined Administrative Action Process

U.S. Department
of Transportation

**Federal Aviation
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FEATURES

DEPARTMENTS

FRONT COVER: A Piper Aztec F. Piper Aircraft Photo
BACK COVER: A Grumman Albatross. Photo by David Clemmer.

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STREAMLINED ADMINISTRATIVE ACTION PROCESS

by H. Dean Chamberlain

FAA has improved its methods of dealing with incidents of non-compliance that do not meet the test for legal enforcement action. It is called the Streamlined Administrative Action Process. FAA Administrator Jane F. Garvey announced on July 15 the results of an agency effort to reduce the delay in processing of administrative actions (AA) for airmen involved in alleged violations that do not warrant legal enforcement action or extensive investigation.

Although administrative action has always been an available tool for promoting aviation safety through compliance, the time to complete a typical AA case with all of its paperwork could typically take an average of about 75 days. Although the traditional AA process is still available, the new Streamlined Administrative Action Process provides an option for FAA aviation safety inspectors to use that not only improves the efficiency of processing and issuing an AA, but the new process will also increase the amount of safety data available to the FAA once that action is completed.

At the heart of the new procedure is a standardized job aid to help the FAA inspector collect the data needed for initiating an AA and the computerized processing of that data once the inspector returns to his or her office. Once the data is entered into the Flight Standards District Office's (FSDO) computer, the data is sent to the FAA's Oklahoma City Aeronautical Center for processing and where a computer-generated letter is then sent to the individual. The letter details the alleged regulatory non-compliance and what recourse the individual airman or company has in the matter.

An example where the Streamlined Administrative Action Process might be used is where an FAA aviation safety inspector personally observes an airman violating an FAA regulation or where an alleged violation has been reported to the FAA and the evidence in the case is readily available. Before the new streamlined process was approved, it might take up to 75 days for the resulting paperwork for a typical administrative action to get to the airman. Although such a delay still might occur when the current, more detailed administrative process is used in those cases where the alleged violation requires it or if the inspector handling the case chooses to use the older, more formal process, the new streamlined process based upon the new job aid and using computer generated notification letters can cut that processing delay time down to a matter of a few days, depending upon the mail.
From the time an inspector submits his or her completed job aid for processing at his or her FSDO until the computer-generated letter is in the mail is from one to three days. No paper work is given directly to the airman at the time of the non-compliance.

Although the streamlined process is new, it is important to note that the basic procedure for dealing with such violations remains the same, and the rules and guidelines for the inspectors remain the same.

For those who have never heard about an administrative action, it is used in those minor situations where a Warning Notice or Letter of Correction is an appropriate means to ensure future compliance with the regulations and therefore promoting safety for all.

The new procedure will not be used for remedial training, voluntary disclosures, or cases where further corrective action must be taken. These type of cases will be processed the current manual way with the accompanying possibility of a long interval.

Under the new streamlined process guidelines issued to the FAA inspector work force, in the case where an FAA Aviation Safety Inspector (ASI) personally observes a violation, the inspector will discuss the alleged violation with the person involved.

The inspector may also gather additional information as required to document the incident. So far the case and paper trail proceed pretty much as they have for years, although the new streamlined process job aid makes it easier for the inspector to collect the data needed to initiate the case back in the office.

What makes this new process different from the more formal, manual process is what happens once the inspector returns to his/her office.

As is currently done, the inspector must determine that an AA is appropriate for the situation based both upon the alleged violation and airman's past history. Once that determination has been made, under the new procedure, the information contained in the job aid will be entered into a computer that forwards the data to the designated FAA Flight Standards division in Oklahoma City for processing. Then using the new computerized program developed for processing these new AA's, that division will produce a computer-generated letter and mail it to the airman within one to three work days. In the past it may have taken weeks for an airman to receive the appropriate administrative action paperwork from his or her local FSDO.

Not only is the optional streamlined AA being produced more efficiently within FAA, but that efficiency is also a benefit to the airman or company involved. With the streamlined AA procedure, an airman or company does not have to wait for weeks wondering what is happening with the case.

In addition to reducing the amount of time needed to process the paperwork and get it to the airman, as part of the new process engineering, the airman or company also has more time to respond to the FAA about any allegations contained in these new computer-generated AA letters. Under the Streamlined Administrative Action Process, an airman or company now has up to 30 calendar days from the date of the administrative action letter to respond to the aviation safety inspector who issued the letter or to his or her district office manager. Under the current, more formal process, that response time is 10 days.

As outlined in a streamlined AA letter, the airman or company may submit additional pertinent information in explanation or mitigation. Based upon the information submitted, the FAA may withdraw the administrative action letter if the facts so warrant. If based upon FAA review, an administrative action letter is withdrawn, the airman involved will be notified in writing by the investigating office in a timely manner.

It is important to note that this

Continued on Page 24

THE STRESS SYNDROME REVISITED

by Frank Sanders and Jeff Ethell

A. Mario Toscano photo

I knew she was going to crash. So did a number of other experienced air show pilots who had watched her perform. An airline pilot with an unlimited aerobatic competency letter, Cindy had just been furloughed from a major airline and was determined to make her living by returning to the show circuit with a dazzling routine.

At the briefing with the FAA monitor, Cindy asked about doing a roll on takeoff though she knew the crowd was standing on the edge of the active runway. She was told the people were far too close and that all show performers would have to fly out to the 500 foot deadline before executing a maneuver. As we watched, Cindy roared by and did a roll on takeoff scant feet from the crowd. She then continued with her first five maneuvers on the center line of the runway still 50 feet away from the crowd and extremely low. We were worried--why would Cindy violate so blatantly the rules she had been given earlier. We knew something was very wrong, and that this talented woman was about to die in front of our eyes.

On recovery from her fifth maneuver, she was nearer the 500 foot deadline and completed three more, the last being an Immelmann entered at high speed from 20 feet. Over the top at 500 feet, she rolled out, pulled the throttle to idle, and entered a two turn spin. Recovery was made by pushing the nose down beyond vertical, and Cindy did not react to the ground until only 50 feet from impact. At that point she rotated abruptly and hit the ground at a 70 degree angle. She died instantly. It appeared that Cindy suddenly realized the earth was there. Didn't she know she was going to die?

The entire area of stress in the cockpit has been left virtually untouched in researching some of the possibilities involved in pilot error accidents. Could it be that much of what we label "pilot error" is a result of the body's chemical reaction to stress (adrenaline) and not simply to stress itself? If so, can we train pilots to recognize the symptoms of what I have defined as extended acute stress as they have been trained to recognize their unique reaction to hypoxia? If Cindy had known more about human performance, could she have recognized the symptoms that we on the ground saw and saved her own life?

The sad fact is that the term "pilot error" has become less an explanation than an epitaph for a pilot or for his career.

This mystery of stress particularly affects commercial pilots, test pilots, fighter pilots, race pilots, and airshow pilots, but it is seldom mentioned directly. On the show and fly-in circuit one sees quite a bit of what has been described as the "unscheduled low-level acrobatic maneuver" that is powered by "Hollywood adrenaline." An otherwise rational pilot during a routine or fly-by suddenly decides to do something in front of the crowd he or she has never practiced, quite often a roll at low altitude or a different sequence, and he or she crashes. The majority of warbird-type accidents each year are attributable to this phenomenon. Restorations are so pristine now that few mechanical difficulties are being experienced.

What has been happening in the cockpit? Indy car drivers call it "brain fade." Beginning skydivers divers are required to make static line jumps since quite often in free fall they plunge to earth without opening their parachutes seemingly in a narcotic-type trance. What's more, those who live on the edge of this experience often become stress addicts.

In talking with experienced pilots who have lived with stress in their aircraft, I have come up with a list of symptoms that will probably ring true to most of you. Obviously the task is to recognize when the risks are getting too large. The greater the stress, the more pronounced the symptoms.

1) Reduced cognitive capability under stress. Adding two plus two and other simple mental tasks become major hurdles.

2) Cavalier attitude towards safety. There is no fear of dying. When a test pilot flies a particularly demanding or extended profile and ceases to care if the aircraft departs and crashes, it's time to call time out and let the pilot recover even though the aircraft could keep on performing the test sequences.

3) Failure to perceive passage of time. One sees things as if in slow motion. Indy race car driver Johnny Rutherford, also an experienced P-51 pilot, described being able to back into a retaining wall at 200 mph as if he were backing into his garage when his car went out of control, watching everything in slow motion. When the car hit, everything went back to a blur and he recalls little else. This example of sudden stress most of us recognize, but with several minutes' time (extended acute stress) the picture changes 180 degrees. People cease to recognize the passage of time. What seems only like several minutes may actually be a half hour. This happens to show pilots who are given four minutes for a routine and fly three times longer thinking they are staying within their time.

4) Personality change. A fighter pilot usually gets more aggressive, more sure of himself. Co-pilots become more submissive, as with the Air Florida, Washington, DC, crash when the more experienced co-pilot who was flying the aircraft silently obeyed his way to death as the captain made all of the wrong decisions.

5) Detachment from the situation. "Watching" oneself perform from a remote position with no way to get hurt.

6) Tunnel vision. Known as target fixation in the military. A new airshow performer rarely sees the crowd or the ground, only what is directly in front of the aircraft. The fighter pilot heads for the target and flies straight into it. Under stress, peripheral vision deteriorates leaving one with foveal vision. The former perceives motion while the latter is used for reading. Therefore, the pilot has no perception of motion and can hit the ground without a clue to what's happening. By consciously expanding your vision to include peripheral vision, then speed, motion, and closure rates are recognized.

7) Voice pitch change. In sudden emergencies most voices elevate in pitch, and, in extreme situations, pilots may lose the ability to make a sound at all. Under controlled stress, many pilots' voices drop in pitch. If you are not talking, it is easy to monitor. Watch yourself or your friends giving a public speech--a very stressful event

for the beginner.

8) Desire for isolation just before performing. People are avoided at all costs as they may add problems to think about. Indy car drivers are in their cars with their helmets on a half hour before the race, even though they will suffer more physical discomfort. Gordon Cooper fell asleep in his Mercury capsule waiting for launch.

9) Uncontrolled shaking. On takeoff before a crowd with a new sequence, beginning airshow performers' feet shake so violently on the rudders they have a hard time flying the plane.

10) Frustration and anger. One's emotions tend to fly to the surface at the smallest provocation. Occasionally this leads to unreasonable risk taking.

11) Butterflies in the stomach. Just before performing many people report this sensation or other, similar sensations.

12) Post-event euphoria. After a crash or close brush with death, one feels high. After crashing his jet-powered car into a salt water pit at Bonneville, Craig Breedlove, having clawed his way out of the cockpit underwater, danced around and said, "and for my next act, I'll set myself on fire," then sat down and laughed like a goon.

The amazing thing about experiencing this kind of stress is its lack of affect on subconscious, practiced skill levels. One can suffer all the above symptoms and still do quite well at the stick and rudder part of flying. I believe this reinforces the need to practice emergency procedures. Chronic stress can be a factor, but it is not the main cause. Certainly divorce, death in the family, one's job, personal problems, etc., can all weigh heavily in our willingness to take the risks, but it is acute stress that captures people--braking for a child who runs into the street, fighting wake turbulence, or trying to control a groundloop.

Extended acute stress is my definition of what we are shooting at. That is, 10 or more minutes of anxiety without let up. Pilots can subject themselves to this well in advance of flying, often for days, anticipating a particularly challenging flight. The heart rate goes up, breathing is heavy, butterflies buzz around in the stomach, and so on. The U.S. Navy parachute test facility at El Centro, CA, did a study on stress with 18 military jumpers.

These men made 88 free fall test jumps, instrumented so that heart rate could be monitored as an indicator of induced stress. A number of the jumpers were exercised on a tread mill to the point of fatigue in order to establish a baseline for comparing stress reactions. One achieved a heart rate of 166 beats per minute on the tread mill. On the same subject's second jump, heart rate was not outstanding even when he sprained an ankle on landing, yet on his third jump when he most likely feared a possible recurrence, his heart rate climbed to a record 220 beats per minute at parachute opening--the result of self-induced psychological stress. Physical stress produced 166 beats per minute, while psychological stress produced 220 beats per minute.

The fatigue that results from this kind of extended stress is debilitating as reflected in the number of end-of-season airshow accidents--a pilot decides to do four rolls instead of three and goes in. One begins to feel as tired on waking up as when going to bed, not to mention feeling dead tired all day. This condition is often referred to as "burn out" in many professions.

Only recently have researchers started to took at the possibility of physical causes for this phenomenon...and there is good reason to believe that it is primarily a reaction to the body's chemical response. Stress starts a chain reaction of defenses to cope with an emergency. Among the first to respond is the hypothalamus, which puts the body on alert. Its neighbor, the pituitary gland, flashes the message through the blood by secretng a stress hormone known as adrenocorticotropic hormone (ACTH), which contains an amino acid or peptide called endorphin.

