

Orbital Technologies Corporation (ORBITEC)

Implementation Partner

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Systems with Flight Heritage

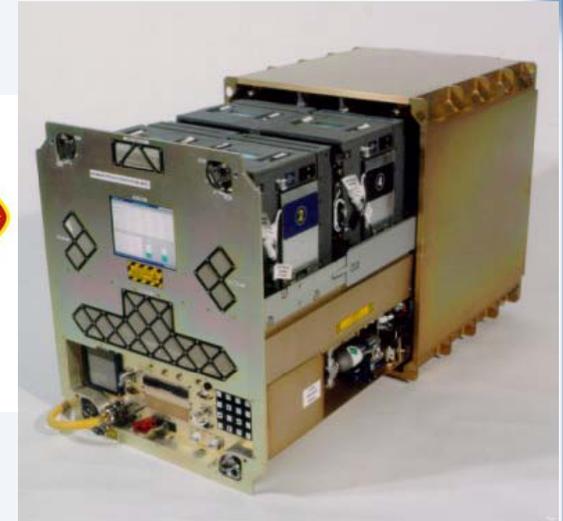
- Biomass Productions System (BPS)
- Astrogarden
- ADVASC on behalf of WCSAR



BPS Specification

MAIN SPECIFICATIONS

- Size: double mid-deck locker
- Chamber shoot area: 964 cm²
- Shoot height: 18.8 cm
- Temperature: 18 – 35°C ± .2°C
- Humidity: 65 – 90 % RH ± 10%
- Light: 0 – 350 μmol/m²/s
 - (cool white fluorescent)
 - up to 750 μmol/m²/s (with red/blue LED lights)
- CO₂: up to 3,000 ppm (no scrubbing)
- Ethylene removal
- Video still imaging of chamber
- In-Flight Access: Allowed
- Express rack Ethernet communication interface
- Regenerable H₂O recovery loop, H₂O supply
- Replenishable CO₂ supply



BPS on ISS



Harvesting Brassica on Station

BPS Enclosure

- Mid deck compatible
- Express rack compatible
- Has flight Heritage (previously flown on STS and ISS)
- ORBITEC can provide structural verification for new payloads to be integrated into enclosure
- Adaptor plates provide flexibility in mounting
- Integrated rail system allows payload to extended from Express Rack



Astrogarden

- Flight Heritage - STS 118
- Can grow a variety of crops
- Relatively low cost to prepare for flight
- Utilizes ambient lighting, temperature, humidity, and gas concentrations



Advanced Astroculture™ Plant Growth Chamber (ADVASC)

- ORBITEC provided on behalf of Wisconsin Center for Space Automation and Robotics (WCSAR)



ISS005E07212



ADVASC Specifications

MAIN SPECIFICATIONS

- Size: Double mid-deck locker
- Chamber shoot area: 496 cm²
- Shoot height: 33.5 cm
- Root depth: 5.5 cm
- Temperature: 16 - 45° C ± 0.5 ° C
- Humidity: 40 - 95 %RH ± 3%RH
- Light Intensity: 0 - 550 μmol/m²/s (LED Red)
- 0 - 70 μ mol/m²/s (LED Blue)
- CO₂: 400 - 2000 ppm
- Ethylene: < 50 ppb
- Nutrient delivery: Capillary mass transfer through rooting matrix
- Water recovery: 1.1 l/day (Max.)
- Control Method: Automated process
- In-Flight Access: Allowed



ADVASC Flight Heritage

- ISS Increment 2, 6A to 7A
Experiment: seed-to-seed development of *Arabidopsis thaliana*
- ISS Increment 4, UF-1 to 8A
Experiment:
 - a) Seed-to-seed development of *Arabidopsis thaliana*
 - b) DNA expression of *Arabidopsis thaliana*
- ISS Increment 5, UF-2 to 9A
Experiment: Soybean seed-to-seed development



