

Area of Operation II - Task A

Aeromedical Factors



Key References:

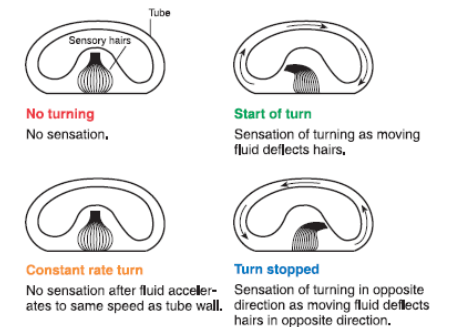
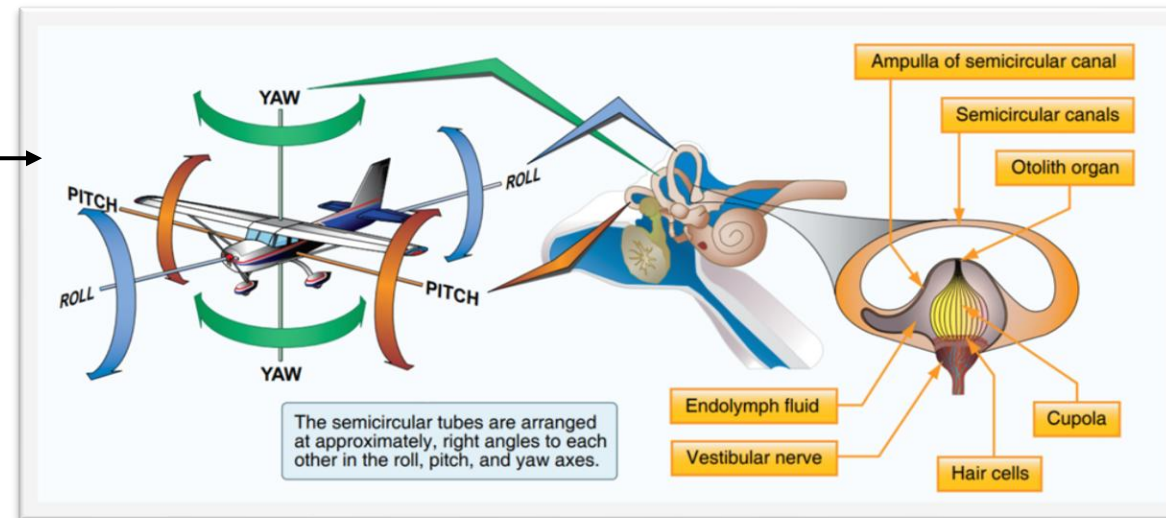
- Airplane Flying Handbook
- Pilot's Handbook of Aeronautical Knowledge
- AIM

Content

1. Introduction
2. Medical Certificates
3. Motion Sickness
4. Hypoxia
5. Hyperventilation
6. Middle-Ear and Sinus Problems
7. Carbon Monoxide Poisoning
8. Fatigue and Stress
9. Dehydration
10. Nitrogen and Scuba Diving
11. Alcohol and Drugs
12. Spatial Disorientation

1. Introduction

- **What:** Learn about health and physiological factors that can influence a pilot's ability to fly safely
 - **Why:** Many of these factors can quickly lead to in-flight emergencies
 - **Types of Human Factors:**
 - Aeromedical → Medical related (e.g. Hypoxia, Fatigue, Dehydration, Alcohol, etc)
 - Spatial Disorientation → Cause illusions and sensorial confusion; Lose of accurate perception of position in space
-
- ✓ **Visual** (eyes)
 - ✓ **Somatosensory** (nerves, joints, G-feeling)
 - ✓ **Vestibular System** (fluid-filled canals in the inner ear)



2. Medical Certificates

Medical Classes (FAR 61.23)

- **1st Class**: PIC of ATP certification or SIC in flag/supplemental part 121 if requires 3+ pilots
- **2nd Class**: PIC of Commercial certification (for hire) or SIC of part 121 if not the above
- **3rd Class**: Private, Recreational, Student pilot, flight instructor, required crew member (except when 61.113(i), which allows basicmed)
- Not required (61.23(b)) → CFI not PIC/Crewmember, DPE, Ground Instruction, Military up to date w/ medical (US airspace)
- Duration (calendar months) →

