NOVEMBER/DECEMBER 1999

# FAA Aviation News

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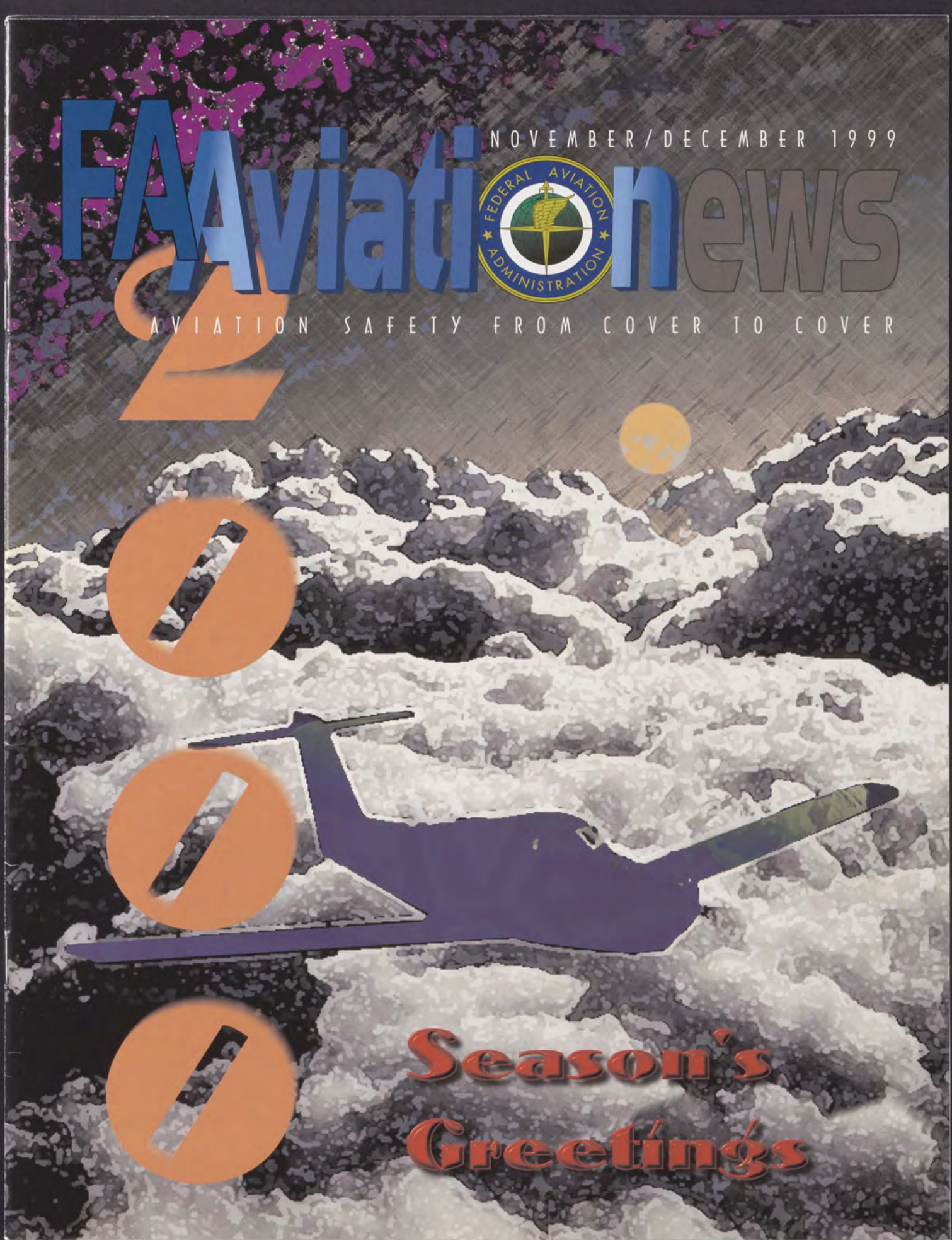

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FEATURES

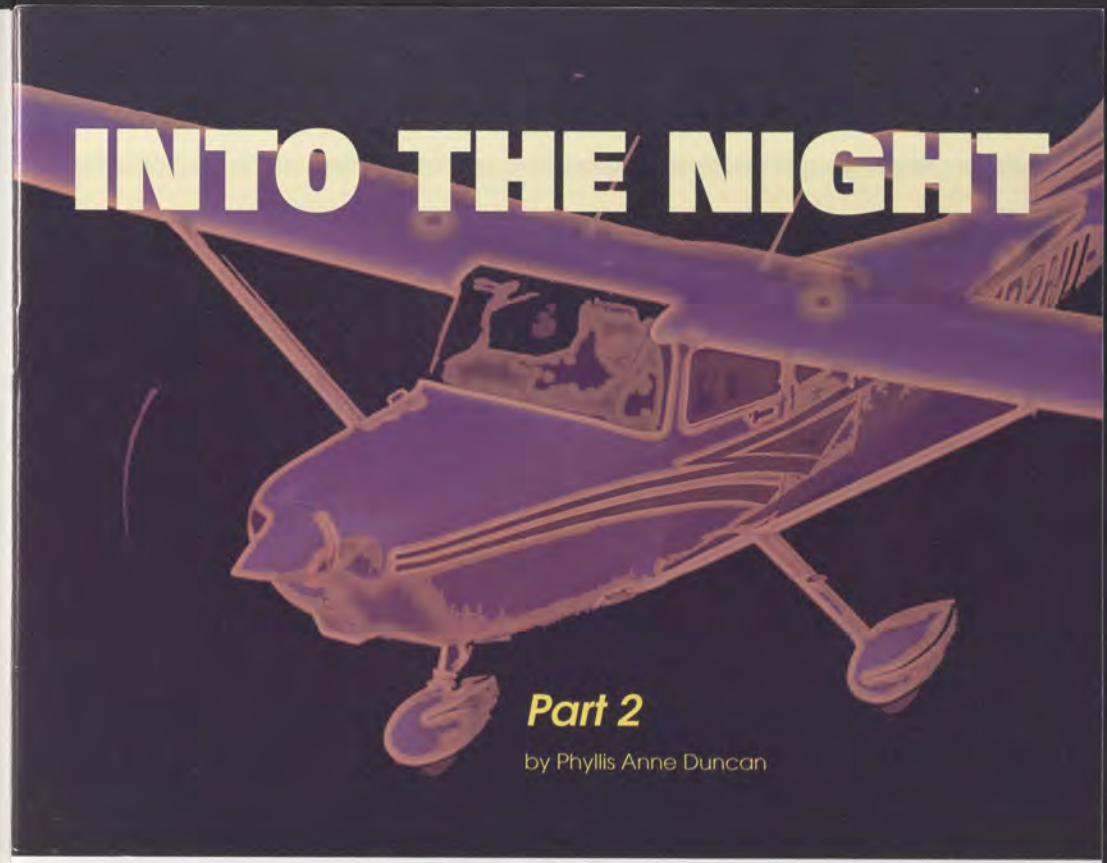


DEPARTMENTS




*FRONT COVER: To all our readers, a warm wish from our staff. (Illustration by Mario Toscano)*
*BACK COVER: This Cessna 172 enjoys the wintery scenery*





# INTO THE NIGHT

## Part 2

by Phyllis Anne Duncan

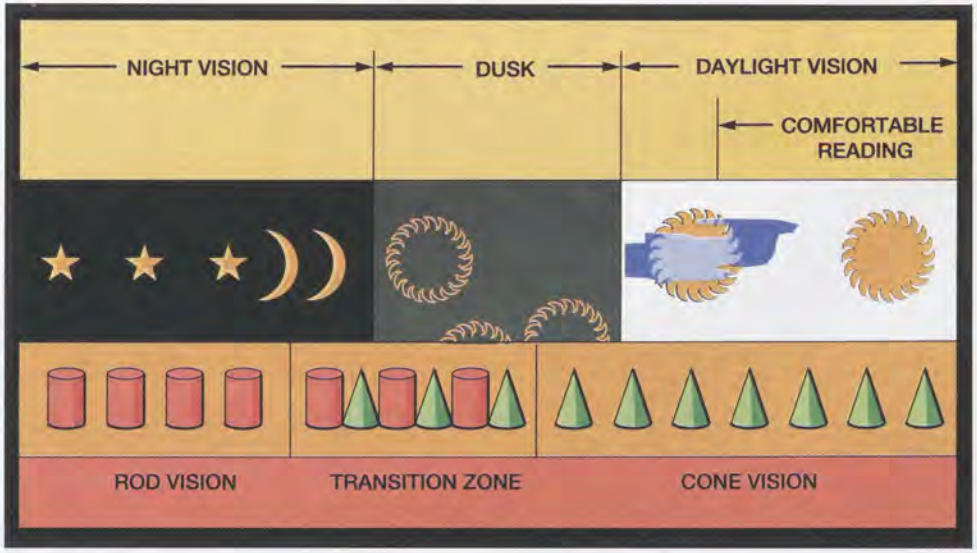
*This is the second of a two-part series on night VFR operations. If you missed Part 1, contact the magazine at (202) 267-8212 for a copy or e-mail: phyllis.duncan@faa.gov and provide your mailing address. None of the information in either Part 1 or 2 should be construed as having any bearing on the as yet to be determined probable cause of the John F. Kennedy, Jr. accident.-Editor*

There is an aviation adage which many have claimed authorship for, and it is a quote which goes something like this: "Aviation, like the sea, is unforgiving of any carelessness or neglect." Night VFR is an aspect of aviation where the slightest carelessness or neglect can be magnified into a situation beyond a pilot's ability to cope unless he or she has adequately planned and prepared. Night operations under Visual Flight Rules can be successfully completed, but it is an operation that we can't fall back on dumb luck to assure safety.

In Part 1, we emphasized the setting of personal limits that may be higher than those required by regulation for an extra margin of safety. In this final part to the series, we're including some additional considerations for that preflight planning and preparations, as well as for en route operations.

### Night Operations

FAA's *Flight Training Handbook*, a training guide for instructors and students, has an entire section on night operations, upon which most of this article is based. There are many other commercial sources out there which provide good advice for night operations, but the *Flight Training Handbook* contains the official FAA "line." In its introduction to night operations, the Handbook




echoes what we said in Part 1:

> "Night operations differ from daylight operations only by the fact that vision is restricted at night. *As confidence is gained through experience* [emphasis added], many pilots prefer night operations over day operations because the air is usually smoother, and, generally, there is less air traffic to contend with."

That first sentence describing the difference between day and night operations is more complex than it sounds. Not only does the absence of light mean a pilot sees less, but darkness also means your eyes respond differently.

(NOTE: AC 61-21A, *Flight Training Handbook* has been recently updated and reissued as the *Airplane Flying Handbook*, FAA-H-8083-3. It is available from the U.S. Government Printing Office. Call (202) 512-1800 for price information.)

## Night Vision

Human beings are long past the time and place when we were nocturnal animals, if we ever were. If our visual anatomy now is basically unchanged from our paleo- and neolithic ancestors, we were really bad nighttime hunters. There are many animals in the world who see far better at night than we ever will, even with the human's use of night optical devices. However, the human eye can be trained or adapted to see better at night, and if we as pilots understand what the limits of our night vision are, we can compensate. To go along with that, if we keep ourselves healthy, we keep our eyesight healthy, and that includes our ability to adapt to diminished illumination. Good eyesight can be diminished by fatigue, a cold, vitamin deficiency, alcohol consumption, stimulants (i.e., caffeine), smoking (oxygen depletion), or even prescribed or over-the-counter medications.

We think of night vision as teamwork between the eyes and the mind, and that teamwork goes back to the consideration of your physical and mental condition that we spoke of in Part 1 of this series. Your mind may be sharp, you may be mentally ready for a night flight, but if your eyes are not up to the task, you're not ready. Conversely, if your eyes are willing and able, but your mind is not into a night flight, again, your readiness is in question.

There is a physical reason for this. Our eyes are built to work differently at night. If we understand that difference, we can adapt and overcome the limits of our night vision. On the back of the eye--the retina--there are thousands of "rods" and "cones," which are light sensitive nerves. They form a layer upon which images are reflected. The rods and cones connect to the optic nerve which delivers the image to the brain for interpretation. That interpretation is nearly instantaneous. The cones are massed in the center of the retina, and the rods surround the cones.

Cones detect color, minute details, and faraway objects. The rods detect grays and provide peripheral vision. They also detect moving objects but not detail or color. In daylight, the rods and cones combine to give us color vision, peripheral vision, and the ability to see grays and moving objects. At night, the cones effectively shut down, and only the rods provide ambient, outside vision. This is a logical evolutionary adaptation: At night in the absence of light, colors are shades of gray anyway. However, if there is sufficient ambient light at night, like moonlight, the cones will function, though the colors will not be as distinctive as they are in full light.

Because the rods surround the cluster of cones in the center of the retina, in daylight you see an object best by looking directly at it. At night, in the absence of light, you'll best perceive an object in your peripheral vision because the rods are perceiving it, not the cones. As a pilot you can't rely on catching an object out of the corner of your eye. Rather, you have to practice off-center scanning of your instruments and of your visual cues outside the aircraft.