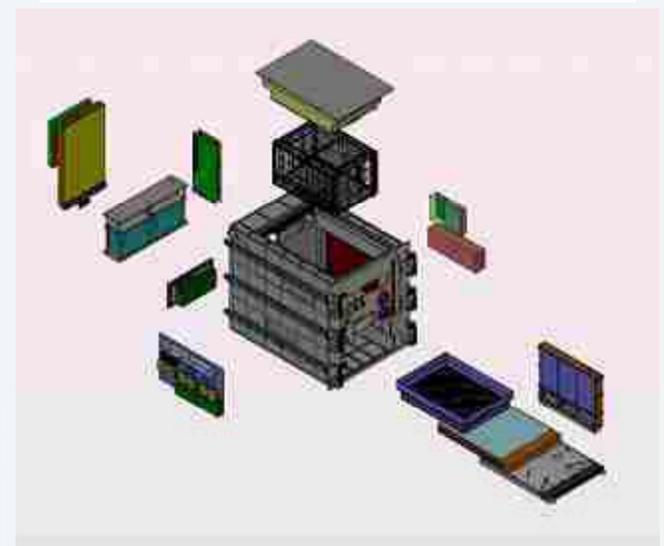
Potential Flight Systems

- Advanced Animal Habitat (AAH)
- VEGGIE
- Solid State Lighting

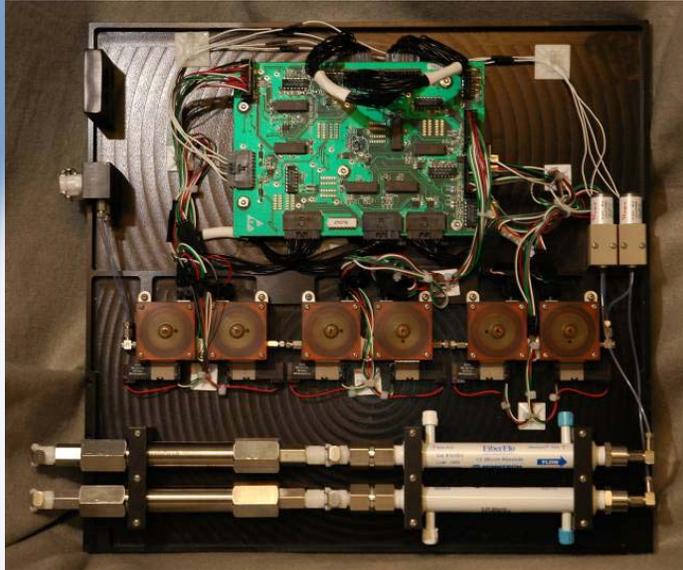


Advanced Animal Habitat (AAH)

- Designed for Rat experiments
- Built and tested Science Evaluation Unit (Ground based)
- Flight Hardware Designed, most prototyped
- Biological Research Program for animals



AAH Component Hardware



Automated Water Delivery



Stowable Cages

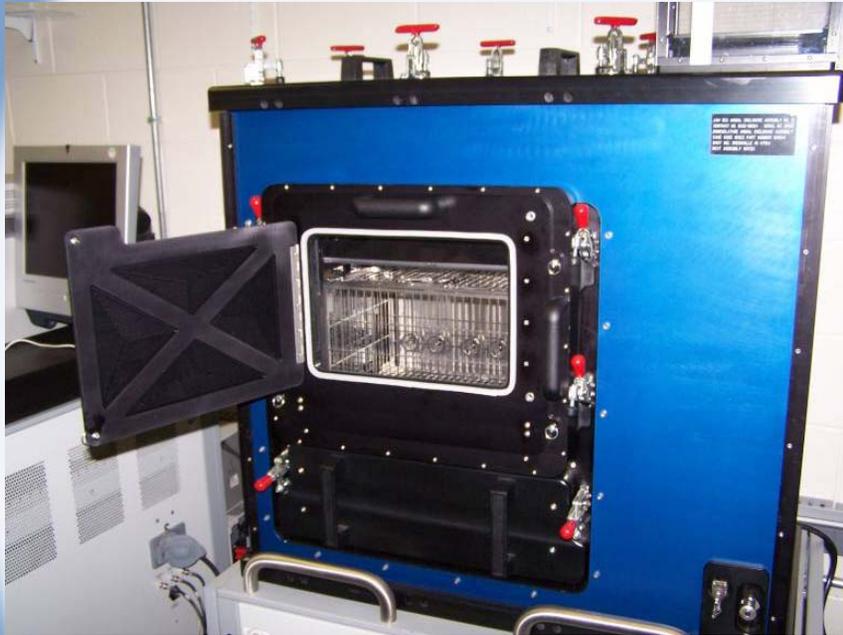


Food Bar Delivery



AAH Science Evaluation Unit

- Built and tested Science Evaluation Unit (ground control based testing)



Deployable Vegetable Production System (Veggie)

- Store several in crew transfer bag
- Growing area: 0.16 m²
- LED based lighting system
- Utilizes ambient environment for temperature, RH, and gas composition
- Currently pursuing efforts to advance flight readiness level



Solid State Lighting

- Can produce up to 50 $\mu\text{mol}/\text{m}^2/\text{s}/\text{Watt}$
- Control of individual spectral components
- Does not require double containment
- Low radiant heat
- Robust



Mission Support Facilities

- LED based Controlled Environment Rooms
 - Biosafety level 2-P
- On site mission support room



Test & Validation SRMQA

ORBITEC uses in-house testing capabilities to validate and verify operations of systems, subsystems, and components. All of the testing capabilities below provide ORBITEC with the ability to conduct testing in a very time-efficient manner along with the ability to generate custom test scenarios where applicable.

- Vibration shaker table w/ slip table (5-30kHz)
- Temp cycling chamber (8 ft³)
- Humidity cycling chamber (9 ft³)
- Space vacuum chamber (<10⁻⁶ torr)
- Acoustic metering equipment
- Controlled environment room
- Gas mixing (up to 10 gases)
- Lunar dust test chamber
- Gas Chromatography / Mass Spectrometer (GC/MS)



Vibration



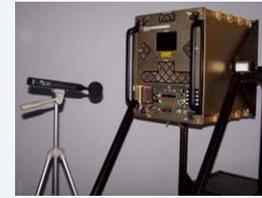
Temp. Cycling



Humidity



Space Vacuum



Acoustics



Controlled Environment



Gas mixing



Lunar dust



GC/MS



Facilities



Main Office Building



Large Scale Development Facility



LED based Controlled Environment Chambers



Class 100,000 Clean Room



Electronics Assembly Lab



Machine Shop



Large Scale Environmental Chamber

