Large Plant Growth Chambers: Flying Soon on a Space Station Near You!

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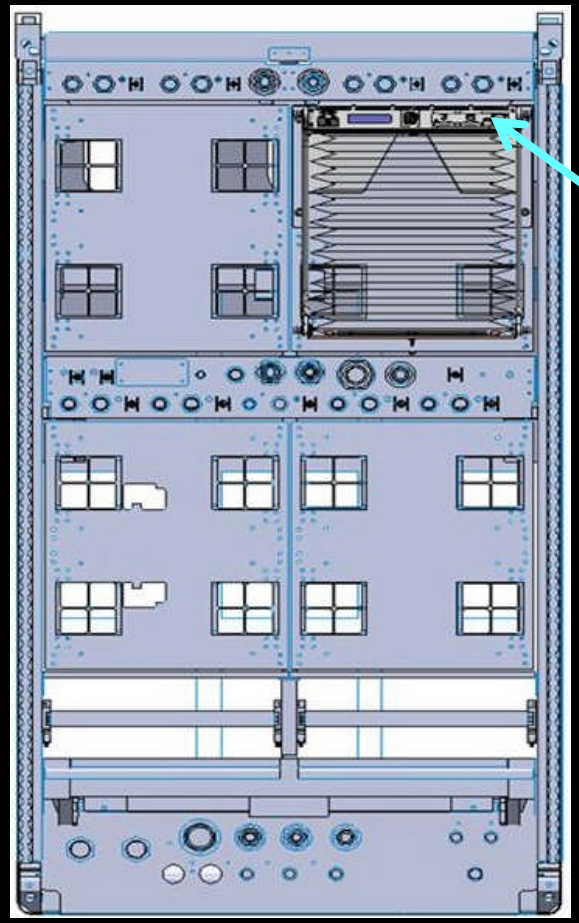
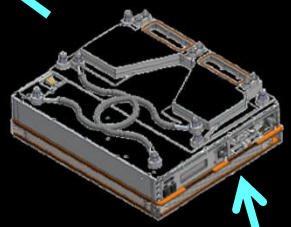
Veggie

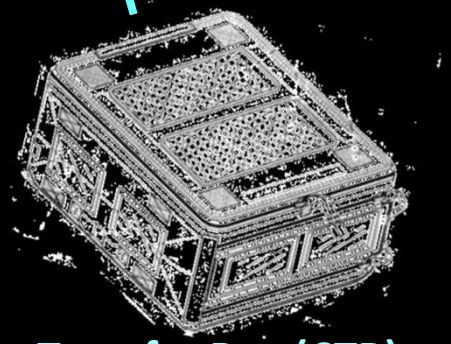
Veggie Concept



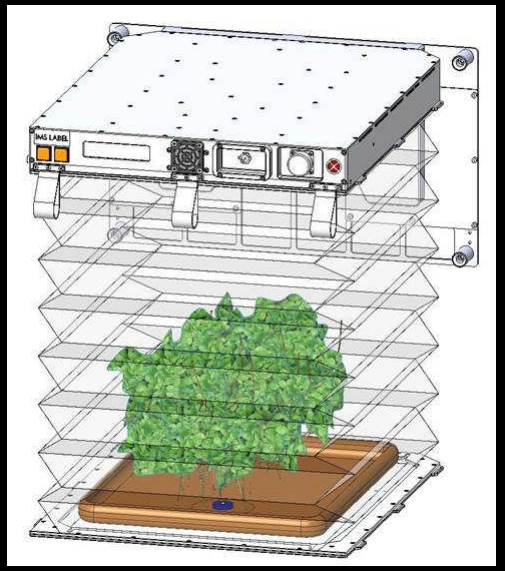
Express Rack



Veggie unit



Cargo Transfer Bag (CTB)



An easily stowable, simple, low resource plant growth system capable of supporting plant growth for improving crew habitability.