Age	Expires	1 st Class	2 nd Class	3 rd Class
≥ 40	24 th mo	6mo	12mo (6 after 1 st class)	24mo (12 after 2 nd class)
< 40	60 th mo	12mo (both 1 st and 2 nd class)		60mo (48 after 2 nd class)
- Steps:
 - *Step 1: Search for an AME and schedule an appointment → <https://designee.faa.gov/designeeLocator>*
 - *Step 2: Populate MedXPress before the appointment → <https://medxpress.faa.gov/>*

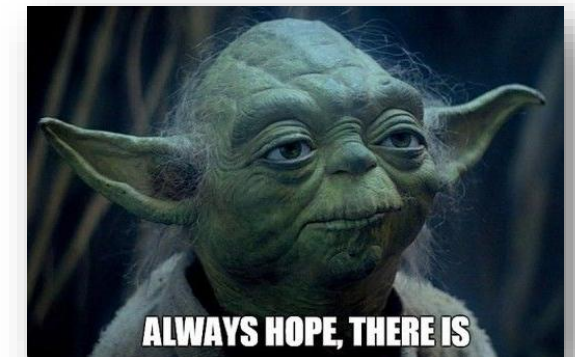
BasicMed (AC 68-1A, FAR 61.113(i), FAA Reauthorization Act 2024)

- Allow operating (PIC) as Private, Recreational, Student or Flight Instructor under §61.113(i)
- Aircraft can carry max 7 people (pilot + 6 passengers) and MTOW of 12,500lbs, flying max 18,000ft / 250kt
- Requirement: US Driver's License (comply with its limitations), held a Medical Certificate after Jul 14th 2006, and:
 - *Step 1: Go to a Physician and bring Checklist form (CMEC) → Every 48 months (to the day)*
 - *Step 2: Take Online Course + Quiz and submit CMEC to FAA → Every 24 calendar months*
 - *Step 3: Keep the course completion certificate and CMEC in your logbook*

2. Medical Certificates

Part 67: Defines Medical Standards

- Disqualifying conditions
 - *Heart related: Angina Pectoris, Cardiac Valve Replacement, Coronary Heart Disease, Cardiac Transplant, Myocardial Infarction, Permanent cardiac pacemaker*
 - *Mental related: Disturbance of Consciousness, Epilepsy, Bipolar Disorder, Personality Disorder, Psychosis*
 - *Other: Diabetes Mellitus (req hypoglycemic drugs), Substance Abuse/Dependence, Loss of Control of Nervous System*
- **Special Issuance** (67.401(a))
 - At the discretion of the Federal Air Surgeon → **May expire**
 - Applicant has a disqualifying condition but has been treated in a manner acceptable to the FAA
- **Statement of Demonstrated Ability – SODA** (67.401(b))
 - At the discretion of the Federal Air Surgeon → **Do not expire** if condition unchanged
 - Usually related to medical disability where ability to fly safely has been demonstrated (e.g. pilot w/o a leg)



3. Motion Sickness

- **Causes**

- Brain receiving conflicting messages about the state of the body
- Anxiety and stress

- **Symptoms**

- Discomfort, Nausea, Dizziness, Paleness, Sweating, Vomiting
- May occur during initial flights, but generally goes away after the first few lessons

- **Treatment**

- Open fresh air vents
- Focus on objects outside the airplane
- Avoid unnecessary head movement
- Take control of the plane and fly smoothly



4. Hypoxia

- **Causes**

- Lack of oxygen in the body tissues, impairing mainly the brain

- **Symptoms**

- Decreased reaction time, impaired judgment, euphoria, visual impairment, headache, cyanosis, drowsiness
- Leads to loss of consciousness and potentially death

- **Types of Hypoxia**

- Hypoxic – low oxygen in the lungs (e.g. high altitudes)
- Hypemic – low oxygen in the circulatory system (e.g. loss of blood, anemia, CO poisoning)
- Stagnant – delivery of oxygen impaired (e.g. excessive G, heart issues)
- Histotoxic – cell is impaired to using oxygen (e.g. alcohol, drugs)

