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Interagency Aviation Accident Prevention Bulletin

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Subject: Hypoxia in an Unpressurized Aircraft

Area of Concern: Flight Safety

Distribution: All Aviation Activities

Discussion: One of the most perilous emergencies an aircrew can face is pilot incapacitation and, it can happen so slowly that the pilot and crew may not even realize it. Hypoxia is a condition where oxygen is not available in sufficient amounts resulting in inadequate oxygen delivery to the brain and tissues of the body. All are susceptible to hypoxia at high altitudes in unpressurized aircraft. Hypoxia can impair the functions of the brain and organs and can lead to grave consequences.

A recent SAFECOM (#22-0356) described a situation where a helicopter pilot began to experience the onset of hypoxia while performing an aerial supervision mission. Fortunately the pilot was able to recognize the symptoms, descend to a lower altitude and safely land the aircraft.

Symptoms of Hypoxia

- Euphoria
- Headache
- Increased response time
- Impaired judgment
- Drowsiness
- Dizziness
- Tingling in fingers and toes
- Numbness
- Blue fingernails and lips (cyanosis)
- Limp muscles
- Confusion or foggy decision-making

What causes Hypoxia? As the altitude increases, the air pressure decreases, reducing the concentration of oxygen reaching the bloodstream. In other words, with increasing altitude, the partial pressure of oxygen gets lower and the lungs cannot effectively transfer oxygen from the air to the blood to be carried to all tissues in the body. Hypoxia has a variety of symptoms and each person may be affected or react differently. Other factors such as rate of ascent, time spent at altitude, fatigue, self-imposed stresses, and individual physiological fitness can all affect the onset of hypoxia. Exposure to carbon monoxide while operating near a fire could also reduce the altitude and onset of hypoxia.

Preventing Hypoxia. The FAA has already developed supplemental oxygen policies to prevent the onset of hypoxia and understanding and following these is important. While pilots receive training on altitude and hypoxia prevention, a recent study showed that nearly 50% of the pilots responding had never experienced the effects of hypoxia. Outside of hyperbaric chamber training, many pilots don't have the experience to draw from to remind them of the warning signs of hypoxia.

FAA REQUIREMENTS

In Part 135 Commuter and On Demand operations in unpressurized aircraft, the required minimum flight crew must use supplemental oxygen for that part of the flight that exceeds 30 minutes above 10,000 feet through 12,000 feet MSL. Above 12,000 feet MSL each member of the flight crew must use supplemental oxygen during the entire portion of the flight at those altitudes (14 CFR § 135.89, § 135.157, § 121.327, & § 121.329).

In Part 91 General Aviation operations the required flight crew must use supplemental oxygen for any portion of the flight that exceeds 30 minutes above a cabin pressure altitude of 12,500 feet mean sea level (MSL) up to and including 14,000 feet (MSL). The flight crew must use supplemental oxygen for the entire duration of flight operations above a cabin pressure altitude of 14,000 feet MSL (14 CFR § 91.211).

Don't be confused by the term public aircraft operation. The FAA guidelines still apply. These rules are set up as guidelines to prevent hypoxia and the type of operation doesn't change human physiology. A contractor must abide by the contract and FAA requirements. Fleet pilots operate under Part 91.

SAFECOM 22-0356 provides an important lesson on the effects of hypoxia. The FAA has temporarily discontinued the Physiology Training due to COVID-19 restrictions. But when it resumes, it is a great opportunity to understand and experience the effects of hypoxia.

If mission planning identifies the need for high altitude operations, first ensure that you have the right aircraft for the mission and then ensure supplemental oxygen is readily available. Additional information for operating at altitude with unpressurized aircraft and the requirements for supplemental oxygen is available from the FAA.

The insidious nature of hypoxia requires you to be constantly aware of how you and your crew feel. Once hypoxia is recognized, quick and decisive action means recovery is only seconds away.

/s/ John Mills	***/s/ Lori Clark***
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