These trophic hormones activate the adrenal glands on the kidneys, which convert fats and proteins into blood sugar for fuel to power the muscles and brain. The heart pumps faster, blood pressure rises, and the pupils of the eyes dilate to improve vision. The combined hormones relax the bronchial tubes for breathing, slow the digestive process, and shift blood chemistry to more easily clot open wounds. As the blood makes a complete circuit of the body every fifteen seconds these phenomena occur very rapidly and can abate almost as quickly.

So much for the emergency reaction which has saved many a life in a tight spot. But what about extended stress and the sophisticated skills involved in technical tasks undreamed of by our ancestors? Through the subconscious, practiced routine seems to be unaffected. The conscious seems to shut off. Why?

The same reason the zebra in Africa being eaten alive by a hyena appears to be in a trance without fear or pain. Within minutes after release, endorphin not only acts as an analgesic or pain killer, but apparently it becomes involved with the synoptic gap function of the brain. So what?

The reticular formation, a cluster of nerve cells at the base of the brain, acts as a gatekeeper to the brain. When stimulation to this batch of ganglia slackens, we sleep. Injury to this area causes a coma. Every second 100 million messages bombard the brain carrying input from the body's senses. A few hundred, at most, are permitted by this gate keeper above the brain stem to the conscious mind which heeds fewer still. As a result, concentration for the most part becomes limited to one sensation at a time. Without the reticular formation alerting action, the cerebral cortex could not sort important messages from the trivial.

Apparently extended stress allows endorphins to cross the blood brain barrier. A high concentration forms in the reticular formation blocking a great deal more information, particularly pain and fear, from the conscious mind. Since the subconscious is unaffected, a pilot can fly beautifully and still kill him or herself, suffering one or more of the symptoms listed previously. This may explain why during stress the incidence of errors of omission (failure to form an intention) by pilots increases over mistakes (error in the formation of an intention) and slips (error in the execution of an intention). If the proper information never gets to the cortex, the pilot is left with a blank slate with which to work .

Of course, stress-induced detachment is likely to be only one factor in pilot error, but it may just be the straw that finally breaks the camel's back by chemically blocking the very behavior needed to cope with the situation at hand.

Where does that leave us? We had better prepare for handling acute extended stress as we would any other physical problem related to flying. Strong competitive physical activity is an excellent method, but few of us can run a race or go skiing just before we fly. There are other methods of "preburning" stress. One military aerobatic team used to sit down to a spirited card game under the wing of one of its aircraft just before each performance. I once flew an aerobatic show before an air race several years ago and made one of my most difficult takeoffs in the face of wake turbulence with very little stress reaction. I had burned it all out.

The worst situation is a canceled show and then being told to fly after all. The body chemicals are all pumped up and out of control with no way to burn them off. In my opinion, these are good grounds for refusing to fly. This happens with aborted alert scrambles in the military. By the time the pilot applies afterburners on the runway the scramble is called off, and the pilot often has great difficulty taxiing back to the ramp. He/she should not fly for some time afterwards. Test pilots often have an unwritten code that they will not declare an emergency regardless of how bad things get. We much prefer the cool of Chuck Yeager. Why? The saying, "Old age and treachery will overcome youth and skill" takes on a new meaning if you believe that the old cool head pilot may still be thinking enough to be treacherous. Unless one pre-decides to bail out, regardless of how much skill one thinks one has, the pilot will most likely go in with the aircraft.

Personality type is a factor as well. The confident, independent leader type with a large ego usually does well under stress, whether male or female.

The only effective way to deal with this complex problem is going to be pilot education which hopefully will lead to self-monitoring. It is very possible that we can teach stress recognition just as we teach pilots to recognize their responses to hypoxia which has similar self-masking characteristics. And like hypoxia, the more one is under the effects of stress, the less he recognizes it--insidious to say the least.

The major problem in getting such a program to work may be the pilot's lack of willingness to come out and say, "I don't feel good, so I won't fly." There is another unwritten code among pilots, particularly in the military, that it is somehow dishonorable to back out of flying once committed...similar to the senseless dictum that it reflects poorly on a pilot's ability if he has to initiate a go around on landing.

Part of the mystery--part of what is killing us--may not be only what we are as psychological organisms, but who we are as pilots. The U.S. Naval Health Research Center in San Diego completed a study designed to predict the personality trait most likely to be associated with carrier landing accidents. Surprisingly, these researchers came up with an adventuresome syndrome. Conducted during a combat cruise, the study found that a measure of attitude toward risk-taking was not just the best, but the only variable that successfully predicted accident involvement among 156 carrier pilots.

Using the same instrument, a team of behavioral scientists at the Army Aeromedical Research Laboratory at Fort Rucker were able to correctly classify 86% of the pilots with respect to whether they had been previously listed as a cause in an aviation mishap.

Similar qualitative findings on pilot tendencies had been reported earlier by the U.S. Naval Safety Center in Norfolk. "This person is adventurous, impulsive, and hard on himself; when personal changes accumulate, he continues to fly to the limits of his personal envelope, which is often demanding because he is a high achiever. Eventually a mistake is make, and a mishap results.

Ironically, the very personality type that deals best with stress and makes the best pilot may also be the one who causes himself the most problem! This brings us full circle--back to ourselves. All of us who fly have large egos, otherwise we wouldn't bother excelling at our craft. Now we must check those egos and begin a program of prevention and self monitoring.

We can start by being aware of the conditions likely to cause the acute extended stress reaction:

1) Personal recognition that participation is dangerous, performance must be correct the first time, and the consequences of failure being pain and death.

2) A period of anticipation.

3) No opportunity for recent practice. Then monitor the 11 symptoms listed. Before landing and after performing, I do a slow pass to demonstrate wake turbulence with my smoke generators, but this is actually a "cool down" maneuver for my body and mind. I find that my landings are much better, and that I am far more in control of the situation than trying to land straight out of a demanding maneuver.

Certainly this discussion is only scratching the surface of a very complex problem. It demands extensive research and professional attention, but we can start the ball rolling by recognizing it now for what it is. The increasingly stressful situations pilots are placed in with their complex built-in human responses cannot be offset by present forms of training. Nor are we likely to enjoy the perfectly designed flight system in the foreseeable future. Can it be that some errors of commission (doing something dumb) may actually be errors of omission (failure to do something smart)?

In the future many pilot errors may be proven to have an organic basis in stress-generated chemicals, endorphins and enkephalins, that have a counterproductive effect on our abilities. If so, the sooner we move toward a clearer description of the problem, the sooner we can take steps to solve it.

Ironically, both Mr. Sanders and Mr. Ethell were killed in aircraft accidents which have been attributed by the NTSB to "pilot error." This article was reprinted from the January 1999 NATA Skylines *with the hope from the publishers and the Sanders and Ethell families that this information will prevent other pilots from ending their lives too soon. --Editor*


Corrosion, The Insidious Foe

Pictured above, bacteria damage on an aircraft part.

The following article is based on a slide presentation on aircraft corrosion. The accompanying photos were taken in Hawaii and show examples of corrosion on interior and exterior aircraft surfaces. Hopefully this article will make pilots owning or renting aircraft more aware of this problem and give them a better idea of what to look for during their preflight inspection. —Editor

Corrosion is a natural phenomenon which, in its most common form, uses an electrolyte to convert the refined metal into a stable metallic compound such as an oxide, hydroxide, or sulfate. The rate at which metals corrode depends greatly on the environment they are exposed to, and the amount of preventive maintenance they receive. Metals that are exposed to marine atmospheres, moisture, tropical temperatures, and industrial chemical atmospheres have the greatest rate of corrosion. Obviously, corrosion is a serious problem for aircraft in most parts of the world.

The amount and rate of corrosion is a function of the type and frequency of preventive maintenance they receive. Stopping the corrosion progress and preventing any new corrosion cells from forming is a constant battle. The following information will help airmen become aware of what to look for when performing an aircraft inspection.

There are ten forms of aircraft corrosion:

1. **Oxidation.** The uniform oxidation of metal surfaces is the most common form of corrosion. Also called "dry" corrosion, it is formed when a metal is exposed to a gas containing oxygen. On a polished surface, this type of corrosion is first seen as a general dulling of the surface. This surface corrosion actually provides a semi-protective coating of the metal below.

2. **Uniform Surface Corrosion.** Uniform surface corrosion results from the direct chemical attack on a metal surface and involves only the metal surface. The most common element in this type of corrosion is atmospheric pollution and is generally observed on all surfaces of the aircraft.

3. **Pitting Corrosion.** A common form of corrosion on aluminum and magnesium alloys is pitting corrosion. It is first noticeable as a white or gray powdery deposit, similar to dust, which blotches the surface. When the deposit is cleaned away, tiny pits or holes can be seen in the surface.

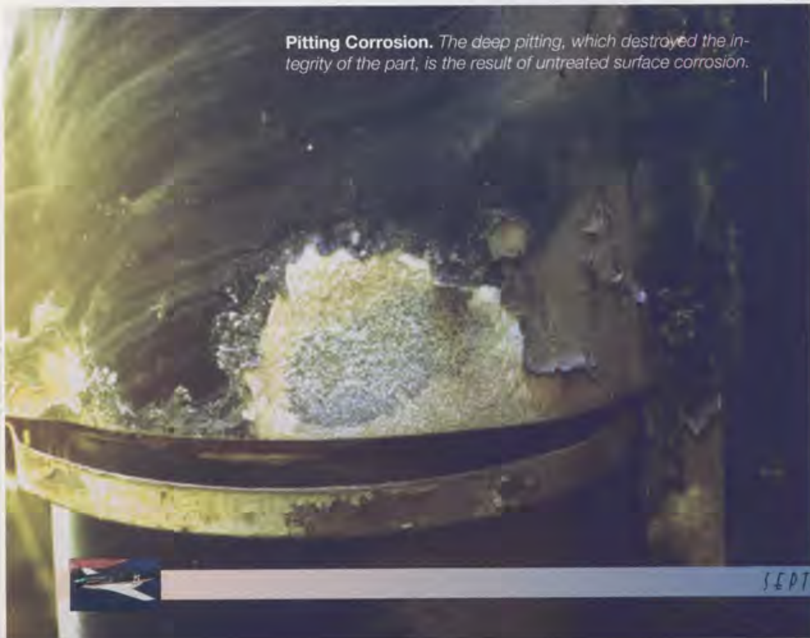
   The corrosion byproducts of aluminum and magnesium are loose, porous, and readily absorb moisture. Over a period of time the metal surface will become rough, pitted and eventually have to be replaced unless it receives a protective coating. The deep pitting will destroy the integrity of the part. To be effective, this coating must remove any moisture present in the corrosion byproduct as well as sealing the surface against further contact with the atmosphere.

4. **Galvanic Corrosion.** Galvanic corrosion occurs when two dissimilar metals make electrical contact in the presence of an electrolyte. The most active metals (those which tend to lose their electrons easily), such as magnesium and aluminum, corrode easily.

5. **Crevice Corrosion.** Crevice corrosion is the corrosion of metals in the metal-to-metal joint. The presence of even minute spaces between metal components provides an ideal location for the intrusion of an electrolyte. There are three types of crevice corrosion:
   - Metal Ion Concentration Cells - The electrolyte usually consists of water and ions of the metal in contact with the water. A high concentration of metal ions will normally exist under faying (tightly joined) surfaces where the solution is stagnant, and a low concentration of the metal ions will exist adjacent to the crevice created by the faying surfaces. The area of the metal in contact with the low concentration of metal ions will be anodic and corrode. The area in contact with the high concentration of metal ions will be cathodic and not show signs of corrosion.
   - Oxygen Concentration Cells - The solution in contact with the metal surface will normally contain dissolved oxygen. An oxygen cell can develop at any point where the oxygen in the air is not allowed to diffuse into the solution, thereby creating a difference in oxygen concentration between two points. Corrosion will occur in the area of low oxygen concentration. Alloys, such as stainless steel, are particularly susceptible to this type of crevice corrosion.
   - Active/Passive Cells - Metals, such as stainless steel which depend on a tightly adhering, passive film for corrosion protection (usually an oxide), are prone to rapid corrosion attack by active/passive cells. The corrosive action usually starts as an oxygen concentration cell. The passive film will be broken by the presence of dirt or other foreign substance deposited on the surface. Once the passive film is broken, the active metal beneath the dirt will be exposed to attack. An electrical potential will develop between the large area of the cathode, which is the passive film, and the small area of active metal, which is the anode. The result is rapid pitting of the active metal.

