November-December 1992

FAA Aviation News

A DOT/FAA FLIGHT STANDARDS SAFETY PUBLICATION

U.S. Department
of Transportation
**Federal Aviation
Administration**

The FAA's Flight Standards Service, General Aviation and Commercial Division, Accident Prevention Program Branch, AFS–810, Washington, DC 20591, publishes FAA AVIATION NEWS in the interest of flight safety. The magazine promotes safety in the air by calling the attention of airmen to current technical, regulatory, and procedural matters affecting the safe operation of aircraft. Although based on current FAA policy and rule interpretations, all printed material herein are advisory or informational in nature and should not be construed to have regulatory effect. The FAA does not officially endorse any goods, services, materials, or products of manufacturers that may be mentioned. **Certain details of accidents described herein have been altered to protect the privacy of those involved.**

The Office of Management and Budget has approved the use of funds for the printing of FAA AVIATION NEWS.

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November-December 1992

FAA Aviation News

Volume 31 Number 6

FEATURES

DEPARTMENTS

On the Cover:
Is the pilot of this Piper Arrow set up for an altitude bust? To learn how to avoid the altitude deviation "trap" see p. 2. Photo courtesy of Piper Aircraft.

On the Back Cover:
A Cessna 172 comes in for a landing with flaps extended. Any number of factors dictate the use or non-use of flaps. If you don't know what they are, see p. 16. Photo courtesy of Cessna Aircraft.

FAA's Best Kept Secret

by Phyllis A. Duncan

Did you know that what you are holding in your hot little hands right now is FAA's "Best Kept Secret?" What I'm talking about is *FAA Aviation News*. We didn't make it secret; in fact, we don't want it to be a secret, but it apparently is. I get a lot of letters (not surprisingly since that is where "letters to the editor" go) from people who say, "FAA's new magazine is great! I just saw my first copy of *FAA Aviation News*, and I'm glad the FAA is finally doing something like that." They teach you in Editor's School to be polite to readers, so I can't say, "Are you blind? Look at the inside front cover where it says 'Volume 31, Number 6.' Volume 31 means 31 years!"

Actually, I don't really care if the reader thinks *FAA Aviation News* is brand new. What counts is that he or she is reading it now, and that is what's important. It means that another person may read something that somewhere down the line may save a life, any life.

But deep down where editor's ulcers grow, I'm a little upset that more people don't know about this publication that FAA's Flight Standards produces for the aviation public. The fine print on the page to the left of this one contains some very bureaucratic language about the content and purpose of this publication. The Office of Management and Budget requires us to put that in, but, quite simply, our sole purpose is to keep airmen from making the mistakes that may cost them their right to fly, the use of their equipment, or, most seriously, their very lives.

More people need to know about us, and we're doing some things differently in order to accomplish that. We're sending a complimentary copy to anyone who calls in or writes in. (If you do that expect to get a subscription push from us.) We're sending copies to major aviation events across the country and doing many other promotional activities. But you can also help us. When you are finished with this magazine, pass it on to a friend and explain why you subscribe. If you are like many of our readers who keep their back issues in their personal aviation library, you can at least use the order form to purchase a gift subscription for someone—it *is* the holiday season, after all! If you are reading this at an airport or FBO and the subscription form is missing from the middle, call us at (202) 267–8017 or write us at *FAA Aviation News*, AFS–810, 800 Independence Ave., S.W., Washington, DC 20591, and we will send a complimentary copy. Or contact your Accident Prevention Program Manager (listed on p. 22), and he or she will tell you how to subscribe.

Ms. Duncan is a commercial pilot and flight instructor with 13 years in the FAA. Her ulcers are only figurative—for now.

Increased subscriptions mean that we are serving more aviation customers, and I can ease up on the antiacid. Joking aside, secrets can be bad or good, but some secrets aren't meant to be kept.

—The Editor ■

This is the second in a series of articles reprinted from ASRS Directline, *a quarterly publication that addresses particular areas of safety that appear in pilot reports received by NASA's Aviation Safety Reporting System and which have been identified by safety analysts as "significant."* ASRS Directline *is free from ASRS, NASA-Ames Research Center, Moffett Field, CA 94035. Altitude busting is of significance to all pilots, not just the airliners. According to the following, the crucial altitudes for deviations appear to be 10,000 and 11,000 feet. Read on to find out why.* **—Editor**

One-Zero Ways to Bust an Altitude Or... Was That 11?

by Don George, ASRS Analyst

Here I am, the PIC (passenger in coach) on a coast-to-coast wide body, cruising along at flight level 350. I am in seat 25B (one of the cheap ones), feeling fairly comfortable after recovering from an earlier incident which involved the guy in 24B suddenly tilting his seat to the full recline position and spearing me with my very own tray table. In any decent football league, that would have been a 15-yard penalty, but I didn't even get an "excuse me."

No cracked ribs, so I try to relax, but I can't because now I'm already worrying about the fact that we will have to descend in a couple of hours, and I know from reading a lot of ASRS reports that our chances of getting down through 11,000 and 10,000 feet without an incident of some sort are pretty remote. I conjure up in my mind a scenario that runs something like this ...

The controller will say, "Descend and cross three zero miles west of Gulch VOR at one-one-thousand, reduce to two five zero knots, report leaving flight level two zero zero, Podunk altimeter three zero zero five." With all those zeros now implanted into the flight crew's heads, one of them will undoubtedly read back "Descend to one-zero-thousand" along with the other values, and the controller will fail to note the wrong altitude in the readback.

Shortly thereafter, we will change over to Approach Control and report "... out of one eight thousand for one-zero-thousand." Again a busy controller will miss the incorrect altitude.

As we start to level off, the controller sees our altitude readout, questions us, and tells us to climb back up to one-one-thousand, where we belong. At the same time, there are a couple of departing aircraft heading in our direction, also at 10,000 feet. We evade them by making some steep turns and climbing rapidly. Not much harm done except a few spilled drinks, and the possible creation of some future paperwork.

Pretty soon, I hear the announcement for flight attendants to prepare for landing. This is the favorite part of the trip for me because it means that the guy in 24B must put his seat back into the upright position, and it also indicates that we have gotten down through 11,000 and 10,000 feet without hitting another aircraft. Both of these occurrences allow me to breathe a lot easier.

Okay. . . so I made up all this stuff about the guy in 24B and the dogfights with other aircraft, but it all could have really happened, because, seriously, there is a real-life 10K/11K problem. I just wanted to get your attention so that we could talk about it.

Why do a lot of altitude deviations occur at 10,000 and 11,000 feet?

In the preparation of this article, I reviewed hundreds of ASRS reports which involved a mix-up with these two altitudes. The reports reveal several causal factors that show up in nearly all of the incidents. These incidents, however, do not usually occur as a result of a single cause. Rather, they almost always reflect a combination of two or more of them.

Similar Sounding Phrases

Pilots misunderstand a clearance, and controllers misunderstand the read back because of expectation and the similar sounding phrases "one-zero-thousand" and "one-one-thousand."

"I believe it is very easy to confuse one-one-thousand with one-zero-thousand and vice versa."

"I don't know if the controller said 10,000 but intended to say 11,000 or if he said 11,000 and I thought he said 10,000."

Readback/Hearback

Controllers fail to note incorrect altitudes in pilot readbacks—the old "hear-back" bugaboo.

"Voice tape reading showed that the clearance was to 11,000 feet but readback by [the] captain of 10,000 feet went uncorrected."

"Controller said, 'Oh, I should have checked your readback.'"

Too Many Numbers

Controllers include several (sometimes, too many) numbers in the same radio transmission.

"The controlling agency, in rapid manner, told us to turn to 310 degrees, slow to 210 knots, and I understood him to say 'maintain 10.'"

"Very often controllers issue four to five instructions in the same breath, such as 'turn left 330 degrees, maintain 2,000 feet till established, cleared for ILS 30 approach, contact tower 119.4 at the outer marker, and maintain 160 knots until five mile final.'"

Similar Numbers

Altitude crossing points stated in miles may be similar to the altitude to which the flight is cleared.

"Were we cleared to 10,000 feet 11 miles west of ARMEL or 11,000 feet 10 miles, or 10,000 feet 10 miles, or 11,000 feet 11 miles?"

"Center cleared us to cross 10 DME NE PVD 11 thousand, 250 knots. I read back 11 miles NE PVD 10 thousand, 250 knots. At 10,100 feet I questioned center, and they said 10 north east at 11,000, 250 knots. We climbed back up to 11,000 feet."

250 Knots at 10,000 Feet

Pilots tend to associate a 250-knot speed restriction with a 10,000-foot altitude assignment since civil aircraft are normally restricted to a speed of 250 knots or less below 10,000 feet.

"A clearance for 250 knots generally makes a pilot think about 10,000 feet [because of] the association of 250 knots below 10,000."

"We think the 250-knot restriction could have led us to assume 10,000 feet because the majority of locations use 10,000 feet/250 knot crossings in their STAR's."

Spring Loaded

Pilots may anticipate receiving a certain clearance but get something just a little different. Perhaps the last SID or STAR they executed had speed and altitude crossing restrictions that were similar but not exactly the same as the one they are currently flying. Noted an air carrier pilot who initiated a premature descent to 10,000 from 11,000 feet:

Piper Aircraft

"I may have anticipated being given 10,000 feet after seeing [an air carrier aircraft] pass below me."

Failing to Question the Unusual

Pilots may or may not be familiar with normal ATC procedures in a particular area and may, in either case, neglect to question an abnormal altitude assignment.

"Next time in and out of DEN we will be aware that the inbound aircraft are normally at 11,000 feet and departure aircraft normally restricted to 10,000 feet."

"The usual clearance for this arrival is 11,000, but we both followed my error blindly to 10,000 feet."

The Ten Mindset

Pilots and controllers get what is referred to as a "number 10 mindset" after hearing a lot of zeros. It seems like one-zero-thousand then becomes the altitude assignment.

"I do think the number of tens in the clearance was a contributing factor."

"Flight crew read back 'one-one-thousand' but somehow had mindset of one-zero-thousand."

Reduced Monitoring

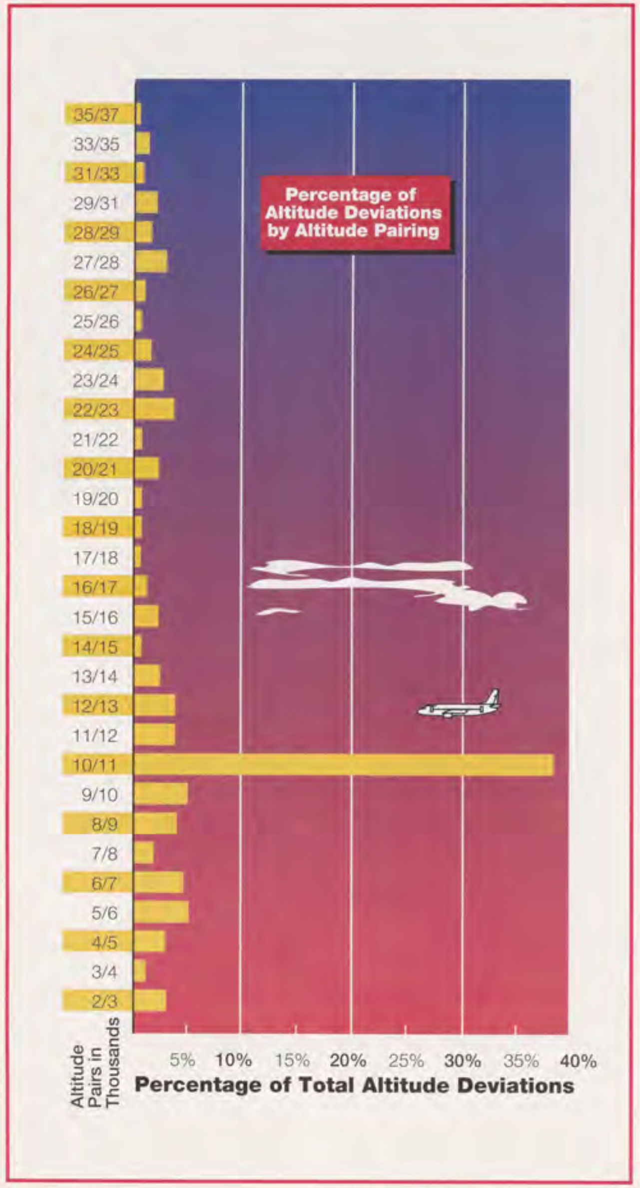
Cockpit duties and distractions may result in only one flight crew member monitoring the ATC frequency. Similarly, controller workload and frequency congestion may be factors which affect the ability of controllers to monitor pilot readbacks closely.

