

# Fighting Pilot Fatigue: New Views on Staying Alert

By Stephen Pope / Published: Nov 26, 2014  
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Through the darkness across the Hudson River, New York City's dazzling all-night light show served as the backdrop for the Beech Baron's descent into Teterboro Airport. For the relatively inexperienced pilot in the left seat, this was a golden opportunity to sit beside the company's high-time training captain and soak up knowledge from the veteran as he pointed out visual landmarks like Giants Stadium and described the unusual noise abatement procedure for the 3 a.m. arrival carrying a planeload of medical samples for testing at a New Jersey lab.



Even though the younger pilot had been on duty for an exhausting 11 hours — and had worked about the same number of hours each of the previous two nights — the chance to fly to Teterboro for the first time with the company's chief pilot was worth the few extra hours of missed slumber. "I'll sleep when I'm dead" is the common refrain of the young and upwardly motivated, a description that unfortunately fits all too well with many new professional pilots clawing their way up the seniority ladder.

As the Teterboro Tower controller cleared the Baron for the wide left base to set them up for landing on Runway 1, the training captain continued to serve as New York-area tour guide. Neither pilot noticed that their speed was still above 200 knots, too fast to configure the airplane for landing. According to an audiotaped interview with the young pilot from his hospital bed days later, the captain finally counseled him, you "had better slow down." The pilot recalled reaching up to bring the power to idle — but instead of grabbing ahold of the throttles, according to the National Transportation Safety Board final accident report, he mistakenly put his hand around the propeller levers and pulled them all the way back.

"What have you done?" the captain barked as the twin Continental IO-550s groaned in protest. "You've lost both your engines!"

What happened next was a blur, the young pilot said. As the captain repeated over and over that they had lost thrust in both engines, the Baron continued rocketing toward the runway at a ground speed of over 185 knots. The airplane sailed along the entire length of the runway, overshooting it and heading for the ominous speckled lights of the

neighborhoods beyond. The pilots quickly discussed their options, debated whether they should contact ATC, and finally began fighting over the controls before the Baron crashed on a street, hit a tree and burst into flames.

It turns out that the captain, who died from his injuries days later, knew something about this particular airplane that the less experienced pilot perhaps did not. The Baron's propeller unfeathering accumulators, which provide oil pressure to the props to bring them quickly out of the feathered position, had been disconnected to make them easier to work on. With the props brought into the feathered position in flight, there was no way to remedy this stomach-churning error in the short amount of time available.

The pilot in the left seat, who survived the crash, later recanted his account of the accident sequence after speaking with a lawyer. That didn't stop the NTSB from accepting his original statement when issuing its probable cause of the accident in its final report. The Baron's propellers were both found in the fully feathered position, just as investigators expected they would be. No other mechanical anomalies were uncovered that would suggest the accident was caused by anything other than what the young pilot told them.

Strangely, however, nowhere in the probable cause statement did the NTSB list fatigue as a causal or contributing factor in the accident. This despite the fact that the accident pilot had flown for long periods over the previous three nights and the crash occurred at 3 a.m., when sleep research shows the circadian rhythm (the body's natural internal clock) exhibits its strongest sleep drive. The captain had also been on duty long hours flying at night, perhaps explaining why he didn't do a better job of monitoring the other pilot's actions.

### **Understanding Fatigue**

The omission caused a minor rebellion within the NTSB as then-Chairwoman Deborah Hersman and board member and noted sleep expert Dr. Mark Rosekind publicly issued dissenting statements in which they argued strongly that the crash showed the classic hallmarks of pilot fatigue. Training deficiencies and other factors undoubtedly played roles too, they acknowledged, but the errors made by the pilots were clear signs that both were overly tired.

"Despite substantial indications of fatigue effects," Rosekind wrote in his dissenting brief, "the present accident report fails to acknowledge fatigue's role in the accident. Based on the factors identified, fatigue was a likely contributory cause."