6. **Intergranular Corrosion.** Most alloys are made up entirely of small crystalline regions, called grains. Intergranular corrosion is an attack along the boundaries of these grains. The grain boundaries differ, from a chemical point of view, from the metal within the grain center. The grain boundary and the grain center can react with each other as anode and cathode when they are in contact with an electrolyte.

7. **Exfoliation Corrosion.** Exfoliation is an advanced form of intergranular corrosion where the surface grains of metal are lifted up by the force of expanding corrosion byproducts beneath. This lifting or swelling is visible evidence of exfoliation corrosion.



Pitting Corrosion. *The deep pitting, which destroyed the integrity of the part, is the result of untreated surface corrosion.*

Intergranular corrosion has caused the skin section to expand to the point where one of the rivets has actually become separated from its head.

8. **Filiform Corrosion.** Filiform corrosion is a special form of oxygen concentration cell corrosion that occurs on metal surfaces which have been coated with polyurethanes. The problem is that the paint is so thick with pigments and resins that the surface of the metal cannot breathe. This means that if there was any moisture there to begin with, it will stay there and grow as filiform corrosion. Filiform corrosion may also start at breaks in the coating system.

9. **Stress Corrosion.** The rate at which corrosion proceeds may be accelerated by a number of mechanical factors. Stress on aircraft parts may be residual within the part as a result of externally applied cyclic loading or as a result of the production process. Corrosion fatigue is caused by the combined effects of cyclic stress and corrosion. No metal is immune to some reduction in its resistance to cyclic stressing if the metal is in a corrosive environment. Fracture of a metal part due to fatigue corrosion generally occurs at a stress level far below the fatigue limit. The amount of external corrosion is a poor indicator of the strength of the part. For this reason, corrosion protection of all parts subject to alternating stresses is particularly important, even in environments which are only mildly corrosive.

   Fretting is another mechanical factor which contributes to the speed of destruction. Damage can occur at the interface of two highly loaded surfaces which are not designed to move against each other. The most common type of fretting corrosion is caused by vibration. The protective film on the metal surfaces is removed by the rubbing action and exposes fresh, active metal to the corrosive action of the atmosphere.

10. **Micro-Organism Corrosion.** Microbial attacks on metallic surfaces include the actions of bacteria, fungi, and molds. Micro-organisms occur nearly everywhere. Those organisms causing the greatest corrosion problems are bacteria and fungi.

- Aerobic bacteria accelerate corrosion by oxidizing sulfur to produce sulfuric acid. The metabolism of an aerobic bacteria requires them to obtain part of their sustenance by oxidizing inorganic compounds such as iron, sulfur, hydrogen, and carbon monoxide. The resultant chemical reactions cause corrosion.
- Fungi are growths of micro-organisms that feed on organic materials. Ideal growth conditions for most fungi are temperatures between 68 and 104°F, and a relative humidity between 85 and 100%. Damage from these organisms can occur in three ways. First, fungi are damp and hold moisture against metal surfaces. Two, because they are living organisms, they may obtain their food from elements in the metal. Third, they secrete corrosive fluids that attack the metal surface.

Conclusions

Corrosion is a constant threat to the integrity of the aircraft. Corrosion is expensive and compromises safety. Corrosion prevention is cost effective. As we have seen, when moisture is present for prolonged periods of time, corrosion cells are formed. These cells act as miniature batteries, feeding the transfer of electrons as long as the oxygen-providing moisture is present. If you can isolate the moisture from the metal surface, the process stops. Preventive corrosion control should be a serious part of your maintenance program.

This article is based on a slide presentation by the Pacific Corrosion Control Corporation.

DID MONROE MAKE HISTORY AGAIN?

Story and photos by H. Dean Chamberlain

Pictured above are many of the people who made this event possible. They include Northeast Louisiana University's administration, faculty members of its Department of Aviation, FAA aviation safety inspectors, and their management team from the Baton Rouge Flight Standards District Office.

Was history made again? I don't know. Sometimes you don't know if you are watching history being made until after the history books are written. But one thing is certain, an event occurred in Monroe, Louisiana last December that just might be in the history books someday. So why are we only talking about it now. It is a matter of timing. As students prepare to start a new year of advanced education, for those students still looking for a demanding career in aviation, they should think about Monroe.

What? You have never heard of Monroe, Louisiana? Then you need to check your aviation history books. Since we are talking about the possibility of another history making event, for those who have not heard of Monroe, it has a long and famous aviation legacy. If you are still shaking your head about Monroe, it was the home of one of the nation's first operators in what was then the fledgling aerial application industry, more commonly known (incorrectly) today as crop dusting. That Monroe applicator was eventually bought out by an employee who later formed a company with the word "Delta" in its name. According to a newspaper article and other documents on display in the Monroe airport terminal, the name "Delta" had something to do about the company being in the Mississippi River "delta" area.

Today, that small Monroe, Louisiana company formed in 1928 is better known around the world as Delta Airlines.

Delta is now a global company that can proudly trace its founding back to a small Louisiana crop dusting company, which leads us back to the purpose of this article. Just as a global airline grew from a small crop dusting company, today's sophisticated aerial application industry grew from what was once a simple business of crop "dusting." Gone are the days when a pilot using a relatively simple aircraft "dusted" a crop with a dry chemical or sprayed it with a liquid chemical. Although the term "crop dusting" may still apply to one method of aerial application, today, the technically correct term is "aerial application".

The need to use the correct term is more than a grammatical exercise. The reason is in today's environmentally sensitive agricultural business environment, aerial application has become both an art form and a high tech science. The art is in the skill of the pilots flying the aircraft. The science is in the precise GPS tracking of the aircraft, the precise control of the application systems on the aircraft, the required chemical knowledge of the applicator and pilot, the operating limitations of both the aircraft and chemical products used, knowledge of the EPA requirements, and the need for accuracy in delivering products and chemicals by air in today's litigious society.

As a result, today, the aerial application business has gone off to college and more courses are being added to those already approved. In Louisiana, that day was December 16, 1998, when the Federal Aviation Administration's Baton Rouge Flight Standards Service's District Office (FSDO) Manager, Sheryl Hammans, presented a FAR Part 141 Flight School Certificate to Northeast Louisiana University (NLU) in Monroe for its special FAR Part 137 Agriculture Aviation course.

What may make this presentation something for the history books is that it was a first for Louisiana and the Baton Rouge FSDO and maybe one of only two or three others in the nation. In addition to being the only FAA-approved agricultural (ag) flight training program at the university level in Louisiana, the course will soon have, when it is completed by its manufacturer, the only flight simulator designed exclusively for aerial application training. Combine the flight simulator with the current three, dual-equipped aircraft dedicated to the NLU's ag course, ,and the oversight provided by the FAA as it monitors NLU's compliance with its new FAR Part 141 certificate and you have a history making course. This course enables pilots and students interested in a career in the aerial application industry an opportunity to learn about the business in a controlled situation where safety and training are equally important.

When asked about some of the many benefits of NLU's new FAR Part 141 course, the Baton Rouge FSDO Manager Sheryl Hammans said, "I see the program benefitting the whole FAA. It is a good example of Vice President Gore's Reinventing Government goal of reducing aviation accidents by 80 percent. If you look at the charts showing where the accidents are occurring, ag ops is the second largest accident group behind FAR Part 91 operations. We in the FAA can't just focus on the air carrier accidents; we have to also focus on other areas where the accidents are happening. With the specialized training provided by this course, instead of people just going out and learning on their own what it is like flying a heavily loaded ag aircraft close to the ground and it operating differently each time they drop part of the load and then loading it up again and doing it again, this course gives them a chance to learn in a controlled environment. Plus it gives them a lot better education from people who have been doing ag work for years, and who can tell and show the students what to expect. This way the students can be safely trained not to get themselves into a dangerous situation. I see this course as a great way to help reduce the ag accident rate and the accident rate overall."

According to Mary Donahue, one of the two primary FAA Aviation Safety Inspectors who worked on NLU's certification approval process, "This school is only one of a few in the world that is available for students interested in becoming an ag operator. It use to be referred to in the industry as crop dusting, but over the years since people have been using aircraft to disperse chemicals, it has become a sophisticated industry. One in which training is necessary to meet the regulations imposed by both FAA and the state in dispersing essentially what are hazardous chemicals. What we are trying to do is provide quality training for ag operators as a way to make the industry safer. Unfortunately, this is an industry that is prone to accidents, so we want to help the industry become safer through structured training and education. This course provides training in such topics as flying low to the ground with high payloads, working out of short fields, how to fly under and over wires bordering fields, and surviving long, hot work days."

Two of the aircraft used in the training program are a Turbo Thrush Commander (left) and a specially modified for instructional use two-place Grumman Ag Cat (above).

"We want to help operators become better neighbors with their local communities. As the rural areas become more developed with people moving in who don't understand what the ag operator is trying to do, we feel education is the key to not only making ag operators safer, but also more aware of all of the environmental issues involved in ag ops," she said.

Contrast this organized and structured training to that of how most aerial applicators have been trained historically. If the prospective ag pilots were fortunate enough to find someone willing to hire them or if they had enough money to buy their own aircraft, they then started the engine and learned the business by the seat of their pants with no or little formal training.

The reason is most agriculture (ag) aircraft are single pilot aircraft where the pilot's first experience in the aircraft was on takeoff. As a couple of experienced ag pilots said at the certificate presentation in Monroe, if you were lucky the owner would talk you through your first couple of runs across a field by radio before you were expected to start working. The training was minimal and the risks were high. If you survived your initial job or two and you didn't quit, the old timers said it would then take an average pilot two to three growing seasons to become proficient.

According to Mr. Robert McCurdy, the NLU course's chief pilot, "An ag pilot has to be able to instinctively fly the aircraft. They don't have time at five feet off the ground to think about how to fly the aircraft. They have to become one with the aircraft." That is why he said it takes a couple of seasons to become really proficient.

Now let's fast forward from the 1940's, 1950's, and 1960's to Monroe on December 16, 1998. Gone are many of the Piper *Cubs* and the surplus World War II military trainers used in past years. Although probably still used in certain areas of the country, these aircraft types are no longer truly efficient. Gone, or soon going, are the days of the crop duster being an "aviation cowboy." Like their Western counterpart, technology and progress are changing the face of both their respective industries. As we all look to the next millennium, so must the aerial application industry.

Today, an ag aircraft may cost more than a million dollars. It may be turbine powered. It may be air conditioned. Its differential GPS system can easily add another $30,000 to the cost of the aircraft and bring flight and ground track tolerances down to within three feet along a specified flight path. Then you add in insurance, the increased environmental and training costs associated with handling hazardous materials and chemicals, the requirements of the Environmental Protection Agency (EPA), and the tremendous growth of housing developments around what were once isolated agricultural areas that restrict the overspraying of areas near the fields; and you begin to understand that what was once a somewhat unregulated crop dusting industry has become the very complex and sophisticated aerial application industry of today. An industry that now uses state of the art ag aircraft designed only for the business of safely applying aerial applicator products on crops and other types of vegetation.

An industry where safety has become more critical with each passing year. Today, an ag pilot has to know more than just how to fly. Today, that

Key members of the certification team included FAA Airworthiness Aviation Safety Inspector Bob Gillaspie (left); the FAA's Baton Rouge Flight Standards District Office manager Sheryl A. Hammans; FAA Operations Aviation Safety Inspector Mary E. Donahue; and the head of the Northeast Louisiana University Department of Aviation John H. Filhiol.

pilot must also be part chemist, part plant expert, part businessperson, and full-time expert in how to safely apply a needed chemical, agent, or product in and over a given area while keeping that chemical, agent or product out of adjacent areas that may include homes, swimming pools, other types of crops, and important water ways.

So how does someone prepare for such a challenging career? Many still work their way into the industry the traditional way. They fly in some segment of aviation until they can meet an operator's minimum flight hour requirement. Then they hope to get a job offer. Some come out of the military. Some may be the second or third generation flying an ag plane. But like other industries that involve long hours, hard work, and a certain amount of risk, the aerial application industry is losing its older pilots to retirement and other endeavors. Today, the average age of an ag pilot is about 48. At some point, these older pilots must be replaced by well-qualified younger pilots. But as one ag pilot said at Monroe, ag flying is like the old *Catch-22* syndrome. You need experience to get a job, but without a job, where are you going to get the experience you need to get the job.

One way is by attending the ag training course at NLU in Monroe. According to NLU Aviation Department Head John Filhiol, one of the reasons the university applied for the FAA certificate was because, since the school was providing quality instruction to its students, it wanted the FAA's stamp of approval on its training. "We want people to recognize the quality education we are giving our students," he said.

