UAS 1010-D01

Operations

Lesson 5e: Physiology

Operations: Objectives

- To determine that the applicant is knowledgeable in radio communication procedures.
- To determine that the applicant is knowledgeable in airport operations.
- To determine that the applicant is knowledgeable in sUAS emergency procedures.
- To determine that the applicant is knowledgeable in aeronautical decision-making.
- To determine that the applicant is knowledgeable in the physiological factors affecting remote pilot performance.
- To determine that the applicant is knowledgeable in sUAS maintenance and inspection procedures.

FAA Prohibitions

- Part 107 **prohibits** a person from serving as a remote PIC, person manipulating the controls, VO, or other crewmember if he or she:
  - Has consumed any alcoholic beverage within the preceding 8 hours
  - Is under the influence of alcohol
  - Has a blood alcohol concentration of .04 percent or greater
  - Is using a drug that affects the person's mental or physical capabilities.

Physiology

According to the FAA's UAS Airman Certification Standards, a Remote PIC should be able to demonstrate knowledge of:

- Physiological considerations and their effects on safety, such as dehydration and heatstroke.
- Drug and alcohol use.
- Prescription and over-the-counter medication.
- Hyperventilation.
- Stress and fatigue.
- Factors affecting vision.
- Fitness for flight.

Why does physiology matter?

- Because your physiology affects your:
  - Judgement
  - Motor skills
  - Endurance
  - To name a few.
- These things may adversely affect your ability to fly safely.

Dehydration

- **Dehydration** is when your body has suffered a critical loss of water. Dehydration can be caused by your exposure to the sun and to hot temperatures or high humidity, but also to how much water you're drinking, what altitude you're at (you'll get dehydrated much more easily at higher altitudes, like in the mountains), and how much you've consumed of diuretic drinks like coffee, tea, and caffeinated soft drinks.
- Dehydration can cause fatigue, which can lead to dizziness, nausea, weakness, and a number of other bad things, which in turn can lead to poor decision-making.
- Avoiding dehydration – Stay hydrated by drinking water. Don't wait until you are "Dying of Thirst" to get a drink of water.

Heatstroke

- **Heatstroke** is a condition caused by any inability of the body to control its temperature. It's a little different than dehydration but obviously related. The same conditions that cause dehydration can also cause heatstroke.
- Aside from drinking water, you can wear loose, light clothing if it's hot outside, and a hat will help to protect you from the sun.
- This is obvious stuff BUT: it is a foundational part of being a smart, safe sUAS operator. AND, the FAA includes this topic on its list of over 127 concepts you need to learn to prepare for your Aeronautical Knowledge Test!

Drug and Alcohol Use

- Consumption of alcohol even in small amounts correlates directly with performance deterioration. Even in small amounts, alcohol can decrease the speed and strength of your muscular reflexes, affect coordination, and lessen the efficiency of your eye movements. It is the responsibility of the Remote Pilot in Command to ensure all crewmembers who are participating in the operation are not impaired by drugs or alcohol.
- 14 CFR part 91 requires that your blood alcohol level be less than .04 percent and that 8 hours pass between drinking alcohol and piloting an unmanned aircraft. A remote pilot with a blood alcohol level of .04 percent or greater after 8 hours cannot fly until the blood alcohol falls below .04 percent.

Drug and Alcohol Use

- Even though blood alcohol may be well below .04 percent, a pilot cannot fly sooner than 8 hours after drinking alcohol. Although the regulations are quite specific, it is a good idea to be more conservative than the regulations. Many pilots go by the mantra "12 hours, bottle to throttle".
- As as far as illegal drugs go, their dangers and how they affect your judgement are pretty well documented. Certain illegal drugs can have hallucinatory effects that occur days or weeks after the drug is taken. Obviously, these drugs have no place in the aviation community.

Prescription and Over-the-Counter Medication

- Be realistic, an Aspirin here and there isn't likely going to directly affect your health and decision-making capacity. But when you start looking at tranquilizers, sedatives, strong pain relievers, and cough suppressants, these medications can impair your judgement, your memory, your alertness, coordination, vision, and the ability to make sound decisions.
- Even some strong antibiotics, as an example, can produce dangerous side effects like vomiting, balance disorders, and temporary hearing loss.
- Title 14 of the Code of Federal Regulations (CFR) prohibits pilots from performing any kind of crewmember duties while using any medication that affects the body in any way contrary to safety. If there is any doubt regarding the effects of any medication, contact your local Aviation Medical Examiner (AME) at this link: https://www.faa.gov/pilots/amelocator/
- You can also check the Aeromedical Factors chapter of the Pilot Handbook of Aeronautical Knowledge.

Hyperventilation - Definition

- **Hyperventilation** is when you suddenly start breathing very quickly and exhale more than you inhale, leading to an abnormal loss of carbon dioxide from the blood. This can lead to lightheadedness, tingling in your fingers and even fainting.
- Hyperventilation can occur when you feel fear, stress, panic, anxiety, nervousness or anger.
- The best way to deal with hyperventilation? Remain calm and hold your breath or try to breathe into a paper bag or cupped hands. The idea is to increase the amount of carbon dioxide in your body.
- You also might want to know that hyperventilation means over-breathing, but hypoventilation is due to breathing that is too shallow.