"This type of situation has occurred with this crewmember 3 or 4 times since flying two-man crew aircraft when one crewmember is busy reviewing approach plate and procedures and is distracted from hearing conversation between [the] other crewmember and controller."

Cockpit Management

Cockpit management and flight crew coordination may be less than optimum, and crew members fail to monitor each other adequately in such tasks as altitude alert setting or readback of clearances.

"Center cleared our flight from 17,000 feet to 11,000 feet MSL. This was acknowledged by me, however the first officer understood 10,000 feet and placed that altitude in the selector."



Analysis of the ASRS database indicates that there are far more clearance misinterpretations involving the altitude pair of 10/11 thousand feet than any other altitude combination—fully 38% of the sample data set. The next largest category accounted for less than 5% of the total deviations.

The sample data on which this finding is based is composed of 191 ASRS reports describing incidents with the following characteristics: (1) an assigned altitude was overshot or undershot, (2) a misinterpreted clearance contributed to the occurrence, (3) the event occurred between 1987 and 1990, and (4) the deviating aircraft attained an altitude 1,000 feet above or below its assigned altitude (2,000 feet when above FL290). The search was confined to ASRS full-form records since only these contain all of the necessary data elements.

The accompanying figure is based on an analysis of these data. Each category relates to a pair of altitudes that were confused with another, leading to an altitude overshoot or undershoot on either climb or descent.

"I will have to watch the music closer while the other guy is playing the piano."

Radio Technique

Very often controllers and/or pilots fail to use proper techniques. I consider this to be the "big one" when in comes to causative factors. Yessir, old number one-one (that's eleven) is a really critical factor.

"The controller was busy--a lot of traffic. Contributing factors: Fast talking, bad radios, long clearances, a lot of numbers--given too fast to comprehend or write down."

"I don't know who was correct, but I know that I was incorrect in not requesting a confirmation of the clearance since some doubt existed."

Confusing Phraseology

Controllers and pilots are frequently misunderstood because of their use of improper phraseology.

"We had understood and read back 'descending to 10,000.' Phraseology contributed to this incident."

"To correct future problems like this, the altitude should be given in the form of 'ten thousand' or 'eleven thousand,' instead of saying 'one-zero' or 'one-one-thousand.' There is too much of a chance of error. We are used to hearing ten or eleven or twelve in everyday life."

Dean Chamberlain

So...what are you going to do about it? Here are a few starter suggestions.

Saying it Twice—Differently

Controllers and pilots are encouraged to use both single digit and group form phraseology in order to reinforce altitude assignments whenever there is the possibility of misunderstanding. Consider the following examples:

Controller transmission: "(Ident) descend and maintain one-zero-thousand. That's ten (with emphasis) thousand."

Pilot transmission: "Roger (callsign), leaving one-seven thousand for one-one thousand. That's eleven (with emphasis) thousand."

Note: A recent Air Traffic Procedure Handbook (FAA Order 7110.65) change allows controllers to use this phraseology to reinforce an altitude assignment. Many "old" pilots have used this technique for a long time and find that it helps.

Radio Technique

Take a good hard look at your radio communication techniques. Do you check to make sure the frequency is clear before transmitting? Do you activate the transmitter before starting to speak? Do you use your full and correct callsign? Do you use an acceptable speech rate? Do you enunciate, and emphasize when necessary for clarity? Do you ask the other party to repeat if transmission was not clear or may have been stepped on? Do you listen for similar callsigns?

These are just a few of the questions you should ask yourself. I'm sure you can think of many other good radio technique questions.

Area Familiarity

Pilots should work to improve their "situational awareness" skills. For instance, you often fly in the Dallas/Ft. Worth area and have observed that normally the departures are restricted to 10,000 feet and the arrivals are held up to 11,000 feet or higher until arrival and departure routes have crossed. You probably should question any altitude assignment which appears to be in conflict with these normal ATC procedures. Most terminal ATC facilities use standard routes and altitudes, and your situational awareness can help prevent an incident.

Reduce the Number of Numbers

Controllers can help make a conscientious effort to defeat the hearback problem by being aware of the nasty effects of including too many numbers in the same transmission and by using named intersections when possible rather than a number of miles when issuing crossing restriction.

Summary

Let's take a final look at some of the reasons for the 10K/11K altitude problem. Factors include:

- Similarity in the sound of one-zero and one-one-thousand, particularly when other numerical information is being transmitted at the same time.
- Pilots may be spring-loaded to expect a 250-knot airspeed in conjunction with a 10,000 foot altitude, this a clearance for an airspeed of 250 knots may lead the flight crew to assume an altitude requirement of 10,000 feet by mistake.
- Failure to question an unexpected or unusual clearance; anticipating 10 when hearing a lot of zeros; flight crew and controller distraction; and breakdown in cockpit management.
- The 10K/11K quandary seems to be rooted in confusing phraseology and improper radio technique—compounded by the Readback/Hearback problem.

The solution to the 10K/11K problem lies in realizing the potential for error when descending or climbing through or near the 10,000- and 11,000-foot boundaries and in using both single digit and group forms to express these altitudes. Be prepared to question a clearance that seems unusual. If pilots and controllers use clear, concise radio technique, paying particular attention to the hearback phase, the potential for error will be reduced. ■

No doubt there are a good many readers of this article who are actively engaged in training activities, and you may want to consider this problem as the subject of a lesson or two. If you are interested in obtaining a small package of ASRS reports (about 20) on which to base training sessions, please write ASRS (address on the first page of this article) and request the 10K/11K Report Package. It will be sent at no charge.

The Aviation Safety Reporting System is a cooperative program established by the FAA's Office of the Assistant Administrator for Aviation Safety and administered by the National Aeronautics and Space Administration.

Answers to the **Piloting IQ Quiz**

1. b. December 21
2. b. high speed. Weather, 92
3. 3–1=c., 3–2=a., 3–3=b., and 3–4=d. Weather, 93
4. a. cloudy. Weather, 92
5. d. all of the above. Weather, 99
6. d. mountainous areas. Weather, 102
7. e. all of the above. Weather, 102.
8. c. always. Weather, 103
9. a. related. Weather, 92
10. a. and c. adjusted as per the handbook or if no information is provided, increased. Weather, 104
11. True. AIM, Para. 7–5c5. Note
12. True. AIM, Para. 7–5e.
13. True. AIM, Para. 7–5g.
14. d. any one of the above. Weather, 103/104, AIM, Para. 7–20b.
15. 15–1=a., 15–2=d., 15–3=c., 15–4=b. AIM, Para. 7–20b.

A Statement on Altitude Deviation

The following is a behind-the-scenes account of a corporate aviation crew who faced enforcement action as a result of an altitude deviation. This incident occurred on a routine, daylight, VFR flight. The crew filed a NASA ASRS form immediately after the incident. Their statement is printed with permission from Business Aviation Issues, *a publication of the National Business Aircraft Association.*

From an intermediate level off at 10,000 feet, we were given climb clearance to what I thought was Flight Level two-two-zero. I'm certain as the pilot flying that I stated, "Climbing to two-two-zero" and confirmed it by a glance at the altitude alerter preselect which had 2-2-0-0-0 selected. The first officer, having set the altitude alerter, was also certain that we were cleared to Flight Level two-two-zero. At some point in the climb, the controller issued traffic at 10 to 11 o'clock position, six miles, eastbound, which was descending to Flight Level two-one-zero. We were given a heading change of 15 degrees to the left for that traffic. The heading change added to my certainty that the controller was providing separation from that traffic as we climbed to Flight Level two-two-zero. With traffic in sight, and after watching it pass in front of us, my thought was, "This is pretty close proximity under radar control." It wasn't until passing Flight Level two-zero-seven, when the controller asked us to confirm level Flight Level two-zero-zero, that I questioned Flight Level two-two-zero as a clearance. Since we had the other aircraft in sight, I knew a descent was not required for collision avoidance. The traffic had passed well ahead and above us. The controller immediately cleared us to Flight Level two-three-zero.

The fact that the first officer believed we had been cleared to Flight Level two-two-zero was evident by her response on radio, stating, "I read back two-two-zero." She also said we had the traffic in sight. I thought the controller had made the mistake in altitude assignment. It was not until three days later, when I heard the ARTCC tape, that I was convinced that we were cleared to Flight Level two-zero-zero. My first conversation was with the Manager of Quality Assurance at the controlling ARTCC. Over the telephone I listened to the tape of the incident and for the first time admitted that the crew was indeed in error. I was invited to tour the controlling ARTCC. He [The manager] implied that this action would be viewed positively by the FAA investigator and would indicate that my approach is constructive rather than resistant.

When I made the inquiry to two Washington-based trade associations I got the idea that I should be noncommittal and refrain from making a statement to the investigator upon initial contact and let the legal process take its course. My other source of advice was a retired FAA air carrier inspector who is familiar with current enforcement philosophy and investigative procedures. He encouraged me to be repentant and cooperative in my approach to the impending investigation.

The [company] Director of Aviation, who was very supportive and encouraging at all times, insisted on maintaining a positive approach to the investigation. Both he and the Training Captain began seeking measures our aviation department could take to prevent similar occurrences in the future. The first step was to review and revise the flight procedures manual to include a clarification of procedures to be used concerning altitude clearances.

Both crewmembers visited the controlling Air Route Traffic Control Center to become more familiar with the operations of Air Traffic Control and to discuss pilot/controller communications. Both crewmembers, with the Training Captain, attended a well-known training organization's refresher course in Cockpit Resource Management.

Before receiving the letter of investigation, someone from the FAA's investigating office called to gather personal data on both crewmembers and to offer an opportunity to make a statement concerning what happened from my perspective. Even though I declined to make a statement, I did indicate that I would fully cooperate with their office throughout the investigation. After receiving the letter of investigation, on the advice of the retired inspector, I called the investigating office to arrange an informal interview at which time both crewmembers could sit down and discuss the incident openly.

During the interview both crewmembers were present, and we each told the interviewer what we recalled of the incident. We admitted our mistake but expressed why we thought we were innocent at the time. Then we presented all the steps that had been taken to prevent similar occurrences. Also, we pointed out published articles reporting on the hearback problem that noted both pilots and controllers have the tendency to confuse altitudes such as "one-zero-thousand" versus "one-one-thousand" as well as "Flight Level two-zero-zero" versus "Flight Level two-two-zero."

Since the FAA is currently attempting to use remedial training whenever possible, and since we had taken all the steps that they would have required of us, the following statements (from letters to each pilot involved) sum up [the FAA's] thoughts on the investigation:

"Discussions with you have indicated that your attitude concerning this incident is cooperative and constructive. . . In consideration of the measures you have taken to prevent similar occurrences in the future, we have concluded that the matter does not warrant legal enforcement action. In lieu of such action, we are issuing this letter which will be made a matter of record for a period of two years, after which the record will be expunged."

IHC staff (left to right) Paul McConnell, Craig Brant, Keith McCutchen, and President Steve Kinnaman accepts the first Flight Standards Safety Award from Director of Flight Standards, Tom Accardi.

Awarding Safety...
... In Deed and Attitude

by Phyllis Duncan, Editor

For years, aviation pundits touted hopping aboard a helicopter from a hub airport for a short trip to "downtown" anywhere as the wave of future business commuting. Then, on May 16, 1977, the worn-out landing gear of a Sikorsky S-61 collapsed atop the Pan Am Building in New York City. Debris rained down on Madison Avenue 808 feet below. Five people died, and seven were seriously injured. Citizens of New York City cried that the middle of a highly congested city was no place for helicopters. The New York City government agreed and shut down the heliport immediately after the accident; it has never reopened. The accident increased public fear of city heliports all over the nation, and others across the country were closed down by municipal governments.

