SAFETY GRAM 4.0

August 2021

AIR FORCE SERVICES

AERO CLUB

FLIGHT TRAINING CENTER

Air Force Aero Clubs,

A recent national news story about an E-3 AWACS crew cancelling a training exercise sortie due to not having sufficient rest had me thinking about how Aero Clubs ensure proper rest before flying and how to recognize fatigue and circadian rhythm disruptions.

AFMAN 34-152 pargraph 6.16 specifically addresses duty day restrictions for Aero Club pilots and amount of rest required between duty periods.

> ***6.16. Duty Day Restrictions.*** *Maximum aero club duty day is 12 hours for a single pilot or 16 hours for two qualified pilots in an aircraft with dual flight controls. Flight duty day begins when the pilot(s) reports to the aero club for the first flight, or to the duty location (place of employment) for the first duty (work) of the day, whichever occurs first. Minimum crew rest between duty days is 10 hours after 8 hours or less of duty time, 12 hours for more than 8 hours duty time.*

The highlighted area is especially important for members to read and understand because flight duty day can begin before showing up to Club facilities to fly. Aero Club Management, Instructors, and Members need to ensure they are honestly assessing the start of their day based on when they start first working for the day. It is especially important for instructors to have early conversations with their students to understand these restrictions and ensure they follow them.

In addition to not getting proper rest there are other things members need to be aware of that can contribute to fatigue to include student pilot stressors, life stressors, poor nutrition, illness and circadian rhythm disruptions (CRD). Specifically CRD's are common on military bases because many bases operate 24/7 to some capacity and implement some type of shift-work schedule to meet the mission requirements. It is particularly important for members who fly, but also work a changing shift schedule understand how that can disrupt their circadian rhythm and put them at a greater risk for being fatigued while flying.

Attached to the Safety Gram are two FAA produced Pilot Safety Brochures focusing on Fatigue and Circadian Rhythm. Use them to help educate members on ways to recognize and combat fatigue. When in doubt always make the conservative decision to cancel or reschedule a flight when fatigued because not worth the risk.

Fly Safely,

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LIFESTYLE RECOMMENDATIONS

Don't…

- Consume alcohol or caffeine 3-4 hours before going to bed.
- Eat a heavy meal just before bedtime.
- Take work to bed.
- Exercise 2-3 hours before bedtime. While working out promotes a healthy lifestyle, 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 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 the nap to less than 30 minutes. Longer naps produce sleep inertia, which is counterproductive.
- Try to turn in at the same time each day. This establishes a routine and helps you fall asleep quicker.
- If you can't fall asleep within 30 minutes of going to bed, get up and try an activity that helps induce sleep (watch non-violent TV, read, listen to relaxing music, etc).
- Get plenty of rest and minimize stress before a flight. If problems preclude a good night's sleep, rethink the flight and postpone it accordingly.

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http://www.faa.gov/pilots/safety/pilotsafetybrochures/