Stows in small volume, but provides large growth volume

Images courtesy of ORBITEC

Veggie

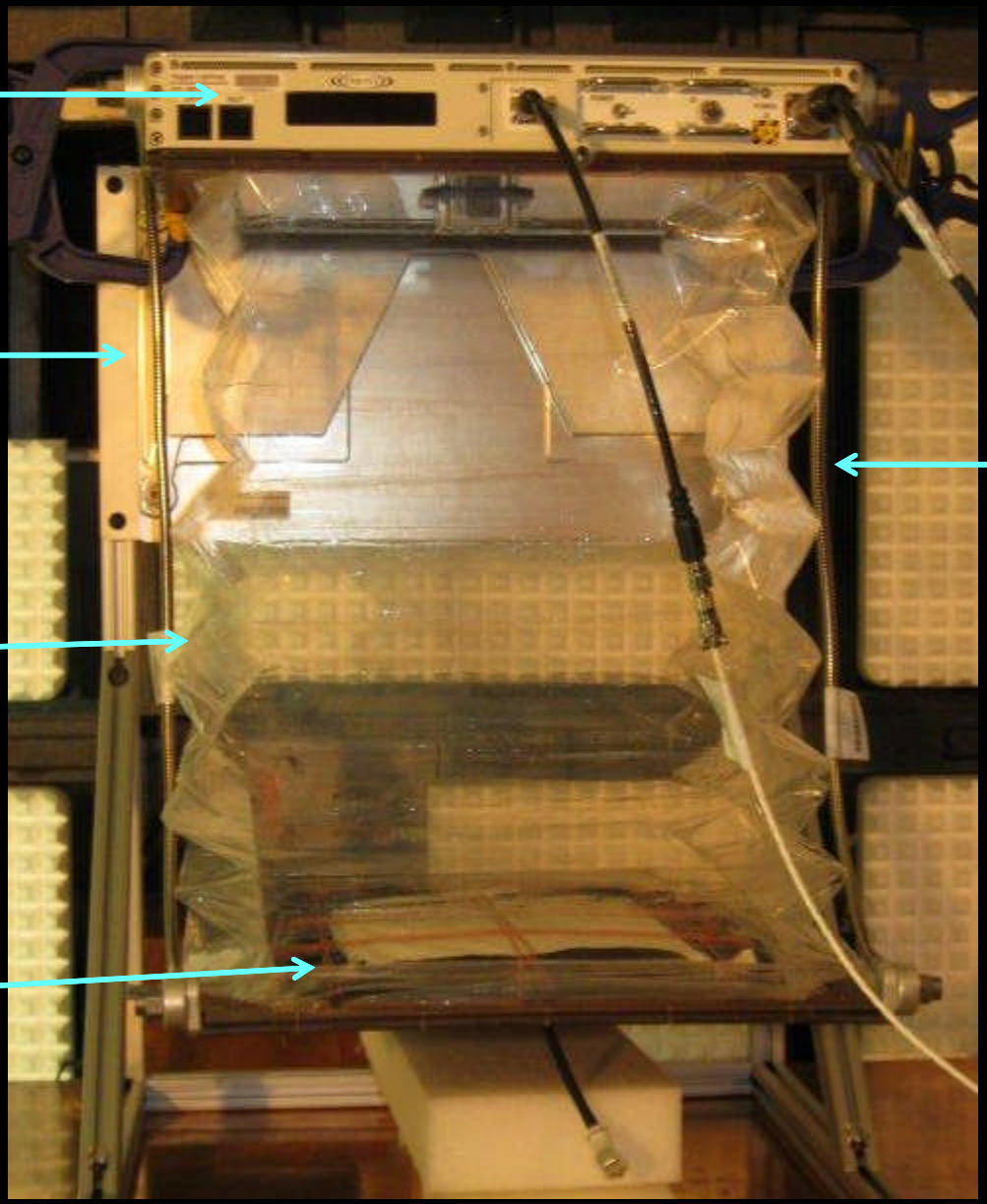


Image courtesy of Felix Joe

Designed and built by Orbital Technologies Corporation (ORBITEC)

Veggie Specifications

- LED Light Cap: Red (630 nm): low, med, high
  Blue (455 nm): low, med, high
  Green (530 nm): on/off
- Cabin Air Fan: Low / High / Off
- Footprint: Baseplate: 29.2 cm x 36.8 cm
  Root mat: 21.6 cm x 35.6 cm
- Max. Height: 47 cm empty; 41.9 cm w/ root mat