In the years after the New York accident, FAA and industry experts tackled the problem of how to fit a heliport in with the bustling downtown of major cities. And a need for such heliports was rapidly becoming apparent with the growth of a new segment of the helicopter industry—emergency medical service (EMS). On May 9, 1985 in Indianapolis, IN, FAA and city officials dedicated the first heliport developed under FAA's National Prototype Demonstration Heliport Program. The Indianapolis Downtown Heliport came to be the example for others to follow. Unlike its rooftop ancestor in New York City, this heliport had the wholehearted support of the municipal government, which saw its convenient location as attractive to business interests for Indianapolis.

In mid-July 1992, FAA and city officials again gathered at the Indianapolis Downtown Heliport, not for another dedication but for an awards ceremony to honor the heliport's operator, Indianapolis Helicopter Corporation (IHC). IHC, one of the country's major providers of Hospital-based Emergency Medical Service (HEMES), was the recipient of Flight Standards' first "Flight Safety Award" for its remarkable safety record. In 1986 when IHC received the contract to provide service at the Indianapolis Downtown Heliport, its management indicated its commitment to serving the public and its customers safely. IHC sought and received a FAR Part 135 air taxi certificate for its all-weather, HEMES operation. This meant IHC would be adhering to the higher safety standard FAA prescribes for certificated operators holding out to the public for transportation.

So, what was so special to warrant an FAA safety award? Quite simply, IHC has amassed over 11,000 hours of accident- and incident-free, single-pilot air ambulance operations since 1986. This record held while the company expanded to six satellite locations in five states, using 12 helicopters, and employing 30 pilots and 20 aircraft maintenance technicians. IHC accrued this record at a time when the overall EMS industry was experiencing an alarming accident rate. (After reaching an overall high in 1986, the accident rate has steadily improved.)

The numbers, however, were not the only aspect of the operation that FAA found noteworthy. The Indianapolis FSDO, manager of IHC's air taxi certificate, cited the company's attitude toward regulatory compliance as well: IHC and its pilots and mechanics have had no incidences of noncompliance. IHC company policy requires all pilots to participate in the Pilot Proficiency Award Program ("Wings"). IHC has all pilots undergo semi-annual, independent contractor-supplied instrument refresher training and provides specific factory aircraft training for all newly hired pilots. The company has also maintained its own internal audit program, similar to the FAA's program for FAR Part 121 and 135 operators.

IHC's record and safety attitude came to Flight Standards' attention through the efforts of Ms. Bernadette Bauer, Manager of the Indianapolis FSDO, Ms. Holly Geiger, former APPM now Geographic Unit Supervisor, and Aviation Safety Inspector Lewis Owens. They passed the information on to Regional Flight Standards Division Manager David Hanley who in turn advised Flight Standards Director Thomas Accardi. Mr. Brian Calendine of the Air Taxi and Commuter Branch in FAA Headquarters proposed the idea of the award after conferring with the Indianapolis FSDO and Aviation Safety Inspectors Ed Robinson and Al Michaels, who oversaw IHC's original certification. The award, first of its kind, was presented to IHC President Steven Kinnaman at a ceremony which included current and previous employees of the company. Kinnaman accepted the award but said, "This belongs to every IHC employee, past and present, who made our safety record possible."

In addition to the Flight Safety Award, Mr. Kinnaman and three members of his "safety team" also received recognition from Flight Standards. They included Lead Mechanic Craig Brant, Director of Operations Herbert McCutchen, and Director of Maintenance John Paul McConnell.

There are many other EMS operators whose dedication to safe transportation of patients in need of critical care is equally deserving of recognition. To them and IHC, thanks for the life-saving service you provide. ■

The increase in the use of the versatile helicopter in EMS has had some growing pains in the form of a high accident rate. In the January/February 1993 issue of FAA Aviation News, *we will provide an in-depth article on the history and current status of EMS and FAA's and industry's efforts to improve the safety record.* ***—Editor.***

Prefright

by Bruce Edsten, Accident Prevention Program Manager, Louisville, Kentucky, Flight Standards District Office

The first step in a safe flight—a thorough preflight.

Looks like I just spelled it wrong, but it was intentional. Happily, it is not as big a problem as it might be, but too often a poor or nonexistent pre*flight* does indeed result in a major, big-time *fright*.

Some Amusing Anecdotes

Probably the classic example is the tale of the two good ol' boys who were partners in a Piper *Tri-Pacer*. This particular airplane was a relatively high-time bird and in need of some tender loving care, particularly in the area of the fabric cover. Several spots had already been patched, and the boys knew they were going to have to spring for a re-cover job pretty soon. Most likely, it would not get through the next Annual, so maybe the coming winter would be a good time to take bird apart and fix her up.

Well, one day when good ol' boy #1 came to fly, he noticed another place on the rudder that needed some immediate help. Now patching the fabric cover is really a bit beyond what pilot/owner types can do on their own, but #1 takes the rudder off and hauls it home for a quick bandaid treatment anyway. Not being especially flush, these guys can only afford to keep the bird in a dirt-floored T-hangar with no doors. They are trying to keep their maintenance costs down as much as possible, too. Like down to ZERO.

Of course, it is a beautiful day for flying, so good ol' boy #2 shows up at the airport, too, and decides to go commit aviation. He checks the gas (got some) and the oil (showin' on the stick). He also notes that it still has three more or less properly inflated tires, so he climbs in and fires it up right there in the hangar. After all, it flew in here, right? What could go wrong?

After a quick mag and carb heat check, our hero swings onto the active and unleashes the fury of all 150 (more or less) of those Lycoming horses, and the *Tri-Pacer* starts down the centerline. Actually, everything went pretty well until he raised the nose, since the *Tri-* has good nosewheel steering. With the nosewheel off the ground, however, the front end starts for the tall weeds on the left side of the runway in a big hurry. In response, our intrepid aviator mashes the right pedal for all he is worth but only gets about 12 feet of slack cable for his trouble.

As the plane starts down the drainage ditch, trailing three runway lights behind it, the pilot decides to yank the power off (about time) and grab the brake handle, but it is already too late. All concerned parties come to rest in the cornfield about 50 feet from the runway, with the left main and the left wing acting as the primary shock absorbers. Fortunately, the pilot had hooked up his seat belt, so he climbs out of the bird without a scratch. Looks like the new fabric job is going to come a bit earlier than anticipated.

Of course, the FAA comes out to see what happened, and as the inspector starts into the corn, the first thing he sees is the tail of the *Tri-Pacer* prominently sticking up in the air because of the wrinkled gear. Conspicuously absent from said tail is the rudder. The inspector asks the pilot where the rudder is, and the response is, "Beats me! I had one when I started, so it musta fell off." On closer inspection, however, it is found that good ol' boy #1 had put all the nuts and bolts back in the hinges and the turnbuckles so they would not get lost. Pretty tough to lose a rudder with all the hardware in place.

Just about this time, good ol' boy #1 shows up in his pick-up truck and drives over to see what all the commotion is about. In the back is the rudder with a new patch in place—so fresh the dope is still wet. Well, as you could imagine, the Inspector had a few well-chosen words for these two.

If you re-read this story a few times, you can probably conjure up some really humorous images, but every once in a while the punch line is a lot more serious. And it is not always a couple of good ol' boys, either. Airliners take off with the landing gear safety pins in place and inspection panels hanging open. Crewmembers have even been left behind.

General aviation has a bunch more airplanes—about 220,000 versus about 6,000 for the airlines—so you would expect that we would see a lot more preflight incidents. How about the *Bonanza* driver who forgot to untie the tail when he started home from the Bahamas? Seems he was parked in the sand alongside a taxiway and figured the reason he needed full power to leave the parking spot was because of having settled into the sand a bit. Actually, he pulled about 10 feet of yellow nylon rope and the concrete block clean out of the sand and flew all the way back to West Palm Beach with it! Lotsa nose down trim.

Late model Piper *Aztecs* come with a huge towbar that folds in the middle so it will fit in the baggage compartment. It attaches pretty securely to the nose gear, so it usually will not even touch the ground. You can see what is coming next, right? I was waiting for takeoff one day when this *Aztec* shows up, and the tower notices something about five feet long hanging down from the nose. The *Aztec* makes a low pass down the runway so the tower can look him over and as he does, I can clearly see what it is. The pilot drops the gear, makes a really good soft-field landing, and does not even scratch towbar. However, there is a really interesting pattern in the rear portion of the nose gear doors where they closed over the towbar.

Causes of "Prefright"

Seriously, though, a lot of preflight items go undone or are done in such haste that the effect is the same. Why is this? Actually, I think the problem has two components. On the one hand, we have complacency and, on the other, dependence on others.

Complacency is sort of a "familiarity breeds contempt" thing. As a pilot gains some experience, his or her thought pattern begins to sound like this, "Heck, I've done this at least a half a gazillion times, and it's always the same, and I never find anything, and I've flown this particular airplane sixty-eleven times, and I wanna FLY not grow old on the ramp, and like that, etc., etc." You get the idea, right?

The other side is dependence on others. We all have to do this to a certain extent, but some folks do a little too much. There is a strong tendency to think that the last guy who flew this thing would surely have written it up if anything were wrong. Of course the mechanic who did the last inspection certainly would not have let the thing out if it were not perfect, either. But, having the most conscientious group of people in the world going before you still will not guarantee that something has not happened in the interim or that something was not overlooked. How about the birds that built a nest in the cowling overnight? Or the new fueler that squirted your *Skyhawk* full of jet fuel and/or backed into your elevator without noticing it? Perhaps that last pilot was not too familiar with this type of airplane and thought the brakes were always like that?

Mechanics make an occasional booboo, too. I am presently the owner of a really good pair of diagonal cutters that I found *on top of the engine* when I opened the cowling to explain a point to a student. Never did find out who left 'em there. Guess the mechanic they belonged (past tense) to figured he had better buy some new ones rather than own up to having left them where he left them. A while back I watched a pilot nearly crash a DeHavilland *Beaver* that had just come out of annual, and the reason he almost lost it was that the ailerons had been rigged backwards. The mechanic messed up, to be sure, but the pilot compounded the error with an incomplete preflight.

Preflighting with a Purpose

What actually prompted me to write this article, though, was watching the many preflight contests held at airshows and safety seminars. I really thought that most of the participants would do better than they did. Perhaps they were not taking it all very seriously because they all knew they would not have to fly the thing, but I am sure that some of it was sloppy preflighting also. One year at Sun 'n' Fun the ones who put the competition together got really sneaky, and put in some stuff that nobody found. But having the seatbelts in backwards? Or would you have noticed that Page 7 was missing from the Approved Flight Manual? Wow! Super sneaky! However, many people missed a rag stuck in the cowling, a broken safety wire on the brakes, screws missing from the wingtips, and lots of other pretty obvious stuff. Not sneaky at all.

The scene was repeated at Oshkosh, and then I got involved in setting one up myself at a local airshow. Once again, we set up some really sneaky stuff, but mostly the items were obvious ones, like no airworthiness certificate, a sparkplug wire hanging loose, and things like that. We told all the participants that there were 10 items to find, but we actually had 12, and the best score was nine. I am quite sure that some of this poor showing was because of having some really hard-to-spot items and some because of assumptions about the paperwork, but a good deal of it was because of *not looking*, and that is the whole answer.

You have to look closely! Having and using a preflight checklist is a big help, too, but simply reciting the items and not really looking will not get the job done. Even really looking is not enough without also knowing what you are looking for. Because of the considerable differences in airplanes, there simply is not enough space here to get into *all* the fine details of what to look for, but an example might be useful. [See "First Check for Safety—The Preflight Inspection," in the September/October 1991 issue of *FAA Aviation News.—Editor]*

Take tires, for instance. When you look at the tire you are looking for proper inflation but also for the general condition of the tire. How about the tread? Any cord showing? Are the sidewalls cracking and checking? Is the valve stem in good condition? How about the slip indicator, that little strip of paint that crosses the rim and the tire? Are both paint marks lined up?