Hyperventilation - Symptoms

Common symptoms of hyperventilation include:

- Visual impairment
- Unconsciousness
- Lightheaded or dizzy sensation
- Tingling sensations
- Hot and cold sensations
- Muscle spasms

Stress and Fatigue

- Stress is the body's response to physical and psychological demands.
- Stress can result in increases in blood sugar, heart rate, respiration, blood pressure, and perspiration.
- Under certain circumstances you may experience short-term, acute stress while flying. Remember that in any sUAS flight emergency, rule #1 is to maintain control of your aircraft.
- If you're feeling tired, i.e. fatigued, it might not be a good idea to operate an sUAS.
- If you're fatigued, you're in an impaired state and should not fly!

Remember: IMSAFE!

Stress and Fatigue

- Stress falls into two broad categories: acute (short term) and chronic (long term).
- Acute stress involves an immediate threat that is perceived as danger. This is the type of stress that triggers a "fight or flight" response in an individual, whether the threat is real or imagined. Normally, a healthy person can cope with acute stress and prevent stress overload. However, ongoing acute stress can develop into chronic stress.
- Chronic stress can be defined as a level of stress that presents an intolerable burden, exceeds the ability of an individual to cope, and causes individual performance to fall sharply.
- Unrelenting psychological pressures, such as loneliness, financial worries, and relationship or work problems can produce a cumulative level of stress that exceeds a person's ability to cope with the situation. When stress reaches these levels, performance falls off rapidly. Pilots experiencing this level of stress are not safe and should not exercise their airman privileges. Pilots who suspect they are suffering from chronic stress should consult a physician.

Stress and Fatigue

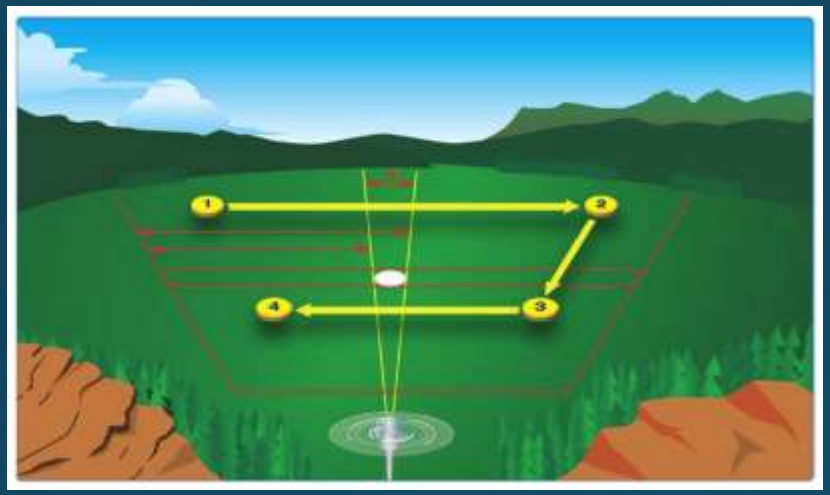
- Fatigue is frequently associated with pilot error.
- Effects of fatigue include:
  - Degradation of attention and concentration,
  - Impaired coordination, and
  - Decreased ability to communicate.
- These factors seriously influence the ability to make effective decisions.
- Physical fatigue results from sleep loss, exercise, or physical work. Factors such as stress and prolonged performance of cognitive work result in mental fatigue.

Factors Affecting Vision

- Of all the senses, vision is the most important for safe remote flight. And while many of the traditional factors affecting vision like water refraction and terrain illusion will matter more to a manned aircraft pilot, as a remote pilot it's important to consider your vision as being a key part of successful sUAS operations.
- Under Part 107, even with a visual observer, the remote pilot-in-command should be able to have a direct line-of-sight to the aircraft, i.e. you should be able to see your aircraft at all times.
- Not having full control over your vision is an excellent reason not to fly.

Vision and Hazards

Vision is critical to identifying potential hazards and problems.



The systematic scanning of the flight area from left to right, or right to left beginning at the greatest distance an object can be perceived (top) and moving inward toward the position of the aircraft (bottom), is an effective and proven method of identifying hazards.

For each stop, an area approximately 30° wide should be scanned. The duration of each stop is based on the degree of detail that is required, but no stop should last longer than 2 to 3 seconds.

Fitness for Flight

Am I ready and able to safely fly?

- **Illness** —Am I sick? Illness is an obvious pilot risk.
- **Medication** —Am I taking any medicines that might affect my judgment or make me drowsy?
- **Stress** —Am I under psychological pressure from the job? Do I have money, health, or family problems? Stress causes concentration and performance problems. While the regulations list the medical conditions that require grounding, stress is not among them. The remote pilot should consider the effects of stress on performance.
- **Alcohol** —Have I had a drink in the last 8 hours? As little as one ounce of liquor, one bottle of beer, or four ounces of wine can impair flying skills. Alcohol also renders a pilot more susceptible to disorientation and oxygen deficiency.
- **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.
- **Emotion or Eating —**Have I fully recovered from any recent upsetting events? Have I eaten enough of the proper foods to keep adequately nourished during the entire flight?