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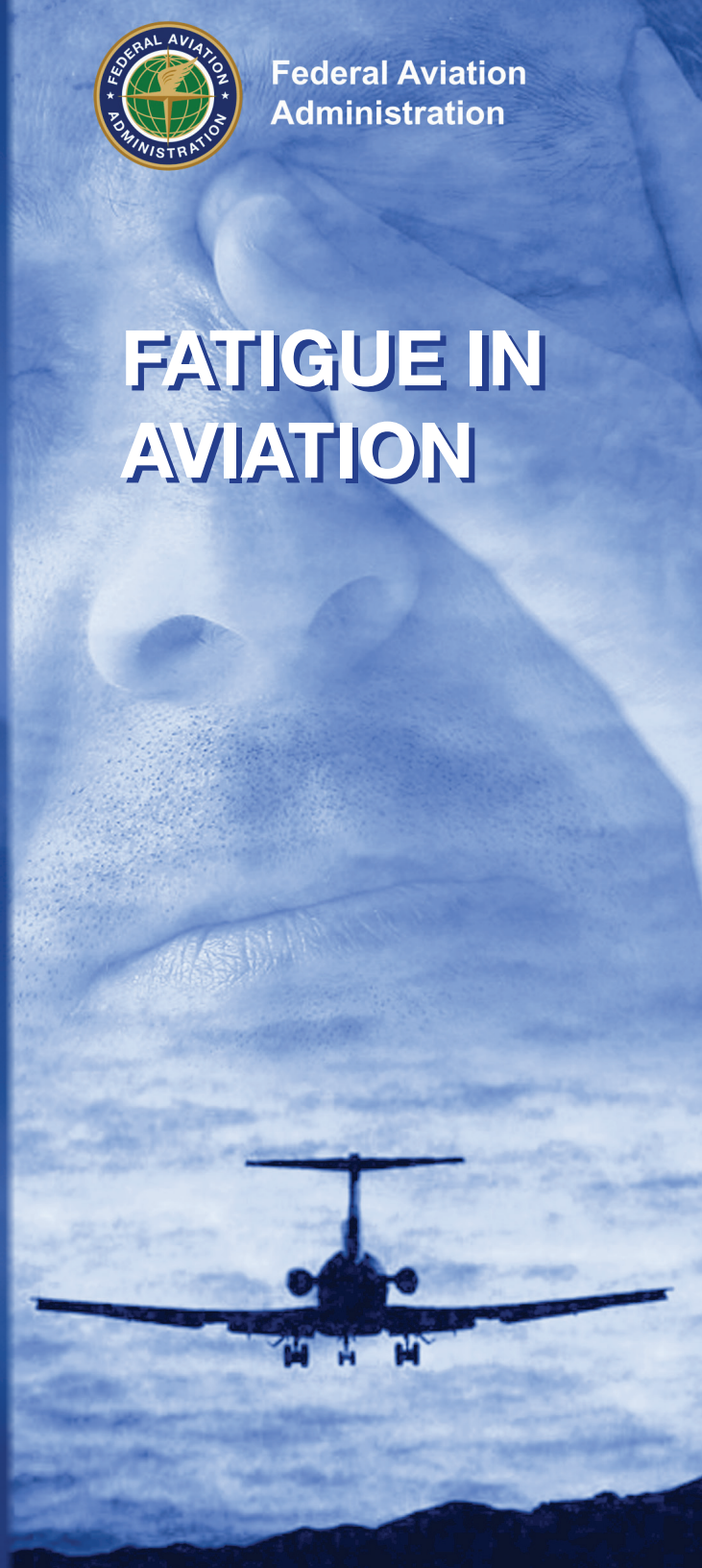
Federal Aviation Administration

FATIGUE IN AVIATION



Fatigue is an expected and ubiquitous aspect of life. For the average individual, fatigue presents a minor inconvenience, resolved with a nap or by stopping whatever activity that brought it on. Typically, there are no significant consequences. However, if that person is involved in safety-related activities such as operating a motor vehicle, piloting an aircraft, performing surgery, or running a nuclear reactor, the consequences of fatigue can be disastrous.

DEFINITION

Defining fatigue in humans is extremely difficult due to the large variability of causes. Causes of fatigue can range from boredom to circadian rhythm disruption to heavy physical exertion. In lay terms, fatigue can simply be defined as weariness. However, from an operational standpoint a more accurate definition might be: "Fatigue is a condition characterized by increased discomfort with lessened capacity for work, reduced efficiency of accomplishment, loss of power or capacity to respond to stimulation, and is usually accompanied by a feeling of weariness and tiredness."

TWO KEY CONCEPTS CAN BE DERIVED FROM THIS SECOND DEFINITION

1. Fatigue can develop from a variety of sources. The important factor is not what causes the fatigue but rather the negative impact fatigue has on a person's ability to perform tasks. A long day of mental stimulation such as studying for an examination or processing data for a report can be as fatiguing as manual labor. They may feel different—a sore body instead of a headache and bleary eyes—but the end effect is the same, an inability to function normally.

2. Fatigue leads to a decrease in your ability to carry out tasks. Several studies have demonstrated significant impairment in a person's ability to carry out tasks that require manual dexterity, concentration, and higher-order intellectual processing. Fatigue may happen acutely, which is to say in a relatively short time (hours) after some significant physical or mental activity. Or, it may occur gradually over several days or weeks. Typically, this situation occurs with someone who does not get sufficient sleep over a prolonged period of time (as with sleep apnea, jet lag, or shift work) or someone who is involved in ongoing physical or mental activity with insufficient rest.

STRESSORS

General aviation pilots are typically not exposed to the same occupational stresses as commercial pilots (i.e., long duty days, circadian disruptions from night flying or time zone changes, or scheduling changes). Nevertheless, they will still develop fatigue from a variety

of other causes. Given the single-pilot operation and relatively higher workload, they would be just as much at risk (possibly even more) to be involved in an accident than a commercial crew. Any fatigued person will exhibit the same problems: sleepiness, difficulty concentrating, apathy, feeling of isolation, annoyance, increased reaction time to stimulus, 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, much less if there is no one else in the aircraft to help out.

