Oxygen Required:

What Every Pilot – and Passenger – Needs to Know at Altitude!

by Laurie Einstein Koszuta

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My 88-year-old mother-in-law was about to take her first flight in our Cirrus SR22 G6, and she couldn't have been more excited. Sharp as ever and still spry on her feet, she rarely takes medication and had been looking forward to the trip for weeks. We'd already walked her through what to expect on the flight while we were at home, but once we arrived at the FBO, we knew it was worth going over everything one more time.

She asked a few questions and nodded as if she understood everything. After the discussion, the two of us waited patiently while my husband, John, went out to preflight the plane. Once he finished, I helped her into the back seat of the plane and made sure she was comfortable. I showed her the oxygen mustache cannula she'd be wearing at altitude, explained how to position it, and reassured her that I'd handle the regulator during the flight. Then, I had her put on the headset and demonstrated how to adjust the volume. She didn't say much, but I felt confident we were all set, so I climbed into my seat.

Moments later, John climbed in, glanced back, and noticed she wasn't wearing her headset and oxygen cannula. Both were on her lap. That's when she looked at him and said, "Oh, I took them off. I don't need to wear all that. I'll be fine." We both stared at her, stunned. "Well, I just had my hair done," she said emphatically.

After a deep breath, John gently explained that without the headset, she risked hearing damage and that at altitude, the air is thinner, so normal breathing doesn't supply enough oxygen to the brain. "You may feel fine," he told her, "but you could get a headache, lose focus or have vision issues as your brain is deprived of oxygen."

After some back-and-forth, she swallowed her vanity and agreed to wear the headset and cannula. That interaction highlighted how confusing and misunderstood the concepts of oxygen deprivation are outside of the aviation community.

As a frequent right-seat passenger, I've worn oxygen routinely on flights above 8,000 feet. It takes some adjustment and coordination, but I know it matters because I feel less fatigued and sharper. For pilots, supplemental oxygen isn't just for emergencies or mountain crossings; it's a critical safety essential.

What the Federal Aviation Administration Requires

FAA regulations require pilots to use supplemental oxygen above 12,500 feet if they're at that altitude for more than 30 minutes and continuously if above 14,000 feet. Passengers must be offered oxygen above 15,000 feet, though they're not required to use it. Still, many experts agree that using oxygen is wise for both pilots and passengers anytime a flight is above 8,000 feet and even lower if someone has an underlying condition. Choosing to use oxygen below the legal minimum is a matter of physiology, not just regulation. Still, some pilots avoid it until required and even then, some gamble with the risks, convincing themselves they're fine without it.

Why Oxygen Matters at Altitude

"Our bodies are designed to function at or slightly above sea level," explained Dr. Brian Turrisi, a pulmonologist, critical care specialist and an accomplished instrument-rated Cirrus Standardized Instructor Pilot (CSIP). "The air we breathe is made up of only 21% oxygen. There is a certain pressure of air that exists at sea level, which diminishes dramatically as we rise in the atmosphere."

Turrisi continued, "When we start climbing to a higher altitude, whether it's on top of a tall mountain or in an airplane, we encounter a problem with getting enough air pressure for our bodies to function normally. With that, the percentage of oxygen stays the same. Still, the actual amount of air pressure available as you ascend becomes less and less, to the point where your body no longer receives the proper amount of oxygen to function normally. Our heart, brain, muscles and virtually every organ system are heavily dependent on oxygen for fuel. It's not just the percentage of oxygen that our bodies depend on to keep us alive and functioning properly, but the pressure that drives it into your bloodstream."

Turrisi added that at 18,000 feet, the atmospheric pressure is half of what it is at sea level. By 35,000 feet, it drops to just 10%.

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finger and determining how saturated the blood is with oxygen. Most oximeters display both oxygen saturation and heart rate on a small screen and provide a readout in less than a minute. Oxygen levels should be tested every 15 to 20 minutes if everything is normal. An oxygen saturation level of 90% or higher is the goal, and if it drops into the 85-90% range, oxygen therapy should be strongly considered. Below 85% oxygen saturation, a pilot faces a serious risk and must either apply supplemental oxygen or descend immediately.

Turrisi explained that pilots should always brief their passengers on how and when to use the oximeter. Additionally, it is worth noting that women who wear nail polish may not receive an accurate reading. The sensor works by detecting changes in light absorption through the fingernail, and polish can interfere with that. If in doubt, use a different finger or remove the polish.

"In the future, innovations like headset-integrated pulse oximeters might be the norm," Turrisi said. "Wearable health monitors, such as the Apple Watch and similar devices, are already available for real-time monitoring and can be used in the cockpit. These tools allow pilots and passengers to continuously monitor oxygen levels, offering early warning signs of hypoxia before symptoms escalate."