- **Treatment**

- Use supplemental oxygen immediately and get to a lower altitude



Altitude	Time of useful consciousness
45,000 feet MSL	9 to 15 seconds
40,000 feet MSL	15 to 20 seconds
35,000 feet MSL	30 to 60 seconds
30,000 feet MSL	1 to 2 minutes
28,000 feet MSL	2½ to 3 minutes
25,000 feet MSL	3 to 5 minutes
22,000 feet MSL	5 to 10 minutes
20,000 feet MSL	30 minutes or more

5. Hyperventilation

- **Causes**

- Excessive rate of breathing causing low CO2 levels in the blood
- Occurs when experiencing stress, fright, or pain, and breathing increases

- **Symptoms**

- Visual impairment, dizzy, muscle spasms, unconsciousness
- Similar to hypoxia, visible excessive rate of breathing
- Leads to **temporary** loss of consciousness

- **Treatment**

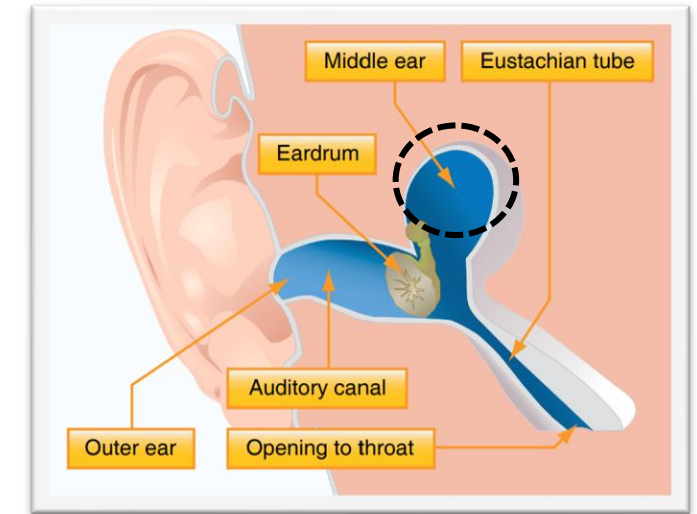
- Force to breath slower
- Breath in a paper bag, keep talking, sing



6. Middle Ear and Sinus Problems

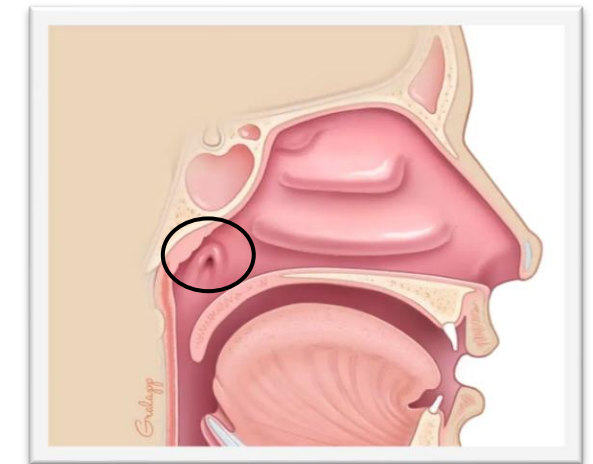
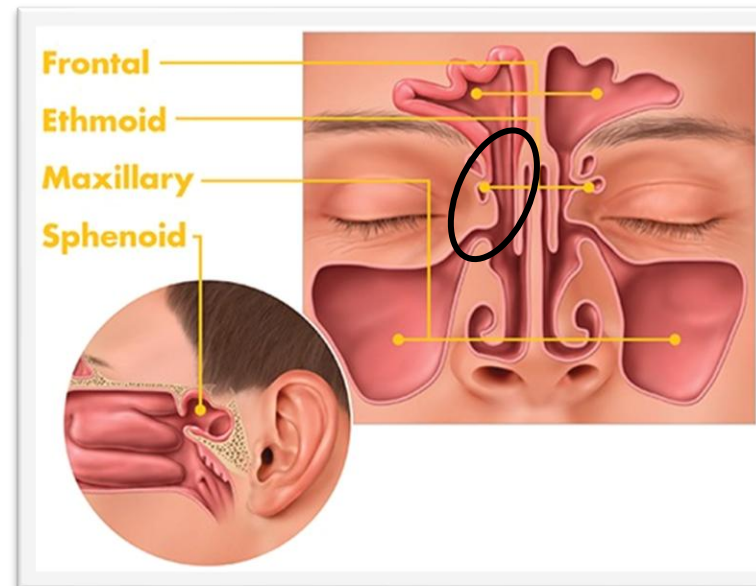
- **Middle Ear**