When I asked him about that accident investigation recently, Rosekind preferred not to open old wounds, conceding that the job of determining precisely what effects fatigue may have had on a pilot involved in a particular accident is still an inexact science. "Sometimes when we investigate, unfortunately the data goes away with the pilots," he said. "There will be situations where we can include fatigue, other times when we can

exclude fatigue, and a third category where there is insufficient information to make a determination."

But our understanding of fatigue and how it impacts everything from pilot decision-making to cognitive ability, he insists, has come a long way since the field of sleep research began in the 1950s. "What we know about sleep is barely 60 years old," he said. "The science has evolved dramatically. During that time we've learned a huge amount, not just about the science, but also how the science applies to operations like flying an airplane."

In the first study of its kind, due to be published soon, the NTSB looked at all major aviation accidents from 2000 to 2012, finding that fatigue played a role in 23 percent of the 183 crashes studied. In the last 25 years, the NTSB has made more than 200 fatigue-related safety recommendations to the FAA, many of which were adopted with the writing of new airline pilot rest and duty-time regulations that went into effect this year. Finally, it would appear, our recognition of pilot fatigue is catching up with the science of sleep research.

Fatigue, of course, has been a risk factor for pilots since the earliest days of flight. The most famous example from history of an exhausted pilot struggling to remain awake and alert is Charles Lindbergh during his famous solo Atlantic crossing. The Lone Eagle sat at the controls of his Ryan NYP for an incredible 33 hours flying nonstop from New York to Paris in May 1927.



What you might not recall from the story of that epic journey is that Lindbergh had actually been awake for 24 hours before his wheels ever lifted off the grass from Roosevelt Field. The night before, he was prevented from drifting off peacefully to sleep by the anxiety of the extraordinary task he faced. It didn't help that rain pelted the metal roof over his sleeping quarters or that newspapermen played cards until all hours in the room next door.

Fifty-seven hours awake, facing thick fog, thunderstorms, ice buildup on his wings and frigid temperatures in the cramped, lonely cockpit, Lindbergh was utterly spent as he made his way eastward. "My mind clicks on and off," he later wrote in his memoir. "I try letting one eyelid close at a time when I prop the other open with my will. But the effort is too much. Sleep is winning. My whole body argues dully that nothing, nothing life can attain is quite so desirable as sleep. My mind is losing resolution and control."

At one point he briefly fell asleep with his hands resting on the controls, jolted back to consciousness by the terror of having nodded off over the desolate North Atlantic as many hours of his journey still lay ahead.

Hopefully you've never faced a situation quite so dire, but if you're like most pilots you've probably served as pilot-in-command when you were less than fully rested. Sometimes it's a fact of modern life — but the latest research is showing just how dangerous flying tired can be.

### **Fatigue Risk Factors**

Many pilots report having trouble sleeping the night before a flight as they fret and worry about the details of the trip, the same as Lindbergh did. Others may be kept awake by a crying child or noisy neighbors or wailing sirens. Some pilots, meanwhile, suffer from sleep-related disorders that can prevent them from ever being truly rested. It's the main reason why some within the FAA want medical examiners to screen overweight pilots for obstructive sleep apnea.

The good news is that in some ways fatigue is becoming less of a risk factor as our understanding of the problem improves. In the last decade alone researchers have made tremendous strides in sleep research, noting in studies, for example, that getting even 30 minutes less rest in a single night can impair performance and memory the next day, and that the effects of sleep loss are cumulative, meaning that the sleep we get is like money we deposit in the bank. If we continually draw down our "sleep accounts" for several nights, the effects can be cumulative — and lethal.

In other ways, of course, fatigue is more of a problem than ever, especially for corporate, charter, airline and cargo pilots. Today we have airplanes that can fly farther, crossing through multiple time zones while remaining aloft day and night in a 24/7 world of aviation that never seems to slow down.

