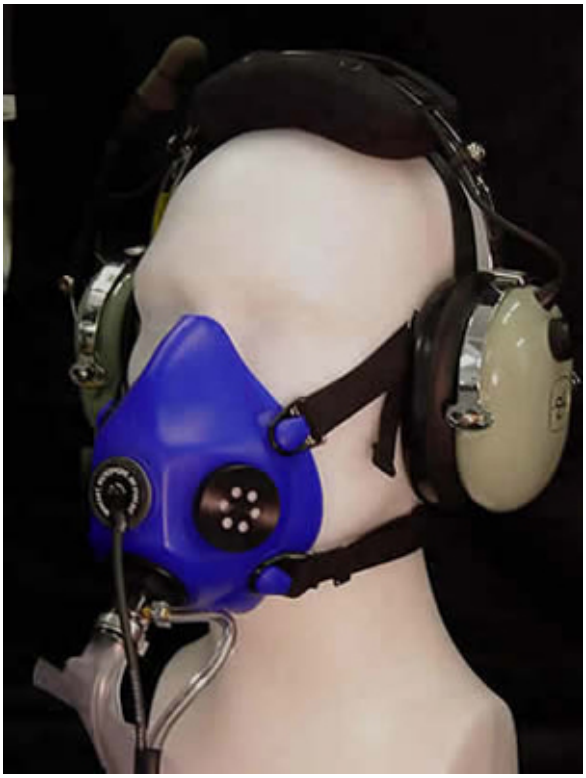
High Altitude Operations

Objective	
To ensure the applicant learns the physiological dangers of high altitude flight and the types of oxygen and pressurization systems available, as well as their use and servicing.	
Purpose	
Flying higher increases aircraft performance, but without proper precautions, it can be dangerous. Additionally, the FARs require pilots to use oxygen when operating at certain altitudes. This lesson introduces pilots to the dangers of hypoxia, the types of oxygen and pressurization systems and their use, as well as the regulations requiring pilot use of oxygen.	

Schedule	**Equipment**
• **Ground Lesson**: 15 minutes • **Student Q&A**: 10 minutes	• Whiteboard / Markers (optional)
Student Actions	**Instructor Actions**
• Ask any questions, receive study material for the next lesson. • Watch linked video. • Review listed references.	• Deliver the ground lesson (below). • Answer student questions.

Completion Standards

- Student can explain the following concepts:
  - Dangers of hypoxia and hyperventilation, effects on vision
  - Regulatory requirements for use of supplemental oxygen
  - The types of oxygen systems commonly used
  - The basic concept of operation for pressurized aircraft and the dangers of rapid cabin decompression

References

- David Moran - “High Altitude Hypoxia Flight Training”
  - YouTube - https://www.youtube.com/watch?v=CptmVSXnEfc
- FAA-H-8083-25B (Pilot’s Handbook of Aeronautical Knowledge) - Chapter 7, Page 34-37 [Pressurized Aircraft], Chapter 7, Page 37-40 [Oxygen Systems], Chapter 17, Page 3-5 [Hypoxia/Hyperventilation]
- FAA-S-ACS-7A (Commercial Pilot ACS) - Area VIII Task A, Area VIII Task B
- FAA-S-8081-6D (CFI PTS) - Area II Task I

Ground Lesson Outline

- Hazards of High Altitude Flight
  - Hypoxia - Similar to drunkenness, confusion, etc. Can lead to loss of consciousness.
    - Hypoxic Hypoxia - Not enough oxygen partial pressure, caused by high altitude
    - Hypemic Hypoxia - Blood can’t bind oxygen, usually CO poisoning
    - Histoxic Hypoxia - Cells can’t use oxygen, usually drugs/alcohol
  - Hyperventilation - Sometimes occurs when breathing pure O2
  - Vision Impairment - Especially at night, over 5,000 feet MSL.
- Supplemental Oxygen Systems
  - Regulatory requirements for use of oxygen - § 91.211
    - >12,500 feet MSL and <= 14,500 more than 30 minutes - Crew provided and uses oxygen
    - >14,000 feet MSL - Crew provided and uses oxygen
    - >15,000 feet MSL - Passengers provided oxygen
  - Importance of using only Aviator’s Breathing Oxygen - Pure, no moisture content (freezing danger)
  - Types of Systems
    - Mask vs. Cannula - Cannula use is only allowed up to 18,000 feet MSL
    - Diluter-Demand - Supply only when user inhales. Automix valve. Used up to 40,000 feet.
    - Pressure-Demand - Similar to diluter-demand but oxygen under pressure over 34,000 feet.
    - Continuous Flow - Usually provided to passengers, uses a reservoir/bag.
    - Electrical Pulse-Demand - Detect users breathing and supplies only when inhaling. Saves oxygen.
  - Care and Storage of Oxygen Bottles, Servicing
  - Pulse Oximeters
- Pressurized Aircraft
  - Concept - Pressurized air source, Outflow valve, max cabin pressure differential
  - Operation - Cabin Altitude, Cabin Climb Rate
  - Dangers of Rapid Decompression, Solutions