Our eyes can adapt to darkness. The pupils dilate to let in as much light as possible. To dilate to their maximum takes about five to 10 minutes, during which time, night vision improves progressively. After that initial five- to 10-minute adaptation, our eyes are 100 times more sensitive to light. After about 30 minutes, the rods become fully adjusted to the lack of light, and when they do adjust they are 100,000 times more sensitive to light than they were in the daylight. Once full adaptation is complete, you can see much more detail than in the early stages of adaptation where only the pupils dilate to let in what light is available. Night adaptation is completely disrupted by even brief exposure to a bright light, and that exposure can cause temporary blindness, after images, and illusions. Moreover, the adaptation process will have to start all over again.

Night vision adaptation needs to occur before flight, and, as indicated, this can take up to a half hour. To be able to see best at night, you need to build this adaptation time into your preflight planning. If you take off in the daylight or twilight, the adaptation occurs in flight, clearly not the best option, but a situation where you have little choice. Because you are aware your eyes are adapting from your knowledge of the process, you can even plan accordingly. For example, a landing is probably better attempted after full adaptation. So, if you've taken off in light or twilight, a half hour or so after full dark, you're adapted, and your eyes can better deal with a night landing.

Big caution here: After adaptation has occurred you have to be careful not to experience bright light, or the adaptation is undone.

Here is a night vision "checklist" that will help you make your night vision as good as possible:

- If possible, avoid bright sunlight before night flying, adapt the eyes to darkness before flight and keep them adapted.
- If you have oxygen on board, use it during a night flight. Since vision deterioration can occur at altitudes as low as 5,000 feet, oxygen will help your eyes function at their best. If you're a smoker, that threshold may be a great deal lower than 5,000 feet, and supplemental oxygen may not be able to achieve a significant improvement.
- When exposed to bright light, close one eye. It will remain night adapted.
- Take your sunglasses off after sunset, Joe Cool.
- Move your eyes more slowly at night.
- Blink your eyes more often if your vision becomes blurry.
- Concentrate to see objects.
- Force yourself to see "off center."
- Maintain yourself in good physical condition and avoid smoking, drinking, and using drugs which may be harmful to your vision.

## Night Illusions

Seeing at night can induce some unique illusions that don't occur during day vision. The brain tries its best to interpret what the optic nerve is feeding it, and what the brain perceives may not necessarily match what you're seeing. If you're night vision adapted, for example, and are exposed to a bright light, you get an after image that can last for several minutes. This is like the flash of a camera going off in front of your face, and the resultant blind spot is annoying. In a cockpit at night, it can be dangerous.

The brain causes the illusions, meaning you can misjudge objects that would be easily recognized in daylight. The slant of a cloud could be mistaken for the horizon, or the lights of a city street could look exactly like runway lights. If the illusions are severe, disorientation can result. If you realize and accept that such illusions can occur, look twice at what you're viewing, and properly interpret your instruments, you can overcome the illusion.

There are other examples of night illusions. If the night is clear, distant, unmoving lights will look like stars or even other aircraft. If you perceive such a light above you and mistake it for an aircraft, you could be led into believing the horizon is below you. You reduce your altitude and strike terrain or an obstruction. The creation of a false horizon is one of the most serious night illusions. If the night is dark (no moonlight or starlight), the real horizon can be impossible to see. Some have called this the "black hole" effect, which can also affect both takeoff and landing. This is why being able to fly solely by reference to the cockpit instruments is an essential night flying skill. If one of these illusions appears to be a horizon, before you pitch to it, check the artificial horizon. Trust it more than the seat of your pants.

Oftentimes pilots at night focus too

intently on a single source of light. Once that occurs, the light appears to move. The phenomenon is called "visual autokinesis," and the trouble occurs when you perceive the moving light as another aircraft, perhaps on a collision course. As you turn to avoid a collision with the phantom aircraft, you contact terrain or become disoriented. Visual autokinesis can occur after fixating on a light for only a few seconds. To prevent this, rather than focusing on the single source of light, expand your visual field, force yourself to take in more of your surroundings, and the light remains stationary.

Regulations require a certain number of outside aircraft lights to be on at night for safety. But a strobe light can be very distracting, especially when you're maintaining legal distances from clouds and you get "echoes" or reflections off the clouds. Internal cockpit lights can flicker for a variety of reasons and distract you from perceiving your visual cues properly. The worst case scenario is that a strobe or intermittent light in the cockpit can cause flicker vertigo, which can incapacitate you through nausea, dizziness, grogginess, headaches, or confusion. Severe flicker vertigo can render a susceptible pilot impaired or incapacitated.

Earlier we mentioned making an approach to landing at night with night-adapted eyes, and we also referenced the "black hole" effect where you lose your horizon. Another "black hole" danger can occur when you make an approach to land from over water or from over terrain which is unlighted. The runway lights are the only source of light, and remember if you focus on them too much, visual autokinesis can occur. The lights could appear to float or move if you use them for your only visual cues. When we're first learning to land, we're taught that many of our visual cues for landing come from our peripheral vision and that it is important to move our aiming point on the runway continuously ahead of the aircraft--a bit of problem at night. At night, because of the brightness or dimness of the runway lights, the runway could appear to be closer or further away, upslope or downslope. This, where electronic navigation and being able to use your cockpit instruments as a substitute for your "missing" peripheral vision, is essential. Lighted or fluorescent-painted VASI's or PAPI's, flying the glide slope, interpreting the configuration of runway lighting, and using flight instruments to maintain proper orientation and height above the ground can help you make a normal night approach and overcome the black hole effect.

A couple of caution notes:

- Approach lighting can be a good visual cue at night, but you have to be familiar with the configuration. Pilots have mistaken the double row of approach lights for runway edge lights. Because the rows of approach lights are closer together than runway edge lights, pilots have landed short of the runway at night, in the midst of the approach light stanchions. The visual illusion was that they were too high, so they did not heed the cockpit instruments and reduced altitude, resulting in a fairly classic controlled flight into terrain accident.
- When turning on pilot-operated runway lights, listen to UNICOM for traffic and other pilots activating the system. Judge very carefully when you turn them on. Most of these systems are on a timer, which turn them off after an amount of time deemed reasonable for an approach and landing. If you turn them on too soon, they could cut off in the middle of your landing. Trying to key the activation sequence again is a major distraction at that point. Turn them on too late, and the sudden flare of light can be a distraction as well. As part of your preflight planning, a call to your destination airport to determine how long the pilot-operated lights stay on will give you the information to know just exactly when during your approach you should turn the lights on.

After all this discussion of illusions and distractions, night flight might seem as frightening as the monsters under our beds at night when we were children. As we grew, though, we realized there were no monsters under the bed (the closet could be a different matter), and so it is with night flying. As our experience as pilots grows, that confidence develops, and a night flight can be not only successful, but rewarding.

## Pilot Equipment

FAR § 91.205, Instrument and Equipment Requirements, lists the required aircraft equipment for day or night, VFR or IFR flights, but pilots should consider one extra piece of personal equipment that is fairly inexpensive and can be one of the most important pieces of safety equipment in the cockpit at night-provided the batteries are fresh. We're speaking of a flashlight, preferably one where you can switch from white light to red. The white beam can be used for night preflights and shouldn't disrupt your eyes' night adaptation if you don't shine it directly in your face. The red beam can be used inside the cockpit for reading checklists and so forth since it won't destroy your night adapted vision. However, since some information on aeronautical charts or checklists is printed in red or a variation thereof, like magenta, the red may not be visible or may be difficult to read. Again, as long as you're aware of this possibility, you can adjust, switching between the two beams as necessary to see all the information clearly.

There are many commercial flashlights out there, from ones which clip in a shirt pocket or onto a blouse and with a flexible neck to put the light exactly where needed to those on a lanyard that can be worn around the neck. The ideal size is probably as small as possible with as much light as possible for the size. Select what



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works best for you and make it a part of your flight bag.

Needless to say, a spare set of batteries and a spare bulb in that same flight bag is essential--and make sure they're the right size for the flashlight.

Another aside here about night preflights. Preflight at night may take longer to accomplish, but it is important not to forego this inspection because there is a lack of light. If you don't have a flashlight--remember, it's not required except on certain air carrier flights--try to do the preflight in a lighted area. Of course, if you do that, you'll have to wait for your eyes to adapt, or re-adapt as the case may be. This is why night flights require attention to planning and preparation and involve details that day flights don't entail.

The appropriate and current aeronautical charts and other information about airports are another important piece of personal equipment for a night flight. Cities and towns which are prominent landmarks during the day, may also be visible at night because of street and residential lighting, but they may not be so easily identifiable. Only current charts can help you with that identification. Here on the east coast, for example, from Boston to North Carolina there is nearly a constant run of city lights which merge into each other. However, with current charts and by checking landmarks carefully and confirming them with electronic navigation, you can safely navigate VFR at night.

One of the night illusions associated with city or town lights is just how far distant lights can be seen at night, particularly in wide open spaces where the towns are spaced apart. The lights which may seem close may actually be miles distant and not the town you've planned to fly to. That is why electronic navigation as a supplement is so important to a successful VFR night flight.

## Airplane Equipment and Lighting

In the previous subject we mentioned FAR § 91.205 and the requirements for night flight, and we listed them fairly extensively in Part 1, but here is a good point to review aircraft position lights and recall how we were taught to interpret another aircraft's position relative to our own when viewing the trio of lights at night. There is a red position light on the left wing, a green one on the right wing, and a white one on the tail.

A word about landing lights at night: Like any needed item, landing lights have been known to fail almost exclusively at night. To build up your confidence so that you know how to deal with that minor emergency, consider taking some time with a flight instructor at night and practicing night landings without the landing light. For safety, pick an instructor who's experienced at night flight and an airport you're familiar with for this practice. That familiarity takes some of the edge off and helps you build a skill that you can call on when you're someplace not so familiar.

## Airport and Navigation Lighting Aids

Again, let's review how we can recognize that we have indeed reached an airport at night and not the parking lot of a shopping mall. Airport locations are indicated at night by a rotating beacon. The beacon rotates at a constant speed with a series of light flashes in different colors to aid in identification. As an old middle school teacher, I just can't resist those pop quizzes. In this one, match the description of the rotating beacon with the type of airport. The answer is at the end of the article. Come on, this is an easy one.

__Alternating white and green
__Two quick white then green
__Alternating white and yellow

a. military airport
b. civilian water airport
c. civilian land airport

White, green, and yellow are used on airports to identify them and red lights, either steady or flashing, denote obstructions off airport that may be a hazard to navigation. High intensity white lights mark supporting structures of powerlines or other tall structures such as smokestacks or towers.

Runway lights themselves are white, and taxiway lights are blue. Yellow lights outline a caution zone on a runway, and sometimes the pilot can adjust the intensity of runway lights, as well as turn them on and off. A large, busy airport at night can be a virtual sea of lights, and understanding the configuration of runway and taxiway lights is essential for safe taxiing. All the various, possible configuration of approach, runway, and taxiway lights are shown in the *Aeronautical Information Manual*, which is now on-line at <http://www.faa.gov/ATPubs/AIM/AIMTOC.HTM>.

All right, after all these cautions and philosophizing, time to get down to it. Let's examine a hypothetical night VFR flight from beginning to end, and within that fiction is knowledge so logical, you may have overlooked it. What follows may seem simplistic to a seasoned pilot, but everybody can stand a review once in a while.

## Preparation and Preflight

Preflight planning and preparation have been themes running through Parts 1 and 2 of this article, and they just can't be emphasized enough, not just for night flights, either. Statistics show that between 1995 through 1997, there were 46 night time VFR accidents which had a probable cause concerning the preflight.

Another good quote from the FAA's *Flight Training Handbook* goes like this:

"Night flying requires that pilots be aware of, and operate within, their abilities and limitations. Although careful planning of any flight is essential, night flying demands more attention to the details of preflight plan-

ning and preparation."

There's the simple logic I mentioned.

FAR § 91.103, Preflight Action, has that catch-all phrase, "all available information." Let's try to define what that might mean for a night VFR flight:

- A thorough review of available weather reports and forecasts, with a good eye to the temperature/dew point spread. Any restriction to visibility complicates a night VFR flight, and a narrow temperature/dew point spread means the possibility of fog. Fog that you can't see because it's dark, that you won't see until you're in it.
- A consideration of wind direction and speed. During the day, you can tell when wind is stronger than forecast by its pattern on crops or water, by the fact that your landmarks come up slower than expected. All of these cues are more difficult to pick up on at night.
- Appropriate aeronautical charts, including the appropriate adjacent charts. Draw your course-line in a heavier weight, and note --maybe circle--prominent lighted checkpoints. Mark as well any obstructions to look out for, but they make excellent visual cues for navigation. Major roads can still be distinguished at night, and electronic NAVAID's along your course should be noted as well.
- Check that you have everything you need in your flight bag before flight--extra batteries or better yet an extra flashlight.
- Check your aircraft position and anti-collision lights for operation during the preflight, the landing light as well. Check for loose connection by tapping the light to see if it flickers.
- Last, but not least, do a walka-round of the immediate area of the ramp or taxiway. Large FOD is easy to spot in the daytime, but not so easy at night.

*Taking off at dusk — are you ready for a night flight? (Gary Livack photo)*

## Starting, Taxiing, and Runup

Preflight planning and preparation are thorough and complete. Time to get this trip underway. Before starting the engine, arrange the items--charts, flashlight, headset, pens, pencils--you will need. Some duties, such as holding onto flashlights and charts can be delegated to a passenger, but when solo, get everything in order yourself. You might also want to fold or unfold your charts, as the case may be, to your course and arrange them in the sequence you'll need them.

