

# Aeromedical Factors

## Objective

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To develop understanding of mental and physical standards required for operating an aircraft

## Outline

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- ➔ Obtaining a medical certificate
- ➔ Causes, symptoms, effects, and corrective action of the following medical factors:
  - Hypoxia
  - Hyperventilation
  - Middle ear and sinus problems
  - Spatial disorientation
  - Visual illusions
  - Motion sickness
  - Carbon monoxide poisoning
  - Stress and fatigue
  - Dehydration
- ➔ Effects of alcohol and drugs, and their relationship to flight safety
- ➔ Effect of nitrogen excesses incurred during scuba dives and how this affects pilots and passengers during flight
- ➔ “IM SAFE” checklist

## Schedule

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Discussion 1:30

## Equipment

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Whiteboard and color markers

## Content

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1. Obtaining a medical certificate
  - 1.1. General rules (standards: part 67, requirements: 61.23)
    - All pilots (except 61.23b - mainly some sport, glider, balloon pilots) must possess current medical to exercise pilot privileges
    - If medical is not required, pilot must certify they have no known medical conditions which prohibit them from exercising the privileges of the certificate

### 1.2. Possible medical deficiency (67.401)

- Student may be issued medical certificate for “Student Priv Only”
- When students completes knowledge, experience & proficiency requirements, they should write a letter to FAA Regional Flight Surgeon requesting special medical flight test
- Medical file is reviewed, and Letter of Authorization or Denial is issued
- If LoA, student will be instructed to contact local FSDO to request testing
- After showing student can operate AC with normal of safety, they are issued a SODA (statement of demonstrated ability) which is valid as long as physical impairment does not worsen

### 1.3. Medical Duration (expires last day of Xth month)

- ATP                      First Class        12 months (under 40 on date of exam) else 6 months
- Commercial            Second Class    12 months
- Private                 Third Class      60 months (under 40 on date of exam) else 24 months
- Class of medical required applies only when exercising privileges of certificate for which it is required

## 2. Causes, symptoms, effects, and corrective action of the following medical factors:

### 2.1. Hypoxia

- Deficiency of oxygen which impairs brain functions and other organs
- Hypoxic (altitude, blocked airway), Hypemic (anemia, CO poisoning), Stagnant (blood not flowing, high G maneuvers), Histotoxic (cells unable to use oxygen, alcohol, drugs)
- Atmosphere decreases in pressure with altitude. O<sub>2</sub> remains 21% of air
- 5000 MSL - Night vision deteriorates
- 12-15k MSL - judgment, memory, alertness, coordination, ability to make calculation. Dizzy, drowsy, aggression or euphoria, tingling in extremities, loss of color vision
- 15000' MSL - within 15 min, Tunnel vision (periphery grays). Fingernails, lips turn blue (cyanosis)
- Ability to take corrective/protective action lost in 20-30 min at FL180; 5-12 min FL200 followed soon by unconsciousness
- Effects occur at lower altitude with smoking, alcohol (1 oz = +2000 ft), some medication, stress
- Difficult to recognize - gradual dulling of senses
- Ability to recognize symptoms greatly improved by altitude (hypobaric) chamber