How General Aviation Oxygen Systems Work

"Since the air pressure decreases as we ascend to higher altitudes," noted Ashton, "we increase the percentage of oxygen we breathe by adding 100% oxygen delivered by masks or cannulas, sourced from an oxygen cylinder located within the airplane, whether it is built-in or a portable system. The oxygen flow rate can be increased to obtain the desired blood oxygen saturation of 90% or better."

Ashton explained further that commercial airliners use chemical oxygen generators to deploy those yellow Dixie cup-type masks in emergencies. With a portable oxygen cylinder, the setup is straightforward: the cylinder typically sits in the cockpit, behind the copilot and you open the valve to ensure oxygen is flowing. Built-in oxygen systems, such as those in the Cirrus, have a large cylinder located near the tail of the plane, a switch to remotely open the valve on the flight management console and plug-in adapters for each person's cannula in the ceiling.

A standard portable oxygen system has three key components:

- Cylinder (not a tank): Stores oxygen under high pressure.
- Regulator: Reduces cylinder pressure to a safe and usable level.
- Delivery device: Nasal cannulas or boom-style oxygen cannulas – the simplest option that fits into the nose with tubing that goes around the ears. This type of device pumps a constant stream of oxygen, which helps with inspiration but wastes oxygen on exhalation.

  Conserving mustache cannulas, which store oxygen between breaths to reduce waste and pulse-demand systems: Both are common and use only one-third the amount of oxygen as nasal cannulas and can be used up to 17,000 feet.

  Masks provide higher oxygen flow and can be bulky for long flights but are necessary for going above 18,000 feet.

The lifespan of a cylinder depends on the number of people using the system. Logically, if only one person is in the airplane, it's going to last a lot longer than if four people are using it. Secondly, it depends on the altitude at which you're flying. The higher the altitude, the more oxygen each person needs to achieve an oxygen saturation of at least 90%.

Hypoxia is not something to be taken lightly or attempted to power through. Recognizing it early and responding decisively can mean the difference between life and death at altitude.

A pulse oximeter *determines how saturated your blood is with oxygen. A saturation level of 90% or higher is the goal. Wearable health monitors, i.e., the Apple Watch, are already providing real-time continuous monitoring of O2 levels.*

Oxygen Myths – Debunked

Myth 1: "I'm healthy – I don't need oxygen below 12,500 feet."

Reality: Healthy individuals can benefit from supplemental oxygen at lower altitudes. Factors such as age, fitness level, fatigue, dehydration and smoking can decrease oxygen saturation, sometimes even below 12,500 feet," said Turrisi. "Many turbocharged general aviation aircraft can reach altitudes as high as 25,000 feet, but that doesn't mean pilots should fly that high, especially if flying solo. As an instructor, I know that pilots want to fly higher than they should. As a physician, I advise that flying at high altitudes isn't just about oxygen. The lack of surrounding air pressure makes you feel lousy and can make the experience uncomfortable, particularly on long flights."

Myth 2: "I can just breathe faster to compensate for low oxygen."

Reality: Hyperventilating reduces carbon dioxide levels but doesn't increase usable oxygen. It can worsen hypoxia symptoms by disturbing your body's acid-base balance. Tingling in the fingers or numbness in the lips can be a sign of low oxygen or hyperventilation, which can be misleading.

Myth 3: "Medical, industrial and aviation oxygen are different."

Reality: The oxygen itself is basically the same – all oxygen is produced cryogenically. The key differences lie not in the purity of the oxygen itself but in the regulatory oversight and testing, as well as the FAA rules governing the delivery system.

Myth 4: "Oxygen in a can works just fine."

Reality: Products like Boost Oxygen may offer a brief hit of oxygen, but only for about 90 seconds. "There's no gauge, no pressure indicator and no reliability," warned Ashton. "It's a false sense of security."

Myth 5: "It's too expensive."

Reality: Ashton said that aviation oxygen systems are affordable, especially when compared to the cost of a hypoxia-related emergency.

Myth 6: "Being fit or living at sea level reduces my need for oxygen."

Reality: The opposite may be true. "If you live at sea level and fly to 10,000 feet, your body experiences a more dramatic drop in pressure than someone acclimated to altitude," Ashton explained. Over time, your body can compensate for the decreased pressure at high altitudes by increasing its oxygen-carrying capacity, such as when you go into the mountains for vacation. However, this compensation takes days to a week or two to accomplish.

Myth 7: "Children have less stringent oxygen requirements."

Reality: Both Turrisi and Ashton note that children require roughly the same amount of oxygen proportionately as adults, but they don't recognize or communicate symptoms of hypoxia. They can be more sensitive to hypoxia because of their lower body weight.