So as not to tax your electrical system before a night flight, don't turn on all your electrical equipment before starting the engine, just what you need for safety: position lights or rotating beacon or strobes, for example, to alert others to aircraft movement. A final pass of your flashlight outside the aircraft and around the propeller area might be a good idea as well before starting the engine. Just because it's dark and quiet, perhaps, doesn't mean you shouldn't call "Clear prop!" at night.

If you have taxi lights or you want to taxi with the landing lights on, turn them on only after you've started the engine. Concerning the landing light--it helps your visibility tremendously but in some aircraft if you operate it continuously at the low RPM's associated with taxiing, the drain on the electrical system can be severe. Slow taxiing speeds can also mean the landing light can overheat and fail. The *Flight Training Handbook* says to use them "as necessary" during taxi, but be mindful that other pilots may be night adapting their eyes and don't need your landing light to suddenly come on. Taxiing itself might need to be slower than what you would do during the day to give you time to see taxiway lines or lights.

That peripheral vision we have during the day also cues us when we're letting the airplane creep during runup. This is not so easily detected at night, so alertness for this is another item on the runup checklist. Hold the brakes as heavily as you can to prevent forward movement.

## Takeoff and Climb

Taxi and runup are on the numbers, and now you're faced with the possibility of making a takeoff into a dark night. Night time VFR accidents between 1995 and 1997 show that you are more than five times as likely to have an accident during the takeoff and climb phase of flight (73 accidents) than you are during the standing and taxiing phase of flight (14 accidents). The use of your cockpit instruments helps you not only en route and on landing but on takeoff as well. Adjust your cockpit lighting so that the brightness doesn't overcome your night-adapted eyes but not so dim that you can't read the instruments. Just the right level of cockpit lighting will let you read and interpret the instruments but will not reflect on windows enough to distract you.

Taxi and landing light on, line up on the centerline, and use the runway edge lights as a visual cue. Check the heading indicator to make sure it reflects the runway heading. You can use that to track the centerline if need be. All the takeoff procedures are the same as for daytime, but you'll need to check the flight instruments more frequently to maintain proper attitude, heading, and airspeed. At the appropriate airspeed, adjust pitch for a normal climb and verify using both cockpit instruments and any outside visual cues, such as runway lights.

Because you can't see the ground move away from you as you can during the day, maintaining a positive rate of climb can be done with the attitude indicator and/or the vertical speed indicator, as well as the altimeter--three instrument sources of information to replace the visual source. At night as in daytime, best rate of climb airspeed should be used, except where best angle is required. Because turns can induce vertigo so quickly at night, wait until reaching a safe maneuvering altitude before beginning turns and use your instruments to verify that the turns are coordinated. If you've taken off with your landing light on, once you've left the runway, it's of little use. To save strain on the electrical system, turn it off.

## Orientation and Navigation

Aside from the daunting prospect of taking off into the dark, night takeoffs vary little from daytime ones. The same is true of navigation en route. VFR at night can be done on instruments (however, the pilot is still responsible for see and avoid) or can be a combination of pilotage and dead reckoning as during the day, but electronic NAVAID's are the best way to keep yourself oriented at night, especially over areas where the night visual cues, such as prominent lighted objects, may be scarce.

Probably the most significant problem that can occur to a pilot navigating at night is flying into weather that you are unable to see. When there are lighted landmarks to see, you can look out for low clouds or fog by noticing when lighted objects on the ground become dim or obscured. The lights themselves will have a halo or glow around them, and when you spot that, continuing in that direction is not a safe alternative. When you're at altitude, above the obscuration, it may not appear to be as problematic as when you begin your approach and inadvertently enter a situation where you lose visibility. If that happens, again, the instruments can keep you straight and level and assist you in making a 180 out of the area. Remember, also that you have less visibility in fog and clouds looking forward than you do looking out the side window and straight down.

Again, the *Flight Training Handbook* states it simply but eloquently:

> "Under no circumstances should a VFR night-flight be made during poor or marginal weather conditions..."

One of our veteran aviation safety program managers, Mr. Scott Gardiner in Seattle, Washington, adds this:

"There have been two occasions in my own personal flying career when I entered clouds while operating VFR at night. Both times I had done a thorough preflight, including extensive weather briefings. Both times, I was convinced that there would be no clouds along my route of flight at my altitude. For example, on one occasion, I would be flying at 7,500 feet MSL, and the only reported or forecast clouds were above 20,000 feet MSL. And yet, I entered clouds and never even saw them coming. They were not serious clouds associated with a frontal condition or thunderstorms. There were rather benign clouds, still they were big enough to require two to five minutes to maneuver out of them. The reason I did not see the clouds coming is--it was night time. Very dark, moonless nights over uninhabited terrain."

How to overcome this potential threat if night time prevents us from seeing clouds?

Training. Practice. Training. Experience. Training. Detecting a pattern?

For VFR at night, being competent at straight and level flight and being able to make coordinated turns may not be enough. You need to be com-



petent at those maneuvers as well as climbs, descents, climbing and descending turns, steep turns, and recovery from unusual attitudes--*all by reference to instruments*. Again, you may be absolutely proficient at these maneuvers, even unusual attitudes, in the daytime, but you perform these maneuvers usually by referencing outside visual cues, supplemented by the cockpit instruments. At night, your recovery depends on your ability to interpret the instruments properly and trust what they are showing over the physical sensations you're experiencing. We've done plenty of articles on the physical causes of spatial disorientation, so we're not going into the anatomy of the inner ear here, but to be a proficient night VFR pilot you must be able to understand that your perceptions of reality and the reality presented by your instruments may be in conflict. The reality presented by your instruments is what you have to follow to operate safely. The only way you can be successful at this is to be trained properly and to practice until it becomes instinctual. Even then, you have to maintain proficiency at flight solely by reference to instruments, or the instinct fades.

If your night VFR flight takes you across a large body of water, and particularly if you're in a single-engine aircraft, you have to be even more cautious, your planning even more thorough. Ditching in the water at night is actually the least of your concerns, given lack of depth perception, the black hole effect, lack of orientation, maritime weather conditions, and so on. Even when the night is clear, and the stars bright, they can reflect on the water and turn up into down unless careful attention is paid to the instruments.

Given all that, you've successfully completed the en route portion of your VFR night flight and are now in range of your destination airport. This seems to be the most hazardous phase of flight. Between 1995 and 1997 there were 223 night time VFR accidents during approach and landing.

## Approaches and Landing

Sometimes we overlook the obvious because it is there in front of us. For example, the FAA's *Flight Training Handbook* again offers some simple wisdom:

"Every effort should be made to maintain the recommended airspeeds and execute the approach and landing in the same manner as during the day."

Airspeed is airspeed day or night, but possibly the biggest hindrance to accomplishing a night approach the same as during the day is a lack of depth perception and the accompanying inability to judge distance. Yet again, the cockpit instruments, particularly the altimeter, is a partial substitute for your depth perception. Of course, that gives you vertical distance and not forward, and we've already discussed the illusions that approach lighting can create when fixating on them to try and judge distance. The key is to fly an exact traffic pattern, one of proper size and direction for the airport in question, and your instruments will help you do that.

On final, align yourself midway between the rows of runway lights. Some airports have lighted centerlines, and this is something you should have determined during preflight so that you don't line yourself up between the centerline lights and one set of runway edge lights by mistake. A stabilized approach works at night just as in the day, as do the use of flaps. During a night approach, the landing light is turned on about halfway down final. Any higher than that, and it's nearly useless in lighting any object for you. In fact, it may reflect off terrain, like water, and back into your eyes, undoing your night-adapted eyes just when you need them the most.

An inexperienced night pilot tends to flare too high, possibly because of a fear of contacting terrain he or she can't see. To overcome this, maintain a stabilized approach until the landing light shows the runway. At that point a good identifying cue for the flare are the tire marks on either side of the centerline. Landing technique from flare on to touchdown is the same as for the daytime.

If for some reason you have no landing light or you and your instructor are practicing landings without the landing light, sighting the runway end lights at the far end of the runway is the cue for the flare. When they appear to rise higher than the aircraft's nose, time to roundout. You may have to "feel" for the runway with a bit of power and pitch, but the point is to use what visual cues you have to complete the landing successfully. Remember not to fixate on any lights used as visual cues for a night landing because of the visual autokinesis phenomenon.

Safely landed at last! There is one more consideration we need to talk about, and that is emergencies. Daytime emergencies are stressful enough and can be dealt with through training and proficiency. A night time emergency is something no pilot wants to experience, in theory or reality.

## Night Emergencies

The thought of an engine-out emergency at night and having to make an off-airport landing as a result can bring sweat to the palms of even the most seasoned aviator. However, accident statistics show that failing to deal with an engine-out emergency at night is not among the top accident causes. (Continuing flight into adverse weather and poor pilot judgement are the top causes.) The old flight instructor adage, "Remember to fly the airplane," applies equally for day or night emergencies, and as during the day, you will find that being busy dealing with the emergency will take your mind off the fact that it is at night. This confidence and ability comes only with...? You got it. Practice.

Here are some things that the FAA recommends you keep in mind in an engine-out emergency at night:

- Fly the airplane, as we've already said, or as the *Flight Training Handbook* puts it, "Maintain positive control...and establish the best glide configuration and airspeed."
- The temptation at night is to "go toward the light," but that usually means a congested area with lots of obstacles and persons and property on the ground. The ideal locale for an emergency landing is always an airport, day or night. Your charts are an essential tool in locating a nearby airport. If you know the terrain or can make a good determination from your charts, head for an unlighted area and plan your emergency landing for there. If you're close to some type of public access--a road, a railroad track, and so on--try to land as close to that as possible for ease of help getting to you or your going for help.
- Follow your emergency checklist and the manufacturer's recommended procedures to try and diagnose the problem and attempt an engine restart.
- Communicate your situation on UNICOM or to air traffic control. 121.5 is always available.
- As in the daytime, land into the wind, and complete the before landing checklist. Check your landing light to see if it is still operative and turn it on to show the terrain or obstacles. Again, just as with an emergency landing during the daytime, at night land as normally as possible and at the slowest possible airspeed. If you have no landing light and no visual references, maintain a level landing attitude and fly to ground contact. After the landing, the procedures to secure the aircraft are the same as for day flights--turn off all switches and get out of the airplane as quickly as possible.

We haven't said much about flight plans for night flights. After all, a flight plan in and of itself does not prevent an accident; it merely gets the search and rescue started sooner when you don't show up. When you've just made an emergency landing at night, perhaps in the middle of nowhere, a filed flight plan can give a feeling of comfort and optimism.

This also brings to mind the importance of a functioning ELT. Even if your emergency landing technique is good enough not to set the ELT off on contact, you need to switch it to "ON" to aid rescuers. And what better time to mention the benefits of being accurately and swiftly pinpointed by a 406 MHz ELT?

## Conclusion

I think we've shown that a VFR night flight can be completed with thorough planning and preparation and by a well-trained and proficient pilot. Give some thought on how to become that pilot, well-trained and proficient enough to deal with a VFR night flight. In recent years, the FAA has made it incredibly easy to obtain an instrument rating. No longer do you have to accumulate a certain number of hours, for as soon as you earn your private pilot certificate you can begin your instrument instruction.

So, why not? Likely if you can afford the average 70+ hours of instruction to receive your private pilot's certificate, the additional hours of instrument training is just as affordable and well worth the effort. Experienced pilots within and outside the FAA have called the instrument rating "the cheapest insurance you can buy." Accident statistics tend to confirm that: accident rates among instrument rated pilots between 400 and 1,000 hours are considerably less than those for non-instrument rated pilots at the same experience level. After my instrument rating I really felt as if I had a better feel for an airplane and definitely more confidence in being able to handle marginal weather situations.

There is a study being done at Embry-Riddle Aeronautical University about the possibility of a combined private-instrument certificate; i.e., while you're learning to become a private pilot, you're also learning to become a instrument pilot. Upon certification you would be a Private Pilot-Instrument Airplane. The research is promising, having reached the stage where practical test standards need to be developed.

In these two articles on night VFR I've beaten to death the concept that VFR night flight can be successful every time if the pilot is thoroughly prepared and trained for night operations. You can be proficient at flight solely by reference to instruments without obtaining an instrument rating, but an instrument rating, judiciously used, can also open another aspect of aviation to you. Getting an instrument rating was also some of the most fun flying I had experienced (seaplane rating has to be tops), and with the ease of obtaining an instrument rating now, there may be no good excuse not to get it. There are many highly experienced, very competent, non-instrument rated pilots out there who will likely disagree, and they can make their case as well as I've tried to make mine. I believe that aviation is an opportunity to grow and learn continuously, and the truly good pilot learns something from every flight. Obtaining the instrument "ticket" is an important step in your continuing aviation education.

We climb mountains because they're there. We participate in extreme sports for the incredible rush. Earning an instrument rating that could save your life or your passengers' lives is more reasonable in some ways than "because it's there" or "because it's a rush." However, earning an instrument rating because it's available or because it's fun is as good as excuse as any.

Instrument rated or extremely proficient at instrument flight, the night sky awaits, and, if you've done everything you need to do, it can be a flight experience both challenging and sublime.