In a variety of studies, fatigued individuals consistently underreported how tired they really were, as measured by physiologic parameters. A tired individual truly does not realize the extent of actual impairment. No degree of experience, motivation, medication, coffee, or will power can overcome fatigue.

ANTIDOTE TO FATIGUE

Obtaining adequate sleep is the best way to prevent or resolve fatigue. Sleep provides the body with a period of rest and recuperation. Insufficient sleep will result in significant physical and psychological problems. On average, a healthy adult does best with eight hours of uninterrupted sleep, but significant personal variations occur. For example, increasing sleep difficulties occur as we age, with significant shortening of nighttime sleep. A variety of medical conditions can influence the quality and duration of sleep. To name a few: sleep apnea, restless leg syndrome, certain medications, depression, stress, insomnia, and chronic pain. Some of the more common social or behavioral issues are: late-night activities, excessive alcohol or caffeine use, travel, interpersonal strife, uncomfortable or unfamiliar surroundings, and shift work.

PREVENTION

No one is immune from fatigue. Yet, in our society, establishing widespread preventive measures to combat fatigue is often a very difficult goal to achieve. Individuals, as well as organizations, often ignore the problem until an accident occurs. Even then, implementing lasting change is not guaranteed. Lifestyle changes are not easy for individuals, particularly if that person isn't in complete control of the condition. For example, commercial pilots must contend with shift work and circadian rhythm disruption. Often, they also choose to commute long distances to work, so that by the time a work cycle starts they have already traveled for several hours. While a general aviation pilot may not have to deal with this, a busy lifestyle or other issues may lead to fatigue. Therefore, general aviation pilots must make every effort to modify personal lifestyle factors that cause fatigue.

Federal Aviation Administration

Circadian Rhythm Disruption and Flying

Circadian Rhythm Disruption and Aviation

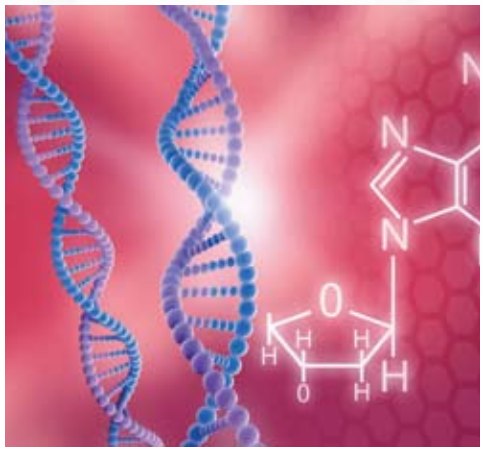
It's All About the Rhythm and Blues

Our body's biological functions work much like a finely tuned watch: Every part works in unison to keep the body in homeostasis (maintenance of the internal environment within tolerable limits). However, when one working part doesn't function normally, it tends to disrupt many other vital parts and can upset homeostasis.

Often, we bring disruptions on ourselves with such things as self-imposed stress, and then we must try to get everything back to normal.

Managing your circadian rhythm is no different. It must be maintained to operate within normal working parameters, or a variety of negative effects will occur, and some of these could become a safety-of-flight issue.

An Internal Biological Clock



Our circadian rhythm is best described as an internal biological clock that regulates our body functions, based on our wake/sleep cycle. Circadian rhythms are not only important in determining sleep cycles but also in feeding patterns. There are clear patterns of brain wave activity, hormone production, cell regeneration, and other biological activities linked to these daily cycles.

Origin

Circadian rhythms are believed to have originated in the earliest cells, with the purpose of protecting replicating DNA from high ultraviolet radiation during the daytime. As a result, replication was relegated to the dark, and a basic pattern of day/night cycle was engrained within the cell and passed down to subsequent generations. At some time in the distant past, the days may have been longer, because when we are deprived of time clues, we gravitate toward a 25-hour circadian cycle.

The Internal Works of Our Biological Watch

In your brain, there is a type of "pacemaker" located within the *suprachiasmatic nuclei*. This area regulates the firing of nerve cells that seem to control your circadian rhythm. Scientists can't explain precisely how this area in your brain "keeps time." They do know your brain relies on "outside" influences called *zeitgebers* (German for *time givers*) to keep it on a normal schedule.

The most obvious zeitgeber is daylight. When daylight hits your eyes, cells in the retinas signal your brain. Other zeitgebers are ambient temperature, sleep, social contact, physical activity, and even regular meal times. They all send "timekeeping" clues to your brain, helping keep your circadian rhythm running on schedule.