### 2.2. Hyperventilation

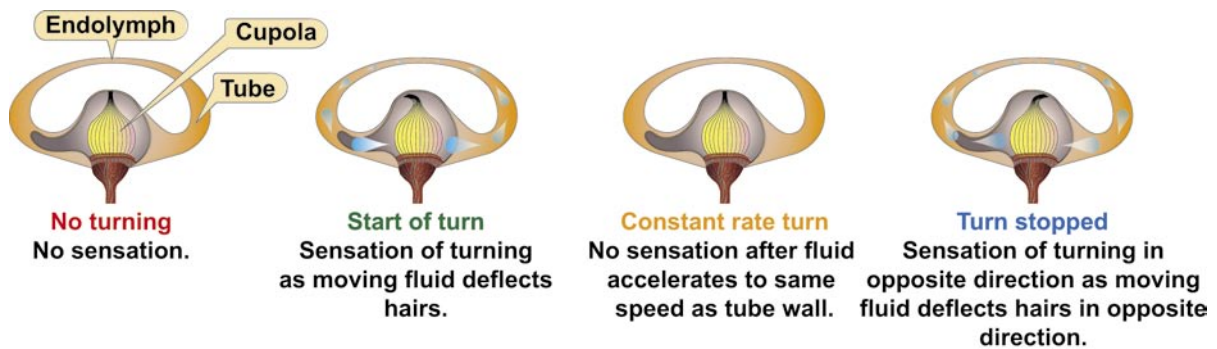
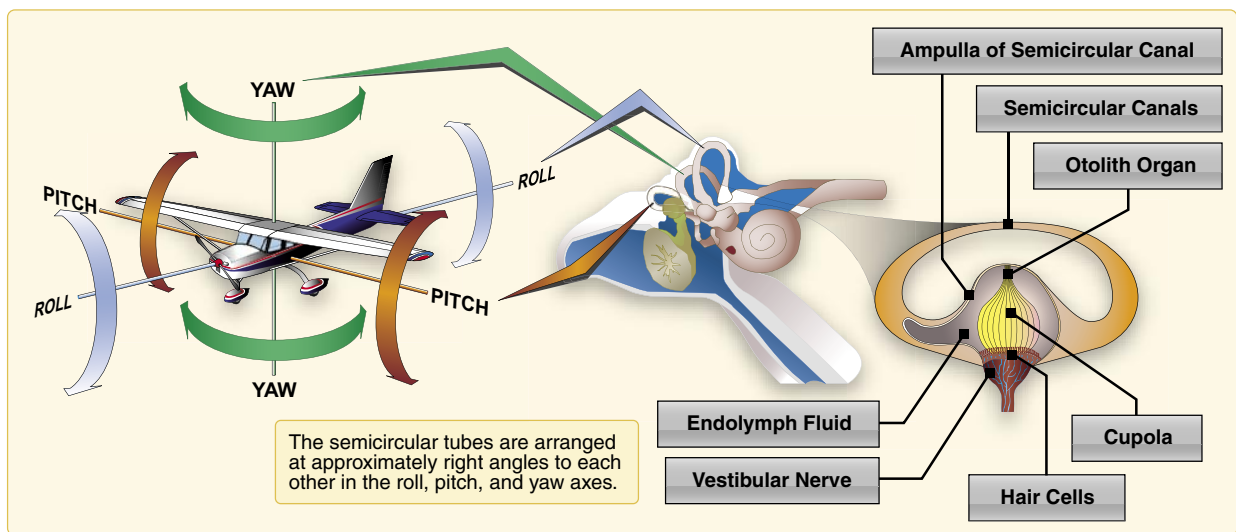
- Abnormal increase in volume of air breathed - reduces excess CO<sub>2</sub> from body
- Can occur subconsciously during stressful situations
- Symptoms: Lightheaded, dizzy sensation, tingling in extremities, hot and cold sensations, muscle spasms, visual impairment, unconsciousness
- Pilot may react with greater hyperventilation
- Symptoms subside within few minutes after rate of breathing is brought under control, use paper bag to rebreathe, talk slowly

### 2.3. Middle ear and sinus problems

- Discomfort relieved by equalizing pressure in Eustachian tube (swallow, yawn, pinch nose and attempt to blow through nostrils), slow descent rate
- Cold or upper respiratory tract infection can make equalization more difficult
- Ear block produces severe pain, loss of hearing, or ear drum rupture on descent
- Oral decongestants often have impairing side effects

### 2.4. Spatial disorientation

- Human body uses 3 systems to ascertain orientation and movement in space: Vestibular system (in inner ear), Somatosensory system (nerves in the skin, muscles and joints), Visual system
- Vestibular: in inner ears 3 semicircular canals at approx. right angles to each other; each canal filled with fluid and has a section full of fine hairs; acceleration causes the tiny hairs to deflect, which stimulates nerve impulses sending messages to the brain