According to Filhiol, several years ago the National Agricultural Aviation Association (NAAA) developed a program called the Professional Aerial Applicators Support System (PAASS) to raise the professional standards of the aerial application industry and to reduce the accident rate within the industry. "Since there has never been really any place for anyone to get that kind of instruction in ag ops, our FAA approved syllabus is providing a way for people to get that kind of training."

"We are providing that training now. We are going along with NAAA to raise the standards, raise the professionalism, cut down on the accident rate, and cut down on the drift problem. Spray drift is a big problem within the industry as is the accident rate," he said.

In addition, the new FAA Part 141 Certificate allows NLU to provide a special training course that consists of 15 hours of dual instruction in an *Ag Cat* aircraft and 25 hours of ground instruction. The ground instruction will also prepare the student to take the Louisiana Commercial Pesticide Applicators licensing examination. The course requires a student to have a commercial pilot certificate and a minimum of 50 hours of tailwheel time. For those commercial pilots without the required 50 hours of tailwheel time, a 115 horsepowered *Citabria* tailwheel aircraft is available for them to rent to build the required flight hours.

This new FAA approved training course can be taken as part of NLU's degree program or as additional training for someone interesting in gaining some dual instruction in a high performance ag aircraft. As the university said in one of its' student response letters, "Our goal is to produce a safety-minded, well-qualified pilot, who understands the aerial application business, as well as the airplane, its systems, and the principles that an aerial applicator must live by if he is to be successful in this rewarding career."

Filhiol pointed out that although NLU's ag courses train its students for a career in ag ops, like many segments of aviation, some ag operators may require newly hired NLU graduates to pay their "industry dues" by working as loaders or doing some of the other "grunt" work in the field before getting to fly. Like other degree programs, NLU's ag courses provide the basic skills and knowledge needed for a career in the industry and for meeting state licenseing etc., then it is up to the graduates to make their own way within the industry based upon hard work and perseverance.

For those students and pilots interested in a career in aviation or in updating their aviation skills, now is the time. As we said, timing is everything.

Editor's Note: For more information about the Northeast Louisiana University's Agricultural Aviation Program, interested readers can contact Mr. John Filhiol, Aviation Department Head, Northeast Louisiana University, Monroe, LA 71209. His telephone number is (318) 342-1780.

Know Your 5 Critical Numbers

You're Far More Liable to Die from Dangerous Cholesterol Levels Than Dangerous Airspeeds

By Glenn R. Stoutt, Jr., M.D

Pilots know all the critical airspeed numbers for their aircraft; but, unfortunately, most of them do not know the few (only five) critical numbers for blood fats (lipids). Cholesterol is the one most people hear about. But you are far more liable to die from dangerous cholesterol levels than dangerous airspeeds. Here is all you need to know about blood lipids:

Cholesterol is a substance found in foods of animal origin, such as beef, lamb, cheese, eggs, poultry, and dairy products. Everyone has and needs cholesterol for such things as building cells, making hormones, and making vitamin D. Young children especially need it for development of the nervous system.

Problems begin only when the level of cholesterol becomes too high. Cholesterol — in the form of the "bad" low density lipoprotein cholesterol or LDL — can become deposited in the walls of arteries, narrowing them — "clogged arteries"— and reducing or even shutting off the blood supply to vital organs and tissues. Think of it as "rusting your pipes." If the artery is one of the coronary (heart) arteries, insufficient blood supply to the heart muscle may result in a heart attack.

Elevations in cholesterol are directly related to the risk of having a heart attack. Good news: For every 1% that high levels of cholesterol are reduced, your risk of heart disease is lowered by 2%.

HDL (high-density lipoprotein) cholesterol is called the "good" cholesterol because it acts as a scavenger and removes the bad cholesterol from the blood. Think of it as a "Pac Man" if you are old enough to remember this computer game where the Pac Man gobbled up his victims.

Really, all you need to do initially is to get your total cholesterol (TC), HDL cholesterol, and triglycerides measured. The LDL is then calculated from these numbers. Triglycerides are the chemical form in which most fats exist in food as well as in the body. High levels are associated with heart disease.

The American Heart Association would like everyone ideally to have a total cholesterol of about 160 mg/dl and an HDL of over 35 mg/dl (mg/dl means milligrams per deciliter). The higher the HDL the better. I would like to see it over 50. A high HDL is great news.

Here are the important numbers you should know:

Total Blood Cholesterol

- Less than 200 mg/dl = desirable blood cholesterol
- 200-239 mg/dl = borderline-high blood cholesterol
- 240 mg/dl or more = high blood cholesterol

Triglycerides

- Under 200 mg/dl

LDL cholesterol

- Under 130 mg/dl

HDL cholesterol

- Over 35 mg/dl

Total cholesterol to HDL cholesterol ratio

- Not over 5 to 1; ideally, 3.5 to 1

Your body gets cholesterol in one of two ways: in your diet or from cholesterol manufactured by your liver. Your liver makes about 80% of your cholesterol and heredity plays a big role in how much it produces and how much is removed from your bloodstream. Even if you eat no cholesterol or saturated fat, your liver will still make as much cholesterol as your body needs, often way too much if you are genetically predisposed.

Dietary cholesterol (eggs, liver, shrimp) plays a significant part, but dietary fat (especially saturated fat) is the bigger culprit. (Fortunately, there is no cholesterol in plant foods like fruits, vegetables, and cereals.) Saturated fat is the "building block" of cholesterol. If you want to look at saturated fat, just look at the marbling on red meat.

The American Heart Association recommends a maximum of 30%of our daily calories from fat. I would like to see it at about 20%. Dietary fat comes in three varieties--limit each to a maximum of 10% of your diet.

Saturated fat: Mostly from animal sources such as meats (lamb, pork, beef) and dairy foods such as cheese, whole milk, and ice cream. A few vegetable products (coconut oil, palm oil, palm kernel oil, and vegetable shortening) are high in saturated fats. All are bad news for your arteries.

Polyunsaturated fat: Cold-water fish oils (tuna, cod, halibut) and vegetable oils such as safflower, corn, sunflower seed, and soybean. Much better for you, and will actually lower your cholesterol, but will still put on the pounds.

Monounsaturated fats: Olive oil and peanut oil are good examples. Olive oil (plus a modest amount of red wine) may be a reason the Mediterranean people have fewer heart attacks. Monounsaturates are the best of all the dietary fats.

What about trans fats? Newspaper and magazine articles have been inundating us with information about these "bad" fats. Essentially, they are polyunsaturated fats that have been artificially hydrogenated by food manufacturers and processors. This "hardening" also makes them almost as bad for us as saturated fats. Essentially, these hardened fats harden your arteries.

These trans fats were designed for two purposes. The first is that they extend the shelf life of the products by reducing oxidative spoilage. But, the main reason is that they make the product firm. This is desirable for stick margarine, cookies, doughnuts, pastries, and dessert buns. Right up there with the hot dog as nutritional poison is the glazed doughnut (a favorite with pilots and police officers)--loaded with trans fat. This doughnut comes out of the oven dripping oil and is so floppy it has to be eaten with two hands. But when it cools to room temperature, it is firm and dry.

Stick margarine is almost as bad as butter. Soft (tub) margarine--used sparingly--is a better choice. Best of all is no-fat margarine. Unfortunately, about five to ten percent of our processed foods, mostly bakery goods, contain these trans fats, and the labels at this date do not tell you this.

With diet and exercise you can reduce your cholesterol level at least by 20%, not much more because of the large amount of cholesterol the liver is genetically programmed to make.

If you cannot get your cholesterol below 240, medication may be indicated, and it is usually effective. Try to get maximum results from diet and regular, vigorous exercise before seeking medication. Remember also that soluble fiber, especially oat bran, reduces the absorption of cholesterol. A researcher at the University of Kentucky thinks that several helpings of oatmeal a day may be almost as good as medication to reduce your cholesterol. (Even if he's wrong, oatmeal is good for you.)

Conclusion: Get a lipid profile. Know what the numbers mean, and if any are out of line consult your physician. In any case, exercise, a low fat diet, and maintaining ideal body weight may not only be life prolonging but lifesaving. (Keep checking your airspeed numbers too.)

Yours for good health and safe flying.

Dr. Glenn R. Stoutt, Jr., is a partner is the Springs Pediatrics and Aviation Medicine clinic, Louisville, Ky., and has been an active AME for 37 years. No longer an active pilot, he once held a commercial pilot's license with instrument, multiengine, and CFI ratings.

Note: The views and recommendations made in this article are those of the author and not necessarily those of the Federal Aviation Administration. This article originally appeared in The Federal Air Surgeon's Medical Bulletin. *Winter 1998*

Factoids

• Only 0.7% of all airmen are denied certification. This is reduced to 0.1% when airmen follow up and provide the requested information. Far better than the figures for life-insurance applicants.

• We need about 25-30 grams of fiber a day. For example, one serving of All-Bran Extra Fiber provides half of your daily needs. All-Bran tastes like shredded cardboard, so add another flavored cereal or some fruit to mask the taste. Alternate with oatmeal for breakfast. Go slowly when adding fiber to your diet. Add a few grams a day to your diet to avoid bloating and intestinal gas.

• About 70% of health problems are caused by faulty lifestyle-- smoking, obesity, drug and alcohol abuse, fatty-salty-sugary diet, and lack of exercise being prime examples.

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Airworthiness: *How do you know if you have it?*

by J.C. Boylls, MCFI

Psssst. Hey, Chief (and you CFI's)! Ya wanna know how to drive pilot examiners and FAA inspectors insane, ruin your school's reputation, and, if you're at a Part 141 school, lose its FAA approval at the same time? Here's the secret: when you send applicants to take their practical tests, pay no attention to anything, except the skills needed to "fly the airplane" and their related knowledge areas.

In the past couple of weeks I've given around 10 practical tests, and three of them ended as failures during the preflight (or, more to the point, the Preflight Actions area of operation in the Practical Test Standards)! Why did these applicants fail? They didn't know what paperwork an aircraft needs to be airworthy. They didn't know what paperwork a pilot must carry to fly legally. And they missed many of the required items in the Preflight Actions area of operation. A 33 percent failure rate is an amazing (if not dismaying) statistic, so let's look at this just a bit. The following may be a bit bureaucratic, but that's part of the world we fly in, and if we want to fly--we must deal with it.

Airplane Airworthiness

My "boss" at the San Diego FSDO indicates that I have to see at least six items in the airplane maintenance records before I can go fly on a practical test. Each one relates to a different regulation and goes a long way toward determining whether an airplane is legally airworthy. Guess who's responsible for the aircraft's airworthiness? Here's a hint--it's not the examiner or the FAA inspector!

FAR § 91.403(a) says, "The owner [the person named on the aircraft's registration document] or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition..." FAR § 91.405(a) requires the aircraft's owner or operator to "have that aircraft inspected...and between required inspections,... have discrepancies repaired...; [and] (b) Shall ensure that maintenance personnel make appropriate entries in the aircraft maintenance records indicating [the work done and that] the aircraft has been approved for return to service...."

Some might argue that the regulations say that the person or business that owns the aircraft is responsible for ensuring its airworthiness. This is not the case. An owner or operator is responsible for maintaining an aircraft in an airworthy condition, and making sure the maintenance records are correct. But, ultimately, the pilot in command is responsible for ensuring that the aircraft is in an airworthy condition.

If you doubt this, read FAR § 91.7, "Civil Aircraft Airworthiness." It says, "(a) No person may operate a civil aircraft unless it is in an airworthy condition." In other words, before a person can fly an aircraft, he or she must ensure that it's airworthy. Who's that person? FAR § 91.3 says it is the pilot in command, because that person is "directly responsible for ... the operation of that aircraft."

During a practical test, FAR § 61.47(b) says the applicant is the pilot in command.

Finally, an item applicants must address during a practical test for most certificates and ratings is PTS "Area of Operation I — Task A, Certificates and Documents." During the applicant's demonstration of the knowledge this task requires, he or she must show me two things: first, an understanding of what makes an airplane airworthy and, second, that we actually have an airworthy airplane to fly. Applicants must show me an airworthy airplane or we don't get very far in the oral portion of the test. What a concept!

What makes an airplane airworthy? This is a big question for everyone, be they renters, owners, partners in ownership, flight school owners, flying club members, practical test applicants--you name it.

In addition to the AROW documents--Airworthiness certificate, Registration, Operating limitations (contained in an aircraft flight manual, on placards, etc.), and Weight and balance data--my FSDO guidance says the applicant must show me six things in the aircraft's maintenance records.