- Cause: difference in air pressure in the middle ear
- Symptoms: Pain, Reduced hearing sensitivity
- Treatment: stretch jaw, chew gum, valsava maneuver (descent only)



- **Sinus Problems**

- Cause: Congestion blocks air passages preventing pressure equalization
- Symptoms: severe pain
- Treatment: slow descent rates, avoid flying



7. Carbon Monoxide Poisoning

- **Causes**

- Colorless and odorless gas produced by the engine get's mixed into the heated cabin air
- CO attaches to hemoglobin 200x more easily than Oxygen and prevents hemoglobin to carry oxygen
- Smoking exacerbate CO poisoning → body already compromised, like flying at 8,000ft

- **Symptoms**

- Similar to hypoxia, but usually evolves slower
- Headache, blurred vision, dizziness, loss of muscle power
- Poisoning accumulates more and more as body continues absorbing CO

- **Treatment**

- Avoid it → **Use of CO detector** (\$5) and assume a “smelly” air to contain CO
- Turn off heater, open fresh air, use supplemental oxygen and land
- Once on the ground, expect to continue impaired by CO for days



8. Fatigue and Stress

- **Fatigue**

- Fatigue impairs the pilot, diminishes reasoning and decision making, neglect of tasks, delay reaction
- **Acute** (short term): skill fatigue causes timing disruption (execute tasks slower), loss of accuracy and perceptual field
 - ✓ *Prevent/Treat: proper diet, adequate rest and sleep*
- **Chronic** (long term): continued high stress level, underlying disease or psychological roots
 - ✓ *Symptoms: weakness, tiredness, heart palpitations, headaches, irritability*
 - ✓ *Prevent/Treat: manage stress and acute fatigue to not let it evolve. Tread by a physician once established.*

- **Stress**

- **Acute** (short term): Triggers “fight or flight” response
 - ✓ *Healthy individuals can usually cope with acute stress*
- **Chronic** (long term): Do not fly!
 - ✓ *Psychological pressures such as loneliness, financial worries, relationship or work problems*
 - ✓ *Intolerable burden exceeding one’s ability to cope and causing performance to fall sharply*



9. Dehydration

- **Causes**

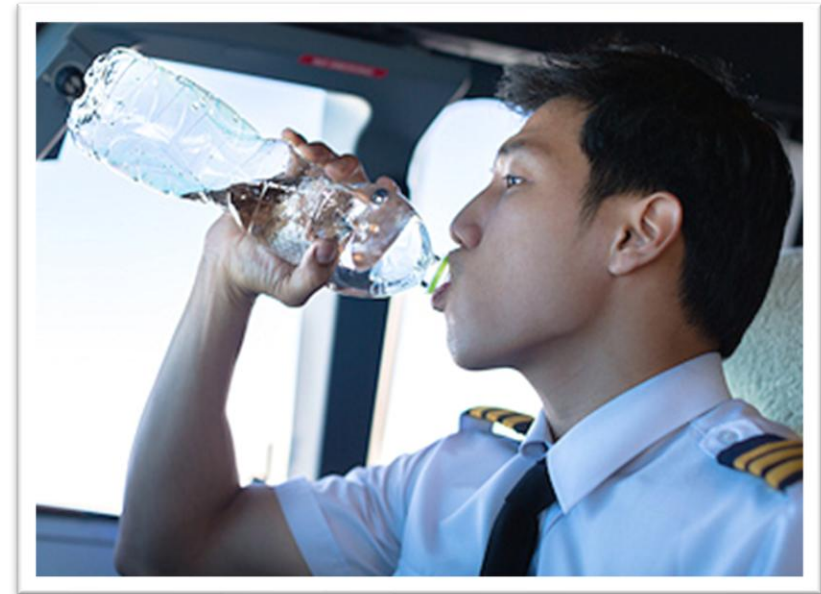
- Critical loss of water from the body
- High temperatures (cockpit, flight line), wind, humidity, diuretic drinks (coffee, tea, alcohol, soda, etc.)

