

Life Sustaining Systems, Subsystems and Components

ORBITEC'S Life Sustaining Systems, Subsystems and Components build on 20 years of company experience with closed human environments for space travel. Many of ORBITEC'S solutions have been implemented and used in spaceflight and the company has repeatedly demonstrated its ability to reduce product costs through the use of commercially available components.

We leverage our experience in flight system development, controlling fluids in microgravity and life support development to maximize our customer's return on investment.

Complete systems are available for environmental control, including atmospheric control and supply, atmospheric revitalization, cabin instrumentation, fire detection and suppression, temperature and humidity control and water recovery and management. Additionally, we have complete science and payload systems. We also offer vacuum and space hardware testing services, including specialized testing to determine component and system impacts resulting from exposure to lunar dust.

Applications

The focus on reliability and safety has placed ORBITEC in a position to capture opportunities from space agencies and the rapidly growing commercial space markets for:

- Suborbital Flight
- Low Earth Orbit
- International Space Station
- Lunar Lander and Surface Operations
- Commercial Orbital Transportation Services (COTS)

Hydrogen / Oxygen Generation

Provides separate oxygen and hydrogen gases through water electrolysis that can be used for human metabolic consumption, regenerative fuel cells, storage, other onboard systems or as propellants.

- Output pressures up to 400psi
- 99.9% Pure O₂ and H₂

Water Processing and Storage

Receives collected condensate and processes it into potable water through several techniques, including the use of filters and biocides to control microbial growth.

- Purification by filtration
- Silver or iodine microbial treatment

Cabin Atmospheric VOC Monitoring

Provides real-time sensing of the major constituents in air, including oxygen, methane, carbon dioxide and hydrogen, as well as provides monitoring of pressure, temperature, and relative humidity.

- Monitor O₂, CO₂, H₂, CH₄, RH, pressure and temperature
- Discrete sensors or mass spectrometry

Active Thermal Control

Active thermal control is achieved through a single fluid loop which utilizes a human-safe fluid. By using embedded thermal loops (cold and moderate) located internal to the vehicle, the placement of the radiators is independent of the internal system's location, allowing for multiple radiator deployment methods.

- Single loop operation (no interface heat exchanger)
- Embedded loops provide several temperature loop options

Gaseous Trace Contaminant Removal

Removes harmful and / or unpleasant gases from the atmosphere including ammonia, methane, hydrogen, and carbon monoxide. Also keeps Volatile Organic Compounds (VOCs) below the Spacecraft Maximum Allowable Concentrations (SMAC). The combination of granular filter beds and catalytic oxidizers works for any size open volume.

- Carbon filtration and catalytic oxidation
- 98% single pass efficiency

Carbon Dioxide Removal

Uses redundant regenerable zeolite beds to scrub CO₂ from the cabin volume. The captured CO₂ can be vented or recycled. Rapid cycling can also be done for smaller systems including EVA.

- Recycle or vent captured CO₂
- Vacuum and / or thermal regeneration

Temperature Humidity and Ventilation Control

Conditions the cabin atmosphere by removing excess heat and moisture while providing gas mixing. The system combines condensing and non-condensing heat exchangers with circulation fans to provide a comfortable environment.