1. Aircraft annual inspection [FAR § 91.409(a)(1)]
2. ELT battery date [FAR § 91.207(c)]
3. ELT annual inspection [FAR § 91.207(d)]
4. Transponder test within 24 months [FAR § 91.413]
5. Altimeter/Mode C test within 24

months [FAR § 91.411] (if the airplane is flown IFR; if it's a VFR-only airplane, then a correlation test [FAR § 91.217] between the Mode C and the altimeter must have been done at some point, with no maintenance on that system done in between times)

6. Some record of compliance with all applicable Airworthiness Directives. Usually, this is a list showing all AD's that apply to the aircraft type, which AD's apply to that particular airframe, engine, propeller, or appliance (by serial number), whether it is a "one-time" or a "recurring" AD, the date, how it was complied with, and an authorized person's real signature.

Because I'm not a flight school's employee, the test aircraft probably doesn't require a 100-hour inspection. Aircraft rental by itself isn't "for hire," and applicants bring the airplane to me for the test. However, the aircraft may have a recurring AD that requires compliance every 100 hours, so although the 100-hour inspection may be unnecessary, AD compliance may be.

After reviewing the items above it's time for some questions. "Are there any open maintenance discrepancies on the aircraft?" and "Is there any inoperative equipment?"

For open (or deferred) maintenance items, the pilot in command makes the decision about whether the machine is safe to fly--in consultation with a maintenance technician, I hope. As the PIC your student makes the decision, but as the examiner, I'd better agree with it. One thing I look at on the test (this is a test, remember?) is your student's judgement and that he or she conducts safe operations.

Inoperative Equipment

Now, what about that inoperative equipment? This'll be a subject for a whole article by itself, but since this is part of the test ...

Assume we're going for a Part 91, Day-VFR flight. During the preflight, your student discovers that the nav lights don't work. Is it OK to take off? Considering the regs, it should be no surprise that the answer is--maybe. To decide if we can legally fly this airplane, the student must answer several questions.

First, does the airplane have a Minimum Equipment List (MEL)? If it does, then he must use it; if it allows the pilot to fly the airplane Day-VFR with inoperative nav lights, that's great! But is your student authorized to use that MEL? If the MEL was issued as strictly a Part 91 operation, then there is no specific authorization required. But the student must be familiar with the MEL and know how to use it. If the MEL was issued as part of a Part 135 or 121 operation, then the student must have completed the applicable MEL training program to use it. If the student has not completed the training, then he or she cannot fly the airplane. Remember, if the student is not authorized to use the 135 or 121 MEL, then the "relief" provisions of FAR § 91.213(d) do not apply, and everything must work. (Isn't this fun?)

If the airplane doesn't have an MEL, your student must go to FAR § 91.213(d). For a Day-VFR flight, FAR § 91.205 does not require nav lights. But, before he can legally fly the airplane, he must do one more thing. The inoperative system must be "deactivated and placarded", and an "appropriately rated" person must make a maintenance log entry. Appendix A of FAR Part 43 lists the things a pilot may do, and deactivating and placarding a system isn't one of them. This means a maintenance technician must do it, even if it's something simple like pulling a circuit breaker. Besides, it's the technician's job, after all.

Now can your student fly? Almost. If the PIC decides he can make a safe flight with the inoperative system, he can fly. But he can't fly until he's completed each of the steps just discussed.

Want another example? (I know, not really, but you're getting one anyway!) Your student arrives for a practical test, and his airplane had its ELT removed for maintenance 95 days ago. The maintenance technician made the proper log entry and put a placard on the panel. FAR § 91.207(f)(10) permits an airplane to fly for 90 days with the ELT removed, and 91.207(f)(3) allows airplanes used for training to fly within a 50 nm radius of the departure airport with no ELT at all.

So, your student is good to go, right? Not exactly. Is a practical test a training flight? Uh, nooo. It's a testing flight, not a training flight, so FAR § 91.207(f)(3) doesn't apply. The airplane is five days past FAR § 91.207(f)(10)'s 90-day limit. The airplane must have a working ELT installed.

Bottom Line

Determining aircraft airworthiness is no trivial task, but it is up to the pilot in command to assess an aircraft's airworthiness before every flight. The regs require it, but, even more important, the PIC is going to be up in the air in the machine!

This is part of the practical test, too, and I find some CFI's do a really poor job of getting this information across to their students.

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CALENDAR OF EVENTS

September 16-19 Reno Air Races will be held at Reno/Stead Airport in Reno, NV. For more information,contact Reno Air Racing Association at (775) 972-6663, FAX (775) 972-6429, or internet <http://airrace.org>.

October 7-10 Copperstate EAA Regional Fly-In will be held at the Williams Gateway Airport (IWA) in Mesa, AZ. For more information, contact Gary Hays (602) 561-9481 for Warbird procedures and Jiff Tougas at (520) 398-9148 for ultralight procedures.

One of the beefy Goodyear Corsairs which dominated the post-war Cleveland Air Races. This one was owned and flown by Ben McKillen. (From Al Chute collection)

Cleveland Air Races

by Don Berliner

Mustachioed pilots strapped onto winged engines, roaring hell-for-leather around checkered pylons in search of gold and glory and immortality. That was the Cleveland Air Races of old; that started in 1929.

Gone is Roscoe Turner, who posed in his golden racer with a pet lion cub. Gone is Jimmy Doolittle, who tamed the ferocious GeeBee and then went on to buoy his country's sagging wartime spirits with a daring raid on Tokyo. Gone, too, are those whose airplanes or skills or luck was not quite strong enough to keep them from arriving at the finish line early.

In their places are sportsmen pilots, who know that fame is brief and the gold barely enough to pay for weekend expenses. Men and women who have as much courage as their predecessors, and perhaps even more skill, but who are not willing to place it all on the line for a brief fling. Speed is just as much a part of today's air racing as it was in 1929. But today it is accompanied by safety, for air racing is now a game, rather than an all-encompassing passion.

It's still played around an aerial race track with brightly colored pylons marking the turns. It's still a game played with the fastest airplanes that can be created within the framework of a set of rules. And while today's rules are far more restrictive than those of 1929, the modern racing plane is vastly more efficient than any of the glamorous craft which the old sentimentalists still wax poetic about.

In the early 1930's, Benny Howard shocked the racing world with his trim little racer, "Pete," which could hit 170 mph with an engine of just 326 cu. in. piston displacement. Today, it is almost routine for airplanes in the 200 cu. in. class to top 225 mph on shorter courses. Such has been the advance in aeronautical science.

A fair share of that advance came as a result--direct or indirect--of the pressure of racing competition at Cleveland. Pressure that would not be surpassed until airplanes went to war. There was competition between streamlined fixed landing gears and retractable landing gears of varying dependability. Competition between beefy radial, air-cooled engines and compact, liquid-cooled in-lines. And the constant battle to reduce drag by hiding more parts inside and carefully

fairing those that remained out in the breeze.

When the Cleveland Air Races began in 1929, it was a continuation of previous races and thus a glamorous field exercise for the flyers of the Army, Navy, and Marines. They had their own races with entries limited to identical airplanes or at least to all-alike engines. It was a chance to show the American public how some of their tax dollars were being spent, but it wasn't very good racing, for the individual was submerged in a sea of khaki and blue.

Then, in 1929, a young Doug Davis appeared on the scene with a slick red and black low-wing Travel Air Mystery racer. It had been designed for racing, and that was what it did, with élan. In the forerunner of the Thompson Trophy Race, Davis soundly whipped the best of the military entries and set off an explosion of enthusiasm for custom-built racing planes, whose echoes can still be heard.

From the Travel Air came a whole flurry of inspired designs from backyard engineers whose goal was speed where it counted. Around the pylons and down the long straight away in front of cheering thousands of Cleveland Airport. The healthy prize money helped, for this was the time of the Great Depression, and flying jobs were especially hard to find. But the real motivation was excellence. And if the breed was improved in the process, so much the better.

The proliferation of custom racers hit its peak in 1932 with the most exciting collections of speedsters ever seen. There were three near-identical Wedell-Williams Racers to be flown by Jimmy Wedell, Jimmy Haizlip and Roscoe Turner. They were pitted against the two new barrel-shaped GeeBee Super Sportsters, to be flown by Jimmy Doolittle and Lee Gehlbach. All had the most powerful Pratt Whitney Wasp engines, while the GeeBees obviously had made a greater sacrifice of handling-for-speed than had any racer yet seen.

In the Burbank-to-Cleveland Bendix Race, the Wedell-Williams pulled off a clean sweep with Haizlip winning at a record 245 mph. The GeeBees gained a good measure of revenge and a huge portion of fame in the Thompson Race when Doolittle left the field in his prop wash, winning with a 253 mph record that would stand for four dynamic years. More than that, he created a permanent symbol of speed, and several generations of youngsters would build models of the GeeBee in homage to the religious dedication of the Granville Brothers to the pursuit of more MPH.

A string of unfortunate accidents put the GeeBees out of action and helped create a myth of danger. In their place came Steve Wittman and his howling "Bonzo," Art Chester and his beautifully streamlined "Goon," and the flamboyant Roscoe Turner. With unsurpassed promotional skill, Turner was able to create a powerful racer he called the "Meteor," which had enough speed to overcome his unfortunate navigational lapses.

With power to burn, Turner became the symbol of the latter part of the 1930's at Cleveland. He won back-to-back Thompson Trophies in 1938 and 1939, setting records which would probably have been even higher had he been pushed harder. After taking the last of his great bronze awards, Roscoe retired with as much flair as he had raced.

Meanwhile, the Bendix Transcontinental Derby had been ruled by Frank Fuller, Jackie Cochran and their Seversky Racers. Designed with more than just racing in mind, the all-metal, low-wing craft eventually led to the Republic P-47 Thunderbolt of World War II fame. Prophetically, as Fuller was winning the final Bendix Race in 1939, Nazi troops were marching into defenseless Poland.

Racing planes were hidden away in dark hangars while their pilots and designers went off to war. A few of the pilots returned to the pylon chase at the end of hostilities, but not a single pre-war race plane ever again awaited the starter's flags. The advances in airframe design and engines were too great. The fastest of the old custom-built racers would have been no match for even the slowest of the new breed which were, in reality, surplus fighter planes left over from the air battles in Europe and the Pacific.

As the Cleveland Air Races resumed in 1946, there was not a single exception to the rules. Every airplane in every event had been military: Ex-fighters like the P-38 Lightning, P-51 Mustang, and P-63 Kingcobra...or ex-trainers like the AT-6 Texans flown in the women's race. Others weren't even "ex," as there were jet divisions of

Cook Cleland, two-time post-war winner of the Thompson Trophy Race, in the cockpit on one of his 3,000+ hp Goodyears F2G-1 Corsairs. (From Al Chute collection)

both the Bendix and Thompson Races, limited to active service pilots and airplanes.

To no one's surprise, records fell like leaves in autumn. Bendix winner Paul Mantz flew from Los Angeles to Cleveland in a souped-up P-51 at 436 mph. In the Thompson Race, test pilot "Tex" Johnston ripped around the 30-mile course in a modified Bell Airacobra at 374 mph. It was indeed a new eras.

It was speed, make no mistake. But it wasn't the kind of speed the crowd wanted, for the airplanes had all been built in factories and they looked too much alike. They weren't personal, they weren't individual, and they weren't racers. There were entirely too many yawns in the crowded grandstands to please the management, so a desperate hunt for a solution was begun with the help of the Professional Race Pilots Association.

Some very experienced racing hands dusted off an old idea, brought it up to date, and saved the day. The idea was the 190 cu. in. class of small, carefully regulated racing planes which would offer the much needed combination of low cost, close competition, and reasonable safety. Goodyear backed the idea with a guarantee of substantial prize money for at least three year, and the solution appeared to be in hand.

The "Goodyear midgets" bowed in during the 1947 Cleveland Air Races and made an immediate hit. With their 85 hp engines screaming, they lapped a miniature two-mile race course at better than 150 mph and edged out each other by a few feet. Their big brothers were staging high-speed parades and winning by as much as half a lap of their much longer courses. Creativity and individuality had returned to Cleveland with gusto.

For four years the Cleveland Air Races prospered. In the Bendix Race from California, movie stuntman Paul Mantz dominated like no one before him, winning three times. In the Thompson, Cook Cleland won twice in his 3,000+ hp Corsairs, once again demonstrating the near-unbeatability of cubic inches. Two of the three Goodyear Trophies were won by Bill Brennand in a post-war conversion of a pre-war Wittman Racer called "Buster," but each of the three races was clear proof of the validity of the formula for close racing at minimum cost with maximum safety.

Then war stepped in again. After an accident in the 1949 Thompson Trophy Race in which round-the-world flyer Bill Odom crashed into an occupied home, the future of Cleveland was debated long and hard before it was agreed to try again with improved safety measures. But in June, 1950, the Korean Conflict began, the military pulled out its demonstration teams, and the race management felt it could no longer justify the expensive program and canceled the 1950 Cleveland Air Races.