See what I mean? How many of us just glance at the tire without ever bending down to take a good look?

About the only way to get to know all the fine details about your airplane is to spend some time with a flight instructor or a mechanic who knows the airplane like the back of a hand. If you are really lucky, you may have a detailed owner's manual or an approved flight manual, but even the good ones leave out some of the details. Take a few minutes to poke around your favorite mount, whether you own it or rent it, and ask questions.

When you get really sharp, you may want to test your skills at one of the preflight contests that are sure to come up in the future. I know they will come up because it is an area that needs work. I promote them at every opportunity. They usually draw a lot of attention, and people stay up nights thinking of truly incredible things to do to the subject aircraft. Of course, they have the advantage of using an airplane that can be tied up for weeks and can then be handed back to the mechanics for restoration to airworthy status. Some people have painted different N-Numbers on each side of the fuselage. Would you believe a recent upholstery job with cloth that did not meet the current fire-resistance standards? Would you catch a trim tab that was rigged backwards? Heavy stuff, dude!

It is not likely that the contest at your local airport will get that wild, but there is still a lot of underhanded stuff that I did not mention. Do not be afraid to try one of the contests when the next one comes up in your area because everybody is going to miss something. You will not be alone. Plus, you will undoubtedly learn something about looking at your airplane.

And, when it comes to preflighting your air machine, let us paraphrase our national motto: **IN GOD WE TRUST. EVERYTHING ELSE, *WE CHECK!*** ■

STOP, LOOK, AND LISTEN

Situational Awareness and the Ground Collision at LAX

by Dean Chamberlain, Associate Editor

At 6:07 pm PST, February 1, 1991, 34 passengers and crewmembers were killed when two planes collided on runway 24L at Los Angeles International Airport (LAX). One plane, Skywest Flight 5569, a Fairchild *Metroliner* (SA-227-AC), had been cleared to taxi into position and hold on 24L at Intersection 45. The other aircraft, USAir Flight 1493, a Boeing 737-300 (B-737), had been cleared to land on 24L. The resulting crash killed all 10 passengers and two crewmembers on the *Metroliner* and 20 passengers and two crewmembers on the B-737.

The National Transportation Safety Board's (NTSB) report on the accident identified several factors that the NTSB felt needed to be brought to every pilot's attention. One of those factors was that the local controller working the two aircraft made a mistake and cleared both aircraft onto the same runway. Although the Board's complete report discusses the controller's workload and training, airport lighting, ATC procedures, and several other factors, the report highlighted the fact that controllers as well as pilots can and occasionally do make mistakes. Because mistakes happen, every pilot operating an aircraft should maintain *an awareness of all of the events affecting his or her aircraft's safe operation.*

In a letter about the accident to the FAA Administrator, NTSB said, "Inherent in the 'see and avoid' concept to avoid collision is a need for pilots to be alert and vigilant in monitoring air traffic communications for situations that may lead to conflicts with other aircraft." Also in the letter the Safety Board expressed a concern that the relatively low number of runway incursions may lead to a relaxed vigilance and a decrease in the high state of situational awareness of pilots that is so critical to their performance.

Complacency in a Radar Environment?

In the radar environment of an approach and after having received specific landing clearance, pilots may relax their attentiveness in listening to communications that are not specifically directed to their aircraft. In addition, they may reduce efforts to scan for aircraft between their position and the intended landing runway. As a consequence, pilots of aircraft on an active runway or on final approach to landing should be especially attentive in listening for information about the runway they occupy or expect to occupy. It is essential that pilots monitor the ATC system to the fullest extent possible to detect unsafe practices or conditions that may affect their flight and to take action to protect themselves from dangerous practices or conditions before they result in accidents. This is not always as easy as it sounds. The Board recognizes the "challenging, inherent difficulties in monitoring the flow of information that is intrinsic to high-density environments." The Board noted that more than 60 ATC transmissions took place in the three minutes and 43 seconds from the time USAir 1493 came on the local controller's frequency until the accident.

Effective training, planning, and resource management may be able to diminish the effects of limitations on the ability of pilots to detect time-critical information. As a result of the LAX accident NTSB has recommended that general aviation and air carriers should take steps to ensure that their respective training programs, including crew resource management (CRM) training and flight operating procedures, place sufficient emphasis on the need for pilots to monitor ATC communications for potential traffic conflicts with their aircraft, especially when on active runways and during final approach/landing segments. All aircrews, therefore, need to develop an increased *situational awareness*.

CRM training is the cornerstone of aircrew preparation for air carriers, and a story on the subject of crew resource management in general aviation operations appeared in the September-October 1991 issue of *FAA Aviation News*. The article, a reprint from *Flight Training* magazine, discussed the need for CRM training, CRM elements, and the CFI's role in CRM training for general aviation. The article highlighted the fact that CRM is as important in a single-pilot cockpit as it is in a crew environment. The article concluded with a list of additional articles and sources of information on CRM training and concepts for general aviation pilots.

In addition to its comments on CRM, the Board also discussed the need for better use of standard words and conversational phraseology between pilots and controllers to avoid any misunderstanding that could cause an accident. At the moment, the FAA is reviewing the question of proper phraseology when pilots request an intersection takeoff and when controllers issue "position and hold" instructions. Any changes will be addressed in a future edition of the *Airman's Information Manual* (AIM).

Responsibilities versus Workload?

But what do developing an increased situational awareness and using proper phraseology really mean? Basically, it means that every pilot is responsible for his or her own safety. Although this accident occurred at a major, towered airport, it highlights the fact that, statistically, the most dangerous segment of flight is on or near an airport. Part of this is because of the number of aircraft operating around, converging on, or departing from the airport. Add to this the extra workload pilots are subject to while starting, taxiing, doing runups, taking off, or preparing to land, and you can understand why a pilot could make an error that may cause an accident. Multiply the number of aircraft operating at a given moment either on the airport or in its vicinity by the number of required ATC radio transmissions and the decisions that the controller has to make, and you can perceive the workload of the controllers responsible for the facility. Throw in the problems of pilots having to navigate and communicate with ATC while operating their aircraft, and you can begin to comprehend why flight at or near airports can be accident prone. The increasing complexity of today's airspace and the resulting number of ATC communications involved in today's operating environment, as noted by NTSB in its discussion of the LAX crash, all add to the problems and stress involved in today's flight operations for both pilots and controllers. Together, all of these factors add up to a lot of distractions that can, as in the case of the LAX crash, result in an accident.

So how can you, as pilot in command, prevent a similar occurrence at LAX or at your own local community airport? We will discuss a few suggestions based upon the NTSB LAX report and general safe flying concepts that may help you avoid this type of accident. If you have any suggestions or ideas that we did not list, please send them to us for possible use in future articles. Listen and Avoid?

First, all pilots and controllers must operate in accordance with the Federal Aviation Regulations (FAR), local airport procedures, and other FAA procedures. The reason is obvious; every pilot must be able to anticipate what another pilot is going to do, and every controller and pilot must be able to anticipate each others' actions. Everyone must be careful, though, not to anticipate an action and do it without authorization. When someone does not follow procedures there is always the potential for an accident.

Listen and Avoid?

So how can a pilot try to avoid an accident? By being aware of what is happening around your aircraft—what we have termed situational awareness. The general aviation pilot is well versed—or should be—in situational awareness. Just consider your actions during a recent weekend of nice weather at a busy non-towered airport that boasts several flight schools, numerous transients, and mixed aircraft operations. You not only broadcast your position when entering and circuiting the traffic pattern, you *listen* for the broadcasts of others as well. When you get through announcing that you are left base and number one for landing then hear some one else make the *same* announcement, your awareness of your situation really heightens—as well as the hackles on the back of your neck. Then, there are the not-so-professional pilots who are too busy or too unconcerned to announce themselves. You have to anticipate their arrival in the traffic pattern when you would otherwise least expect it. This same situational awareness applies both to flight and ground operations at towered *and* non-towered airports.

TIPS ON BEING SEEN

In addition to stressing the need for increased emphasis on monitoring ATC communications, especially when on the runway or landing, and the need for increased situational awareness when in those flight segments, the Board outlined several other good ideas that all pilots should think about. First, the accident report highlighted the fact that in testimony and flight tests after the accident there may have been a problem in the USAir crew being able to see the *Metroliner* on the runway. According to the report, in tests which simulated the accident conditions, the test crews had problems in differentiating a similar *Metroliner* from the lighted runway environment at LAX. And according to testimony of the surviving flight crewmember when asked to account for the fact he did not see the *Metroliner* earlier, he testified, "It wasn't there. It was invisible."

As a result of the flight tests and testimony NTSB made the following recommendations: (1) "The visual approach exercises also indicated that the likelihood of detecting an aircraft from the rear on an active runway by an approaching aircraft can be increased if the first aircraft is displaced from the runway centerline lighting by approximately 3 feet. Moreover, when this offset procedure was used in conjunction with high-energy strobe lighting and anticollision and navigation lighting, aircraft conspicuity was enhanced." (2) "The Safety Board considers that the use of strobe lighting, along with the practice of displacing the aircraft off the centerline lighting, would significantly enhance the ability of pilots and air traffic controllers to visually detect traffic conflict situation." (3) Aircraft operators should upgrade their aircraft anticollision lighting installations on those aircraft certificated before September 1, 1977, to meet current standards. The installation of higher-standard lighting systems would help increase the nighttime conspicuity of the aircraft, particularly while on the ground. It should be noted that aircraft position and anticollision lighting is primarily designed for inflight use, not to maximize conspicuity on the ground.

Seeing and Being Seen?

The Board also emphasized the need for pilots to "see and avoid" other aircraft. You might say, "see and avoid" is a two-part problem. One part is seeing. The other part is being seen. One part is teaching pilots how to look and scan for other aircraft. The other part is thinking of ways of making your aircraft more "seeable" to other pilots. "Operations Lights On" is one way to help—i.e., turn on the aircraft navigation lights, rotating beacon, and strobes when in a terminal area. Of course, strobes should be *off* when in clouds, and at night at a busy well-lighted airport, your lights may become just another shining spot in the background. This is where situational awareness in reverse comes in—you want other pilots and any controllers to be aware of where you are situated. This is again why takeoff and landing announcements are so important at non-towered airports. At towered airports, do not be hesitant to remind a controller of your position if a significant amount of time has passed between ATC transmissions. At towered airports with simultaneous operations off multiple runways, there is no problem with reminding ATC that you are "ready for takeoff on 18" after a position and hold clearance. Your transmission requires a response and may serve as a life-saving memory jogger. That transmission on frequency to ATC helps also to make you more "seeable" to other pilots—if they hear you, they will look for you.

Stop, Look, and Listen?

The need for increased situational awareness might be paraphrased by saying all pilots should, stop, look, and listen before putting themselves at risk. Before someone says that you cannot stop an aircraft in flight, think of airborne stopping as not entering a block of airspace without knowing for certain that it will be clear of another hard object, such as another aircraft or a mountain. This can also apply to ground operations but requires that single pilots and aircrews spend as much time as possible protecting their airspace block as best they can. They can do this by knowing their position at all times and knowing where they are going. The time-honored "see and avoid" concept has always meant that pilots must look outside of their aircraft as much as possible, but pilots must also listen to ATC communications for possible conflicts in their airspace whether in flight or while waiting to takeoff and while landing.

One way pilots can do this is through increased training and proficiency. By knowing their aircraft and their flight operating environment, pilots can maximize their "look and listen" time without jeopardizing flight safety. Knowing your aircraft is important. Remember the last time you got checked out in a new aircraft and the amount of time you spent looking for gauges, controls, and other items in the new cockpit? Now remember the amount of time you have to spend looking inside the cockpit of the aircraft you fly frequently. The time you can save by being familiar with your aircraft and its systems is time you can spend looking outside the aircraft for your own safety. Another example of how you can save valuable time for looking outside your aircraft is by having studied the airport diagram and departure procedures, including radio frequencies, before starting engines at a strange airport. If you do not review this information before starting engines, you will have to spend valuable time looking inside the cockpit at charts, etc., instead of looking outside the aircraft for possible problems. The same is true when preparing to land at a new airport. Simply stated, being prepared maximizes the time you can dedicate to safety.