The NTSB put pilot fatigue on its "Most Wanted" list of safety improvements and kept it there for 22 straight years, but it wasn't until the crash of Colgan Air Flight 3407 in Buffalo, New York, in February 2009, in which 50 people died, that the FAA rewrote airline pilot rest and duty-time rules.

The new regulations, which went into effect at the start of this year, require that airline pilots get at least 10 hours of rest between shifts. Eight of those hours must involve uninterrupted sleep. (In the past, pilots could spend those eight hours getting to and from the hotel, showering and eating.) Pilots will be limited to flying eight or nine hours each day, depending on their start times. They must also have 30 consecutive hours of rest each week, a 25 percent increase over previous requirements.

Researchers, of course, have been focusing on pilot fatigue for a long time. NASA launched a fatigue countermeasures initiative in the 1980s, and the NTSB over the years has studied pilot fatigue and looked for ways to mitigate the risk of flying without adequate rest. But only very recently has our understanding of fatigue allowed regulators to apply science-based ideas to combat the negative effects of sleep loss.

## **The Science of Sleep**

There are four main physiological factors related to sleep, and each is critically important to receiving adequate rest. The first, as you might guess, centers on the amount of time we actually spend sleeping. Our bodies and minds are hard-wired for 16 hours of wakefulness and eight hours of sleep per day. Get any less and you begin to dip into that sleep account. And it doesn't take much for the negative signs to start showing, researchers say.

Second, we need to consider how long we've been awake. It's one thing to get a solid eight hours of shut-eye the night before a flight, but if we then stay awake for the next 18 hours or more, we enter the fatigue danger zone.

A third critical factor, as touched on earlier, is the circadian rhythm, our body's 24-hour master clock that controls our sleep-wake cycle. It does so within a cluster of densely packed nerve cells in our hypothalamus, an area of the brain just above the optic nerve. Circadian rhythms are produced by natural factors within the body, but environmental stimuli such as light also play a role. The body's internal clock controls the production of melatonin, the hormone that makes us sleepy. Since the hypothalamus is located just above the optic nerves, which relay information from the eyes to the brain, when there is less light — such as at night — the nerve cells tell the brain to make more melatonin, so we get drowsy. When the lights stay on, melatonin production drops.

The fourth factor relates to sleep disorders. In the early days of sleep research, they were barely understood. Today scientists have identified 90 different kinds of sleep disorders, from insomnia on one end of the spectrum to narcolepsy on the other. These days pilots are most concerned with obstructive sleep apnea after the FAA began pushing for mandatory screening of heavy pilots. OSA occurs when the throat muscles intermittently relax and block the airway during sleep. The most noticeable sign of obstructive sleep apnea is snoring. The sleep disturbances caused by sleep apnea can lead to sleepiness and fatigue during the day.

Now that we know the dangers of fatigue, what can we as pilots do to minimize the dangers? First it's important to consider how fatigue affects performance. When we are suffering from a lack of rest, falling asleep isn't the biggest risk we face. Rather, it's the 20 to 50 percent drop in across-the-board mental performance we suffer as a result of being fatigued, Rosekind said.

"Our reaction times are slower; our memory suffers; communication and basic decision-making degrade," he said. In other words, "a tired brain changes."

That's not hyperbole. Sleep deprivation studies conducted by the U.S. Army showed through brain imaging that the frontal cortex — the area of the brain responsible for executive decision-making — appeared as though the test subjects had a literal hole in their brains.

Another, more insidious problem we face when we are tired is our poor perception of our reduced mental capacity. We may not even feel particularly drowsy, and not realize we are making critical mental errors such as missing checklist items, reading back controller instructions incorrectly, or, God forbid, pulling the propeller or mixture levers when we mean to adjust the throttles.

### **Fatigue Checklist**

Professional pilots often feel as though there's nothing they can do to avoid fatigue — it's simply a part of the job. Obviously since pilots are complaining about it, we know it's a problem, and that's a good thing. Now that we've acknowledged the issue, we can take action.