Circadian Rhythm Disruption

Any time that our normal 25-hour circadian rhythm is altered or interrupted, it will have physiological and behavioral impacts. This is better known as *circadian rhythm disruption*, or CRD. Normal circadian rhythms are naturally altered as one ages including changes in sleep pattern with respect to earlier onset of sleepiness, early-morning awakenings, and increased need for daytime napping.

Sleep Disorders and CRD

Several chronic sleep disorders can lead or contribute to circadian rhythm disruptions, including:

- **Delayed Sleep Phase Syndrome.** This disorder causes a delay in the normal sleep onset time by two or more hours. People affected by this disorder complain of late-evening insomnia and/or excessive early-morning sleepiness, have difficulties falling asleep before 2:00 a.m., have short sleep periods during weekdays, and prolonged (9-12 hours) sleep periods during the weekends. These individuals tend to experience depression and other psychiatric disorders.
- **Advanced Sleep Phase Syndrome.** This is a disorder where sleepiness occurs well before the desired sleep schedule. The resulting symptoms include evening sleepiness, an early sleep onset, and an morning awakening that is earlier than desired. A person feels the urge to go to sleep between 6:00 and 8:00 p.m. and wakes up between 1:00 and 3:00 a.m. the following morning. This disorder can have a negative impact on an individual's personal or social life because of the need to leave early-evening social activities to sleep. Evening sleepiness may also represent a driving hazard.

- **Non 24-Hour Sleep-Wake Disorder.** This disorder is the result of an inadvertent delay of the sleep onset time, followed by unsuccessful attempts to sleep at the desired sleep schedule. People affected by this disorder constantly delay sleep onset times that interfere with circadian rhythms. They have a normal sleep duration pattern but live in a free-running "biological clock" of 25 hours instead of the community-accepted 24-hour clock. The sleep cycle is affected by inconsistent insomnia that occurs at different times. Those affected will sometimes fall asleep at a later time and wake up later; or fall asleep at an earlier time and wake up earlier.

Even if you do not have a chronic sleep disorder, there are several measures that can help you get a good night's sleep. Among these are:

- Mental or physical relaxation techniques (reading, meditation, yoga).
- If you don't fall a sleep within 30 minutes of going to bed, get out of bed and try an activity that helps induce sleep such as reading, listening to relaxing music, watching something boring on TV, etc.
- Ensure you are in an environment conducive to sleeping (dark, quiet, comfortable temperature and mattress).
- Exercise regularly, but not too near bedtime.
- A nutritious, balanced diet.

Shift Work and CRD

Shift work almost always causes a circadian rhythm disruption—the internal body clock is at odds with the shift schedule. Shift-work problems are well documented, ranging from performance issues to accidents and health problems.

Recognizing Circadian Rhythm Disruption

Pilots or passengers who are suffering from CRD may experience one or more of the following symptoms:

- Difficulty falling and staying asleep, late-night insomnia.
- Increased daytime sleepiness.
- A general lack of energy in the morning.
- An increase of energy in the evening or late at night.
- Difficulty concentrating, being alert, or accomplishing mental tasks.
- Oversleeping and trouble getting up.
- Increased negative moods.

The most debilitating symptom of CRD is, of course, fatigue. Fatigue is typically characterized by:

- General discomfort.
- Sleepiness.
- Irritability.
- Apathy or loss of interest.
- Decreased concentration.
- Loss of appetite.
- Impaired sensory perceptions.
- Mood changes.
- Impaired decision-making.

Fatigue, itself, is a very dangerous condition for any pilot attempting to operate an aircraft. Realizing the cause of the fatigue (in this case, CRD) is the first and most important step in treating it.

Jet Lag is a CRD!

Of all the stressors in aviation, **jet lag**, or **rapid time zone change syndrome**, seems to have the biggest impact. This syndrome consists of symptoms that include excessive sleepiness and a lack of daytime alertness in people who travel across time zones.

Other Symptoms: Fatigue, insomnia, disorientation, headaches, digestive problems, lightheadedness.

Jet lag is more evident if you fly from west to east because it is more difficult for your body to adjust to "losing time" when you journey east than to "gaining time," when you fly from east to west.