SOP versus Creativity?

Whether departing or landing, pilots also need to follow standard procedures when operating on or near an airport. This includes using standard radio phraseology and reporting procedures. Your own protection depends upon other aircraft knowing exactly where you are at any given moment. Being creative on final or downwind is not the way to avoid an accident. Save being creative for those times that need creativity; otherwise, follow standard procedures whenever possible. For example, how many of you have heard pilots reporting their downwind position using non-standard terms, e.g., CB lingo? How many of you have heard someone reporting their position, and, when you looked to find them, they were not where they had said they were. As we all know, communication requires that everyone knows and follows the same set of guidelines. In the complex world of aviation, pilots and controllers must be able to understand each other. The *Airman's Information Manual* (AIM) not only defines proper airport operating procedures, it has a pilot/controller glossary of aviation terms with their meanings. Since the AIM and its glossary are subject to change, all pilots need to review the current edition of the AIM to ensure compliance with the latest procedures

In addition to reviewing the latest AIM, another safety item is that pilots must use the latest charts and facility information. Before a flight, a pilot should review the latest *Notices to Airmen* publication as well as checking with Flight Service for all changes to charts (both IFR and VFR) facilities, and procedures.

In summarizing some of its recommendations from the LAX accident, the NTSB said that—

- Pilots should remain alert at all times when operating their aircraft, especially when on the runway or when landing.
- Pilots should do all they can to increase the conspicuity of their aircraft either through improved lighting equipment or through such NTSB recommended techniques as offsetting from a runway's centerline lighting when operating in reduced visibility, e.g., during periods of darkness or other periods of reduced visibility.
- Pilots should monitor all ATC communications that could affect their aircraft, and we will add, not just ATC communications but also UNICOM or CTAF transmissions at non-towered airports.

Hopefully through better pilot training and increased situational awareness and, using such techniques as crew resource management, accidents such as the one on the night of February 1, 1991, at LAX can be prevented. ■

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by Kris Kjos, DOT Management Intern and Louise Oertly, Associate Editor

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Flaps or No Flaps?

by Fred G. DeLacerda, owner/operator of Delta Aviation, Stillwater, OK.

Cleared for takeoff, the commercial airliner started its takeoff roll with 149 passengers and six crew members on board. Less than a second after takeoff, the MD-80 was in trouble. The airplane climbed slowly, rolling slightly then sharply. Fourteen seconds after takeoff the airplane was less than 50 feet above the ground. At this point first contact was made with a ground obstacle. The ensuing crash left only one survivor.

Approximately one year later the official report by the National Transportation Safety Board (NTSB) stated that the high-lift devices—the wing's leading edge slats and trailing edge flaps—were retracted. Hence, the airplane was not properly configured for takeoff, and, as a result, the airplane's climb performance was severely limited. In an effort to gain altitude, the climb pitch was too high, causing a decrease in roll stability. This resultant roll further degraded climb performance.

The purpose of citing this accident is not to show fault, either human or mechanical, but rather to illustrate how slat and flap configuration affect the performance of a particular airplane. Improper flap configuration can be equally disastrous for less complex airplanes. Consider, for example, a Cessna 182, equipped with a short field takeoff and landing (STOL) kit. The pilot took off with the flaps extended to 35 degrees; however, the pilot thought the flaps were extended to only 20 degrees. Consequently, the pilot established a climb at a pitch angle that exceeded the critical angle of attack for the flap configuration. At an altitude of approximately 100 feet, the airplane stalled and crashed.

A contributing factor in many airplane accidents is the misuse of flaps. Pilots involved in these accidents range from the novice with minimal flight time to the veteran with many hours. Although flap misuse is relatively rare in large air carrier-type airplanes, the failure to use flaps properly on a jet airliner can have tragic results. Misuse of flaps on light airplanes do not necessarily cause an accident, but failure to recognize the effects of a particular flap configuration on the flight characteristics of a certain airplane is a contributing factor to some accidents.

Flaps are used only during a small portion of flight—the takeoff and landing of the airplane. Therefore, the use of flaps becomes either a mechanical process whereby a certain flap setting is used for a particular flight operation or else the pilot relies on judgement as to when, where, and how much flaps to use. In either case the pilot should understand the general effects of flaps, and the specific effects relative to the airplane's design. Unfortunately, some pilots of general aviation airplanes may lack this comprehensive understanding of flaps. This is may be because of a superficial treatment of the subject during flight training, simply because some instructors may not consider flaps an indispensable item for flight safety.

Despite the fact that flaps are used for only two flight conditions, takeoff and landing, these flight conditions are critical because of the airplane's proximity to the ground. Any alteration in the control configuration of the airplane during these flight conditions must be understood by the pilot. The purpose of this article is to provide a detailed analysis of flap operation so the pilot is aware of the complexities involved in the design and use of a seemingly simple control device. Such an awareness could remove "misuse of flaps" as a probable cause or contributing factor to certain accidents.

Airplane Design

It is possible to tell by looking at a parked airplane whether it was designed to fly fast or slow. High speed requires thin, moderately cambered airfoils with a small wing area, whereas the high lift needed for low speeds is obtained with thicker, highly cambered airfoils with a larger wing area. Many attempts have been made to compromise this conflicting requirement of high cruise and slow landing speeds.

Since an airfoil cannot have two different cambers at the same time, one of two things must be done. Either the airfoil can be a compromise, or a cruise airfoil can be combined with a device for increasing the camber of the airfoil for low-speed flight. One method for varying an airfoil's camber is the addition of devices to the leading edge (slats) and/or trailing edge (flaps). Engineers call these devices a high-lift system.

While the flap/slat high-lift system increases wing area and drag, the drawback is the added weight and complexity of the system. In the interest of simplicity, trailing edge flaps only are used on most general aviation airplanes.

Function of Flaps

Flaps work primarily by changing the camber of the airfoil since deflection adds aft camber. Flap deflection does not increase the critical (stall) angle of attack, and in some cases flap deflection actually decreases the critical angle of attack. The traditional definition of angle of attack seems to contradict the decrease in critical angle of attack with flap deflection. Every pilot learns early in flight training that the angle of attack is defined as the angle of the chord line to the relative wind. The chord line is a straight line drawn from the leading edge to the trailing edge of the airfoil. Exceeding a specific angle of attack for a given airfoil, called the critical angle of attack, results in a stall.

The definition of a chord line does not remain the same when flaps are defected despite the degree of deflection being defined relative to the chord line. Chord line is referenced with the zero-lift line, this being a straight line that starts at the leading edge of the airfoil and is parallel to the relative wind when the airfoil angle of attack is such that no lift is produced. Now the angle of attack is redefined relative to

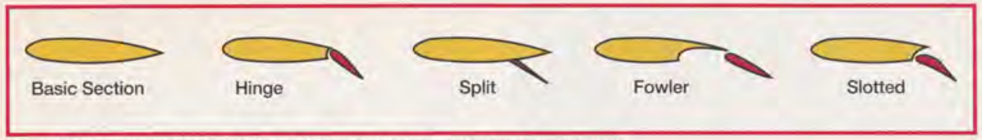

Figure 1. Shown are the four basic types of flaps: plain (hinge), split, Fowler, and slotted.

the zero-lift line so that as the flaps move, the zero-lift line also moves, changing the angle of attack. Hence, as flaps are deflected lift is increased without change in the pitch attitude. The greater the camber, the greater the lift although the angle of attack does not increase.

Deflection of trailing edge control surfaces, such as the aileron, alters both lift and drag. With aileron deflection there is asymmetrical lift (rolling moment) and drag (adverse yaw). Wing flaps differ in that deflection acts symmetrically on the airplane. There is no roll or yaw effect, and pitch changes depend on the airplane design.

Pitch behavior depends on flap type, wing position, and horizontal tail location. The increased camber from flap deflection produces lift primarily on the rear portion of the wing. This produces a nose-down pitching moment; however, the change in tail load from the downwash deflected by the flaps over the horizontal tail has a significant influence on the pitching moment. Consequently, pitch behavior depends on the design features of a particular airplane.

Flap deflection of up to 15 degrees primarily produces lift with minimal drag. The tendency to balloon up with initial flap deflection is because of lift increase, but the nose-down pitching moment tends to offset the balloon. Deflection beyond 15 degrees produces a large increase in drag. Drag from flap deflection is parasite drag and, as such, is proportional to the square of the speed. Also, deflection beyond 15 degrees produces a significant nose up pitching moment in most high wing airplanes because the resulting downwash increases the airflow over the horizontal tail.

Flap Effectiveness

Flap effectiveness depends on a number of factors, but the most noticeable are size and type. In most general aviation airplanes, the flap length depends on the size aileron required because the flaps are located between the ailerons and the fuselage. Consequently, the length of most flaps are approximately 40% of the wingspan. Effectiveness increases with increase in flap chord up to about 40% of the wing chord; however, general aviation airplanes have a flap chord approximately 20 to 25% of the wing chord.

The type of flaps used on general aviation aircraft are limited by structural and weight considerations to trailing edge flaps of four basic types: Plain (hinge), split, slotted, and Fowler. (Figure 1)

The *plain* or *hinge flap* is the simplest in terms of structural requirements since it is a hinged section of the wing. The structure and function are comparable to the other control surfaces—ailerons, rudder, and elevator. The *split flap* is more complex. It is the lower or underside portion of the wing; deflection of the flap leaves the trailing edge of the wing undisturbed. It is, however, more effective than the hinge flap because of greater lift and less pitching moment, but there is more drag. Split flaps are more useful for landing, but the partially deflected hinge flaps have the advantage in takeoff. The split flap has significant drag at small deflections, whereas the hinge flap does not because airflow remains "attached" to the flap. Split flaps can increase the maximum lift coefficient as much as 1.0 compared to .9 for the hinge flap.

The *slotted flap* has a gap between the wing and leading edge of the flap. The slot allows high pressure airflow on the wing undersurface to energize the lower pressure over the top of the flap thereby delaying flow separation. The slotted flap has greater lift than the hinge but less than the split, but, because of a higher lift-drag ratio, it gives better takeoff and climb performance. The slotted flap can give a maximum lift coefficient of 1.2. Small deflections give a higher drag than the hinge flap but less than the split. This allows the slotted flap to be used for takeoff.

The *Fowler flap* deflects down and aft to increase the wing area. This flap can be multi-slotted making it the most complex of the trailing edge systems. This system does give the maximum lift coefficient—as much as 1.7. Drag characteristics at small deflections are much like the slotted flap. Because of structural complexity and difficulty in sealing the slots, Fowler flaps are most commonly used on larger airplanes.

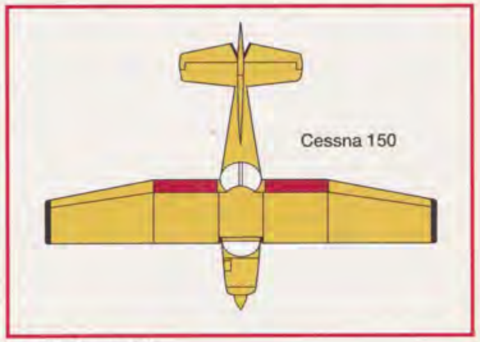

Figure 2. Cessna 150

One Airplane's Example

It would be overwhelming to compare the many airplane/flap design combinations, but the Cessna 150 is a good example to discuss here because it has a fairly complex flap system for a two-place airplane. The Cessna 150 (Figure 2) is a high-wing trainer with a conventional tail and a compromise wing—rectangular inboard and tapered outboard. The flaps, a single slot Fowler type (Figure 3), are located on the rectangular portion of the wing. They move aft eight inches when fully extended. Flap actuation is by electric motor which allows any degree of deflection from zero to 40

Figure 3. Located on the inboard portion of the wing of this Cessna 150 is a single slot Fowler-type flap. Airplane courtesy of the Professional Flight Service, Ft. Washington, MD.

degrees. Full extension requires nine seconds and retraction six seconds. The flaps represent 11.5% of the total wing area, 17.1% of the wing span, and 30% of the wing chord. Full flap extension decreases the stall speed by 12.7%. The first 20 degrees of deflection lowers the stall speed six mph while the second 20 degrees lowers it only one.

