

The Air Up There



Earth's breathable atmosphere is a testament to just how phenomenal the planet's ecosystem is. Human beings, and other animals, must breathe oxygen in order to live. However, when they do, they turn that oxygen into carbon dioxide, which they cannot breathe. If they were the only living things on Earth, life would not last very long. But, fortunately, they share the planet with plants, which complete the cycle. Plants use carbon dioxide, and produce oxygen. This

ongoing cycle is what allows animal and plant life to exist on our planet.

With that in mind, how are astronauts able to breathe in space? Humans have been living on the International Space Station (ISS) for almost 3 ½ years now, since November 2000. While plants have been grown on the Station during that time, there are not nearly enough to produce enough oxygen to continuously support two or three people. And, in the vacuum of space, crew members certainly cannot just open a window to get some fresh air. So, why didn't the ISS run out of oxygen years ago? The primary source of oxygen on the Space Station is a Russian system called Elektron. This system produces oxygen gas through a process called electrolysis, in which electricity is used to split water into hydrogen and oxygen gasses. The electricity for the Elektron system is generated by the Station's solar panels. Water can be carried to the ISS on the Space Shuttle or the Russian cargo supply ships. In addition, the Station has systems to recycle the water. Currently, about 98 percent of the water on the ISS is recycled, including minute amounts in sweat and water vapor in astronaut's breath. The oxygen created by the Elektron system is released into the atmosphere aboard the Station. The hydrogen it produces is vented out into space. Some day, NASA hopes to install a system on the ISS that would combine the hydrogen with exhaled carbon dioxide to produce water, which could then produce more oxygen.

As a backup to the Elektron system, the ISS also has redundant supplies of stored oxygen. One of those is "perchlorate candles," or Solid Fuel Oxygen Generation canisters. Burning perchlorate inside a metal canister produces enough oxygen to supply one astronaut for 1 day. There are about 100 of these candles on the Station. In addition, there is also



several months' worth of oxygen in two storage tanks attached to a Station airlock. Sometimes, the crew can also use air from a docked Progress supply ship to replenish the ISS atmosphere. In addition to making sure there is enough oxygen for the crew to breathe, the life support systems on the Space Station also have to remove other gases from the atmosphere. Carbon dioxide is removed from the air by a device that uses a material called zeolite to clean the gas from the atmosphere, and is then vented into space. Other substances, such as methane, ammonia, and carbon monoxide, are removed from the Station's air via charcoal filters and catalytic oxidation reactors.



In addition to making sure the atmosphere on the ISS is breathable, precautions are in place to make sure the air pressure remains at a safe level. Normal air pressure on the Space Station is 14.7 pounds per square inch (psi), the same as at sea level on Earth. While members of the ISS crew could stay healthy even with the pressure at a lower level, the equipment on the Station is designed to function within certain air pressure parameters. If the pressure were to drop too far, it could cause malfunctions in Station equipment.

In order to prevent problems stemming from a drop in air pressure, extra nitrogen gas is kept in storage on the ISS. The nitrogen, in addition to the backup oxygen supply, is routinely used to restore air pressure aboard the Station as needed. This system was used to restore air pressure after a leak developed in a hose by the window in the Destiny Laboratory Module around the beginning of the year. The leak caused air pressure aboard the Station to drop to 14.0 psi. Fortunately, the Expedition 8 crew was able to identify the source of the leak and repair the problem.

Breathing is something we take for granted here on Earth, but it takes a complex ecosystem working together to make it possible. Although there are many differences, that is one thing the Station's atmosphere has in common with Earth's—maintaining breathable air on the ISS also requires different parts of complicated system, all working together. But, thanks to advanced technology and extra backup systems, astronauts living in the void of space don't have to worry about their next breath of air.

*Courtesy of NASA's
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