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FLYING LESSONS for January 22, 2009

suggested by this week's mishap reports

FLYING LESSONS uses the past week's mishap reports as the jumping-off point to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific make and model airplane have little direct bearing on the possible causes of aircraft accidents, so apply these *FLYING LESSONS* to any airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence.

Feel free to forward this message for the purpose of pilot education. *FLYING LESSONS* is also available in PDF through a link in the left column at www.thomaspturner.net.

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FLYING LESSONS is featured on the FAA's safety website!

See www.faa.gov/gslac/ALC/lib_categoryview.aspx?categoryId=21.

This week's lessons:

The acknowledged principal hazard of night flight is reduced vision...both because unlighted objects are hard if not impossible to see, but also because our eyes are not very good at distinguishing dimly illuminated objects as well.

A 2004 article in AOPA's *Flight Training* magazine further categorizes night flying's heightened risks in four ways, three addressing vision:

- The optical illusion that occurs while flying on clear moonless nights over sparsely populated areas.
- The disorienting phenomenon in VFR conditions (exacerbated by a little summertime haze) that results when flying toward a large body of water.
- Obstacles in a variety of forms, including buildings near approach paths, TV/radio antenna towers, and electrical utility towers.
- Engine failure.

The AOPA Air Safety Foundation's [2007 Nall Report](#) summarizes NTSB-

Condition	Accidents/ 100,000 hrs	Fatal/ 100,000 hrs	% Fatal
Day	7.1	1.4	19.20%
Night	6.6	2.6	34.60%

Data from AOPA ASF 2007 Nall Report pg. 19 figure 32

reported accidents and incidents that occurred in 2006, and includes a breakdown of those that occurred at night. According to the Report, although the accident *rate* in daytime is actually higher than at night (7.1 accidents per estimated 100,000 flying hours in daytime compared to 6.6 per 100,000 hours at

night), the rate of *fatal* mishap is nearly twice as great at night (1.4 fatal accidents per 100,000 hours day versus 2.6 fatalities per 100,000 at night). Thus, if you have an accident at night, it's roughly twice as likely to be fatal as a daytime accident.

See www.aopa.org/asf/hotspot/articles/5079.html
www.aopa.org/asf/publications/07nall.pdf

The Aeronautical Information Manual devotes but two paragraphs to nighttime vision ([AIM 8-1-6b](#)). The *Airplane Flying Handbook's* [Chapter 10](#) covers night vision, illusions, required airplane equipment and nighttime emergencies, as does [Chapter 16](#) of the *Pilot's Handbook of Aeronautical Knowledge*.

See www.faa.gov/airports_airtraffic/air_traffic/publications/atpubs/aim/Chap8/aim0801.html
www.faa.gov/library/manuals/aircraft/airplane_handbook/media/faq-h-8083-3a-5of7.pdf
www.faa.gov/library/manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2016.pdf

But maybe something else is going on at night that affects the mishap record. The issue of **pilot fatigue** is only beginning to be scientifically addressed for commercial flight operations, and is largely untouched for private vehicle operation (including general aviation airplanes). Little about fatigue exists in typical civilian pilot training texts beyond this simple self-evaluation guidance, part of the "IMSAFE" model, in [Chapter 17](#) of the *Pilot's Handbook of Aeronautical Knowledge*:

Fatigue—Am I tired and not adequately rested? Fatigue continues to be one of the most insidious hazards to flight safety, as it may not be apparent to a pilot until serious errors are made.

See www.faa.gov/library/manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2017.pdf

We do have some guidance, however. Dr. Samuel Strauss of NASA's Johnson Space Center Office of Aerospace Medicine [writes](#):

Fatigue is a threat to aviation safety because of the impairments in alertness and performance it creates. "Fatigue" is defined as "a non-pathologic state resulting in a decreased ability to maintain function or workload due to mental or physical stress." The term used to describe a range of experiences from sleepy, or tired, to exhausted. There are two major physiological phenomena that have been demonstrated to create fatigue: sleep loss and circadian rhythm disruption. Fatigue is a normal response to many conditions common to flight operations because of sleep loss, shift work, and long duty cycles. It has significant physiological and performance consequences because it is essential that all flight crewmembers remain alert and contribute to flight safety by their actions, observations and communications. **The only effective treatment for fatigue is adequate sleep** [emphasis added].