+

*Quiz answers: c, a, b*

# Winter Flight Safety

by H. Dean Chamberlain

Gary Livack photo

In preparing for the Winter of 1999, all pilots should remember what survival experts have said for years. Pilots should always carry a survival kit appropriate to the conditions along their route of flight and to always dress to be able to walk home in the conditions in or over which they will be flying. The same is true of all passengers onboard. For example, Alaska and Canada have specific survival kit requirements and restrictions for pilots and passengers that must be followed when operating within those areas or within designated areas. Even though the "lower 48" have no such requirement, a winter survival kit may be a good "best practice."

If you are flying from one set of conditions such as a cold, snow-covered area to a warm, sunny beach area or from a beach area to the ski slopes, you need to consider the needs of both areas for yourself and your aircraft. But to give yourself the best chance to survive your trip in case you have to make an off-airport landing, the most important instruction is to always fly your aircraft. A controlled off-airport landing rather than an out of control crash is your most important aircraft survival tool. Then, once you are safely on the ground, you need to think about the following.

## The Essential 10

The list of items that some organizations consider the essential 10 items every survival kit should contain is shown in the sidebar on page 11. Once you have the essential 10, you can decide, based upon your local environmental conditions and how much money you want to spend or what other items you may want to carry. Some people will never carry any type of survival kit. Some will carry a very basic kit. Others will be very well-prepared. To best illustrate that point, an Air Force survival expert made an important point at a safety meeting several years ago by asking the question, "Why would you want to carry one of those small reflective type emergency survival blankets when you can carry a real sleeping bag and be warm and comfortable?" I thought he made a good point. Why restrict or limit your comfort if you have the space and load carrying capability to carry what will keep you both alive and comfortable?

## Preparedness

Only you can determine how comfortable you want to be in case you have to land off-airport. Recently, the media reported on some tourists who took a helicopter sight seeing trip over a glacier in Alaska. What made this item news was the fact they had to spend the night on the glacier after the helicopter had to make a precautionary landing. Then the rescue helicopter had problems. I expect it was a chilly if not a down right cold night on the glacier for some of the tourists. I wonder how many had thought to carry some extra clothing or some simple survival items in their pockets. How many times have you left the house to go flying without taking a bottle of water or a simple snack with you? The point is you need to be prepared whenever you leave the comfort of your home to fend for yourself until you can return there. Some people have written that they had to survive in the wild after an off-airport landing with only what they carried in their pockets. (Their aircraft sank in water with their gear.) Survival may be as simple as not having to eat junk food at the local FBO on a late crosscountry flight, or being able to sit out a storm at the end of a unfamiliar airport, or making a precautionary landing along a deserted highway miles from anywhere without undue stress or discomfort.

## Is Your Aircraft Ready

Once you have the items you wouldn't want to be caught dead without, pilots need to think what items their aircraft may need for the local flight conditions. When was the last time you reviewed your aircraft manual for how to prepare your aircraft for winter and your local conditions? Is the recommended grade of oil installed based upon the anticipated local temperatures? If you fly in the really cold conditions, are engine baffle plates required or recommended? Has the aircraft heater system been checked? Is your heater safe? If you use an aircraft preheater to warm your engine before you start it, has it been serviced and is it ready and safe to use? Do you remember how to safely operate the preheater? And what about your battery, has it been checked recently? Will it be able to start your engine when the temperature drops to nothing? Does your aircraft require any special lubricants in cold weather? If your aircraft has control cables, have they been adjusted for the change in temperature?

Have you reviewed the recommended safe operating procedures for operating on snow or ice covered runways? Do you know the regulations concerning flight in known icing conditions? Do you know the rules for preflighting your aircraft when frost is present? Have you checked your flight manual for any recommended operating procedures for operating on wet

## ESSENTIAL 10

1. Compass
2. Clothing to survive most adverse conditions probable and some form of emergency shelter
3. Extra food and water (Note: Water is more important.)
4. Flashlight with extra batteries and bulb
5. Fire starting material such as a candle or cotton balls covered in petroleum jelly, (35 mm plastic film containers make great storage containers for the cotton balls)
6. First aid kit
7. Sunglasses or some type of eye protection
8. Knife (Note: Big is not necessarily better.)
9. Map (A topographical one for your local area is best.)
10. Waterproof matches or other means of starting a fire

For pilots, some of these basic items should be in your aircraft such as a compass, map, and flashlight.

Other nice to have items include some form of tent, bivy sack, or emergency shelter, emergency signal mirror, loud whistle, plastic sheeting and tubing for collecting water, needle and thread, flexible wire saw, safety pins, cleaning wipes, solar still instructions, fishing line and hooks, wire, space blanket, some type of rope or line, more than one type or method of starting a fire, extra water in multiple bottles or canteens so if one breaks during a rough landing, you still have some water remaining, appropriate hat and coat, windbreaker, waterproof raincoat or poncho, large leaf or lawn plastic garbage bags, bug or sunscreen lotion, a metal cooking/drinking cup or container to heat food or drinks over an open fire, toilet tissue, sleeping bag in a waterproof container, insulated sleeping ground pad, ground cloth, water purifying kit, cooking and eating utensils, soap and towel, insulated waterproof sitting pad, backpack large enough to contain the items you decide to carry, cellular telephone, aircraft frequency transceiver, handheld GPS unit, lots of extra batteries, extra eyeglasses if required, large handkerchief or bandanna, canteen, any special medicines, fleece or wool sweater, appropriate fleece or wool clothing for layering, shorts, notebook and pencil, lip balm, mosquito head netting, multi-function tool, small folding wood saw, one or two hacksaw blades, duct tape, mini flares, and some basic tools that might be found in your aircraft.

Hopefully, this list of possible survival items will give you a good starting point to develop your own kit designed to protect you in your local environment. Space, weight, and cost will determine what you carry. However, regardless of what you carry, if you don't know how to safely use and carry those items, you will not gain the most protection and benefit from those items. Nothing will save you if you don't know how to survive, but people have survived on practically nothing because they knew what they were doing and their will to live over came their environment. Have a safe winter of flying and traveling.

## SURVIVAL INFORMATION

For those with access to the Internet, it has some great outdoor survival sites and various government sites contain more data than you will ever need. Also, several national organizations publish good emergency or survival type books. Examples include survival or disaster type books published by the American Red Cross, the Boy Scouts', and the U.S. Government. There are also many good hiking and camping books sold by some of the national outdoor recreational stores or those for sale on the Internet. An excellent source for survival type information especially for natural disasters and one I recommend highly are those produced and distributed for free or sold through the Government Printing Office (GPO). Information produced by the various Federal agencies such as the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency (FEMA), or even the FAA contain some great information. One manual I recommend highly is sold through GPO. Its title is "Aircrew Survival." It is a Department of the Air Force, Air Force Pamphlet 36-2246, dated 1 March 1996. Although it contains escape and evasion data for airmen in enemy territory, the new waterproof green spiral bound booklet contains some great survival ideas and data for all types of terrain. From building shelters to finding food to basic first aid, the book has it all in a size that is perfect for a flight bag. For those who may want to build a good survival library, GPO also sells both the U.S. Air Force and U.S. Army detailed survival manuals that go into more detail than you ever wanted or possibly need to know. Some of the data in the military manuals are in color to aid identification of select plants, snakes, and other exciting things in the boonies. Another good source of data is your local state government. Local state data is particularly valuable if you are going to operate within a relatively small area. The bottom line is quality information is available either for free or for a small fee, the question is are your interested enough to find it before you need it?

runways in freezing conditions? If your aircraft has retractable landing gear, what is the recommended procedures for retracting the wheels in icing conditions? Have you checked with your local aviation maintenance technician for any manufacturer's required or recommended maintenance procedure? And if your aircraft is not equipped for operating in known icing conditions, what is the recommended procedure to follow if you find your aircraft suddenly icing up? If your aircraft is approved for flight into known icing conditions, do you know the recommended operating procedures for your particular anti- or deicing system? Have you read the latest FAA recommended de-icing boot operating procedures? If you have pitot heat, does it work?

Does your aircraft flashlight or flashlights have fresh batteries? After all, the days are getting shorter and more flying is being done at night. If nothing else, you might need a good flashlight to preflight your aircraft in the dark. Are you night current? Are you night proficient? Are you instrument rated and current? Have you checked your aircraft's tire pressure? Have you checked for water in your fuel system? If there is water in your tanks or lines, it might freeze and cause your a moment of extreme silence. Have you checked your emergency locator beacon (ELT)? Has the ELT been inspected as required by regulations and is the battery current? Better yet, for a faster search and rescue response in case of an accident, you might want to upgrade your aircraft to a 406 MHz ELT. The reason is 406 MHz ELT alerts get checked out faster by the search and rescue folks compared to the more false-alert prone 121.5 MHz ELT alerts.

### Passing Through

If you normally operate in a warmer area of the country during the winter months, are you prepared for cold weather operations in case you decide to fly home for Christmas in a colder part of the country? Are you and your aircraft prepared for the change in operating environment? Can you land and takeoff on a snow covered runway? Can you even spell ice and snow? (This writer is jealous of those who cannot spell either or who have never seen ice or snow.)

These are only a few of the many questions that pilots and aircraft owners should ask themselves as most of the nation changes to cold weather operations. I think it is safe to say that for those who operate year round in cold areas such as along the northern tier states and in Alaska, pilots, operators, FBO's, and maintenance technicians know what has to be done to safely operate their aircraft in cold conditions and should have passed that information along to the new folks operating in those areas.

But since we have had an increase in the number of new students learning to fly aircraft, and since the economy has been so good this year that more pilots can now afford to fly, I think it is important that everyone should review their aircraft's operating manual for cold weather operations. For those who have not yet learned the lessons, and for those who may have forgotten the lessons, now is a good time to take a few minutes and review the books both for your aircraft and on the art of winter survival. It is never too early to prepare for a safe and prosperous winter season of flying.

*Continued on Page 24*



# Santa Claus 1999

by Patricia Mattison.

Jingle Bells, Jingle Bells, Jingle all the way," sang Santa as he looked over the list of toys boys and girls had asked for. It had been a hectic year preparing for the Christmas season. Not to mention the fact that Martha Claus had sprained her ankle and two of the reindeer had been ailing. Every year there was always some problem to overcome. As you will see this year is no exception to the rule.

"You sound mighty happy dear," said Martha Claus as she limped into the workshop office. "Is everything in order for your Christmas Eve delivery?"

"Seems that this year will go very smoothly, Martha. At least I have all the gifts packed and labeled properly for delivery"

"No more mix ups like last year." Martha was remembering the problem of misdirected gifts last year. "What a mess that was! May I help you Nicholas, you look tired?"

"No, Martha, I am just fine. I'm always a little tired by this time, but soon the gifts will be delivered and I can rest. Maybe we can go on a trip, you know, a vacation, just the two of us."

"That would be wonderful, we've had a standing invitation to King Cole's Castle. He was here a year ago and it would be so nice to see him and the Queen again. I'll make the arrangements by the time you return from your rounds."

The night before Christmas Eve was always frantic in the workshop as the elves scurried about making last minute changes to orders. The senior elf, Gunther, had

been with Santa literally forever and could almost read Santa's mind. Recognizing a look of weariness in Santa's face Gunther said "Why don't you go on to bed, sir. We elves can finish up. The sleigh will be ready as usual tomorrow evening."

"What about Dasher and Vixen? They were a bit under the weather last I knew. Will they be up to the trip?"

"They're much better and should be just fine by tomorrow. The Vet was past and gave them a tonic that should help. Now, you go on to bed sir, and don't worry about a thing."

So, knowing that he could rely on Gunther to make things right, a very tired Santa went up the stairs, crawled into his feather bed, nestled down into the soft pillows, covered himself with a down comforter, and fell fast asleep.

Sunrise came all too early for Santa. He was still tired when he reluctantly got out of bed to the smell of breakfast cooking.

"Martha," called Santa toward the kitchen downstairs, "have you seen my red socks?"

"They are in the middle drawer dear, right where they have always been. Your suit is hanging in the closet and the belt is on the hook on the closet door." Husbands, thought Martha they are the same the world over.

After a short time Santa came down the stairs, his coat buttoned crooked, looking for the glasses he had on his head. " Boy, I am just completely tired out, Martha. I hope I wake up and get some more energy before I take my trip tonight."

"Why don't you try to nap this afternoon. The sleigh is ready to go and you haven't had any real rest for weeks. You need to be rested for your trip you know."

"I really can't take the time, I have so much to do. I'll be just fine, the reindeer know the whole route and I have your GPS to refer to. Besides, don't forget that I'm magic after all." Said Santa with a smile.

That evening, just like all Christmas Eves are for Santa, was clear and cold. The reindeer were anxious to get going and stamped their hooves in their traces, eager for Santa to climb up into the sleigh, so they could be off. The elves, under the direction of Gunther, had done a wonderful job of packing the cargo area, making certain all was within weight and balance and tied down. The list had been checked twice and all was ready.

"Nicholas, you look so tired, I hope that this trip isn't going to be too much for you. After all, you are not as young as you used to be." Martha was justifiably concerned. Being tired and flying didn't mix and she knew it.

"I'll be fine, now, don't be such a worry wart and give me a kiss for luck and a hug, just because you love me." Santa wrapped his big fur-covered arms around his wife. "I'll be home before you know it."

In a blink of an eye he was off with promises to keep to all the children of the world.

The trip was going along very well until Santa reached New York City. So far he had delivered to all of the North America except New York State and New York City in particular. He began to realize that he was tired, more so than usual at this point in the trip. He had planned to nap from North America to Europe so he fought to keep his eyes open a little while longer.