It all starts with pilots, who must take steps to ensure they get proper rest. That might mean investing in earplugs and eyeshades. It could mean having a conversation with your spouse and the kids about getting the rest you need. If you still aren't getting enough sleep, it's time to bring that to the attention of your employer.

That leads us into the second part of the rest equation. Companies must also acknowledge if they have a pilot fatigue problem and take action. That can involve educating pilots about fatigue dangers and providing an honest mechanism for nonpunitive reporting, allowing a fatigued pilot to say he or she can't fly without fear of retribution.

GA pilots who fly for transportation are at high risk of flying while fatigued. The same factors that go into becoming a pilot/owner of a high-performance airplane, an attractive income and high-achieving attitude, are often associated with a lifestyle that lends itself to fatigue. Typical GA pilots have crazy work schedules, many family commitments, and hobbies about which they're passionate but which further impact their schedule. The lifestyle of high-achieving individuals puts them at constant risk of flying while fatigued.

All fatigued pilots, meanwhile, will exhibit the same dangerous symptoms: difficulty concentrating, apathy, feelings of isolation, increased reaction time to stimuli, slowing of higher-level mental functioning, decreased vigilance, memory problems, task fixation and increased errors while performing tasks. None of these are good things to have happen to a pilot, but if there is no second crew member in the cockpit to help out, the risk factor ratchets way up.

Thankfully there is a simple checklist pilots can follow to ensure fatigue doesn't pose unacceptable risks for a given flight, Rosekind said. And it's the same list of factors that cause fatigue problems in the first place: How long did you sleep, how long have you

been awake, where are you in the circadian rhythm, and are you suffering from a sleep disorder?

"If anything on that checklist is in the red zone — if you haven't gotten the sleep you need, you have a sleep debt, you've been awake too long, you're in the wrong circadian phase across time zones, you've got a sleep disorder that hasn't been treated — any one of those is enough to tell you that you need to have a countermeasure strategy to mitigate fatigue so that you're safe to fly."

### **Getting a Good Night's Rest**

If you're like most people, you know what it's like to lie awake in bed, sleep refusing to come as the minutes, and then hours, tick by. Hopefully it doesn't happen often, but it's a fact of life for most of us. The stress of everyday life from family and job commitments or environmental factors that are often beyond our control can affect the length and the quality of sleep we get. But there are strategies you can employ to give yourself the best chances of drifting into sleep and getting the full recommended eight hours of shut-eye each night. Dr. G.J. Salazar with the FAA's Civil Aerospace Medical Institute in Oklahoma City recommends these lifestyle practices to ensure you get proper rest.

Don't ...

- Consume alcohol or caffeine three to four hours before going to bed.
- Eat a heavy meal just before bedtime.
- Take work to bed.
- Exercise two to three hours before bedtime. (Working out promotes a healthy lifestyle, but it shouldn't be done too close to bedtime.)
- Use sleeping pills (prescription or otherwise).

Do ...

- Be mindful of the side effects of certain medications, even over-the-counter medications — drowsiness or impaired alertness is a concern.
- Consult a physician to diagnose and treat any medical conditions that may be causing sleep problems.
- Create a comfortable sleep environment at home. Adjust heating and cooling as needed. Get a comfortable mattress.
- When traveling, select hotels that provide a comfortable environment.
- Get into the habit of sleeping eight hours per night. When needed, and if possible, nap during the day — but limit naps to less than 30 minutes. Longer naps produce "sleep inertia," which can be counterproductive.
- Try to turn in at the same time each night. This establishes a routine that can help you fall asleep more quickly.
- If you can't fall asleep within 30 minutes of going to bed, get up and try an activity that helps induce sleep (such as watching nonviolent TV, reading or listening to relaxing music).

- Get plenty of rest and minimize stress before a flight. If problems preclude a good night's sleep, consider postponing the trip.

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