Tips to Help Minimize Jet Lag

- *Adjust your bedtime by an hour a day* a few days before your trip. This will adjust your sleep pattern to match the sleep schedule you will keep at your destination.
- *Reset your watch* to the destination time at the beginning of your flight to help you adjust more quickly to the time zone you will be visiting.
- *Drink plenty of water* before, during, and after your flight. The air you breathe on airplanes is extremely dry, and some experts believe that dehydration is a predisposing cause of jet lag. Virtually everyone agrees that dehydration can make jet lag worse.
- *Eat lightly but strategically*. What you eat can have a direct influence on your wake/sleep cycle. Remember that high-protein meals are likely to keep you awake, while foods high in carbohydrates can promote sleep, and fatty foods may make you feel sluggish.
- *Relax on the first day at your destination*. If you have the luxury of arriving at your destination a day or two before you have to engage in important activities that require a lot of energy or sharp intellectual focus, give yourself a break and let your body adjust to the time change a little more gradually.
- **As a Passenger:**
  - *Avoid drinking alcohol* or anything with *caffeine* in it during your flight (includes many soft drinks, coffee, and tea.) Both alcohol and caffeine increase dehydration.
  - *Sleep on the plane if it is nighttime at your destination.* Use earplugs, headphones, eye masks, or other sleep aids to help block out noise and light, and a travel pillow to make you more comfortable so you can sleep.
  - *Stay awake during your flight if it is daytime at your destination.* Read, talk with other passengers, watch the movie, or walk the aisles to avoid sleeping at the wrong time.

CRD Affects Your Flying Skills

CRD-induced fatigue that goes untreated or ignored will have both physiological and psychological ramifications that not only can jeopardize your personal health but can also become a safety-of-flight issue. A few of the more well known undesired personal affects are:

1. **Increased reaction time**
   - Impaired responses in sequential tasks that require time synchronization.
   - Need to increase the magnitude of sensory stimulation to elicit response.
2. **Decreased attention**
   - Omission or displacement of individual elements in sequential task.
   - Channelized attention to one task at the expense of others.
   - Impaired visual monitoring patterns.
   - Difficulty in self-identifying performance impairment.
3. **Impaired memory**
   - Difficulty remembering recent events during flight.
   - Tendency to forget secondary tasks.
4. **Personal conduct of isolation**
   - Tendency to avoid interpersonal interactions.
   - Tendency to avoid tasks that require low workload.
   - Increase distraction due to discomfort.
   - Emotional irritability.
   - Indifference.

Consequences of CRD on the Flight Environment

- Increased frequency and severity of piloting errors during aircraft operations.
- Increased frequency of operational incidents.
- Increased risk in aviation operations.

Resetting Your Biological Clock and Recovering

Once you have fallen victim to CRD, it is imperative to reset your biological clock. Here's how:

- **Catch Some Rays.** Exposing yourself to as much daylight as possible might also be a good idea, because it has been scientifically shown that bright light helps reset circadian rhythms. In addition to resetting the clock, light has a direct and positive affect by increasing brain serotonin levels. At the same time, circadian light therapy has a depressing affect on daytime melatonin, a clear link to depression and sleep disorders.
- **Be Active.** When you arrive, taking a nap is the worst thing you can do because it sets your body's rhythms back to home time. Staying active on arrival will help the body adjust to the new time zone. Eating and sleeping are your body's time indicators, so it's important to fit in with what the locals are doing when you arrive. Consequently, if it's breakfast time, eat breakfast.

Coping With CRD While On Duty

- Sleep well at home before any flight.
- Try to get at least as much sleep per 24 hours as you would normally at home.
- If you are sleepy, try to sleep. Employ strategic (combat) napping techniques.
  1. Whenever possible, take a 30-minute nap prior to a long flight.
  2. Avoid naps of more than 30 minutes, as they involve deep sleep.
  3. Taking a nap is better than not sleeping at all.
- Avoid pilot adaptation to a local circadian rhythm following transmeridian flights with short layovers.
- Try to maintain the circadian rhythm from your place of origin, and at the same, time try to sleep longer.
- Use caffeine strategically during the flight to counteract circadian rhythm sleepiness.
- While in the cockpit seat, converse with others, stretch your legs, and take regular breaks.
- Try to avoid night flights following a transmeridian flight.
- Transmeridian flights should be alternated with intrameridian flights, enabling you to return to your normal circadian rhythm.

Remember, circadian rhythm disruption can lead to acute or even chronic fatigue. Fatigue in the cockpit has shown to be just as debilitating as drugs and alcohol. Do not let CRD-induced fatigue become a hindrance to aviation safety.

MEDICAL FACTS FOR PILOTS

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