The Cessna manual indicates that normal landing approaches can be made with flaps up or down. When landing in a strong crosswind, the manual recommends that a minimum setting be used as required by runway length. For short field landings, an approach with 40 degrees of flaps is recommended with a power-off touchdown. No more than 10 degrees should be used for takeoff. The 10 degrees shortens the ground roll but hinders the climb.

A go-around requires an immediate 20-degree retraction. It takes approximately two seconds to accomplish this. Any remaining flap retraction is restricted to 10-degree increments, thereby allowing the airplane to accelerate to a speed adequate for a safe climbout.

During the long production life of the Cessna 150 several significant changes were made to the flap system. The early models had mechanically actuated flaps for four positions of deflection at 10-degree increments. The speed for deflection was controlled somewhat by dynamic air pressure on the flaps, but retraction was assisted by this air pressure. Consequently, full flap retraction could be accomplished very rapidly, so rapidly that on low-level go-arounds the loss of lift could allow the airplane to make ground contact. The mechanical flap system was replaced with an electrical system that had a controlled rate of extension and retraction, but even then the manufacturer was specific regarding flap retraction during a go-around. Rather than four positions the electrical system allowed any degree of flap deflection over a range of 40.

Although the geometrical design of the Cessna 152 flaps remained the same as the Cessna 150, there were two significant changes. First, the flap switch was changed for flap settings at 10-degree increments. Second, flap deflection was limited to 30 degrees. The latter design change resulted from pilot problems during go-around. With a 40-degree deflection of the flaps, the application of full power produced a significant increase in airflow over the flap portion of the wing. The sudden increase in lift caused the airplane to pitch up rapidly, requiring significant forward yoke pressure in order to prevent a takeoff/departure stall.

As stated earlier, the position of the horizontal tail relative to the wing determines pitch reaction with flap extension or retraction. The Cessna 150 horizontal tail is below the wing so that with 40 degrees of flaps there is a large downwash over the tail causing a pitch up, a condition that addition of power and nose-up trim aggravated. Therefore, in a go-around, application of full power while simultaneously raising the nose to climb will quickly produce a power-on stall that can be complicated by failure to compensate for torque with the appropriate rudder pressure.

Operational Procedures

As we said, it would be impossible to discuss all of the many airplane design and flap combinations, but the discussion of the Cessna 150 illustrates the importance of the pilot's operating handbook (POH) for a given airplane. However, while some handbooks are specific as to operational use of flaps, most are lacking, particularly for light general aviation airplanes. Hence, flap operation makes pilot judgement of critical importance. In addition, flap operation takes place for landings and takeoffs, operations with the airplane in proximity to the ground where the margin for error is small.

Since the recommendations given in the POH are based on the airplane and the flap design combination, the pilot must relate the manufacturer's recommendation to the aerodynamic effects of flaps. This requires that the pilot have the basic background knowledge of flap aerodynamics and geometry presented earlier. With this information the pilot must make a decision as to the degree of flap deflection and time of deflection based on runway and approach conditions relative to the wind conditions.

The time of flap extension and degree of deflection are related. Large flap deflections at one single point in the landing pattern produce large lift changes that require significant pitch and power changes in order to maintain airspeed and glide slope. Consequently, the deflection of flaps at certain positions in the landing pattern has definite advantages. Incremental deflection of flaps on downwind, base, and final allow smaller adjustment of pitch and power compared to extension of full flaps all at one time. Should the need arise to make a go-around, the degree of flap retraction required will depend on one's position in the landing pattern.

A soft or short field landing requires minimal speed at touchdown, so the flap deflection that gives the minimal ground speed is the flap setting of choice. If obstacle clearance is needed, then the flap deflection that gives the steepest angle of approach is used. It should be noted that the flap setting that gives the minimal speed at touchdown does not necessarily give the steepest angle of approach; however, maximum flap extension gives the steepest angle of approach and minimum speed at touchdown. Maximum flap extension particularly beyond 30 to 35 degrees, gives a large amount of drag. This requires higher power settings than used with partial flaps. Because of the steep approach angle combined with power to offset drag, the flare with full flaps becomes critical. The drag produces a high sink rate that must be controlled with power, yet failure to reduce power at a rate so that it is at idle at touchdown allows the airplane to float down the runway. A reduction in power too early results in a hard landing.

Wind conditions include not only the velocity but the crosswind component and the degree of turbulence. As stated previously, touchdown speed should be at a minimum, but one must be reminded that airspeed and ground speed are not necessarily the same. The stronger the headwind at touchdown the slower the ground speed will be. The greater the flap deflection the slower the ground speed at touchdown for a given headwind component. This is particularly true when the flap setting exceeds 30 to 35 degrees. Needless to say, maximum flap extension on final approach in a strong headwind would require a high power setting, the setting dependent on the velocity of the headwind. There reaches a point in a strong headwind approach where the pilot must consider the merits of flap setting versus power setting. There is little need to use maximum flaps if the wind condition makes full power a requirement to make the runway. This is a case where pilot judgement, based on airplane performance and manufacturer recommendations, is the determining factor.

A crosswind component is another factor to consider in the degree of flap extension. The deflected flap presents a surface area for the wind to act on, and the more the degrees of deflection, the more surface area that is affected by the wind. In a crosswind the "flapped" wing on the upwind side is more affected than the downwind wing. This is, however, eliminated to a slight extent in the crabbed approach since the airplane is more nearly aligned with the wind. In a wing low approach the lowered wing partially blankets the windward flap, but the dihedral of the wing combined with the flap and wind make lateral control more difficult. Lateral control becomes more difficult as flap extension reaches maximum and the crosswind becomes perpendicular to the runway.

Crosswind effects on the "flapped" wing become more pronounced as the airplane comes closer to the ground. The wing, flap, and ground form a "container," so to speak, that is filled with air by the crosswind. With the wind striking the deflected flap and fuselage side and with the flap located behind the main gear, the airplane tends to lift the windward wing and turn into the wind. Therefore, proper control position and flap retraction upon positive ground contact is essential for maintaining runway alignment.

Gusty and turbulent wind must also be considered when making a decision about flap settings. Generally, approach speeds are increased during gusty and turbulent wind conditions. When gusty and turbulent air strikes the "flapped" wing asymmetrically, lateral control of the airplane becomes more difficult. Such wind conditions call for minimum flap settings or per the recommendations in the POH.

The go-around is another factor to consider when making a decision about degree of flap deflection and about where in the landing pattern to extend flaps. Because of the nose down pitching moment produced with flap extension, trim is used to offset this pitching moment. Application of full power in the go-around increases the airflow over the "flapped" wing. This produces additional lift causing the nose to pitch up, a motion that does not diminish completely with flap retraction because of the trim setting. Expedient retraction of the flaps is desired to eliminate drag, thereby allowing rapid increase in airspeed; however, retraction of flaps also decreases lift so that the airplane sinks rapidly.

The degree of flap deflection combined with design configuration of the horizontal tail relative to the wing requires that the pilot carefully monitor pitch and airspeed, carefully control flap retraction to minimize altitude loss, and properly use the rudder for coordination. Considering these factors, it is important to extend flaps the same degree of deflection at the same point in the landing pattern. This requires that a consistent traffic pattern be used. Therefore, the pilot can have a pre-planned go-around sequence based on the position in the landing pattern.

There is no single formula to determine the degree of flap deflection to be used on landing, simply because a landing involves variables that are dependent on one another. The aircraft's POH will contain the manufacturer's recommendations on flap usage for some landing situations. On the other hand, POH information on flap usage for takeoff is more precise. The manufacturer's requirements are based on the climb performance produced by a given flap design. Under no circumstances should a flap setting given in the POH be exceeded for takeoff.

Although pilots receive considerable emergency training, there is very little given for flap malfunctions. Although highly reliable, flap systems do fail. While a flapless landing is not necessarily a problem, there are certain factors to be considered. First, the pitch angle is higher for the airspeeds normally used in the pattern, making detection of traffic more difficult on some models of aircraft. Second, the landing speed will be higher, thereby requiring more runway. Because of the increased pitch angle, the pilot has difficulty seeing the runway, hence, there is a tendency to lower the nose, which in turn increases the approach speed.

A more critical emergency situation is the asymmetrical flap deflection. Such a condition immediately produces a rolling moment that must be countered with aileron opposite to the rolling moment and rudder opposite to the aileron to offset the yaw produced by the one deflected flap. Again, consult the POH's emergency section to see if there are specific procedures for this situation. If there is not, the pilot is faced with a critical decision: Continue with the asymmetrical flap extension or retract the flaps. Unless the pilot has increased the airspeed, the sudden retraction of the down flap at a low airspeed and low to the ground could result in a stall. In either case, a stall must be avoided. With asymmetrical flaps an uncontrollable roll in the direction of the "unflapped" wing will probably produce a stall and subsequent spin if the airspeed slows below stall speed. The unflapped wing will stall at a lower angle of attack than the flapped wing. The differential in lift on the two wings at stall produces the yaw needed for spin entry. To ensure against a stall, approach speeds should be higher than normal, at least 30% greater. Of course, this will require a longer than usual landing distance.

Conclusion

Full flaps or partial flaps? The answer depends on consideration of the following factors: 1) flap aerodynamics, 2) airplane and flap design combinations, 3) manufacturer recommendations, 4) runway and approach conditions, and 5) wind conditions. Pilot judgement based on a working knowledge of these factors ensures safe flight—and flap—operations. ■

We Are Here to Help You

by Dean Chamberlain, Associate Editor

When was the last time you called the FAA for something other than a flight plan or weather briefing? If you cannot remember, something is wrong. Either your memory is failing or you have been avoiding the FAA. Avoiding the FAA is easy. What with DUATS, electronic flight plan filing, consolidated Flight Service Stations, designated pilot examiners, and computerized airman testing, today airmen can go years without ever meeting anyone from the FAA except after an incident, accident, or inspection.

This article is a reminder for airmen to get to know their local FAA aviation safety inspectors (ASI) and Accident Prevention Program Managers (APPM) before they have to meet them officially. The reason is simple. Your local inspectors and APPM can provide you with a lot of good aviation information. Since help is only a telephone call or visit away, you owe it to yourself to take advantage of all of the FAA services and information available. You should be proactive and go meet your local FAA representatives, and one of the easiest ways to do that is through the Accident Prevention Program. To find out more about the Program call or visit your local APPM. And while you are talking to the APPM, you can ask about the next FAA safety meeting in your area. So the next time you are near your local Flight Standards District Office (FSDO) stop in and say hello. Some pilots do, but more do not.

Why is that? Fear may be one of the reasons more airmen do not routinely visit their local FSDO. Apparently, there are still a few intrepid airmen across

National Manager of the Accident Prevention Program, Roger M. Baker, Jr., speaking at the EAA fly-in at Oshkosh, WI.

the country who are willing to risk their lives by gulping their coffee, jumping over small restaurant tables, leaping tall counters, crashing security gates, and flying through open T-Hangars just to get across the airport to avoid an FAA inspector walking on the ramp near the airport's restaurant. Why these brave airmen would want to risk spilling their coffee or risk life and limb to avoid an inspector looking for a cup of coffee remains a mystery. If nothing else, they could take a taxi to the other side of the airport, but that is not the point of this article. The point is many airmen avoid the very people who can help them fly or work safer. In many cases, unless these airmen work for a large company that can afford the high cost of keeping up with the constantly changing information in aviation, the local FAA safety inspectors and Accident Prevention Program Manager may be the best and only free source of information about new rule changes, airworthiness directives (AD), and other changes in the industry. After all, the FAA works for you. Your tax dollars pay the bills, so you should make sure you get your money's worth. If you have been avoiding the FAA for years or are a new airmen, you may not know what services are available. The following article briefly lists some of the services the Accident Prevention Program and its parent organization, the Flight Standards Service, offer airmen. For instance, we know many airmen do not know about the new FAA Maintenance Technician Awards Program discussed in our September-October 1992 issue. Why the emphasis on Flight Standards? Because it is responsible for airmen certification, aircraft maintenance and airworthiness issues, aircraft operations, and many other areas that impact all airmen.