The skies immediately above Ohio's largest city would remain empty of racing airplanes for more than 15 years. The National Air Races moved to Detroit, but soon died there too. Minor races were held throughout the country, but on nothing like the scale of the great Cleveland speed festivals. As far as most people knew, air racing had passed into history, a view encouraged by an aviation industry that was bent on selling flying as practical, rather than as fun.

In 1964, a wealthy Reno, NV, rancher and sportsman, Bill Stead, decided that if he was ever to see big-time air racing, he'd have to do it himself. And so he did, turning the gambling and divorce capital into the world center of air racing and forever endearing himself to the casino operators by packing their glittering palaces with racing fans.

Cleveland heard about this and did nothing, knowing that the glorious days of the air races were past. Until an out-of-town promoter talked them into adding racing to the program of the annual air show at their scenic Lakefront Airport. In 1967, air racing came home. There was no Bendix Race, no Thompson Trophy Race, and little of the flag-bedecked atmosphere of the old days.

But there were pylons and race pilots and checkered flags and stopwatches. There were 190 cu. in. "midget" racers (a few of which had raced in the Goodyear, 18 years before) and a group of the new Sport Biplane Racers, which had first competed at Reno. There were some four-place personal planes, which women were gratuitously allowed to race

The Cleveland Air Races continued on this scale--limited prize money, limited publicity, no prestigious trophies--until 1971, with Goodyear Race veteran Bill Falck ruling the 190 cu. in. class in his unique "Rivets." But after a few years of just hanging on, the races lost even the lukewarm support they had gotten from City Hall, and the annual air show reverted to its routine format.

Once again there was no racing at Cleveland, though this time the drought lasted but six years. In 1977, a tentative agreement was reached between the air show managers and the Eastern Region of the U.S. Air Racing Association, whereby a new try would be made. It was all to be on the shoulders of the race pilots and their friends: laying out courses, erecting pylons, officiating, etc. And they would get any blame for failures.

So far, it has worked. From one class of competition in 1977, it grew to two classes in 1978, and the promise of three in 1979. Prize money was minuscule, as was the attention paid the winners who contribute every bit as much skill and daring as did the glorified pioneers a half century ago. But the 1978 race of the Formula One (the old 190 cu. in. class with improvements) was as exciting and meaningful as any in Cleveland's history, with a winning speed of 233 mph and a winning margin of just 1-3 seconds.

OK, so it wasn't like the good old days, but what is? What counts is that it was air racing. For Cleveland, the air racing stopped again in 1980's never to be started again. This Labor Day weekend marks the 70th anniversary of the Cleveland Air Races so it is only appropriate we acknowledge this historic event that will forever be associated with names like Turner, Doolittle, Mantz, and Wittman.


Vertigo and Disorientation

by Patricia Mattison

Recall the perverse enjoyment you felt when you turned in circles until you became so dizzy that you either fell down or became violently ill. It's a fact that turning around in circles makes you dizzy. But when you stop turning, why do you feel like you are still spinning? (Answer: somato gyral, angular illusion)

Several physiological events take place to create the dizzy sensation. First, what you see is the most important determinant of your spatial orientation. Second, the inner ear acts like a six axis gyro system in an airplane, with roll, pitch, and yaw axes. Third, nerve endings (from the limbs) report pressure points to the brain. The brain takes all of this information into account, computes the data, and presents it back to you as your reality and orientation in three dimensions. When the signals given the brain are mixed, such as when the eyes see one thing and the inner ears feel another, the brain interprets the information erroneously, resulting in sensory conflict and spatial disorientation.

In flight, spatial disorientation is likely to occur when a pilot enters instrument weather as a visual flight rules (VFR) pilot. Since a VFR pilot is unaccustomed to relying entirely on the instruments and is used to conducting the flight by looking outside the aircraft, he or she trusts the senses transmitted to the brain by the eyes, ears, and nerve endings. Unfortunately these sensations are frequently incorrect in instrument weather.

The feeling that the airplane is straight and level while it is actually banked (the Leans) is a common false sensation that most pilots have experienced. Therefore, to overcome disorientation, a pilot must concentrate on the aircraft instruments. If a pilot, relying on his or her senses, attempts to correct a perceived turn, the resulting correction could develop into a steep turn in the opposite direction (somato gyral).

During a gradual, undetectable turn, bank angle (in some people two degrees per second roll rate) will increase and develop into a steep spiral with a noticeable loss of altitude. The pilot will still feel straight and level. When the bank is reduced and the airplane is rolled back, the pilot will suffer the illusion that the airplane is banked in the opposite direction. To make matters worse, in an attempt to decrease the resultant altitude loss, the pilot will pull back on the wheel. The outcome will be a steepening of the spiral, unless the pilot first decreases the bank angle. Since the initial roll was not felt, the roll back will register with the inner ear, causing the illusion of being banked.

Spatial disorientation is insidious. These physical sensations can lead the pilot down the primrose path to destruction. Instruction in flight by reference to attitude instruments is a step toward maintaining orientation in instrument conditions.

Unless you are instrument-rated and current, your only safe choice is to remain VFR.

The author is the Safety Program Manager at FAA Juneau (AL) Flight Standards District Office.

For years, both FAA and the aviation public have made reference to a warbird accident that occurred almost 30 years ago. It happened in Sacramento, CA, and they call it, for reasons soon to become obvious...

The "Ice Cream Parlor" Accident

by Chuck Parnall

Because time has an annoying habit of rearranging some of the facts stored in our memory banks, we thought a booster shot of information about this infamous tragedy might help set things straight again. To ensure accuracy, our data comes from the Aircraft Accident Report issued by the National Transportation Safety Board (NTSB) on March 28, 1973.

Due to the excessive loss of life, this gruesome mishap will no doubt remain a symbol of what can go wrong in a system involving man and machinery, no matter how restrictive it may be. The accident has been, and probably always will be, portrayed as the ultimate warbird disaster--at least until a worse example takes its place. Because it happened in a jet warbird, that segment of sport aviation was tainted before it really got started. And because there was a spillover effect into other high performance warbird aircraft operations, it served to alienate jets from their piston counterparts.

Is the status attached to this accident justified? Most certainly! Twenty-two people were killed, many of them children, and another 28, including the pilot, injured. It was a major catastrophe by any standard, and it must be remembered. But it must be remembered accurately. Otherwise, the lessons learned may become distorted and ineffectual, and possibly misinterpreted to serve other purposes.

It was Sunday, September 24, 1972, the final day of the two-day Golden West Sport Aviation Show. The purpose of the show was the static and aerial exhibition of "experimental and antique" aircraft. Proceeds were to go to charitable and aviation educational support.

The location chosen was Sacramento's Executive Airport. All paperwork had been forwarded and approved in a timely fashion, including obtaining a waiver from the provisions of 14 CFR Section 91.71(c) and (d) (now FAR ß 91.303). There was nothing unusual about any of this. In fact, had Sunday been a carbon copy of Saturday, you would not be reading this article. But it wasn't. There was one particular unexpected guest at the Sunday show, and when he departed, sport aviation history was forever changed.

The 37-year-old Oakland, CA, pilot decided to fly his company's experimental jet airplane to this experimental aviation event. And why not? An F-86 Sabre is quite a sight at an air show today ... imagine how rare it was back in 1972! Imagine how proud the pilot must have felt bringing such an historic aircraft to this gathering. Then imagine how he felt when the reality of the afternoon became clear to him.

At approximately 1000 hours, Sabre N275X took off from Runway 29 at Oakland International Airport. After rendezvousing with a Grumman F8F Bearcat, the two aircraft proceeded to their destination. Approaching Sacramento, the Sabre pilot requested permission for a low pass. A low approach was granted to Runway 30 and the jet flew across the field at 100 to 150 feet, followed by the Bearcat approximately 3,000 feet behind. Normal landings ensued and the Sabre was soon parked beside a Ford Tri-Motor (owned by the same company) in a roped off, static display area.

At about 1400 hours, during a pause in the aerial display, the pilot preflighted his Sabre in preparation to leave. However, an adequate starting unit wasn't found until about 1545. After a normal start, the pilot requested departure instructions. By this time, the air show had ended and many other aircraft were departing. The Sabre pilot requested Runway 2, which is 6000' x 150', but was told there would be a delay because Runway 30 was the active runway. The controller gave the length of Runway 30 (5000 feet), and the winds (three-two-zero at eight), and asked, "Can you handle that?" The pilot replied, "Yeah, as long as I don't have to wait for an hour out there." He was given taxi instructions.

Approaching the end of Runway 30, N275X was cleared into position and hold. At 1623:40, the controller advised, "Sabre Liner Seven Five X-ray, observe the two aircraft at the, ah, northwest field boundary climbing out ahead of you, cleared for takeoff." The pilot acknowledged, "Okay, thanks a lot, huh." It was the last transmission from the aircraft.

Sacramento Executive Airport is located in a commercial/residential urban area, at the time approximately three miles southwest of the city. In January 1964, a shopping center was proposed at the northwest corner of the airport. Initially, four obstructions exceeded the height maximum. After the number was reduced to three, with a maximum excessive height deviation of 13 feet, FAA agreed to the construction.

In December 1969, an addition to the center was proposed ... an ice cream parlor. It exceeded the height

standard by five feet. The next month, FAA circulated another aeronautical study ... the proposed construction of a sign for the ice cream parlor. It exceeded the standard by 26 feet (later reduced to 21 feet). The sign was approved after it was agreed to displace the threshold of Runway 12 in order to meet runway approach slope criteria.

September 24, 1972, was a sunny, Sunday afternoon with temperatures in the low 80s and light winds ... the kind of day that makes some people think of ice cream. When N275X began its takeoff run, between 100 and 150 such patrons were in the ice cream parlor at the end of Runway 30. A few seconds later, the F-86 Sabre jet crashed through the chain link fence surrounding the airport, hit a fire hydrant, skidded across a 112-foot-wide divided highway, and smashed into the building full of unsuspecting patrons.

As the aircraft went through the fence, the external fuel tanks ruptured; other tanks failed as the aircraft skidded across the street. The main fireball occurred on the airport side of the street and the fire trail followed the aircraft into the building. The rapid reaction of airport fire and rescue crews was credited with commencing fire-fighting activity within a short period.

AIRCRAFT HISTORY

N275X (serial number 1054) was a Mark 5 Sabre manufactured by Canadair, Ltd., on September 19, 1954. It was flown by the Royal Canadian Air Force for 300 hours until placed in long-term storage on October 31, 1961. Periodic inspections continued through June 19, 1967.

The aircraft was first registered in the United States in July 1971 and purchased by Spectrum Air, Inc., on November 4. For three months, in Syracuse, NY, N275X underwent what was described as routine maintenance in preparation for its ferry flight to California, where it was to be based. A series of special airworthiness certificates was issued in January and February 1972, and the ferry flight was completed to Napa County Airport (CA). In March, it was flown to Oakland International Airport where the final airworthiness inspection was conducted.

On May 8, 1972, the Oakland GADO (General Aviation District Office, now the Oakland Flight Standards District Office) issued N275X a one-year special airworthiness certificate for the purpose of exhibition. Compared to the restrictions issued today, they were somewhat relaxed and included: flights authorized for the purpose of exhibiting the aircraft at bona fide air shows and exhibits; movement of the aircraft to exhibit locations; and proficiency flights by persons so authorized. Flights were to be conducted during daylight hours and in VFR conditions, and the pilot was required to hold a Letter of Authority issued by the Administrator. In all, eight limitations.

PILOT HISTORY

The pilot was General Manager of Spectrum Air, Inc., and held several General Aviation qualifications...ATP ratings for airplane multiengine land and DC-3, and commercial privileges for airplane single-engine land and CV-PBY (VFR only). He also held a valid certificated flight instructor certificate, flight engineer (recip) certificate, mechanic certificate with A&P rating, and first class medical with no limitations. His logbook indicated almost 2,100 flying hours, of which 342 were in jet aircraft, 3.5 in the Sabre. The pilot claimed another four Sabre hours were not logged. The last entry was dated September 17, 1972.

According to the NTSB report, the pilot attended a ten-hour formal ground school given by a former F-86 pilot in May 1972. He received an additional two hours of emergency procedures and two hours of flight procedures instruction on the day of his first flight. All ground instruction was monitored by an FAA representative. The initial flight consisted of performing basic airwork maneuvers, including approaches to a stall.

FAA issued a seven-day Letter of Authority (LOA) on June 2 for proficiency flying. On June 6, FAA issued a second LOA permitting flight for proficiency or exhibition at bona fide air shows. It had an expiration date of December 1, 1972.