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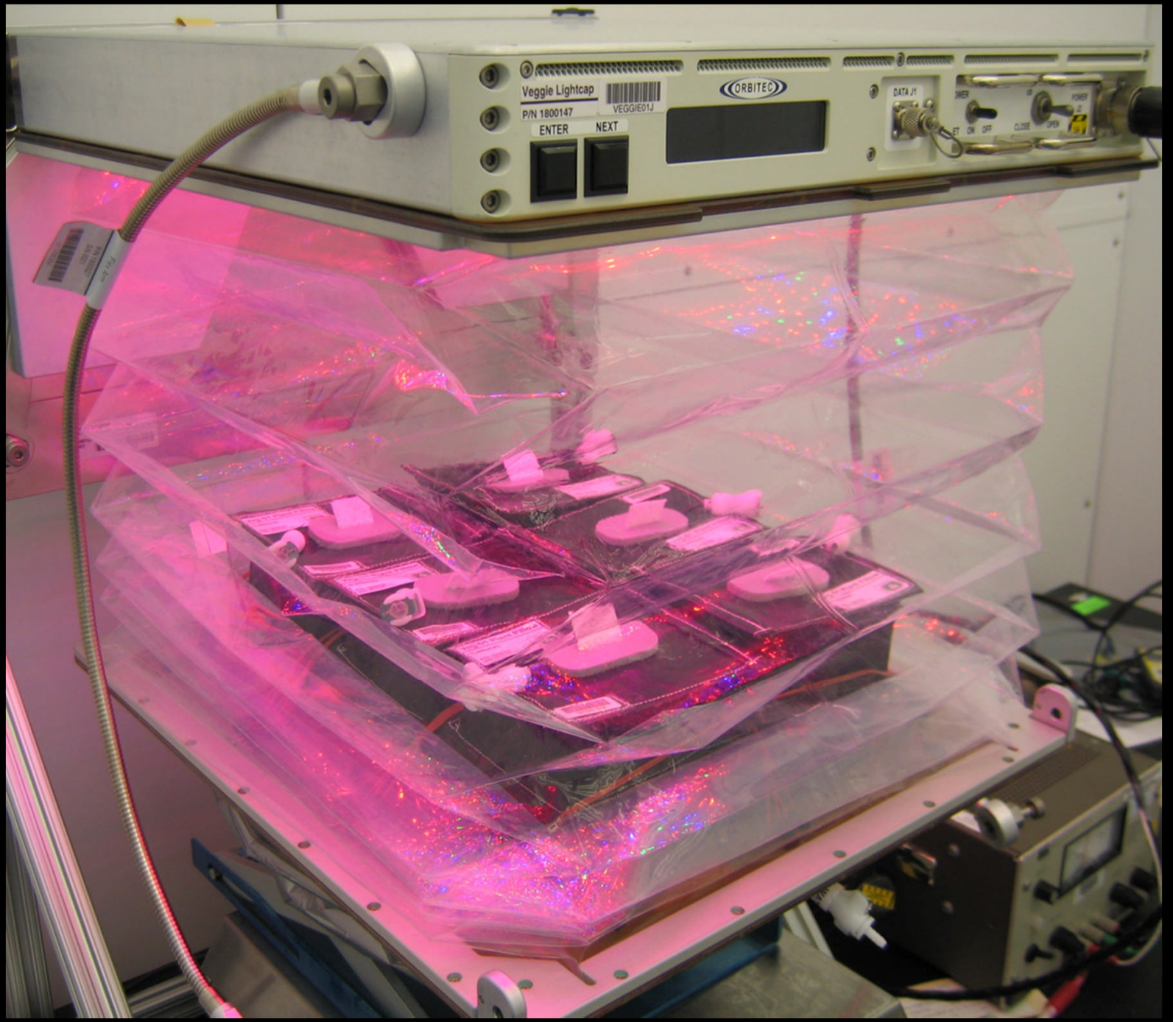