A National Transportation Safety Board (NTSB) safety study of US major carrier accidents involving flight crew from 1978 to 1990, one finding directly addressed the concern about fatigue. It stated: "Half the captains for whom data were available had been awake for more than 12 hours prior to their accidents. Half the first officers had been awake for more than 11 hours. Crews comprising captains and first officers whose time since awake was above the median for their crew position made more errors overall, and significantly more procedural and tactical decision errors."

GA pilots have no dispatch support structure to assess levels of fatigue, and sleep needs vary between individuals, changing as those individuals age. Dr. Strauss continues:

There is considerable variability in individual sleep needs. Some individuals do well with 6 hours sleep per night, yet others need 9 or 10 hours sleep. However, most adults require 8 hours of restful sleep to stay out of sleep debt. With aging there is usually a significant decline in habitual daily sleep due to increased nighttime awakenings. Therefore, in older individuals decreased quality of nighttime sleep can result in increased daytime fatigue, sleepiness, dozing and napping.

Napping seems to compensate for the loss of quality sleep during nighttime hours, but the need for a mid-day nap may not be compatible with flight duty demands on short haul flights. Research has demonstrated that pre-planned cockpit rest has improved in-flight sustained attention and psychomotor response speed....

Complete recovery from significant sleep debt may not occur after a single sleep period. Usually 2 nights of recovery are required. Eight to 10 hours of recovery sleep per sleep period may be required for most people to achieve effective levels of alertness and performance.... Off duty time must be adequate to allow for at least 8 hours of restful sleep per night in order to recover from sleep debt, and therefore the potentially hazardous effects of flying while fatigued.

So how can you tell when you're too fatigued? Here are some warning signs:

- Eyes going in and out of focus
- Head bobs involuntarily
- Persistent yawning
- Wandering or poorly organized thoughts
- Spotty near term memory
- Missed or erroneous performance of routine procedures
- Degradation of control accuracy

But if you have these symptoms in flight it's already too late to avoid the hazards of fatigue. The trick is to assess not only your fatigue condition before taking off, but to make an educated guess at how fatigued you'll be **at the end** of your flight...in the highest workload phase of flight, approach and landing (and, if needed, missed approach and diversion to an alternate).

Your best defense is to establish personal duty time limits. Air carrier rules (FAR 121.471) generally require, with some exceptions:

- Rest for scheduled flight during the 24 hours preceding the completion of any flight segment:
 - Nine consecutive of hours rest for less than eight hours scheduled flight time
 - 10 hours rest for eight hours or more, but less than nine hours scheduled flight time
 - 11 hours rest for nine hours or more scheduled flight time

But often for GA pilots the flight comes at the end of a work or vacation day. Substitute the word "awake" for "flight" time and you'll get a good start at establishing personal duty limits:

- Nine consecutive of hours rest for less than eight hours scheduled awake time
- 10 hours rest for eight hours or more, but less than nine hours scheduled awake time
- 11 hours rest for nine hours or more scheduled awake time

Your "awake" time ends at your estimated arrival time at the end of your flight, including flight to an alternate. If you don't have adequate rest for the work day plus the flight time, take time for a real nap before departure, or stay over and begin your trip the next morning. You can't accept the risk of suffering the symptoms of fatigue while at the controls of an airplane.

See http://aeromedical.org/Articles/Pilot_Fatigue.html for the full article including citations.

What are your personal limits for fatigue and duty time? Email me at mastery.flight.training@cox.net

For piston Beech pilots

The January 22, 2009 Weekly Accident Update is now posted at www.thomaspturner.net, including these reports:

- An S35 suffered cylinder head separation in flight....
- A Sierra landed gear up....
- A Baron's gear collapsed on landing....
- A Beech Sport crashed under unknown circumstances....
- An A36's gear collapsed on landing....

There is an NTSB update on an A55 runway excursion taking off from at Corona, CA.

For more information, commentary and analysis see the Beech Weekly Accident Update link at www.thomaspturner.net/WAU_2009.htm.

Fly safe, and have fun!

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I welcome your comments and suggestions. Contact mastery.flight.training@cox.net.

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