"Dasher, if I take a nap while we cross the Atlantic will you wake me please?" Dasher replied with a nod of his great head. With that problem solved, Santa finished the big city and proceeded to cross the Atlantic, and took a nap.

The sleigh soon crossed the ocean and approached the shore when Dasher, true to his nod, attempted to rouse a very tired Santa from a sound, sound sleep. Dasher nickered and snorted, he made the sleigh buck, went in circles all in the hope of waking Santa. Pretty soon all the reindeer were joining the effort to waken Santa. No such luck. Santa slept on and on, peacefully snoring with his head resting on the undelivered gifts.

Somehow Santa had to be awakened, but how, who would wake him up? He had gifts to deliver, a lot of them, before dawn. Dasher had an idea. He remembered the bells of Big Ben in London, how loud they were and that they rang on the hour. Quickly he led the others, picking up speed as they went through the night sky. He had to reach the bells on the hour and only ten minutes remained. Just as the sleigh carrying the sleeping Santa arrived to circle the tower, the bells began to peal. The great bells were so loud that even the soundly sleeping Santa could not ignore the racket and woke with a start.

"Where am I," thought Santa. "I can't have slept that long, but this place looks like London. It is London. Oh my! What have I done. I knew that I was tired but not so tired that I missed half my route."

Looking at the huge face of Big Ben he realized that it was midnight and he had two thirds of the world left to visit.

"I can make it if I don't fool around and the weather holds. Thank you Dasher for your quick thinking. You saved me from sleeping away Christmas Eve. I'll see to it that you get an extra ration of oats when we get home."

Back on course and making up time Santa managed to deliver all the presents, just before the sun came up over the horizon. It was a exquisite sunrise as he landed in front of his house at the North Pole. Martha Claus was waiting for him on the doorstep as usual when he arrived.

"How did it go dear?", Martha asked, placing a kiss on Santa's cheek.

"You would not believe what happened. I took a nap over the Atlantic when...."

Santa told the whole story to Martha, and then he said to her, "I will never fly that tired again, I should have taken the nap you suggested before I left." Then he smiled and said, "You know I really hate it when you're right."

*Patricia Mattison is the Safety Program Manager at the Juneau (AK) Flight Standards District Office.*



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FAA photo

# Inside the Research Development and Human Factors Lab at the FAA Technical Center

by Bill Belanger and Mike McAnulty

Aircraft 1: "Jacksonville Center, American 346 is with you at flight level three five zero.

Controller: "American 346 roger."

Aircraft 2: "Jacksonville Center, TWA 22 descending to flight level three five zero."

Controller: "TWA 22 Jacksonville Center, understand descending to flight level three five zero."

Aircraft 3: "Jacksonville Center, USAIR 550 turning right heading 150 to avoid weather."

Controller: "USAIR 550 Jacksonville Center, heading 150 approved."

Aircraft 4: "Jacksonville Center, Citation 12345 is with you at flight level two seven zero climbing to flight level three seven zero direct Philadelphia."

Controller: "Citation 12345 roger. Expect vectors in two minutes to avoid traffic, an MD-80 ten o'clock seven zero miles, flight level three one zero, converging."

Aircraft 4: "Citation 12345 has the traffic on our display. We'll level off flight level two niner zero to avoid the traffic. We show him sixty miles south, about to enter our alert zone."

Controller: "Citation 345, flight level two niner zero is approved."

Aircraft 2: "Jacksonville Center, USAIR 550 has the Citation on our display."

Suddenly, the controller's scope goes blank.

Normally, such an event would be cause for a frantic effort to reestablish radar contact or to find some other way to maintain separation of IFR traffic. Only this time it doesn't happen that way. This is not a power failure or a computer glitch. It was planned in advance that these events would happen. Instead of a panic-filled attempt to reestablish radar contact, the controller presses a touch screen with numbers from one to 10. Then she turns around to a computer screen and begins entering data from her memory on aircraft position, altitude, speed, and any potential conflicts. Actually, it's just another day in the Research Development and Human Factors Laboratory (RDHFL) at the FAA William J. Hughes Technical Center. There were no real aircraft in the air talking to the controller; the targets on the radar screen were being generated by a computer. The voices of the pilots were people in the next room who were playing the role of pilots.

The goal of the RDHFL is to improve the way the system fits the people (pilots and controllers), not to make the people fit the system. The controller whose radar just went blank was participating in a simulation of a free flight concept. [Editor's note: Free Flight is an innovative concept designed to enhance the safety and efficiency of the National Airspace System (NAS). The concept moves the NAS from a centralized command-and-control system between pilots and air traffic controllers to a distributed system that allows pilots, whenever practical, to choose their own route and file a flight plan that follows the most efficient and economical route. Free Flight calls for limiting pilot flexibility in certain situations, such as to ensure separation at high-traffic airports and in congested airspace, to prevent unauthorized entry into special use airspace, and for any safety reason.]

The scenario above is fictitious and may or may not reflect the final form that Free Flight might take. It was just a test of one of a number of possible ways in which Free Flight might be implemented. There is no "success" or "failure" in such a simulation. Our goal is only to test the concept to see how well it works when people are included in the system.

The controller is a volunteer from an Air Route Traffic Control Center or an Approach Control Facility or another part of the ATC system. The experiment is designed to collect information on how the system affects a typical controller. When the radar screen went blank, the first thing the controller did was to respond to a question, "How hard do you feel you're working?" This information is entered by touching a screen with numbers from one to 10. This is followed by a memory test. The idea behind this test is to find out how well the controller has formed a mental picture of the air traf-

*A controller console at the National Simulation Capability facility. (FAA photo)*

fic in the sector. A well-formed picture would mean the system is helping the controller to keep up with the situation, while a poorly formed picture may mean the system does not fit the controller well.

When the controller participated in the simulation, the system was being evaluated, not the controller. There is no pass or fail for the controller. In fact, the identity of controllers is deliberately kept out of the test results. The goal of the study is to invite a number of controllers to take the same test. If all or many of them have trouble with the proposed system, Free Flight for example, then the system is not well suited to the people as it is implemented in the test. On the other hand, if most or all individuals do well then the system has a good chance of working well in the real world with the people who will have to use it.

## MEASURING HUMAN PERFORMANCE

Of course, it's not quite as simple as just bringing in a group of people to take a test. The experiment is specifically designed to make a realistic assessment of how well the proposed system will work. As with any measurement, you have to be sure the instrument is measuring the thing you want to measure. That is, it is calibrated to some reference, and that it is not responding to something you don't want to measure. The design of such measuring tools is a significant undertaking in itself. A performance measurement could be something as simple as a count of the number of controller errors or could be as sophisticated as a scan of controller eye movements to see how much time is being devoted to each target.

It doesn't do much good to know that a whole lot of controllers do well or poorly on a test, unless you know what the result means. Does it predict how well the system will perform when the real thing comes along? There are many ways to measure how close the test is to reality. Does the experimental participant, a controller in this case, really feel he or she is working traffic, or does it feel like a video game? Simply imitating the physical setup is not enough to assure the simulation reflects reality. Remember, the whole experiment is based on a series of performance measurements that put numbers on the quality of system performance. The simulation, as judged by the performance measurements, should behave the same as its real world counterpart. If it doesn't, something is wrong and the simulation doesn't reflect reality. A simulation that doesn't reflect reality may produce a lot of data, but it would be a lot of useless data.

To this end, the RDHFL goes to great effort to produce a realistic environment. The radar scope is an advanced CRT display which is programmed to look a great deal like the radar screen in an Air Traffic facility, but the CRT gives a lot more flexibility. For example, the CRT allows you to test different display colors, different fonts in the data block, etc. A conventional scope wouldn't allow this. All the strip holders are there, and the room is dimmed to simulate an ATC facility.

In a small simulation, such as the preliminary Free Flight experiment, there would be only two controller positions. The controllers talk to pilots over simulated radios, which may be as simple as intercom links. In a different experiment the communication links may simulate possible future radio systems, such as digital radios. The pilots are actually located in a room across the hall. They fly airplanes that only exist within a computer. When ATC instructs one of these airplanes to turn to a heading, the pilot gives a readback on the simulated radio and then types in the new heading. On the controller's scope, it looks just like a real airplane is making a normal turn to a heading. The airspace can be a simulation of a real ATC sector or a generic airspace designed to be easy to learn, but representing no particular airspace. The advantage of the generic airspace is that it puts all controllers on the same footing rather than having some who are familiar with the airspace and others new to it.

The end result is a measurement of system performance. Using these measurement tools it is possible to tell how well the new system compares with the real world. It is also possible to test a number of new systems and to compare how well they do. Again, the object is to test the system, not the people. It is also possible to challenge people with unusually heavy (or unusually light) workloads. Such a test can give advance warning of coming problems without endangering people's lives. It can also avoid some very expensive mistakes that tend to happen when hardware is designed without the operator in mind.

## NATIONAL SIMULATION CAPABILITY

Simulation is an essential part of the design of the National Airspace System. It allows the system to be stressed to and beyond its limits without creating real world dangers. In 1988, Congress recognized this need in the Aviation Safety Research Act and mandated the National Simulation Laboratory be created. This was originally envisioned as a single stand-alone facility, but in 1991 the FAA recognized that it would be quicker and more cost effective to combine the existing simulation capabilities into a single distributed system. The name was changed to the National Simulation Capability (NSC). This is the tool that is used to assure that the National Airspace System continues to function effectively and safely. While the two-position experimental setup described above can test limited situations with one or two controllers, the National Simulation Capability can simulate a complex environment much more like the real ATC system. Although NSC no longer exits as a distinct entity, the simulation capabilities that were developed under this program are still being used.

The National Simulation Capability includes full-scale mock-ups of ATC facilities, complete with conventional-looking radar displays. All the furniture, displays, and equipment are the same as those in typical ATC facilities. Each test facility can become a convincing replica of a real facility by simply mounting the proper maps and programming the computers to simulate the airspace. Controllers quickly begin to feel they are controlling traffic in a real environment.

The facility uses many of the same pilots who sit at computer consoles. However, it also has the ability to tie into cockpit simulators around the world. This makes it possible for the aircrews in the simulators to talk to real controllers and move in a complex simulated traffic environment. Thus an aircrew in a simulator in Seattle may be "flying" in Atlanta airspace talking to controllers located in Atlantic City.

*The CRT controller console used for Human Factors experiments. The device being worn by the controller is an oculometer which detects the position of the subject's eyes. This allows the experimenters to determine what he is looking at. (FAA photo)*

## VIRTUAL REALITY

Virtual reality has been the subject of several science fiction movies. Today many entertainment complexes offer virtual reality games where you can shoot aliens or engage in combat with an enemy from the black lagoon. In more serious commercial applications you can even walk around your new kitchen before it's built.

At the RDHFL, virtual reality is put to serious use. In cooperation with the Turkish government, the Lab produced a virtual reality mockup of the Greater Anatolia Airport and the surrounding terrain. Representatives from Turkey and their U. S. based engineering firm were able to place their viewpoint anywhere in the airport to observe the tower, cargo terminal, passenger terminal, runway, taxiways, roads, etc. This allowed problems to be identified and corrected before they were literally cast in concrete.

The next generation of Air Traffic Control display consoles have received similar treatment. This allowed a team of designers to view three-dimensional consoles from any angle in the virtual air traffic control rooms. Even moveable features, such as adjustable tabletops, tilting displays, and sliding printer stations, were animated to help the future users and designers of the consoles to correct flaws very early in the design process.

A virtual control tower allows the tower environment to be created for use in the various experiments performed by the lab. From the controller's viewpoint the tower can be viewed through a wide visual angle. Virtual aircraft can be seen out the virtual windows, and the aircraft respond to the control inputs of pilots stationed at computer consoles or simulators. The viewer can also move anywhere in the airport environment, perhaps to follow the airplane down the approach path.

A virtual human can be inserted to represent a person who is any size from the smallest to the largest one percent of the population. This tech-

*The audiometric booth used to simulate a cockpit noise environment, allowing realistic evaluation of the impact of cockpit noise on ATC communications. (FAA photo)*

nique allows the usability of the virtual equipment to be studied. It answers questions such as can he or she reach the controls from a normal sitting position and will he or she bang knees every time he or she sits down? This assessment can be very helpful when equipment is designed to fit the people who will have to use it.

## HUMAN FACTORS DESIGN GUIDE

With the recent change in Federal purchasing laws, much more of the equipment purchased for FAA use will be commercial off-the-shelf. This change means an end to the fabled $100 hammers, but in its place comes a new problem of ensuring that the equipment purchased is suitable for the job it is being asked to do. With less and less custom-designed equipment being purchased, there is a greater need to assure that commercially available equipment will do the job in the often special environment of FAA facilities.

There are the simple problems such as assuring that chairs and keyboards will adjust to the right height to prevent repetitive motion injury. There are more complicated problems like assuring that the equipment can be maintained after it is installed and working. For example, frequently changed cables should be routed through the front of the equipment, not the back. Displays and front panels need to be uncluttered so they can be easily understood and operated. Lighting must be bright enough for the job, but not so bright as to interfere with special needs or create glare. In particular, you would not want reflections on a radar screen, nor would you want an environment so noisy that a controller could not hear their radios.

