

## Physiological Training for Pilots

**You're  
Not  
Tired,  
Are  
You?**



By Eric Simson

**IT'S ABOUT 8 PM, YOU'VE** completed the aircraft inspection and pre-flight checklist, finding no problems. The flight plan has been filed, and a check of the weather shows clear skies to your destination, two hours away. Your qualifications are current and you consider yourself a better-than-average pilot.

Life couldn't be better-but are you really ready for that flight? How well you will be able to perform could come down to whether you are able to stay alert and awake. A dangerous situation, fatigue, could ruin your perfect day.

Your body is a "well-oiled machine" and, like most machines, works on a cycle. The cycle, in the case of the human body, is the circadian rhythm, also referred to as the "biological clock." It is a 25-hour period in which the body goes from a state of rest, through activity, and returns to rest. As we are in a 24-hour world, this usually does not present a problem. So long as we are working within the body's activity schedule, this type of fatigue is less likely to be a problem. Unfortunately, when we work outside the "normal" series of daily events, such as late at night or where time zones are crossed which detract from the hours in our day, circadian fatigue can, and often does, pose a serious hazard.

In the average circadian cycle, we come from our deepest state of rest, at about 4 to 6 AM, and gradually increase to a peak of alertness around 4 to 6 PM. From there we begin a slow energy decrease until 10 to 11 PM, where we experience a significant plunge, returning to the deep sleep realm at about 1 to 2 AM. The times indicated here are approximate. As individuals, our capabilities will vary depending on whether we are "early birds" or "night owls." Those who naturally rise early tend to go to sleep early, and just the opposite is true for those who wake later.

Additionally, we experience acute and chronic fatigue. Acute fatigue is experienced as we actively perform tasks requiring muscle and mental activity. Chronic fatigue is accumulated fatigue as the result of time involved with various activities, even if they are not of a strenuous nature.

These three types of fatigue do not act independently on an individual. Instead, they act synergistically. That is, they compound one upon another and "add up." This effect can cause you to feel "good to go" as you start a late evening event, only to find yourself

becoming tired and unable to concentrate after a short while. The results are loss of situational awareness, task/target fixation, and complacency. In an aircraft, these could add up to a mishap.

Getting back to the 8 PM flight we started at the beginning, let's look at things you might do and how they could affect your ability to resist fatigue. As happened to a military pilot, who had a fatality mishap in a tactical jet aircraft, you could choose to wake as usual and try to cram a lot of activities into your day before the flight. In his case, he woke at about 5 AM, went for a run, did some weight lifting, and spent the day catching up on some yard work. This type of schedule, prior to a late flight, would result in acute fatigue from physical exertion, accumulated fatigue from being awake for a long time, and circadian fatigue as normal bedtime approaches. As you can well imagine, this situation, along with other factors, created a significant disadvantage in this pilot's ability to combat fatigue. The same factors have caused countless instances of controlled flight into terrain, near mid-air, and mid-air collisions.

What could we do to improve upon this scenario? For starters, you could get up a little later. Essentially, what you would be doing is reversing some of the sleep debt that may have accumulated up to that time. Light, heat, sounds, and smells help to set your biological clock naturally and would wake you up closer to your normal time, so you'll have to shield yourself from those things in order to sleep later. Second, it's important not to overly exert yourself during the course of the day prior to a late flight. Taking care of some paperwork that has been piling up might be a better, and less physically demanding, activity. Additionally, a nap a few hours prior to the event can be a real "pick-me-up" that could result in a little energy boost. By napping, you would be well rested- not exhausted -and prepared for the effects of circadian fatigue.

What you eat is also important. Eating a candy bar or drinking something having high sugar/high caffeine properties will only provide a short-term fix. The sugar will burn off quickly, resulting in a rapid lack of energy, and too much caffeine can cause dehydration and irritability. Food that is high in protein, such as peanuts, will provide energy for a longer period of time, without the rapid "energy crash" associated with the metabolism of sugars.

I'm sure there are some skeptics out there who believe they can be just as alert late at night as they are during the day and that coffee and candy will keep you awake. I was one myself when I was provided this information in a night vision goggle course, so I tested the theory. Starting out on a road trip at 3 AM, after five hours of sleep, I drank about three to four cups of coffee between 4 and 6 AM, eating a piece of hard candy every five minutes as I began to nod off. Thankfully, the sun came up then and woke my biological alarm clock. On the return, I started at the same time, with the same amount of sleep, and drank one to two cups of coffee between 4 and 6 AM, eating a handful of peanuts every 30-45 minutes to stay awake. And, I wasn't nearly so drained of energy when the sun came up as I had been on the previous trip.

Recently, the use of melatonin has been promoted, through the media, as a way to assist with circadian fatigue and jet lag. While studies have demonstrated some benefit from its use, they have also indicated drawbacks from the sedative and hypnotic effects. Additionally, melatonin ingested at the incorrect time may further desynchronize an already troubled circadian rhythm through the addition of another cue.

Therefore, it is cautioned that melatonin should not be taken within 24 hours of flying, and professional guidance should be sought in the proper use of this neurohormone to achieve maximum benefit without adverse reaction. (Sanders DC, Chaturvedi AK, Hordinsky JR (1998). Aeromedical Aspects of Melatonin-An Overview. Washington DC: DOT/FAA/AM-98/10)

Fatigue can be a factor when flying late, but it doesn't have to be. The choice is strictly up to you: Prepare for the flight ahead of time and be ready to combat fatigue. And, if you feel fatigued before you fly...don't.

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*Mr. Simpson is an aviation physiology instructor at the Civil Aeromedical Institute's Aeromedical Education Division (see [related story](#)).*

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