- Vestibular illusions: Coriolis illusion (movement of the head while turning pilot will attempt to correct the aircraft's perceived attitude), graveyard spiral (long turn, illusion of not turning, during recovery sensation of turning in the opposite direction; then rolling more and thinking the aircraft is in level descent - pulling back and tightening the spiral), sematogravic illusion (illusion of nose-up attitude while accelerating), climbing illusion while in a steep turn (+1.5G)
- SD can be prevented by visual reference to reliable fixed position on ground or to flight instruments

## 2.5. Visual illusions

- Runway width illusion (narrower - illusion being higher, low approach), runway slopes (upslope - being higher, low approach), featureless illusion (black hole approach, low), haze (illusion of greater distance, low approach), fog (pitching up)
- Use PAPI/VASI, check altimeter, be familiar with the airport
- Blind spot - where there are no receptors (cones and rods) on the retina because of optic nerve



## 2.6. Motion sickness

- Can jeopardize pilot's flying efficiency at critical times
- Caused by continuous stimulation of inner ear (which controls balance)
- Symptoms are progressive: loss of appetite, saliva collecting, perspiration, disorientation, nausea
- Preventive drugs (dramamine) can cause drowsiness, impair brain functions, loss of motor skills
- Solutions: keep eyes on point outside of plane, avoid unnecessary head movements; open air vents, loosen clothing, use oxygen

## 2.7. Carbon monoxide poisoning

- Colorless, odorless, tasteless gas contained in exhaust fumes
- Even small quantity breathed over time will reduce the ability of blood to carry oxygen (hypoxia)
- Light AC heaters use exhaust pipe shrouds
- If smell of exhaust, or headache, drowsiness, dizziness, suspect CO poisoning
- Shut off heat, open air vents and land

## 2.8. Stress and fatigue

- Stress: body's response to life's demands. Anything perceived as a threat that causes the body to gather it's resources to cope with the situation
- Stressors: physical (noise or vibration), physiological (fatigue) and psychological (personal, work)
- Upon stress heart rate quickens, blood vessels constrict & divert blood to the organs that need it
- Stress overload: pilot begins to use poor judgment, which leads to poor decision making
- Avoid unnecessary stress - flying into deteriorating weather; overflying a fuel stop

- Fatigue: physical results from sleep loss, exercise or physical work; mental results from stress and prolonged performance of cognitive work
- Degradation of attention and concentration, impaired coordination, decreased ability to communicate

### 2.9. Dehydration

- Vital organs require certain level of water and blood salts (K, Na)
- Easy to dehydrate in airplane - summer hot temperatures, high altitude and stress increase rate of water loss from the body; also caffeine, alcohol
- Keep well hydrated, stop if necessary

## 3. Effects of alcohol and drugs, and their relationship to flight safety

### 3.1. Alcohol - One safe rule. Don't.

- Alcohol impairs judgement, sense of responsibility, coordination, memory, vision, hearing
- Altitude multiplies effect of alcohol on body
- 8 hours / 0.04%; better rule is 12-24 hours
- While experiencing a hangover the pilot is still under the influence

### 3.2. Drugs & Over-the-counter Medications

- Check with AME
- If in doubt, don't fly

## 4. Effect of nitrogen excesses incurred during scuba dives; how it affects pilots and passengers during flight

- If excess N is not allowed time to dissipate, decompression sickness can occur - bubbles in joints (like bubbles in a soda bottle)
- If flying up to 8000' MSL, wait 12 hours after dive, or 24 hours if controlled ascent
- Over 8000', wait 24 hours after any dive

## 5. "IM SAFE" checklist

- Illness, Medication, Stress, Alcohol, Fatigue, Eating/Emotion

## Completion Standards

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Lesson is complete when the students can demonstrate understanding of aeromedical factors during oral quizzing.

## References

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1. FAR/AIM
2. FAA-H-8083-25A Pilot's Handbook of Aeronautical Knowledge - Chapter 16