This LOA stated four limitations in addition to those issued to the airplane. In essence, the pilot was limited to a 100 mile proficiency radius that included two airports from which he could operate: Oakland and Sonoma County (except in an emergency, in which case the Oakland GADO was to receive a full written report within 48 hours of the occurrence). Flights from either airport were to be approved by the respective airport manager; he was to avoid heavy air traffic areas; and he was not to create a hazard to persons or property on the ground. Finally, no persons other than the pilot could be carried in the aircraft. In other words, do not add a jump seat!

Because it is so important, the following SYNOPSIS is taken verbatim from the report:

"Spectrum Air, Inc., Sabre Mark 5, N275X, crashed during a rejected takeoff from Runway 30 at Sacramento Executive Airport, Sacramento, CA, at approximately 1624 Pacific daylight time, on September 24, 1972. The aircraft collided with several automobiles and came to rest in an ice cream parlor across the street from the airport. Twenty-two persons on the ground were killed and 28 others, including the pilot, were injured. The aircraft was destroyed.

"The aircraft became airborne twice during the attempted takeoff, but each time returned to the runway. The pilot reported that the aircraft acceleration and control response were normal until he felt a vibration shortly after initial liftoff. He did not recall whether it persisted through the subsequent liftoff and the rejected takeoff.

"The National Transportation Safety Board determines that the probable cause of this accident was the over-rotation of the aircraft and subsequent derogation of the performance capability. The over-rotation was the result of inadequate pilot proficiency in the aircraft and misleading visual clues.

"As a result of this accident, the Safety Board recommended major changes in the regulations and procedures governing certification of aircraft in the experimental category and the control of pilots who fly them. Recommendations were also made in regard to the safety of persons and property around airports."

HOW DID NTSB ARRIVE AT ITS CONCLUSION?

Even in 1972, spectators were focusing their cameras on departing aircraft ... not video-cams, but 8 mm movie cameras, and there were at least two of them. In addition, 18 eyewitnesses were interviewed. Everything generally corroborated the pilot's story that the entire runway was used and there were two separate liftoffs. By comparing the films of the accident Sabre to that of another Mark 5 taking off, it became apparent that the pilot of N275X had over-rotated his aircraft and become airborne in ground effect with a too high nose attitude. The aircraft simply did not have the power to fly out of it. Subsequent testing of fuel controls, fuel pumps, and the fuel distributor assembly showed all were functioning properly and capable of supplying the required amount of fuel to develop maximum rated thrust for takeoff at sea level and standard temperature.

Why did the pilot over-rotate this time, but not during any of his previous takeoffs at Oakland? NTSB came up with two reasons -- lack of familiarity with the Mark 5 Sabre, and the effect of visual cues at Sacramento as opposed to Oakland.

Prior to the accident, the pilot had accumulated between 3.5 and 7.5 hours in the Sabre. His only other swept-wing experience was 31 hours as second-in-command in a Lockheed Jetstar. The bulk of his jet experience was in a Lear Jet, again as second-in-command.

NTS13 noted the Sabre has a lower thrust/weight ratio than the Lear Jet, but it has more effective elevator power at low speeds. This would enable the pilot to reach higher angles of attack before flying speeds are reached. In the Lear Jet, they said, an application of excess nose-up control input before reaching flying speed generally does not result in an over-rotated condition because the airspeed increases faster than does elevator effectiveness.

In this case, when the pilot over-rotated to what was estimated at more than three times the takeoff attitude of the test Sabre, N275X became airborne. When it didn't fly away, the pilot lowered the nose, the aircraft touched down and began accelerating to takeoff speed, and the pilot repeated his erroneous inputs. The second time it touched down there was little runway left when the unsuccessful rejected takeoff was attempted. The vibration was explained as disturbed airflow because of the excessive nose-high attitude.

All takeoffs in this aircraft--except for the accident flight--were made from Runway 29 at Oakland International. Here is where we can all learn another lesson.

Departing Runway 29 at Oakland with its "wide open" expanse of San Francisco Bay creates an indefinite horizon, one that would appear to recede as the aircraft moves along the runway. By contrast, Runway 30 at Sacramento is closely surrounded by trees, buildings, water towers, and other objects. This creates a well-defined horizon. It was the pilot's first takeoff in the Sabre from an airport other than Oakland. The shorter runway, combined with the visual effects, accentuated the rate of closure, thus creating a sense of urgency not felt at Oakland.

NTSB FINDINGS

1. The aircraft was certificated in accordance with existing regulations.

2. The pilot was certificated and held a valid letter of authority for the flight.

3. The regulations and procedures concerning certification of experimental aircraft and issuance of letters of authority for pilots were inadequate.

4. The aircraft was capable of taking off from Runway 30 without incident under the conditions at Sacramento.

5. The differences between the horizon and runway length at Oakland and Sacramento created visual illusions that induced an apparent need for rapid liftoff at Sacramento.

6. The pilot did not have sufficient experience in the Sabre Mark 5 to enable him to compensate for the misleading visual cues.

7. The catastrophic consequence of this accident is directly attributed to the proximity of the shopping center to the runway.

PROBABLE CAUSE

The NTSB determined the probable cause of this accident was the over-rotation of the aircraft and subsequent derogation of the performance capability. The over-rotation was the result of inadequate pilot proficiency in the aircraft and misleading visual cues.

NTSB further stated that although the accident was a result of pilot technique, the catastrophic consequences resulted from two entirely separate circumstances: 1) inadequacies in the rules governing the operation of experimental aircraft, and 2) the location of the ice cream parlor.

In addition, because the pilot could only have gone to Sacramento in order to participate in a "bona fide air show," NTSB reasoned that the rejected takeoff was directly related to the air show, even though N275X was not specifically identified as part of it.

CONCLUSION

What can we learn from this tragedy? For one, there has not been another like it, which means we must be doing something right--both FAA and their customers. Certainly, there have been accidents, but none have come close to this level of destruction. One might reasonably suggest that current regulations are adequate and jet operators suitably qualified. The real test, however, will come should another event like this occur.

Past EAA Warbird Director John Harrison remembers the controversy surrounding the placement of a shop-

ping mall at the end of the runway. And he remember seeing an F-86 circling overhead that fateful morning, drawing him to the airport.

John flew F-100s in the Air Force, so the F-86 was of interest to him. He'd seen them operate in Korea ("on takeoff, they rolled and rolled..."). John questioned the use of Runway 30 as he watched the ill-fated Sabre commence its takeoff roll. Because he was behind the terminal building, the next thing he heard was the crash bell. Then he saw smoke, but failed to realize the enormity of the accident until he arrived at the scene. There, he showed firefighters where to cut the ejection seat cartridges.

John confirms the NTSB report, adding several personal insights and comments. He testified at a subsequent hearing during the lawsuit phase. John says the shopping center never recovered and the airport will never lose its stigma.

Everyone agrees that pilot error caused this accident. But building a mall (and an ice cream parlor) near the end of a runway isn't a brilliant move either. Unfortunately, society is not immune to such lapses in judgement by those in high places.

Still, most of the accountability must be shouldered by those who choose to fly these exotic aircraft. The pilots are on center stage and in the spotlight by choice. And because they are, it is imperative they become intimately familiar with their aircraft... systems, operating limitations, and flying characteristics. More important, they must know their own capabilities. Indeed, even if one operates well within the letter of the law, failure can result without the use of good old common sense.

We've seen how quickly laws can change as a result of an over-reacting public or its elected officials.... Pilots and owners must do their utmost to protect others from their actions. Flying is a privilege. Flying exotic military aircraft is a mega-privilege. Neither can be taken lightly. Are you doing your part to keep us all flying?

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STREAMLINED ADMINISTRATIVE ACTION PROCESS

Continued from Page 2

new Streamlined Administrative Action Process is only one of the important safety tools an FAA inspector has available to ensure compliance with the regulations. As stated, it is an optional process that an inspector may use at his or her discretion. This optional computer-based procedure is designed for simple, straight-forwarded cases. If the alleged violation is more complex or requires more information, the inspector may choose to follow the more formal procedures outlined in FAA Order 2150.3A, Compliance and Enforcement Program. In either case, the inspector will follow the same FAA policies and procedures for determining what action is required to complete the case. Simply stated, although the new processing procedure will speed up the mailing of the appropriate AA letter to an airman, the new process uses the same policy guidelines and FAA order as the current more formal method of issuing AA letters.

Another benefit of the new additional process for issuing AA's is that the airman or company involved will not have to wait in some cases weeks for the appropriate AA letter to arrive to complete the case. Under the new process, an FAA letter of investigation will not be sent to the airman or company as is done under the more formal AA process. This process results in a faster response to the airman and reduced paperwork for the inspector. This also allows the inspector to have more time to work with his or her operators and others within aviation promoting safety than spending limited inspector time drafting paperwork.

In addition, aviation safety is enhanced overall by the faster response time to conclude an AA action and the personal interaction between the airman or company and the FAA inspector that will take place as part of the new process.

As noted on the computer-generated AA letters, although the alleged violation and resulting AA letter do not warrant legal enforcement action, the alleged violation will be made a matter of record. That information is subject to the Privacy Act and Freedom of Information Act procedures. Records complied under this new complementary AA process for individual airmen will be expunged two years after the date of issuance. As in all AA's, the airman's future compliance with the regulations is expected. In the case of companies receiving an AA, their records are retained indefinitely.

As stated previously, FAA expects the airman who receives an AA letter to comply with the regulations in the future to ensure the safety of those in the air as well as those on the ground. Safety is everyone's business and FAA is working hard to ensure that everyone does his or her part in promoting aviation safety. FAA is now going hi-tech to do its part in promoting aviation safety through effective and timely corrective action in those cases that require such action. Then through the compilation of the data collected through the processing of the streamlined AA's, the FAA will be better able to track any developing trends that could jeopardize aviation safety.

Flight FORUM

• IA'S ARE NOT ALONE

I was one of the Safety Program Managers involved in the Inspection Authorization renewal program written about in the July-August 1999 *FAA Aviation News* article, "Keeping IA's Current." Although the article was written about IA's, I want to remind everyone that in addition to IA's being able to sign off an aircraft annual inspection, a certificated repair station, representatives of the repair station, commercial air carriers, and aircraft manufacturers can also sign off an annual inspection within their respective authorizations.

George Mahurin
Long Beach (CA)
Flight StandardsDistrict Office

Thanks for reminding everyone.

• Ground Trainer

In reading the definition of flight simulators and flight training devices in FAR § 141.41, some schools do not have flight simulators and flight training devices that meet this definition. They only have ground trainers. Will they still be permitted to use these old ground trainers as previously permitted bfore the issuance of this final rule and will the student still receive training credit when they are performing the training in these old ground trainers?

Name withheld

Yes, as long as these old ground trainers were approved for use in the school's approved Part 141 course before the issuance of the new rule. And, yes, the students will receive the same credit, because these old ground trainers are now considered flight training devices per the new § 61.4(b) which states: "Any device used for flight training, testing, or checking that has been determined to be acceptable to or approved by the Administrator prior to August 1, 1996, which can be shown to function as originally designed, is considered to be a flight training device provided it is used for the same purposes for which it was originally accepted or approved and only to the extent of such acceptance or approval."

• Balloon Flight

What constitutes a flight in Lighter-Than-Air, Balloon? We have some of the sharpie pilots saying that it is a "takeoff and landing." Therefore, they intend to log several flights with only one set-up and inflation.

Name withheld

As per FAR § 1.1, the definition of a "flight" in a balloon is no different than a "flight" in an airplane, helicopter, glider, etc. ["...from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the next point of landing..."] In accordance with the "flight" definition in § 1.1, a balloon pilot would not need to deflate and break the balloon down and than re-setup and re-inflate the balloon to credit multiple "flights."

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. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to FORUM Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address: Dean.Chamberlain@faa.gov

Mario Toscano photo.

FAA TO TOUGHEN RULES FOR REPAIR STATIONS

To keep pace with rapid growth in the aviation industry and advancements in aircraft technology, the FAA on June 16 proposed to revise and strengthen the federal rules for maintenance performed at domestic and foreign repair stations.