- 3 kW total heat removal capability
- Passive gas / liquid separation

Pressure Control and Supply

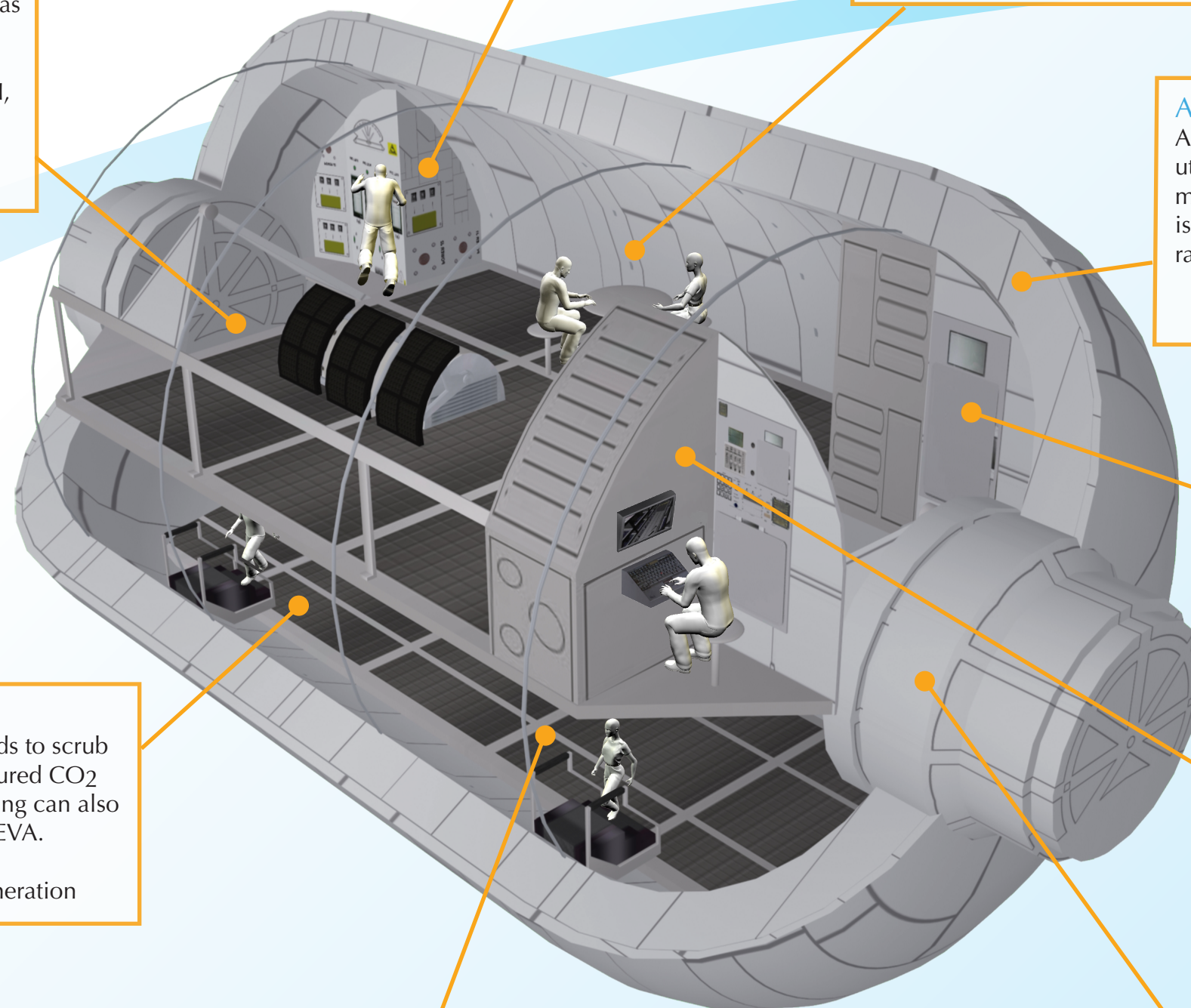
Maintains the cabin total atmospheric pressure and oxygen partial pressure by controlling N₂ and O₂ gases. Controls access to gas vacuum vents for controlled release of waste gases. May also be used to control the inflation of an expandable module, as was demonstrated in flight on the Bigelow Aerospace Genesis.

- Complete under / over pressurization control
- Control high-pressure gas use

Internal / External Lighting

Use of state-of-the-art solid state lighting provides efficient mass and power solutions for navigation, crew and biological illumination. Lighting solutions provide slim profiles, a small footprint and effective thermal energy management.

- Custom color / wavelength, intensity and dimmable
- 50,000 hour lifetime



Payloads and Science Research Tools

ORBITEC's years of environmental control experience have resulted in the development of a number of flight-ready payloads, new payload designs and commercially available ground-based science research tools.

Flight Ready Systems

Biomass Production System: First flown in 2002, BPS is a double middeck locker / express payload with four automated plant chambers, each with individual control of temperature, humidity, light level, nutrient level and carbon dioxide.

Astro Garden: First flown in 2007, Astro Garden is a small hobby garden system for growing flowers, herbs and small vegetables on orbit. The kit's unique design requires minimal resources and needs no supplemental power. A ground-based classroom version complements the flight version.

Payloads Available

Plant Research Unit: Originally designed for the ISS centrifuge, the PRU is a multi-chambered, closed-loop payload to study the effects of various levels of weightlessness on plants.

Advanced Animal Habitat: Also designed for the ISS centrifuge, the AAH is a single-chambered, closed-loop payload to study the effects of various levels of weightlessness on rodents.

Deployable Vegetable Production System: Affectionately known as "VEGGIE," this plant growth facility for growing fresh fruits, vegetables, herbs and flowers is optimized for long-duration space flight. The design uses minimal mass, power, volume and stowage while providing a supply of fresh food.

Humidity Validation Payload: An automated payload to study the effectiveness of various condensing heat exchanger technologies.

Many human support system products also have potential terrestrial applications in areas such as waste recycling and water treatment. They can also be applied to plant and animal science systems, ground-based air and water systems, naval submarine environments and plant-based controlled environments.

Testing Capabilities

ORBITEC uses in-house testing capabilities to validate and verify operation of systems, subsystems and components. The test capabilities include vibration, vacuum, thermal cycling, humidity cycling, shock, lunar dust exposure and lifetime testing.

These combined capabilities provide ORBITEC with the ability to conduct testing in a very time-efficient manner along with the ability to generate custom test scenarios when applicable. Other capabilities supporting testing include precision gas mixing capabilities and gas chromatography mass spectrometry.



Human Support Systems & Instrumentation

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