- **Symptoms**

- Fatigue, headaches, cramps, tingling, sleepiness, dizziness
- Physical and mental performance is degraded

- **Prevention**

- Stay hydrated → Don't wait until thirsty to drink)
- Wear light, porous clothing, and a hat
- Keep the cockpit ventilated
- Limit soda, caffeine, and alcohol intake



10. Nitrogen and Scuba Diving

- **Nitrogen and Flying**

- Scuba diving subjects the body to increased pressure which allows more nitrogen to dissolve in the body
- Reduced pressures associated with flying can release the excess nitrogen
- Nitrogen bubbles can form in the bloodstream, spinal cord, or brain

- **Symptoms**

- Decompression Sickness (DCS): severe pain, impairment, death in extreme cases (Bends, Chokes, Neurological)

- **Prevent**

- Provide time to allow nitrogen to return to normal levels before flying
 - ✓ *If No Controlled Ascend → wait 12h (<8,000ft MSL) or 24h (>8,000ft MSL pressure altitude, not cabin altitude)*
 - ✓ *If Controlled Ascend → wait 24h*
- Treatment: Descend and seek hospital treatment



11. Alcohol and Drugs

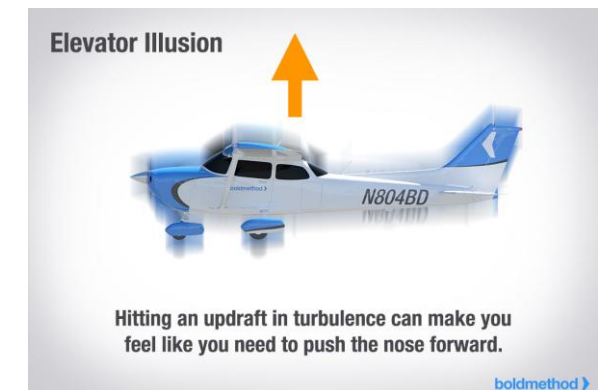
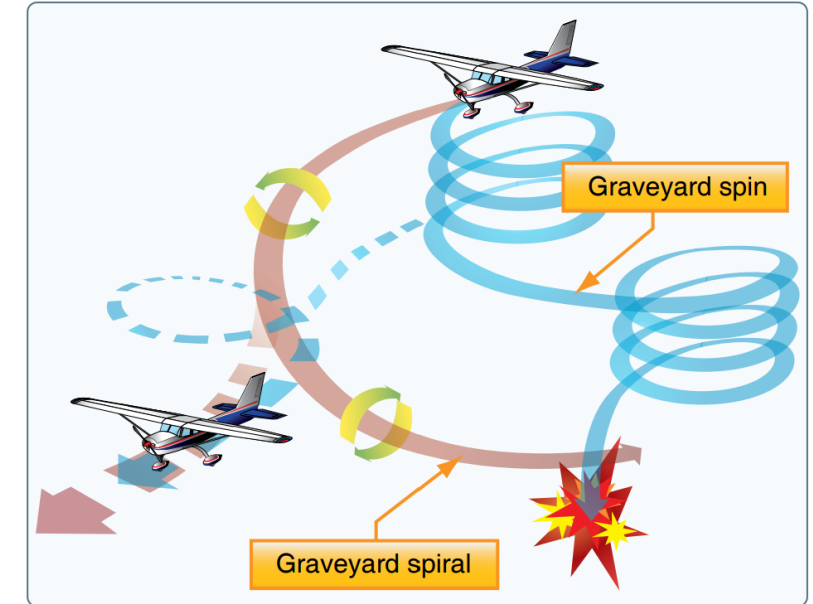
- **Basic Guideline:** **Do not fly while taking any medications, unless approved by the FAA**
 - Drugs that cause no side effects on the ground may create serious problems airborne
- **Alcohol or Drugs (§91.17)**
 - Cannot act as crew member within 8h of alcohol consumption, or
 - While under the influence of alcohol, or
 - While using any drug that affects the person's faculties, or
 - While having alcohol concentration ≥ 0.04 (grams of alcohol per dL of blood)
 - No pilot may allow a person that appears intoxicated be carried in the aircraft
 - ✓ *Except in an emergency or if a patient under proper care*
- **Prohibition on Operations during Medical Deficiency (§61.53)**
 - Prohibits flying if taking medication that would prevent obtaining a medical certificate