Flight Standards Service

For those airmen not familiar with the Flight Standards Service, its mission as stated in its most recent five-year management plan is "To provide the public with accident-free aircraft operations through the highest standards in the world." That plan, the *Strategic Management Plan, 1992-1997*, outlines the Service's eight strategic goals it plans to accomplish during the next five years. One of the goals addresses safety. Another addresses quality service and productivity. One safety goal the Service wants to accomplish is to continue to increase safety though a partnership with the aviation industry, a partnership that stresses voluntary industry compliance with appropriate regulations and safety procedures rather than through FAA enforcement. At the same time, the Service wants to improve the quality of service it offers the public by anticipating customer needs and responding in the public interest.

As it strives to accomplish its stated goals, Flight Standards will continue to perform its traditional role of ensuring safety within the aviation industry through the certification and surveillance of: air carriers, commercial and general aviation operators and air agencies; airmen and their proficiency; maintenance programs for U.S. aircraft; operational use of instrument flight procedures and aviation weather services; through management of the Accident Prevention Program; and through its investigatory role in aviation accidents, incidents, and regulatory non-compliance.

Flight Standards is involved in all segments of aviation involving airmen and aircraft. To manage such a wide range of activities, the Service is divided into major functional areas or divisions at FAA Headquarters in Washington D.C. Each division then provides the Service, the FAA Administrator, and the industry the expertise, policy guidance, and support needed within its specialized area. The names of the specialized headquarters divisions tell what industry segments they serve. The divisions are: Air Transportation, Aircraft Maintenance, Technical Programs, Field Programs, and General Aviation and Commercial. The divisions are then organized into branches and other offices to serve the unique needs within an industry group. For example, the Accident Prevention Program Branch (AFS-810) is a branch within the General Aviation and Commercial Division (AFS-800). That Division's other branches include the Operations Branch (AFS-820) which deals with general aviation pilot and aircraft operating procedures under FAR Parts 91, 103, 105, 125, 133, and 137; the Certification Branch (AFS-840) which deals with airmen certification and training; and the Regulations Branch (AFS-850) which deals with general aviation regulatory matters, including rulemaking and exemptions.

The divisional concept is also reflected in a somewhat modified form down through each of the FAA's nine Regional Offices to the Service's field operating units, the 90-plus national Flight Standards District Offices. The Service's Washington Headquarters organizational structure is representative of the way Flight Standards provides support at the FSDO level. Each FSDO has specialists assigned who can handle most of the questions and problems that an airman (which includes organizations and operators as well as individual airman) may have. Quick service is why airmen should contact their local FSDO's whenever they have a question or need help in resolving any FAA or aviation matter. If your question cannot be answered at the FSDO level, the person handling your question will forward it to the appropriate level, the respective regional office or FAA Headquarters, that has the expertise or authority to answer your question.

General Aviation and Commercial Division

This division serves the needs of general aviation, which is normally defined as all segments of aviation other than the FAR Part 121 Air Carrier operators and Part 135 Air Taxi Operators. To put the Division's responsibilities into perspective, we must review the size and scope of general aviation. According to the division's 1992-1997 *General Aviation Action Plan* (GAAP), general aviation accounts for about 97% of all of the nation's pilots and aircraft. It also provides about 530,000 jobs and contributes about $38 billion to the nation's economy. In 1990, about 700,000 general aviation pilots operated about 220,000 general aviation aircraft a total of about 35 million flight hours. These numbers show that general aviation pilots, maintenance technicians, and the industry supporting them represent a significant national investment in terms of operations, equipment, and economic impact. Since general aviation means every operation other than air carrier, air taxi, and commercial operators, the general aviation fleet ranges from the historic Piper J3 *Cub* flown by a new recreational pilot from a grass strip to the pipeline patrol pilot flying a Cessna *Skyhawk* to the latest business jet (which in some cases can be a Boeing 747) flown by a crew of seasoned pros.

This diversity of types of pilots, flying, and aircraft can cause difficulties. It created a safety problem for the industry and the FAA in the 1950's and 1960's. General aviation's accident rate skyrocketed out of sight. As a result, the FAA, working with industry, organized the Accident Prevention Program in the early 1970's to try to reduce the accident rate through education. Because of the support of the aviation industry and dedicated airmen everywhere, the Program has been very successful. Since its founding nearly 20 years ago, the Accident Prevention Program and the dedicated people supporting the concept, both within industry and the FAA, have all worked together to reduce the general aviation accident rate from the deadly rates of the 1950's and 1960's to its lowest rate ever last year. The diversified Accident Prevention Program means different things in different parts of the country, but within the Program there is a common goal: Accident Prevention through education.

Accident Prevention Program

A National Accident Prevention Program Manager and staff provide resource support and policy guidance to the nine Regional Accident Prevention Program Managers (RAPPM) who direct the activities of the APPM's working at the various FSDO's. Although most FSDO's have an APPM assigned, some of the satellite FSDO's and specialty offices do not. In those cases, the safety needs within their areas are served by the nearest APPM. An interesting point many airmen may not know is that each APPM is an experienced Aviation Safety Inspector (ASI) and a well qualified pilot and instructor. Although every ASI is dedicated to aviation safety, each APPM's full-time job is promoting safety within his or her area. This is why your local APPM should be your first point of contact at your FSDO for access to all of the FAA's safety information and related products. Each APPM has access to safety films, video tapes, pamphlets, and other safety material that can be used in safety presentations or meetings. In addition, because of their safety work, APPM's normally know of both FAA and industry experts within their respective areas who are willing to provide safety help and advice when needed. APPM's also have access to a wide range of other types of information, including *FAA Aviation News*, to support their local programs. And since the APPM's work closely with many of the aviation trade and membership groups, they can normally tell you about the types of safety information available from these groups as well. As you can see, your local APPM is a valuable information resource waiting to serve your needs.

In addition to the direct support your APPM can provide you or your group, he or she may also refer you to one of the many volunteer Accident Prevention Counselors (APC) who support and make the Accident Prevention Program work. The Accident Prevention Program would not be the success it is today without the 3,000-plus APC's across the country who volunteer their time and aviation knowledge and expertise to help their fellow airmen. Although the volunteer support the APC's provide the Program is critical to its success, in many cases, they seldom receive the public recognition they deserve. As a result, many airmen may not even know about the help and support available from their local APC's. But without the APC's, the Accident Prevention Program could not provide the quality support that airmen have come to expect and rightly deserve over the last 20 years.

This lack of public awareness of the support and dedication of the APC's and APPM's to aviation safety and of the Accident Prevention Program in general is why we are listing the names and addresses of the following APPM's by their respective FSDO's and regions. Because of the number of APC's nationwide, we cannot list their names and addresses. Airmen should contact their local APPM for the names and telephone numbers of APC's within their areas.

When you combine the APC's and APPM's knowledge of the unique pilot operating requirements within their respective geographical areas and their aviation expertise with your own skills and knowledge, you have a winning safety combination that cannot be beat for your next flight. For example, before your next extended cross-country flight you could contact the APPM at each FSDO along your route of flight with any questions you might have about his or her respective area. While we are not proposing that you contact an APPM or APC in lieu of your obtaining proper preflight information required by the FAR, we are suggesting that APPM's or APC's be contacted for such information that is not provided elsewhere. Such information might include tips on how to fly safely in mountainous terrain if you have never flown in the mountains, or how to safely fly over-water from Florida to the Bahamas, or similar questions on pilot techniques or operating procedures such as how to fly in or near a TCA or some other question that is bothering you. In addition, since most APC's are flight instructors, you may want to arrange a local checkout with one of them when you visit the area. APPM's can also answer your questions about other flight safety areas such as when the next FAA safety seminar will be held in your area or in the area you are planning to visit. Simply stated, everyone within the FAA and the Accident Prevention Program is dedicated to providing you with the safety tools and information necessary to ensure your next trip or operation is a safe one. The necessary resources to manage your own personal safety program is only a telephone call or visit away. And if you have any questions about pilot certification, airworthiness issues, or such diverse subjects as how to start an air taxi operation, arrange a flight test, or how to hold an airshow, please contact your local ASI or APPM. They are there to help you.

And no discussion of the Accident Prevention Program would be complete without mentioning its Pilot Proficiency Awards Program, or "WINGS Program," for short. If you do not know about the program, or how it can be used to satisfy your FAR Part 61 Flight Review requirement, call your local APPM.

Although FSDO addresses and telephone numbers are printed in various FAA publications, and are listed in the *Airport/Facility Directory* and under the U.S. Government/Department of Transportation/Federal Aviation Administration in the telephone directory for example, we are printing the names of all of the current APPM's and FSDO's by region, including those FSDO's without APPM's for your information and ease of access. We will update the list as space permits. Remember to fly safely. ■

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• Curtiss not Wright

Congratulations on producing a publication which turns a dull and dreary, yet important, subject into a sparkling pleasure to peruse. However, on page 27 of the July/August issue the striking photo from Oshkosh '91 is captioned as a replica Wright Flyer. It is really Vern Dallman's Curtiss Pusher—even the logo on the rudder appears to be Curtiss! So we now may have three of our oldest aviation pioneers whirling in their graves.

Also in the May/June "Famous Flights" the first blind flight by Jimmy Doolittle was mentioned. He had much more instrumentation than the three items listed. He had something on the order of eleven instruments including marker beacon and I/r needle.

Charley Hayes
Park Forest, IL

You are correct; the airplane is a Curtiss. Our apologies to Messrs. Wright, Curtiss, and Doolittle for not doublechecking our facts.

• Fueling Headwinds

Please explain what "headwinds" have to do with fuel endurance as stated on page 11 of your July/August 1992 article, "Rescued by the FAA."

George Vogler
Bakersfield, CA

Headwinds have nothing to do with endurance. What the author meant was range, which is reduced by headwinds. Thank you for the catch.

• Log Jam

I am writing so that you can resolve a debate among instructors, examiners, and my local FSDO personnel regarding the definition and logging of cross-country flight time. I have heard three different interpretations of what is a cross-country flight. I will use the attached box diagram to illustrate my point. The distance from Point A to Point B is 100 miles. The following scenarios illustrate the three different interpretations.

1. A pilot flies from Point A to Point B in a C-172. En route the pilot does some airwork, flies over the airport at Point C, then flies over the airport at Point D, and finally lands at Point B. The total flight time from the takeoff at Point A to the landing at Point B was three hours. One group, including the FAA's Airman Certification branch at Oklahoma City, says the pilot can log three hours cross-country flight time.

2. Another group says the pilot can log only one hour cross-country flight time, or the direct flight time from Point A to B. This group would not allow any deviation or loitering flight time to be included in their interpretation of "cross-country" flight time.

3. Finally, a third group would only allow the three hours of cross-country flight time if the pilot's original intent was to fly from Point A to Point B. If the pilot took off with the intent to do some airwork, then decided to land at say Point C after three hours to be able to log the time as cross-country time, then this group would not allow the total flight time to be logged as cross-country time.

My problem is one FSDO is not allowing certain ATP candidates' total cross-country flight time to be counted because the office is using example 2 as the basis for determining cross-country flight time. The FAR only refer to certain minimum distances regarding cross-country flight time needed for the various pilot certificates. The FAR does not mention "intent" in defining cross-country flight time.

Please clarify the definition of "cross-country" flight time.

James R. Waydula
Maple Grove, MN

Interpretation number one is correct. The FAR do not specifically address the questions you are asking. The FAR only discusses the type of cross-country flights (normally in terms of distances) needed to meet specific pilot certification requirements such as those for the private pilot or instrument pilot ratings. The key to your question can best be answered by remembering aircraft flight time is "block-to-block" time. Time starts from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the next point of landing. Only pilot certification requirements specify how far that point must be from the point of original departure to qualify as cross-country time. The determining criteria is distance, not time. Remember the purpose of a certification cross-country flight is either pilot training or for the pilot to demonstrate the various levels of piloting skills required to meet the minimum qualifications specified for a particular certificate.

