



## Daniel Mollicone, PhD., CEO of Pulsar Informatics.

With over 12 years of experience in biomedical engineering, Daniel has played an active role in the development of the field of neurobehavioral performance measurement. A co-founder of Pulsar Informatics, he has acted as Principal Investigator on research funded by a number of government agencies, including NASA, the Department of Defense, the Department of Homeland Security, and the National Institute of Health. Daniel has co-authored five publications on topics of cognitive performance measurement and fatigue modeling. Dr. Mollicone holds degrees in Engineering Physics and Biomedical Engineering.



## Fatigue in corporate aviation: The science of fatigue, operational risk, and mitigation strategies.

Fatigue risk impacts every part of flight operations including pilots and flight attendants as well as mechanics and ramp personnel whose mission critical activities ensure the plane is ready for flight. Unmanaged fatigue risk can jeopardize the safety of the passengers and crew, be very costly, and negatively impact company reputation. This document highlights some of the key aspects to consider.

### **Our ability to be alert on the job is governed by two well understood biological processes.**

The first is our circadian rhythm—this rhythm, which is produced by a group of cells in our brain acts as our biological clock. It signals our body to feel more alert during the day and sleepy at night. The second process is our sleep battery which needs to be recharged every day. On average, adults need 7-8 hours to recharge this battery.

Mitigation: The best fatigue mitigation is making the habit of getting daily adequate sleep a priority.

### **Another biological process to consider is sleep inertia.**

This is what makes us feel disorientated when we first wake up. It takes our brain time to fully switch between being asleep and being awake. Sleep inertia is usually much stronger when we wake up in the middle of the night during our window of circadian low (WOCL).

Mitigation: If napping in flight give yourself at least 30 minutes to allow the sleep inertia to dissipate. Coffee helps to dissipate the sleep inertia.

### **If we go day after day without getting adequate sleep our battery never fully recharges.**

Instead, we accumulate a sleep debt. Each day we do not get enough sleep we add to our sleep debt. It takes extra sleep over multiple days to recover and pay off a sleep debt.

Mitigation: If you accumulate a sleep debt pay it off by planning to get 8-10+ hours of sleep for 3 or more days.

### **Irregular work schedules can increase fatigue risk.**

Flight schedules can result in extended shifts, night work, jet lag, disrupted daytime sleep, and irregular or unpredictable sleep opportunities.

Mitigation: Flight schedulers should use tools that provide quantitative guidance in setting schedules that are within acceptable fatigue limits. There are tools in the market place that quantify fatigue based on flight schedules to enable fatigue optimization. Pulsar has developed Aviation Fatigue Meter™ to support flight schedulers and pilots.

To learn more about Aviation Fatigue Meter, visit:

[pulsarinformatics.com](https://pulsarinformatics.com)

## Fatigue affects our ability to be alert and can cause lapses in attention or microsleeps.

A microsleep is when the brain actually goes to sleep for a half of a second, or longer. A half of a second is a dangerous amount of time especially in critical phases of flight. Microsleeps can cause us to miss a critical step in a procedure. These can be simple mistakes on a task that we have done correctly 1000s of times. These simple mistakes may result in expensive or grave consequences. The microsleeps occur without warning, and you may not even realize you experienced one.

Mitigation: There are tools in the marketplace to measure the stability of your behavioral alertness. One such test is called the Psychomotor Vigilance Test (PVT). Pulsar has developed an iPad app for researchers that can be used to take the PVT.

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## There are certain phases of flight that result in greater risk when you are fatigued.

Top-of-descent to landing is a risky phase of flight. This is because this phase of flight involves tasks that have to happen in a particular sequence and right on time. Tasks with time pressure are particularly vulnerable to fatigue. When we are fatigued our brains are impaired, and slow down. But tasks with time pressure don't allow us to slow down. That's why when our impaired brains are forced to go fast we tend to make more errors.

Mitigation: The landing pilot should be the most rested and alert. If you are feeling tired have a coffee 20-30 minutes before top of descent to give an alertness boost for the landing phase of the flight.

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## Driving home after your duty may be the riskiest part of your day.

We know that to be a safe driver we must pay attention to the road and surrounding traffic. Fatigue impairs our ability to reliably sustain attention. Surveys indicate that 30% of motorists have experienced micro-sleeps behind the wheel and that as many as 80% of those working night shifts had micro-sleep episodes.

Mitigation: A taxi is the best way to get home after a fatiguing trip. If this is not feasible then have a 30 minute power nap at the hanger or in your car prior to driving home. A coffee will help too but while coffee will give you an alertness boost it may interfere with your sleep if you intend on sleeping when you get home.

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## Our products and services are designed to make fatigue risk management decisions easy.

Aviation Fatigue Meter shows you exactly how operational factors such as long duty hours, jet lag, night work, and restricted sleep opportunities combine to create elevated fatigue risk.

Using our data-driven and scientifically validated tools, you can implement mitigation strategies such as crew reassignment, schedule changes, planned naps, and augmented crews with confidence.



## Ready to start managing fatigue risk?

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