A big step in facilitating the use of off-the-shelf equipment is the Human Factors Design Guide. This thousand-page guide was published in final form in January 1996. It contains the latest information about human factors and equipment purchase. There are sections on designing equipment for maintenance, human-equipment interfaces, human-computer interfaces, workplace design, personal safety, environment, and other topics. For those who would like a copy, it is available from the National Technical Information Service in Springfield, VA 22161 as report number DOT/FAA/CT-96/1 (order number PB96-191267INZ). Sorry, it's not free. Call 1-800-553-6847 for the price. Or, for those with Internet access, you can find it at <http://www.tc.faa.gov/hfbranch/ hfdg>

These are only a few of the things going on at the William J. Hughes Technical Center. The RDHFL is only a small part of a much bigger facility. There are many other projects being conducted on a regular basis. For more information, the Technical Center is on the worldwide-web at http://www.tc.faa.gov.

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*Bill Belanger is an employee of the Environmental Protection Agency, who was on a temporary detail to the FAA William J. Hughes Technical Center. Mike McAnulty is an Engineering Research Psychologist and Team Leader in the NAS Human Factors Branch at the Technical Center's Research Development and Human Factors Laboratory.*

*The glove used to sense hand position for virual reality experiments. The hand on the CRT screen is computer generated and responds to the movements of the glove. This allows the operator to open the virtual drawers and move the virtual desktops. (FAA photo)*



# Warning Bells

by David B. Higginbotham

*There's a difference between being legal to fly and having proficiency in a particular situation. The clouds are not the place to make that discovery.*

As the Safety Officer for my part-time National Guard unit, I get to read plenty of statistics and accident briefs. Like many of my colleagues, I often wonder why normally rational pilots put themselves into avoidable situations. All too often we read about the poor guys who have bitten off more than they could chew. Never thought it could happen to me...

(Ding!)

In the National Guard we enjoy trying to maintain expected military proficiency and balancing a civilian career at the same time. If the civilian career doesn't involve flying, I must honestly admit that at times our proficiency is not what it could be. The UH-1H helicopter presents its own challenges in that it has no stability augmentation system or autopilot and is remarkably unstable without the constant attention of the pilot. Add to that the fact that our normal flight modes are literally in the trees at 90 knots or more and you can probably guess that many of us are not instrument proficient. However, we are all instrument rated. Big difference. Check my wallet and you'll find "instrument-helicopter" on my certificate. I must be capable, right?

(Ding!)

Read on.

My day began as normally as any other. I headed for Richmond, Virginia, noting that the skies were overcast but that visibility below the clouds was quite good. Upon reaching the airport my observations were confirmed. ATIS indicated that the sky condition was 800 overcast with six miles visibility. After checking the weather forecast, I figured it would be a great day to practice some real IFR training. My copilot wasn't as enthusiastic, but he agreed.

(Ding!)

The forecast showed no thunderstorms or convective activity, a high freezing level, and the weather would stay above our planning minimums through mission completion.

At Richmond we are fortunate to be able to plan a two-hour IFR flight and fit in a VOR approach, NDB holding, an NDB approach, and a localizer or ILS approach. So that's what we planned. My copilot did the preflight while I did the paper work. After completing our respective duties, we met for the briefing. At this point my copilot asked "Are you sure you want to do this?"

"Sure!" I confidently replied.

(Ding!)

While filing our flight plan with our local operations, one of the instructors asked when we had last flown IFR. My copilot mumbled something, and I announced that I had flown the simulator several hours over the last six months.

(Ding!)

Now let's digress. Many of us have flown flight simulators during our careers. But no matter how nasty it gets in that cockpit, you can always hit the freeze button, or if you crash, you joke about it over lunch. Ah, to have a freeze button in the aircraft. But back to the good stuff...

Our initial clearance was "cleared as filed, climb and maintain 3,000 feet, expect 5,000 feet 10 minutes after departure." We hovered to the helipad, got set up, checked our weather void time, and called tower to say we were ready to go. Tower told us "Maintain heading 090, cleared for takeoff."

Our initial instrument takeoff and ascent were fine, but as we approached circling minimums, at which point I started my turn to 090, I took one more look at Mother Earth. "Don't try to fly VFR and IFR at the same time." How many times have we heard that?

I started my turn while still looking outside the aircraft, then poof, we were in the clouds. That's right about the time my old friend Mr. Vertigo stopped in for a visit. It's also the point at which tower called us to say they weren't receiving our transponder. Nice. My copilot looked down and decided that since we hadn't done it before, now was as good a time as any to TURN IT ON!!!

(Ding!)

Was the heat on? I sure was feeling warm. "We're receiving your transponder now. Contact departure, good day!" Good day. Not yet, it wasn't. Wasn't I sure I could do this while I was back in operations?

I continued our climb to 3,000 feet, at points slowing to as low as 60 knots, (which got the copilot quite excited) all the while fighting the leans, the urge to orient the aircraft to what I felt was "up," and wishing the windows were open. As we approached 3,000, departure cleared us to 5,000. Then they cleared us again. And again. "Guard 682, if you're receiving this transmission squawk ident." Oh, now it's getting good!

Within minutes we determined we'd had enough unusual attitude

training. Once we re-established radio contact with departure, we requested immediate vectors back for the localizer 34 approach. The controller must have sensed a bit of concern in our voices because he asked if we were requesting assistance. You know what that means. Fire trucks. Not just yet, thanks. (After getting on the ground, and reflecting on it, I wished I'd responded with a snappy, "Sure, ya got anybody down there who knows how to fly instruments?")

This had seemed like a cakewalk when we were planning it. Now I was coming to realize just how far legal can be from proficient. About 5,000 feet. It's funny the things you think about at times like this. If we completely lose it, how many seconds will it take to reach the ground? What grim final transmission will I make over the radio?

Departure gave us a vector that put us on a long downwind for Runway 34 and let us descend. We were still that close to the airport. Vertigo made it seem like we'd gone a lot farther. Downwind went fine, and we completed our before-landing checklist. Then our approach controller gave us a vector to intercept the localizer course. OK, no problem. Here comes the CDI, start my turn, and there goes the CDI. We flew right through the course!

Now the really fun thoughts started sprouting up: "If I can't nail the localizer, I can't descend. If I can't descend, I'm..." I was still having a tremendous amount of difficulty just maintaining control of the aircraft because of the spatial disorientation. Then my favorite thought of the day: "I can't die today because tomorrow is my son's birthday." This is not a good thought to stumble across when you're in the clouds. Here came that hot feeling again. Where is that air vent?

Approach observed us screwing up their airspace and turned us to the east again for another vector to the localizer. We struggled along for a few minutes and approach told us, "Guard 682, turn right, heading 340, intercept the localizer, you're cleared for the approach." Well that's good: from 090 to 340. A 250-degree turn. That should be good for this continuing case of vertigo I've been fighting. Turns out the controller knew more than I did.

As my long turn to 340 continued, I noticed that I was going to roll out right on the inbound course. Good ol' ATC. I take back everything I've ever said about them. Established on the localizer with a good correction into the wind, we now just had to wait for the outer marker so we could descend. But that's another thing. Army aircraft are permitted to fly instrument approaches without a marker beacon receiver as long as ATC can let you know when you reach the descent point. We let ATC know, and they acknowledged that we were five miles from the outer marker. After what I'm sure was several minutes, I told the copilot to ask how much further we had to go. ATC said we were still 1.5 miles out. At least the radios still worked. And hey, it's finally starting to cool off in here.

We reached the outer marker and started our descent and within a few minutes broke out right at 800 feet. Finally brain, body, and aircraft agreed which way was up. I had never really considered the beauty of 8,000 feet of concrete, but Runway 34 was a welcome sight.

We landed to the helipad, sheepishly thanked ATC for their help, and hovered into parking with our tail between our skids. Total flight time: 1.1. Total time in the clouds: about 0.7. Years off my life: I'm not sure yet.

Lessons learned:

- Legal (i.e., holding an instrument ticket and meeting the currency requirements) does not make one proficient.
- All the simulator time in the world doesn't make up for going out with a proficient instructor and getting comfortable in real clouds.
- When people start asking things like, "Are you sure you want to do this?" and "When was the last time you flew that particular mission?" TAKE THE HINT.
- If you're behind the counter in operations, and you're not so sure about the PIC's proficiency, make like the concerned party host and take away the car keys. Don't make yourself one of the links in the chain of events that leads to an accident.
- Breaking basic rules by taking one last peek and forgetting to turn on the transponder clearly show that we weren't as good as we thought we were.
- As for the vertigo, that can happen to anyone. But for some reason we didn't brief that if one of us got vertigo we should transfer control of the aircraft to the other pilot. It is very rare for both crewmembers to get vertigo at the same time. I squeezed those controls so hard for the entire flight that I'm sure you could still find my fingerprints.

I was fortunate to have good ATC and a good copilot. Although he never took the controls, my copilot diligently called out any significant deviations in heading, altitude, or airspeed (which kept him plenty busy!), and handled all the radios. This took the load off me, and let me concentrate on that which I would not have otherwise been capable of accomplishing: flying the aircraft. I was lucky. I was humbled by the confrontation with the solid brick wall of my personal limitations.

But I know that those limitations aren't fixed. They are variable. With a lot more recent experience in the clouds, and to be fair, a lot more time in the simulator, I know I can achieve what I once had: proficiency.

Have a safe flight.

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*Mr. Higginbotham is an FAA manufacturing aviation safety inspector in the Production and Airworthiness Certification Division of the Aircraft Certification Service. We thank him, and we hope you do, too, for his candor and willingness to share his experience with others.*



# Charles E. Taylor: The Man Aviation History Almost Forgot

by Bob Taylor

*When I was appointed the position of Safety Program Manager (Airworthiness) for the Cleveland FSDO, one of the duties assigned to me was to conduct the Charles E. Taylor Award Program. The purpose of this program is to honor the mechanics who have been connected with aviation in the maintenance field for 50 years or more. However, there was one question that always came up about the program. Who is Charles Taylor? I was embarrassed because I didn't know the answer. So I did some research and here's what I found.*

Three men were involved in the invention and development of the first powered airplane-that's right three. Everyone knows about the Wright brothers, but that third man was Charles E. "Charlie" Taylor, a quiet genius who loved cigars and the sound of machinery. Although he contributed to one of man's greatest achievements, "Powered Flight," his name was almost lost in aviation history--until now--and if it hadn't been for Charlie that first powered airplane would never have gotten off the ground.

Charlie Taylor was born on a little farm in Cerro Gordo, IL, on May 24, 1868. As a boy Charlie moved to Lincoln, NE, with his family. Charlie quit school at the age of 12 and went to work as an errand boy for the *Nebraska State Journal*. However, Charlie was mechanically inclined so later, when he began working with machinery in the *Journal*'s bindery, it came easy for him.

When Charlie was in his twenties he moved to Kearney, NE, where he went into a business of making metal house numbers. While in Kearney, Charlie met a young lady named Henietia Webbert in 1892 and married her two years later. In 1896 the Taylors moved to Dayton, OH, where Charlie worked for a Stoddard Manufacture which made farm equipment and later bicycles. It was in Dayton where Charlie met the Wrights. Mrs. Taylor's uncle rented the building on West Third Street to the Wright brothers for their bicycle business. This was a convenient connection, because, in 1898 when Charlie started his own machine shop, Orville and Wilbur Wright brought him special jobs, including a bicycle coaster brake they had invented but later dropped.

Charlie eventually sold his tool shop for a profit and went to work for the Dayton Electric Co. However, he didn't like his job so he accepted, when the Wright brothers asked him to work for them at $18.00 per week. This was a good decision for several reasons: The Wright brothers' shop was only six blocks from where Charlie lived, he could ride a bike home for lunch every day, he was making eight dollars a week more, and he liked the Wright brothers a lot.

Charlie started to work for the Wright brothers on June 15, 1901, doing routine repairs on bicycles. This let the Wright brothers pursue their experiments with gliders which included many trips to Kitty Hawk. After one of

these trips, the brothers decided they needed more accurate information then was available and decided to build a small wind tunnel with delicate force balance. With this, they would measure the amount and direction of air pressures on plane and curved surfaces operating at various angles and improve their theories based on their gliding experiences.

Building the wind tunnel was the first job that Charlie Taylor did for the Wright brothers that had any connection with aeronautics. The wind tunnel was a rectangular box with a fan at one end driven by a natural gas engine. Charlie ground hacksaw blades and used them for balance in the tunnel. The Wright brothers did many experiments in their wind tunnel and from this data they began to make their 1902 glider with Charlie machining many of the parts.

On August 13, 1902, the brothers shipped the glider to Kitty Hawk. They did several flights with the glider and on October 31, 1902, the Wrights returned to Dayton to make plans for a powered airplane. Through their experiments, the Wrights were able to accurately predict the horsepower--eight--which was needed to produce and achieve powered flight. The next problem was where to get a light engine that would produce eight horsepower. The Wrights knew that a steam engine might suit their purpose, but a gasoline engine would be safer and more efficient.

On December 3, 1902, the Wrights sent letters to almost a dozen automobile companies and gasoline engine manufacturers asking if they could produce or modify an engine that would develop eight to nine brake horsepower, weigh no more than 180 pounds, and be free from vibration. Most companies replied that they were too busy to undertake building such a special engine.