Under current FAA policy, distance is not a factor when determining ATP cross-country flight time after the commercial pilot has met all of the appropriate cross-country requirements through the commercial pilot rating. Once those commercial pilot requirements are met, the ATP applicant has no minimum cross-country distance requirement. The only ATP cross-country requirement is a landing at a point other than the airport of departure.

> FAA AVIATION NEWS welcomes comments from its readers. We may edit letters for style and/or length. We will select one representative letter from those on the same topic for publication, and, because of our bimonthly publishing schedule, responses may not appear for several issues. We will send personal replies only upon request. We will not print anonymous letters, but we will withhold names upon request. Address: Editor, FAA AVIATION NEWS, AFS-810, Washington, DC 20591.

• Battery Replacement

Can an owner/pilot replace ELT batteries under FAR Part 43, Appendix A Section C, Preventive Maintenance? Some people have argued that this rule doesn't apply to ELT's because Appendix A was written before ELT's existed. Before Appendix A was revised in 1982, item (24) read, "Replacing batteries and checking fluid level and specific gravity." The change to "Replacing and servicing batteries" was apparently intended to include ELT batteries. This seems reasonable since replacing ELT batteries is a simple operation, not requiring the expertise of a mechanic and ensures that ELT's are ready for an emergency. ELT batteries that involve complex assembly operations should be changed by an A&P, but the average pilot can easily replace the battery in most ELT's.

Robert K. Henry
Kingsport, TN

You are correct. According to FAR Part 43, Appendix A, Section C, an owner/pilot can replace ELT batteries, but FAR §§ 43.9(a) and 91.207(c)(2) must also be complied with by making the proper maintenance record entry and by placarding the exterior of the ELT with the new battery expiration date.

• Caption Missing

The "Spin or Not to Spin, Part 1" article in the May/June 1992 issue of *FAA Aviation News*, inadvertently left off the illustration credit line on page 12. It should have read: "Figure 1 reprinted by permission from The Flight Instructor's Manual by William Kershner by the Iowa State University Press, Ames Iowa 50010. Our thanks to Mr. Kershner for letting use his illustration.

AV**NEWS/BRIEFS**

Changes in Latitudes—and Longitudes

If you are still using out-of-date Terminal Area Charts, here is a good reason to recycle them for the most current editions: The horizontal geodetic referencing system is changing. No, the earth's axis has not shifted, but what has happened is that the datum used by the National Oceanic and Atmospheric Administration (NOAA) for charting has been updated. As of October 15, 1992, all chart and chart products produced by NOAA will now be drawn according to the North American Datum of 1983. Lest you wonder why NOAA is "updating" to a nearly 10-year old reference, be aware that its previous reference was the North American Datum of 1927 (NAD27). Technological advances in Global Positioning Systems (GPS) now allow satellites to pinpoint locations much more accurately by a reference to the center of the earth. NAD27 used a reference point in Kansas for all North American latitude and longitude control points.

The greatest coordinate shifts will be in Alaska and Hawaii, where latitudes will move by as much as 1,200 feet and longitudes will move by up to 950 feet. In the *conterminous* U.S., the maximum changes will be approximately 165 feet of latitude and 345 feet of longitude. However, this shift will not be significant enough to change the latitude and longitude grids on sectional charts or WAC's, but it could affect TCA charts, helicopter charts, and sectional insets and will most definitely affect airport diagram charts. All digital products sold by the National Oceanic Service (NOS) or FAA and coordinates in the Digital Aeronautical Chart Supplement, the *Airport/Facility Directory*, the Pacific and Alaska Chart Supplements, and on Enroute navigation charts will be affected.

Users of digital data from NOS or FAA must purge their entire data bases when the new datum (NAD83) comes into use. If you have questions about charts and chart products, call 1-800-626-3677. For technical questions on the datum conversion, contact Mr. Doyle at the National Geodetic Survey on (301) 443-8684. For questions about the FAA's conversion efforts, contact David Thompson on (202) 267-9303.

Computer-based Testing

FAA has approved Sylvan Learning Systems as the third organization authorized to give computer-based FAA airmen written tests. Recreational pilot, private pilot, commercial pilot, instrument rating, flight instructor, flight engineer, airline transport pilot, mechanic-general, airframe, and powerplant computerized written tests are available at over 100 Sylvan Technology Centers around the country. The computerized tests are graded upon completion of the test, and applicants are given certified score sheets as soon as the test is graded.

Applicants are reminded that they must have a certified test score form issued by Sylvan for the test results to be accepted by either a designated pilot examiner or FAA inspector as proof of passing the appropriated written test.

Airmen wanting additional information on Sylvan's airmen testing services can call 1-800-967-1100 for the location of the nearest Sylvan testing center.

AD Summary Available

The FAA has announced the sale of the *Summary of Airworthiness Directives* for the cycle beginning in 1992 and ending in May 1994. The AD summaries are published in four books and are available to the public in paper or microfiche.

The *Small Aircraft and Rotorcraft* Books 1 and 2 relate to aircraft of 12,500 pounds or less maximum certificated takeoff weight and to all rotorcraft and balloons, regardless of weight. The *Large Aircraft* Books 1 and 2 pertain to aircraft of more than 12,500 pounds maximum certificated takeoff weight (except for rotorcraft). Book 1 of both editions contain AD's issued from the 1940's through December 1979. Book 2 of both editions contain AD's published from January 1980 to December 1991.

New subscribers for the paper edition should be aware that full AD coverage can only be obtained by having both Books 1 and 2 and the *Biweekly Supplements*. U.S. subscribers may purchase the *Biweekly Supplements* in paper format only without ordering a new Book 2. However, Book 2 has been revised and is available. The January 1992 *AD Index* reflects these revisions and the page references are those found in the revised Book 2. Neither *Small Aircraft and Rotorcraft* Book 1 nor *Large Aircraft* Book 1 was revised. The 1990 revisions of both Book 1's are current and do not have to be reordered. Subscribers to the 1992 microfiche edition of the *Summary of AD's* will not see any changes but should note the subscription will expire in May 1994, the same as the paper subscription.

Anyone interested in subscribing may obtain ordering and cost information from Advisory Circular 39-6P, "Announcement of Availability—Summary of Airworthiness Directives." AC 39-6P is available from the DOT Utilization and Storage Section, M-443.2, Washington, DC 20590. You may also obtain information from: FAA Manufacturing Standards Section, AVN-113, P. O. Box 26460, Oklahoma City, OK 73126-0460, Telephone: (405) 680-4103, FAX: (405) 680-4104.

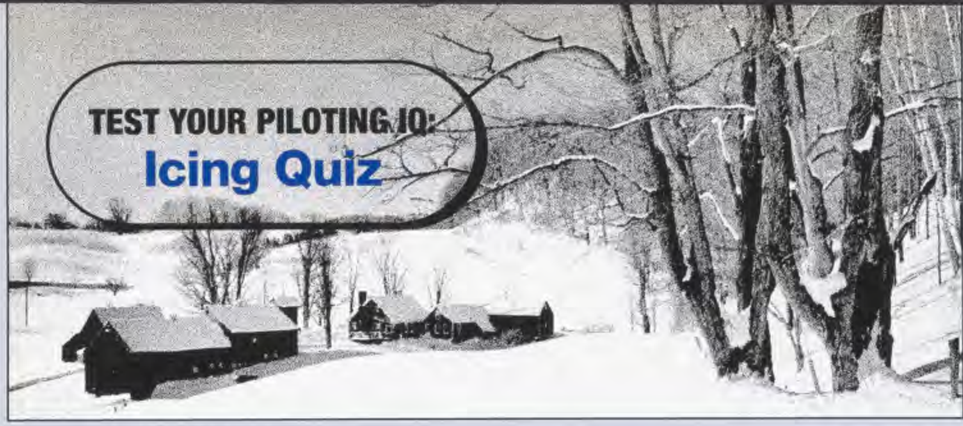
EAA'S Young Eagles Program

Do you remember your first airplane ride? Most pilots clearly remember the day when they first soared into the air. In fact, many pilots have become "hooked" on aviation as a result of their first airplane ride, whether they were five years old or 50! The Experimental Aircraft Association (EAA) is well aware of the excitement experienced during first flights by young people in particular. With the slow decrease in general aviation activity during past years and concern about the lack of young people entering aviation, the EAA has created the "Young Eagles Program" to spark youngsters' interest in aviation and to demonstrate aviation's accessibility.

The premise of the "Young Eagles Program" is this: EAA and the EAA Aviation Foundation will lead the aviation community into its second century by providing 1,000,000 young people a personal flight experience by the year 2003, the 100th anniversary of powered flight and the 50th anniversary of EAA. The first Young Eagles, who are primarily between the ages of eight and 18, "spread their wings" at the EAA OSHKOSH '92 Fly-in Convention in Oshkosh, WI. These young people made friends, met aviation "mentors," and were introduced to exciting future possibilities of personal flight. To enhance their flight experience, the "Eagles" participated in forums, workshops, and in other educational activities.

The "Young Eagles Program" will continue its success during the next 10 years at airports, museums, in classrooms, and in the air all over America. The FAA is equally eager to expand aviation opportunities and education for young people, and will support and join with the EAA as "mentors" for the Young Eagles.

For more information on the "Young Eagles Program" write to the EAA, P.O. Box 3065, Oshkosh, WI 54903-3065 or call 414-426-4800.



TEST YOUR PILOTING IQ: Icing Quiz

Test your icing knowledge. Choose the correct answer or answers. More than one answer may apply. Answers are on page 5. Information sources: *FAA's Aviation Weather* (AC 00-6A) handbook and the FAA *Airman's Information Manual* (AIM). The answers include reference and location.

1. The first day of winter is?
   a. November 27
   b. December 21
   c. December 25
   d. I don't care; how many days until summer?

2. The following is not a requirement for structural icing in flight
   a. flight through visible moisture
   b. high speed
   c. aircraft external surface temperature at or below freezing
   d. ambient air temperature a degree or two above freezing

3. Match the following definitions with the type of icing
   a. Rime
   b. Mixed
   c. Clear
   d. Cloudy

   3–1__ Hard, Glossy, and Heavy
   3–2__ Brittle and Frost-like
   3–3__ Hard Rough Conglomerate
   3–4__ Not a Type of Icing

4. This is not a type of structural ice
   a. cloudy
   b. clear
   c. rime
   d. mixed

5. Cloud factors affecting icing include
   a. drop size
   b. drop distribution
   c. aerodynamic effects of the aircraft
   d. all of the above

6. Icing is more hazardous in
   a. flatland areas
   b. desert areas
   c. ocean areas
   d. mountainous areas

7. Icing can occur in
   a. winter
   b. spring
   c. summer
   d. fall
   e. all of the above

8. Frost should be removed from an aircraft before flight
   a. sometimes
   b. never
   c. always
   d. only at gross weight

9. Stall speed and icing are
   a. related
   b. not related
   c. somewhat related
   d. none of the above

10. Approach speed when "iced up" should be
    a. adjusted as per the aircraft handbook
    b. decreased
    c. increased
    d. none of the above

11. A Convective SIGMET implies severe icing
    __ True
    __ False

12. SIGMETS are issued for severe icing
    __ True
    __ False

13. AIRMETS are issued for moderate icing
    __ True
    __ False

14. When icing conditions are encountered what action/s should be taken
    a. depart the area
    b. climb to above freezing temperature
    c. descend to above freezing temperature
    d. any one of the above depending upon circumstances

15. Match the following PIREP icing terms with their respective definitions
    a. Trace
    b. Light
    c. Moderate
    d. Severe

    15-1__ Ice becomes perceptible. Rate of accumulation is slightly greater than the rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not used unless encountered for an extended period of time (over 1 hour).
    15-2__ The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.
    15-3__ The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.
    15-4__ The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

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