12. Spatial Disorientation

Vestibular Illusions

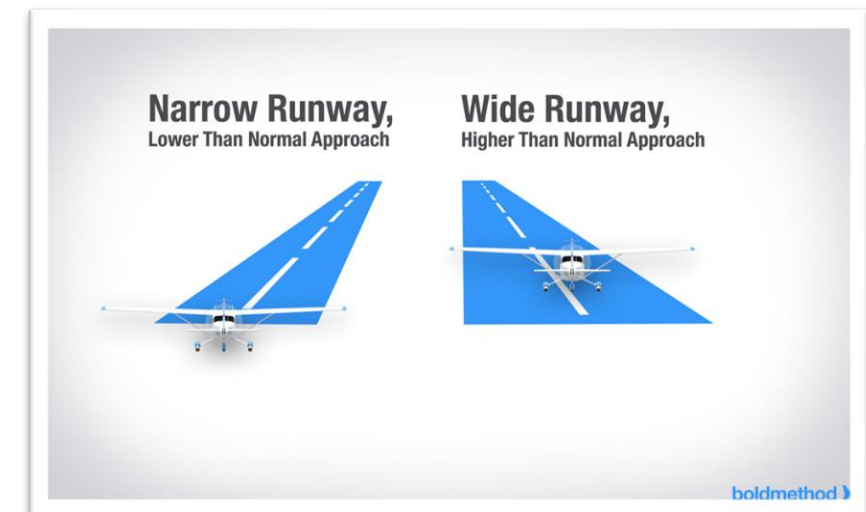
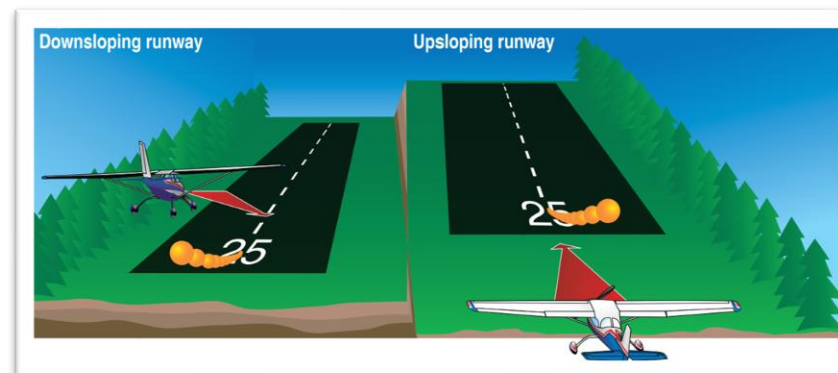
- **Leans**: pilot levels after prolonged turn and thinks it is now turning opposite
- **Coriolis**: movement of head (looking down on iPad and up, gets disoriented)
- **Graveyard Spiral**: the Leans causes pilot to return to turn, loses altitude, pitch up
- **Somatogravic**: acceleration feels climbing, decelerations feels descending.
- **Inversion**: change from climb to straight/level feels tumbling backwards
- **Elevator**: updraft causes the pilot to pitch down



12. Spatial Disorientation

Visual & Optical Illusions

- **False Horizon:** attempt to align the aircraft with sloped terrain, clouds or lights
- **Autokinesis:** in the dark, a stationary light may appear to move
- **Runway Width:** narrower runway appears high; wider runway appears low
- **Runway Slope:** upslope appears high; downslope appears low
- **Featureless Terrain** (“Black Hole”): the aircraft appears to be higher than it is
- **Rain:** illusion of being at a greater altitude (water refraction, horizon appears low)
- **Haze:** makes it appear of being at greater distance
- **Fog:** illusion of pitching up
- **Ground lighting:** other lights can be mistaken for runway/approach lights



Questions?