Falling back on their own mechanical experience, the Wright brothers decided to design and build their own engine. They estimated they could build a four cylinders engine with four inch stroke and four inch bore, weighing no more than 200 pounds with accessories included. By their calculation, it would develop the horsepower necessary to power the glider in flight. Now the problem was who was going to build the engine, but it was easily solved. The brothers decided that they would give the task to Charlie and they would build the airframe. Charlie was excited about this new challenge. From his knowledge of mechanics and design he knew that the engine design was basic, straight forward, simple, and capable of being successful. Charlie had very limited knowledge about gasoline engines, but he used his craftsmanship, genius, enthusiasm, and efficiency to tackle the task.

Charlie started building the engine in the winter of 1902-03. Without any formal drawings available, it was necessary for each part to be crudely sketched out by the Wrights or Charlie on a piece of paper. After a thorough discussion about it, Taylor would pin the drawing above his workbench and go to work to complete it. Using these sketches and specifications, he finished the engine in six weeks--an amazing accomplishment.

I want to describe in some detail of how Charles Taylor made the engine so you can appreciate the craftsman he was. The first problem that Charlie and the Wrights faced was the crankcase. The case had to be light and strong. Aluminum was still a rare metal in those days and it was difficult to get a good sound casting. John Hoban, foreman of Buckeye Iron and Brass Foundry in Dayton, took on the job of making the crankcase using the strongest aluminum he had. The cylinders were turned from fine-grain gray cast iron and had a bore of four inches. The top and bottom of the cylinders were threaded so they could be threaded into the crankcase and a water jacket could be threaded on them.

The next major task for Charlie was making the crankshaft. Being a mechanic most of my life, I would never even attempt taking on a project of making a crankshaft with the equipment that Charles Taylor had--a drill press, a lathe (both run by a natural gas engine), and hand tools. Charlie secured a plate of high carbon tool steel that measured 1-5/8 inches thick, six inches wide, and 31 inches long. On the plate he traced an outline of the crankshaft and carefully, painstakingly drilled hundreds of holes along the outline of the crankshaft. This weakened the plate enough so he could knock the excess material away with a hammer and metal chisel. Once this was done, he had the rough cut crankshaft ready for the lathe and the finish cut. With the small natural gas engine chugging away at full power driving the large wide leather belts that turned the lathe, Charlie turned out a near perfect crankshaft to the thousandth of an inch. The next part that Charlie worked on was a fly wheel from a solid block of cast iron.

The connecting rods, intake valves, exhaust valves, pistons, valve guides, rocker arm, and numerous other parts that made up the complete engine were carefully thought out by Charlie and tailored to fit the operation of the engine. Charlie painstakingly assembled the engine part by part, fitting and refitting each piece with the meticulous care of a jeweler making a watch. He scrutinized every detail. He assembled and disassembled the parts, time and time again, making sure of their operation until all the parts were working in harmony.

It took a lot of genius and ingenuity and the engine was finally complete and assembled in February 1903. It was mounted on a test stand and ran well, producing eight horsepower at 670 rpm and 11 hp. at 1000 rpm. Charles E. Taylor had successfully built the first aircraft engine.

As a result of the engine producing 12 horsepower at full rpm, the Wright brothers were able to add another 150 pounds to the aircraft which allowed them to strengthen the wings and framework. The engine with its dull propeller drive drove two counter rotating pusher propellers by means of chains. The Wright brothers designed and tested propellers in the wind tunnel and built several propellers that would be used for the first successful flight. Charlie also made all of the metal parts such as all of the metal fittings where the wooden struts joined and spruce spars and Roebling truss wires were attached.

On September 23, 1903, the Wright brothers left Dayton for Kitty Hawk to start preparation for man's first powered flight and the *Flyer* followed on September 25. The *Flyer* was assembled and the engine was installed on November 2. To reduce the danger of the engine ever falling on the pilot in case of a wreck, it was placed on the lower wing to the right of center. When the engine was started, the vibration from the irregular firing caused failure of the prop shaft extensions. Charlie made new shafts out of solid steel which held up during the first flights.

On December 17, 1903, in the mid morning after a run of about 40 feet at a rate of approximately seven to eight mph, the first successful powered aircraft lifted off and flew 120 feet in 12 seconds thus introducing a new era of transportation. Although the first flight wasn't publicized that much, Charlie and the Wright brothers were very excited.

The Wright brothers decided to build another flying machine, but decided against going again to Kitty Hawk. They looked near Dayton for a level place for flying. After a few days of searching the Wrights found a suitable ninety-acres pasture, often called "Huffman Prairie," belonged to Torrence Huffman, a Dayton bank president. He allowed them to use it free--provided they didn't run over his cows. Charlie and the Wrights built a hangar to house the airplane and moved into the new facility on April 20, 1904. Charlie took care of the field and facility while the Wrights were going around the country and world. He was the first airport manager.

In a 1948 interview Charlie said that he had "always wanted to learn to fly, but I never did. The Wrights refused to teach me and tried to discourage the idea. They said they needed me in the shop and to service their machines, and if I learned to fly I'd be gadding about the country and maybe become an exhibition pilot, and then they'd never see me again." How prophetic those last words were!

The Wrights were trying to sell the aircraft to the military and started to do demonstration flights on September 3, 1908. Orville flew and Charlie kept the aircraft in good flying condition. On September 17, Charlie was slated to fly with Orville, but before the flight, larger propellers were installed to compensate for the heavier weight of the two men. At the last minute Charlie was replaced by Lieutenant Thomas Selfridge, a 20 year old West Point graduate from San Francisco. During the flight Orville heard a strange noise. He looked around, but didn't see anything. However, he decided to shut the engine down and land. Suddenly, there were two large thumps and the aircraft shook violently, as Orville tried to control aircraft to the ground. About 20 feet from the ground the aircraft started to correct itself, but it was too late. The aircraft hit the ground, killing Lieutenant Selfridge and badly injuring Orville Wright. Lieutenant Thomas Selfridge became the first passenger casualty in a powered aircraft.

After the accident, Charlie investigated the crash scene and found the new propellers that they put on before the flight had delaminated. Charlie reported his findings to Orville, who was in the hospital recovering from his injuries. Charles was the first person to investigate a powered fatal accident flight.

Charles Taylor continued to work with the Wright brothers until 1911. At this time an adventurer and a pilot, Calbraith Perry Rodgers, wanted to make the first continental flight across the United States. He purchased an aircraft from the Wright brothers and enough parts to build two more aircraft. Orville realized that the aircraft would not last more than 1,000 miles without proper maintained, so he lent Charlie to Rodgers knowing that he would be the only one that could keep the plane flying for that distance successfully. Charlie sent his family ahead to California and got on the three car train that was to accompany the flight. One car of the train was a repair car where the aircraft parts would be stored and the aircraft repaired. It took Cal Rodgers 49 days to cross the United States. Three days, ten hours of that was actual flying time. His longest single flight was 133 miles. He had 16 crashes and the aircraft was repaired so many times that at journey's end only the vertical rudder, the engine drip pan, and a single strut of the original plane remained--a test to the skill which Charlie used in keeping the aircraft flying.

This was the last of Charlie's big adventures. Charlie returned to Dayton and worked for the Wright-Martin Company until 1920. Charlie eventually moved to California and lost touch with Orville Wright, but things turned bad for Charlie. The Depression hit and Charlie's machine shop failed. He lost his life's savings in a real estate venture and his wife died. Charlie Taylor's contribution to aviation was forgotten until 1937 when Henry Ford was reconstructing the old Wright bicycle shop in Dearborn, MI. Detectives found Charlie working at North American Aviation in Los Angeles for 37¢ an hour. None of his co-workers realized he had built the first aircraft engine. Charlie worked for Ford until 1941 when he returned to California and worked 60 hours a week in a defense factory. However, in 1945 Charlie suffered a heart attack and was never able to work again.

In November 1955, a reporter discovered Charlie in Los Angles General Hospital's charity ward--he was almost destitute. His income was his Social Security and an $800 a year annuity fund belatedly established by Orville Wright before his death in 1948. The aviation industry immediately started a campaign to raise funds for Charlie. He was moved to a private sanitarium where he died a few months later on January 30, 1956, at the age of 88. Having no close relatives, Charles E. Taylor was buried in the Portal of Folded Wings Mausoleum dedicated to aviation pioneers, located in Valhalla Memorial Park, Los Angeles.

Charles E. Taylor was the last of the three that shrunk the world by building the first successful powered airplane--the mechanic who made the flight possible.

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### The Dangers of Cotton Clothing

One important survival note everyone should remember is that cotton clothing can be deadly. If the cotton clothing (and you) becomes wet through such exciting things as landing or falling in a lake, river, or ocean, or while being exposed to rain, sleet, wet snow, or even your own sweat, yes, your own sweat, you may be in danger. Perspiration can wet cotton clothing enough to make you hypothermic if the environmental conditions are conducive. Whether the temperature is below freezing or is 80 degrees and sunny, but with a strong wind, hypothermia can become a killer if you are not protected. As noted, hypothermia can occur at any time of the year. The key danger numbers are both temperature and the wind chill index.

The good news is there are some things you can do to protect yourself. These include staying dry and out of the wind. Another is wearing the right kind of clothing. Wool or the newer synthetic fleece fabrics used in some types of winter clothing are the preferred choices for winter clothing anytime you are subject to hypothermic conditions or you are at risk of becoming wet. The reason is wool and the synthetic fleece materials can help keep you warm even if they get wet and still provide a degree of insulation. Cotton cannot provide the same warmth when wet. Nor can the best natural insulator and possibly the best insulator natural or synthetic known to man, down, protect you when it gets wet. Although down has many unique advantages such as its great insulating qualities and its ability to be compressed into a small space, down like cotton cannot protect you from heat loss when it gets wet. Anytime you are wearing down insulated clothing, you need to take care to stay dry. If your flight takes you to or over areas or through conditions where you are at risk for getting wet, you may want to carefully think about what type of clothing to wear before you leave.

### The Dangers of Fire

But of the two types of material that can help protect you even in wet conditions, wool and synthetic fleece, wool is the preferred material if there is also a fire risk. The risk of fire leads to our next safety comment. If you are one of those paranoid, white knuckle-type flyers getting on your average big commercial aircraft as you prepare to takeoff on your annual mid-winter getaway flight, you may want to wear a shirt with long sleeves and long pants made of natural fibers such as wool or cotton on the flight rather than the synthetic nylon or polyester shorts and short sleeve tops or shirts many passengers wear. The reason is in case of an accident and the resulting possibility of a cabin flash fire, natural fabrics will protect you more because they won't melt or burn like many synthetic materials. Natural fabrics may char and possibly burn, but the wounds they cause are normally less severe then those of a burning synthetic material that can melt into your flesh. The long pants and long sleeve shirt simply protect more of your body. If you are flying your own aircraft and you don't like wool, now you have to balance the risk of wearing cotton for fire protection compared to its hypothermia risks if it gets wet.

### Traveling Shoes

The final safety comment for any flight is to wear shoes that don't restrict your mobility in case you have to quickly evacuate the aircraft. Good walking shoes (with no or low heels for women) that lace securely are one style of shoe that meets this recommendation. However, shoes with extremely thick soles or cushioning, like top of the line running shoes, can actually interfere with your "feel" of the rudder pedals.

### Conclusions

There is both a need to prepare yourself and your aircraft for the winter season if you live where it gets cold. Your aircraft manual and local aircraft maintenance technician can help you prepare your aircraft. Your local certificated flight instructor or FAA Safety Program Manager can help you prepare your piloting skills for the change in operating conditions. But the most important item you have to prepare is yourself. In addition to preparing yourself, as a pilot in command, you have a responsibility to your passengers to ensure their survival in the event of an off-airport emergency landing or accident. The question is are you prepared to save yourself and your passengers? If you have any doubts of your ability to save yourself and your passengers, you may want to take an emergency survival course or at least read a few books on the subject. In any type of survival situation, common sense and a desire to survive are the most important elements. A good survival kit just makes surviving that much easier.

### PS

One final thought, although we have been discussing how to prepare your aircraft and yourself for winter operations and survival in the event of an accident, please remember you are also at risk driving to the airport or on any trip away from home out of sight of someone who can or would be willing to help you in the event of an accident in bad weather. There have been recorded deaths of people whose car broke down along the road in remote areas during snow storms who tried to walk to a nearby house only to die from exposure within sight of the house. As in an aircraft accident, if you are in your car or even on a snowmobile during a snow storm you must consider the risks of leaving the vehicle in search of help or shelter. The risks are real. In many cases the best recommendation would be to stay with the aircraft or vehicle until help arrives, but only you can make that decision based upon all available information. Although winter is a beautiful time of the year, it does pose some unique dangers. The key is knowledge and preparedness.





### • Logging Actual Instrument Time

An aircraft certified for two pilots is being operated under Part 121. The pilot in command (PIC) is "flying" the aircraft and the second in command (SIC) is the non-flying pilot. Can the SIC log actual instrument flight time for those periods of actual IMC conditions when the PIC is flying the aircraft? Is the SIC considered to be "operating" the aircraft at this moment to justify logging this instrument time?

