

# World Oxygen Day

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### NASA Johnson Space Center's Participation in Oxygen Generation Technology

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NASA has used oxygen generated using cryogenic air separation methods since the earliest days of the agency. The oxygen that took Apollo astronauts to the moon was generated using cryogenic air separation methods. I'm standing next to the first stage oxygen tank of the Saturn V rocket. The first stage tanks held more than 1.2 million liters of oxygen, enough to fill two Olympic size swimming pools. Essentially all propellant grade oxygen is produced using cryogenic air separation methods. NASA is proud to be part of the air separation community.



I'm standing next to a mockup of an Environmental Control / Life Support System rack designed for human exploration missions beyond Low Earth Orbit. The cylindrical object represents a water electrolysis cell stack. Water electrolysis is the primary method of producing breathing oxygen for astronauts living aboard the International Space Station. Water, which is safe and stable, is delivered to the ISS, and onboard water electrolysis systems convert the water to gaseous oxygen and gaseous hydrogen. ISS will celebrate 25 years of continuous use in November 2025.



NASA also uses Pressure Swing Adsorption systems to extract oxygen from spacecraft cabin air. NASA is currently testing this PSA oxygen generator that is designed to provide medical oxygen that can supply a ventilator. This PSA technology is especially helpful in confined space environments such as submarines or spacecraft, because medical oxygen can be provided continuously without increasing the oxygen concentration of the cabin. This allows for long term use of medical ventilators without causing a fire safety risk.



NASA is especially excited to help with the development of ceramic ion transport membrane oxygen generation systems. Air separation, water electrolysis, and pressure swing adsorption are commercially available technologies, but ceramic ion transport membrane systems have been restricted to research and are not commercially available. The prototype system shown here has been operated continuously for more than 1 year, with no measurable changes in system performance.