The FAA's Notice of Proposed Rulemaking (NPRM) would ensure that certificated repair stations are held responsible for all maintenance work that is outsourced to contractors. A repair station would have direct responsibility for contractor work, establish quality assurance programs for contractors, verify the work, and take ultimate responsibility for return-to-service of maintenance work performed by a contractor. The proposal also revises the Federal Aviation Regulations by simplifying regulatory language and updating technical information. Highlights of new requirements for U.S. repair stations are:

- *Tougher standards for contract maintenance.* Maintenance work outsourced to contractors would receive greater scrutiny.
- *Quality control and assurance.* Each repair station would be required to establish a quality assurance program that ensures that all maintenance meets FAA requirements.
- *Responsibility for contractors.* Repair stations would be required to state general and quality control responsibilities, provide technical direction, and evaluate and audit contractor performance.
- *Manuals.* Repair station manuals would include qualification, training, and quality assurance procedures for work on new equipment and components.
- *Ratings and classes.* The NPRM eliminates the "airframe" rating (based on aircraft weight and construction) and establishes an "aircraft" rating in keeping with current industry practices and computer technology.
- *Capability list.* Each repair station would list the work that the repair station is capable of performing and the ratings under which it is approved to operate.
- *Training.* Each repair station would be required to have an FAA-approved training program for initial and recurrent training for all aviation maintenance personnel.
- *Satellite repair stations.* The FAA would require that manuals be consistent with the parent station's manuals.
- *Contractors.* In addition to the current requirement for listing all contractors on an air carriers' operations specifications, a repair station would be required to list all facilities to which it contracts work. A repair station would also have to list, in its manual, procedures for qualifying and overseeing those facilities.
- *Personnel at foreign repair stations.* The NPRM would require workers at foreign repair stations to have a minimum of 18 months of practical, related maintenance experience; adequate training and familiarization with maintenance practices, tools and equipment; and understand, read and write the English language.
- *Recordkeeping.* The NPRM would strengthen the requirements to ensure that inspection and follow-up actions are documented.

There are currently 4,509 repair stations in the United States and 525 abroad.

The comment deadline is 90 days from publication in the Federal Register.

ROMANIA BECOMES 50th IAOPA AFFILIATE

According to the International Council of Aircraft Owner and Pilot Associations (IAOPA), Romania became the 50th member of IAOPA on April 30, 1999.

Starting with only five members in 1962, IAOPA was formed to represent general aviation on the international stage. "The increasingly global nature of GA/AW [general aviation and aerial work operations] activity requires a strong central voice to present its needs to the worldwide aviation community," said IAOPA Secretary General John Sheehan. "IAOPA is growing to fulfill that role."

PROPOSED RULES MAY QUIET GRAND CANYON

The FAA has unveiled a package of proposals for air tour operators to maintain and further enhance the "natural quiet" of the Grand Canyon National Park (GCNP). The proposals were crafted with input from the National Park Service (NPS) and accommodate the interests of Native American tribes and local businesses.

The proposals include a FAA Notice of Availability of new and modified proposed air tour routes over and around the Grand Canyon. In addition, the agency has issued two Notices of Proposed Rulemaking (NPRM) that propose to modify flight-free zones and set up an innovative allocation system for air tour flights over the park.

Substantial restoration of natural quiet has been defined by the NPS as more than half the Grand Canyon National Park being free of aircraft noise 75 to 100 percent of the day. Currently, aircraft cannot be heard in 32 percent of the park 75 to 100 percent each day. Today's proposal would increase this amount to 41 percent of the park.

Today's effort further implements a 1987 law requiring the FAA and NPS to work together to "substantially restore natural quiet in the GCNP." The improvements would modify portions of the flight free zones associated with the FAA's 1996 rule, which also limited the hours flights could operate in the eastern portion of the park.

The Notice of Availability slightly modifies existing east/west routes to help restore natural quiet in the park, meet Native American concerns, and allow the routes to be used for air transportation and tours. These modified routes require aircraft to fly at a higher altitude than current commercial air tours. The notice modifies the air tour routes that go around the western area of the park, known as Sanup Flight-Free Zone (FFZ). This area contains many Native American traditional cultural properties that are potentially eligible for listing on the National Register of Historic Places.

The first NPRM proposes to modify the dimensions of the Grand Canyon National Park Special Flight Rules Area and FFZ. The airspace over the easternmost portion of the park is known as the Desert View FFZ. The NPRM proposes to add a five-mile section to this flight-free zone to address Native American tribal concerns. In addition, an "incentive corridor" is proposed through a flight-free airspace known as Bright Angel.

In the future, air tour aircraft that meet stricter noise standards, currently in development, would be permitted to fly through this corridor.

The second NPRM proposes an innovative system of limiting the number of flights for each air tour operator. This new system ensures that the number of these flights will not increase, while assessing the progress in noise reduction and the need for future action. The number of allocated flights is based on the number of air tours reported during May 1, 1997, through April 30, 1998. The allocations are granted for airspace routes in and over the park.

The rulemaking permits revising the number of allocations no earlier than every two years. In addition, an air tour operator may transfer allocations to another air tour operator.

FAA AND CAA TEST NEW SAFETY TECHNOLOGY

The FAA and an industry group will conduct the first large-scale test of a technology designed to enhance safety by giving pilots and air traffic controllers more information about aircraft locations. The first phase of the tests occurred July 10 in Wilmington, Ohio.

The main goal of the tests, being done in partnership with the Cargo Airline Association (CAA), is to evaluate how Automatic Dependent Surveillance -- Broadcast, or "ADS-B," can help pilots be more aware of aircraft in their vicinity. Using an aircraft's Global Positioning System sensor, ADS-B equipment sends very accurate position information, along with speed and identification data, to other similarly equipped planes and ADS-B ground receiving stations. The technology is not currently designed to serve as an airborne collision-avoidance system.

In the Ohio test, participating flight crews will monitor aircraft in their area using a special cockpit display. Air traffic control facilities will receive combined radar and ADS-B target information for evaluation, but the data will not be used to handle live traffic. Ground receiving stations in Wilmington and Louisville, KY, will provide coverage throughout the 500-square-mile test area.

"If the tests are successful, the resulting enhancement of pilots' situational awareness could lead to improved efficiency and safety in our increasingly crowded skies," said Shelly Myers, head of the FAA's communications, navigation and surveillance office.

Approximately 25 planes are expected to participate in the test, including three FAA aircraft. Several avionics manufacturers also plan to fly test aircraft, as do the U.S. Navy and NASA.

This ADS-B operational evaluation is the first in a series planned for the next three years under the FAA's Safe Flight-21 Program. The FAA expects future testing to expand into other Ohio River valley sites, including Louisville and Memphis, TN. Areas of Alaska also are installing equipment that will let them participate in the ADS-B evaluations. The FAA hopes ADS-B can eventually be used on a wide scale, in accordance with the agency's plans to modernize the nation's airspace.

The Safe Flight-21 Program is a government-industry cooperative effort to develop and demonstrate a set of operational enhancement capabilities leading to the implementation of the "Free Flight" concept.

NEW 82 GRADE AVIATION FUEL

According to the Experimental Aircraft Association (EAA), it has received FAA approved for the use of the new 82 grade unleaded aviation fuel in those aircraft being fueled with automobile fuel under EAA's Supplemental Type Certificate (STC) that permits the use of auto fuel in engines originally type certificated for 80/87 aviation gasoline. For more information, readers should contact EAA at 1-800-564-6322. Internet users can check its


Editor's Runway

from the pen of Phyllis-Anne Duncan

Vice Admiral Donald D. Engen USN (Ret.)

May 24, 1924 - July 13, 1999

Obituaries are some of the most difficult pieces to write. If you're not acquainted with the deceased, you still want to do the person justice and, at the same time, provide insight into the type of person he or she was to an audience who largely is not acquainted with the person. Yet, knowing the person who has died almost guarantees a lack of objectivity. The first "obit" I ever wrote was 17 years ago for my father, and I've always wished I'd done a better job. This one following likely—and unfortunately—won't be the last, and I sincerely hope I do the man justice.

Admiral Donald D. Engen was the first of what we like to call the "Friendly Administrators" here at the FAA. He rode the public elevators with the employees, not the private one for Administrators. You stood on line with him in the cafeteria, and he always greeted you with that bright smile, a smile that deepened and broadened if you happened to get him on his favorite subject, which was flying. It is almost fitting, if you have to lose a respected individual and especially if he is an avid aviator, that Admiral Engen died doing something he loved, flying gliders.

(Because the accident is still under investigation, I will offer no details except those that can be released to the public. The accident occurred approximately 1315 PST on July 13 approximately four miles southeast of the Minden/Tahoe, Nevada, Airport. Admiral Engen was in the glider with William Ivans, a renown glider pilot and holder of many international records. Witnesses reported seeing an in-flight break-up, and Admiral Engen and Mr. Ivans were killed instantly when the glider, a Schempp-Hirth Nimbus 4DM, crashed from an altitude of 11,000 feet. (The Nimbus 4DM is a motorized glider.)

A pilot with more than 7,500 hours in more than 260 types of aircraft, Engen was an instrument-rated, commercial pilot with single and multiengine airplane and glider ratings.

For those of you who may vaguely remember him as the FAA's Administrator in the mid-1980's, here's a little, just a little, of whom the man was. He served the U.S. Navy in three wars, World War II, the Korean Conflict, and Vietnam after declaring to his parents in the fourth grade that he was going to sea as a Naval officer. He was a 17-year old college student when the Japanese bombed Pearl Harbor on December 7, 1941. He dropped out at once and enlisted as a seaman. He was eventually to become a Naval aviator who would receive a Navy Cross for valor.

Admiral Engen was a Navy test pilot who developed and tested many safety mechanisms taken for granted today, among them the ejection seat. While testing an early model ejection seat, he was injured but accepted the injury with his characteristic forward-thinking: It was worth it, he indicated, if lives are saved. It is estimated that more than 6,000 military pilots' lives have been saved by their ejection seats.

Admiral Engen retired from the Navy in 1978 after 36 years of service and went to work in general aviation as a general manager at Piper Aircraft Corporation. In 1982, Engen became a member of the National Transportation Safety Board (NTSB), and the NTSB, along with the FAA, of which he was Administrator for three years between 1984 and 1987, is investigating the circumstances of the accident that took his life.

Over the years as a military pilot, the Admiral had also enjoyed civilian flying, and flying gliders was one of his loves. *Aviation News* Staffer and glider pilot Dean Chamberlain recalls seeing him a few years ago at a Soaring Society of America convention, where he spoke about the plan to expand the National Air and Space Museum, but Dean remembers him more as a member of the audience, who asked questions at the workshops and spoke with his friends about their mutual joy at flying gliders. That understated manner was typical of him.

Another FAA employee who worked often with him, Jerry Lavey, said, "Don was a kind, gentle man, but he could be tough when he had to be as those who were the recipients of his withering notes could attest." An apt description of a man who loved flying and who, during his time at the FAA, seemed to enjoy the practical aspects of his job—getting out among other aviators at industry events—rather than the bureaucracy. Administrator Garvey, who sought and enjoyed his counsel—

A Man Who Loved to Fly

their offices are just across the street from each other—was moved by the "terrible tragedy." She noted that in their encounters he was still concerned about the FAA and the people there who had worked so briefly for him. The president of the General Aviation Manufacturers Association, Ed Bolan, called Admiral Engen a "consummate aviator and public servant." Others have referred to him as "a true aviator." Though unassuming personally, the Admiral would have preferred the accolades exactly that way—pilot first and foremost.

In the last year of his term at FAA, he was before the press a great deal on various safety and non-safety issues, and he once came up to me at an industry function after he left the FAA and told me that he always looked forward to seeing a member of the *Aviation News* Staff among his press audience. "That way I knew there was at least one friendly face out there," he remarked.

Engen embarked on a very active "retirement" after leaving the FAA, serving on the boards of several aviation organizations and continuing to fly. In 1996 the Smithsonian Air and Space Museum had a crisis of confidence over a proposed exhibit that became controversial. For the first time, donations to the museum fell off, and Admiral Engen was appointed the museum's director. As perfect a match as he seemed for the FAA, this was a better one. His personal integrity and prestige restored both for the Air and Space Museum, and it was a job he genuinely loved. His "pet" project was the museum annex to be built on the grounds of Dulles International Airport and which will be both a museum and a restoration facility. Some of the largest aircraft ever built will be show-cased in a facility the Admiral himself had a hand in designing. And, in my humble opinion, an ideal name for that new museum for the 21st Century would the Admiral Donald D. Engen National Air and Space Museum Annex.

My last encounter with him was this past April when he led the Air and Space Museum event honoring Brian Jones and Bertrand Piccard for their around-the-world balloon flight. The Admiral was beside himself with excitement that the gondola from that flight would be in a place of honor at the Air and Space Museum. In the midst of the post-press conference activity, he spotted me among the crowd of reporters and called out, "How's it going? The magazine's looking great." There came that incandescent smile and a thumb's up. For those of you who knew him or knew of his integrity, intelligence, kindness, and compassion, keep that image in mind. For those of you who didn't know him, you missed an opportunity to be touched by a truly good man and a memorable aviator. Admiral Engen is survived by his wife of 56 years, Mary, four children, and seven grandchildren.

July 14 dawned a bright day in the Nation's Capital, but two buildings met the day with a pall over them, their flags at half-staff, their halls unusually quiet and subdued—the Federal Aviation Administration and the National Air and Space Museum. Buildings of concrete and steel, symbols of a sometimes indifferent bureaucracy, but so important to and beloved by a man who loved to fly.

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