Chris Fleury
from the Internet

*The SIC is permitted to log the time as SIC time, as per §61.51(f). However, he/she is not permitted to log the time as instrument time, because the person can only log instrument time "...for that flight time when* the person operates the aircraft *[emphasis added] solely by reference to instruments under actual or stimulated instrument flight conditions...." In your scenario, you stated the SIC was the non-flying pilot. So the SIC crewmember was not operating the aircraft.*

*Even though you didn't ask, be aware that the logged time has limited value. It cannot be used for recency of experience under §61.57(c) because "...operates the aircraft..." (otherwise meaning hands-on, flying pilot, etc.) is required. Nor can this SIC time be used for meeting the ATP instrument aeronautical experience requirements of §61.159(a)(3) [i.e., "75 hours of instrument flight time, in actual or simulated instrument conditions, subject to...."]*

### • Amphibious Rating?

In order to fly an amphibious airplane, does the PIC need both land and sea ratings or can the pilot fly off land with only a land rating or off water with only a sea rating? My guess based on reading the rules and discussions with some folks flying such planes is that you can fly only one rating if you stay on the surface on which you are rated.

R. B. Levy
from the Internet

*To operate an amphibious airplane for water operations using the float landing gear, one must hold the Airplane Single Engine Sea or Airplane Multiengine Sea rating, as appropriate. To operate an amphibious airplane for land operations using the wheeled landing gear, one must hold the Airplane Single Engine Land or Airplane Multiengine Land rating, as appropriate. [reference: §61.31(d)(1)]*

### • Counting Crosscountry

I'm a student pilot in training seeking a private pilot certificate with the airplane single engine land rating. On my night cross country flight I had to land 45 nautical miles from the original departure airport to take on fuel. Then I proceeded on to a destination that was beyond 50 nautical miles from the original departure airport. Does this still count as a crosscountry since I made an intermediate stop within 50 NM from the original departure airport?

David Avery
from the Internet

*Yes, this counts as a crosscountry flight if it included "...a point of landing that was at least a straight-line distance of more than 50 nautical miles from the original point of departure..."[ref: §61.1(b)(3)(ii)(B)] because after your intermediate stop to take on fuel you continued on to a destination that was "...more than 50 nautical miles from the point of departure..." Of course, this is assuming that you were also complying with the other provisions of §61.1(b)(3)(ii): (A) flight "conducted in an appropriate aircraft," in your case a single engine land airplane, and (C) you utilized "...dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems to navigate to the landing point."*

*The only place where your crosscountry would not have counted is in §61.109(a)(5)(ii),the at least 150 nautical mile solo crosscountry, which specifically states "...and one segment of the flight consisting of a straight line distance of at least 50 nautical miles between the takeoff and landing locations..." During the other segments of that crosscountry flight you could have made numerous takeoffs and landings inside the 50 NM from the original departure airport and it would have counted as a crosscountry flight provided that one of the landings made was at least"...more than 50 nautical miles from the original point of departure..."*

*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

## 90 CONTINUOUS YEARS AND STILL COUNTING

College Park Airport, MD, recently celebrated two anniversaries: 90 years as the world's oldest continuously operating airport and the first year of operation for the College Park Aviation Museum. The airport began in 1909 when the Wright brothers set up a training school for Army pilots. Later civilian aviation companies would set up operations and, when the military finally left, general aviation took over and continues today. The museum's interior photo shows some of the historic aircraft on display: (front to back) a 1918 Curtiss Jenny, the 1924 Berliner helicopter, a 1936 Taylor Cub, and a 1932 Monocoupe 110. For more information call (301)864-6029 or visit their website at <http://www.smart.net/~parksrec/cpam.htm>

## FAA OFFICE OF AVIATION MEDICINE GOES INTERNET

To better serve those who need flight physicals, the FAA's Office of Aviation Medicine began using a new secure Internet-based Aeromedical Certification System (AMCS) October 1. Designed to speed up the processing of physical examination data to the FAA's Aeromedical Certification Division (AMCD) in Oklahoma City, OK, the new interactive system allows Aviation Medical Examiners to transmit data taken from the physical examination form, FAA Form 8500-8, via the Internet. The new system replaces an older DOS-based system that had some "Year 2000" compliance problems. The new system will also use the redesigned FAA Form 8500-8.

The new system is self-checking. If a medical examiner fails to enter a required data field, the system prompts the doctor for the information. The benefit of such review and prompting is to increase the accuracy of the data sent to AMCD. The new AMCS is another tool for the Office of Aviation Medicine to use to reach its stated goals of "correct certification" and "same day service." Because of Privacy Act issues, the medical examiner is responsible for ensuring the applicant's data is handled in accordance with the Act.

As is currently done, once an aviation medical examiner completes a physical examination and the applicant meets the appropriate standard, the doctor will manually issue the applicant the appropriate medical certificate.

When the examination data is transmitted to AMCD, AMCD will review the new data for compliance with the appropriate FAA standards and regulations and file the information with the airman's permanent medical file. As part of the process, the airman's medical data will be reviewed electronically, and if there is a problem, the system will flag the individual for follow up by AMCD. If there is a problem, the new system will help AMCD notify the person within days of the examination.

This new system is one more way the Office of Aviation Medicine is striving to support the needs of medically certificated airman through increased responsiveness, timeliness, and accuracy.

### ATTENTION SUBSCRIBERS

We are beginning to think of this box as bad news corner. Last issue it was about the delay in printing the magazine. This issue we have to announce an increase in the subscription price of the magazine.

Effective immediately, the Public Printer (Superintendent of Documents, U.S. GPO) has approved an across the board increase in the selling price of all publications. This means that annual subscription price for the *FAA Aviation News* magazine will be $20.00 (domestic) and $25.00 (foreign).





## DON'T BE A TURKEY – ARRIVE EARLY FOR HOLIDAY FLIGHTS

Thanksgiving and December holidays, traditionally the busiest time of the year for the nation's airlines and airports, are fast approaching. The FAA has issued some simple suggestions to help passengers avoid delays.

- Arrive early. Large holiday crowds coupled with current security measures may increase the time you need to check in. Build even more time into your schedule if you need help with infants, young children, elderly or disabled passengers, or passengers with medical conditions.
- Parking lots may be full, so consider using public transportation or having a friend drop you off. If you are driving, add extra time to your schedule.
- Don't leave your car unattended in front of the terminal and be sure to observe all parking restrictions. Because of increased security, local parking rules are being strictly enforced.
- Keep your photo identification handy. Some airlines require you to have proper identification to fly. If you do not have a photo identification card, make sure you have two pieces of identification, one of which must be issued by a government authority. Minors are not required to have identification. Failure to have proper identification can also result in additional security scrutiny.
- For international flights, airlines are required to collect your full name and ask you for a contact name and phone number. The Department of Transportation recommends that you provide the information.
- Keep your eyes open for unattended packages and bags, and report them to authorities. Watch your bags and don't accept packages from strangers.
- Be prepared to answer questions about who packed your bags and whether you might have left them unattended at any time. Think carefully and answer honestly--history has shown that criminals and terrorists use unwitting passengers to carry bombs or other dangerous items on board aircraft, either by tricking passengers into carrying packages or by simply slipping items into unwatched bags. Answering "yes" to either question will only lead to a little extra scrutiny of the bag.
- Do not joke about having a bomb or firearm in your possession. Security personnel are trained to react when they hear these words. Penalties can be severe, and can include the possibility of time in prison and/or fines.
- Both carry-on and checked bags are subject to being hand-searched, so it's a good idea to leave gifts unwrapped until after you arrive at your destination. If airline security personnel cannot determine by X-ray the contents of a package, they can and will open it, or ask you to open it, for inspection.
- Leave your firearms at home, and do not pack fireworks, flammable materials, household cleaners, or pressurized containers. Remember that violators of hazardous

## VFR WAYPOINTS DEBUT ON TERMINAL AREA CHARTS


To help GPS-equipped pilots navigate complex Class B and C airspace, new VFR waypoints are being tested on the San Diego and Los Angeles Terminal Area Charts. If all goes well, these waypoints will appear on all Terminal Area Charts within the next two years. The waypoints are indicated on the chart with a four-point star or a flagpole-and-pennant and are named in the database with five-letter identifiers beginning with "VV."

materials regulations are subject to civil penalties of up to $27,500 per violation, as well as possible criminal prosecution.

If you would like to find out if there are any special travel advisories in effect, call the Department of Transportation's Travel Advisory Line at 1-800-221-0673.

## HOMEBUILTS FLYING OVER POPULATED AREAS

The FAA has issued a bulletin in May 1998 on "Issuing Operating Limitations for Experimental Category, Amateur-Built Aircraft for Flight over Densely Populated Areas." However, this bulletin generated a number of questions, so another bulletin was issued in July 1999 to clarify the information and to answer those questions.

Experimental, amateur-built aircraft that received an airworthiness certificate before May 28, 1998 and that "received an authorization in the form of operations limitations allowing operations over densely populated areas for the purpose of takeoffs and landings are considered to have authorization for takeoffs and landings and en route operations over densely populated areas without revising or re-issuing the existing operating limitations." Those aircraft that received a special airworthiness certificate after May 28, 1998, may be issued operating limitations which allow flight over densely populated areas if the following conditions have been met:

(1) The operator has determined that the aircraft has no unsafe or hazardous operating characteristics or design features; and
(2) The operator has determined that the aircraft is controllable throughout its normal range of speeds and during all the maneuvers to be executed in accordance with FAR §91.319(b).

The operating limitations which allow flight over densely populated areas may be issued prior to the completion of Phase I testing, which is the initial testing of the completed amateur-built aircraft. The authorization should clearly state that the Phase I testing must be completed in order to make the authorization valid. Upon completion of the Phase I testing, the operator need NOT be issued a separate letter to authorize flight over congested areas.

These authorizations may be issued by Flight Standards District Office inspectors or Designated Airworthiness Representatives (with concurrence from the applicant's local FSDO) may issue these authorizations.

For further information, see Flight Standards Handbook Bulletin for General Aviation (HBGA 99-13) or look it up at <http://www.faa.gov.afs.hbga/hbgal.htm>.

## HISTORIC REDUCTION IN AIRCRAFT NOISE

In an August Congressional report, Transportation Secretary Rodney E. Slater announced that the nation's commercial jet aircraft fleet is the quietest in history and will continue to achieve record low noise levels into the next century.

The Airport Noise and Capacity Act of 1990 required that all civil aircraft over 75,000 pounds be "Stage 3" by January 1, 2000. While highly technical to calculate, the Federal Aviation Administration (FAA) has found that roughly five Stage 3 aircraft equal the noise levels of one Stage 2 aircraft. A total of 7,438 aircraft are affected by this law -- with 86 percent of this fleet being Stage 3 compliant. On December 31, 1998 all individual operators met or exceeded the interim date for compliance for 75 percent of their fleets to be the quieter Stage 3. The FAA fully expects the nation's aircraft fleet to meet the 100 percent requirement by next year's deadline.

FAA Administrator Jane Garvey said, "I am very pleased that, working with the airlines, we have been able to make these significant environmental benefits in aviation. The FAA and the entire aviation community are committed to a cleaner, less noisy airspace system, and this report shows we are living up to that commitment."

For the seventh consecutive year, both foreign aircraft flying into the United States and domestic operators have been ahead of the requirement for the transition to quieter airplanes. The FAA report to Congress shows that during 1998 there were 479 noisier Stage 2 aircraft removed from service and 745 Stage 3 aircraft have entered service in the United States.

## EAA FOUNDER INDUCTED INTO AVIATION HALL OF FAME

Experimental Aircraft Association (EAA) founder and Chairman of the Board Paul Poberezny was inducted into the National Aviation Hall of Fame July 24 in Dayton, OH. Poberezny and 35 others founded the EAA in 1953. From that humble beginning, EAA has grown from an organization that can trace its history from Poberezny's basement to one that has become a world-wide 170,000 plus member organization with more than 975 local chapters. Each year hundreds of thousands of EAA members and their families descend upon EAA's annual convention and fly-in, AirVenture, in Oshkosh, WI. About 12,000 aircraft fly into AirVenture each year.

Poberezny served as EAA's president until 1989. He has been chairman of the board since then.

He is one of only 166 individuals and 20 groups inducted into the National Aviation Hall of Fame. The Aviation Hall of Fame was chartered by Congress in 1964 to recognized those individuals and groups who have made significant contributions to America's aviation heritage.



# Editor's Runway

*from the pen of Phyllis-Anne Duncan*

## Reflections

The year 1999 was fraught with aviation highs and lows, just like life.

In 1999 we saw the first balloon make it all the way around the world.

In 1999 we saw that 1998 was one of the safest years on record for general aviation.

In 1999 general aviation continued its revitalization on a record pace.

Also in 1999 we lost Admiral Donald Engen, former FAA Administrator and Director of the National Air and Space Museum in a glider accident.

In 1999—and this is still so hard to believe—we lost John F. Kennedy, Jr., a young man just starting out in aviation but whose enthusiasm for it was life-long.

In 1999, we lost pilots and their passengers whose contributions to aviation and whose enthusiasm for it rivaled Admiral Engen's and Kennedy's.

If we were to make up a holiday aviation gift list for the year 2000 (the real last year of the decade, century, and millennium), what would be on it?

More well-trained, safe, and enthusiastic pilots.

Fewer airports falling to the developer.

More job opportunities in aviation.

Even fewer accidents, so that we can enjoy the experience and wisdom of people like Admiral Engen and revel in the enthusiasm of people like JFK, Jr.

Et cetera, et cetera, et cetera.

I got news for you. Santa ain't gonna pull any of this outta his bag. A safe and prosperous year 2000 for aviation depends on us at the FAA, but it's a responsibility we share with YOU. Have a safe holiday season, and we look forward to sharing the airspace with you next year.

'Til Y2K...

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