Rooting Pillow Concept

- Different sizes for variety of plant types
  - 1, 2, 3 or 6 per Veggie
- Media and fertilizer containment
- Plant/glue seeds dry
- Hydrate on orbit
- Passive wicking from reservoir
- Minimal crew time
- Single use, disposable

Crop Selection for VEG-01

- Reliable germination
- Rapid growth
- Low native microbial levels
- Palatability / acceptability
- Attractiveness
- Antioxidants

'Outredgeous'
red romaine lettuce

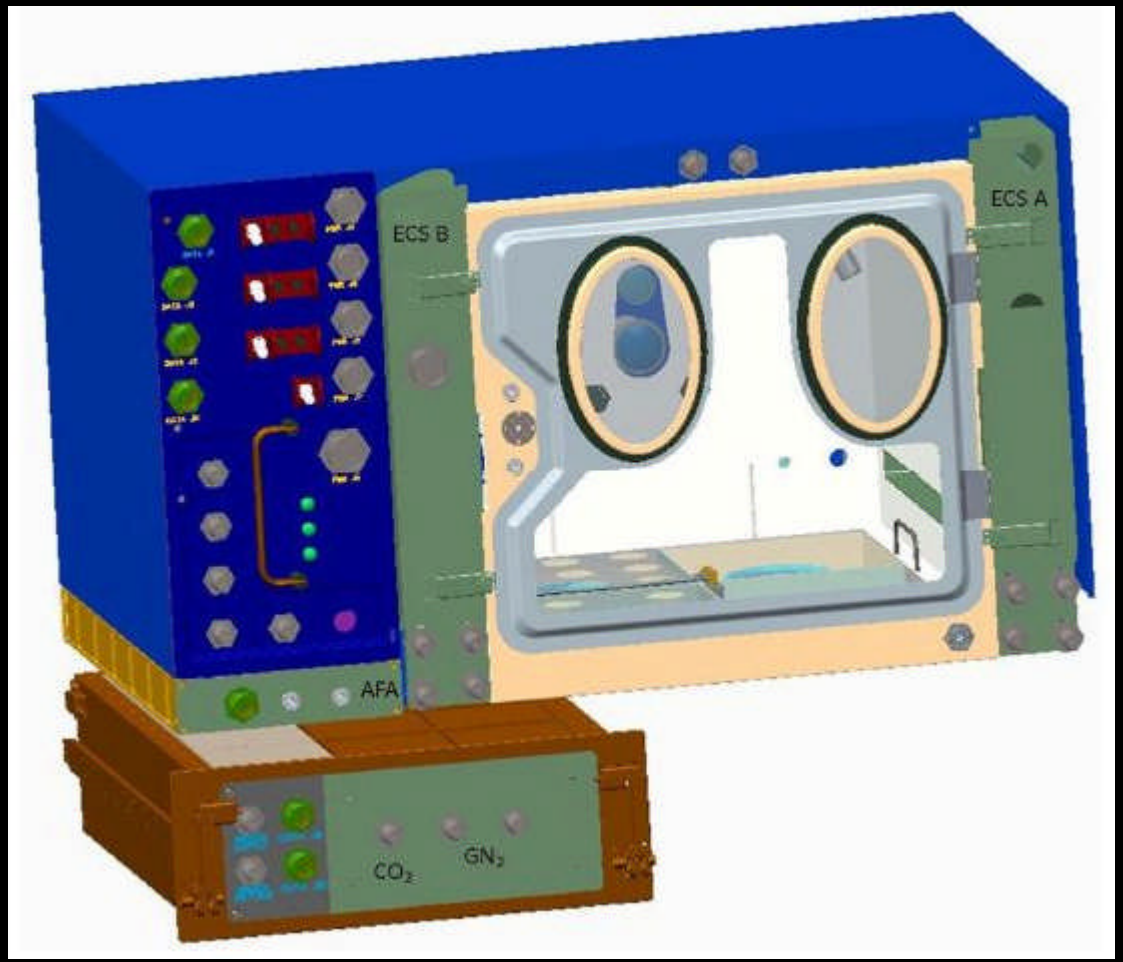
VEG-01
Hardware Verification Test - Goals

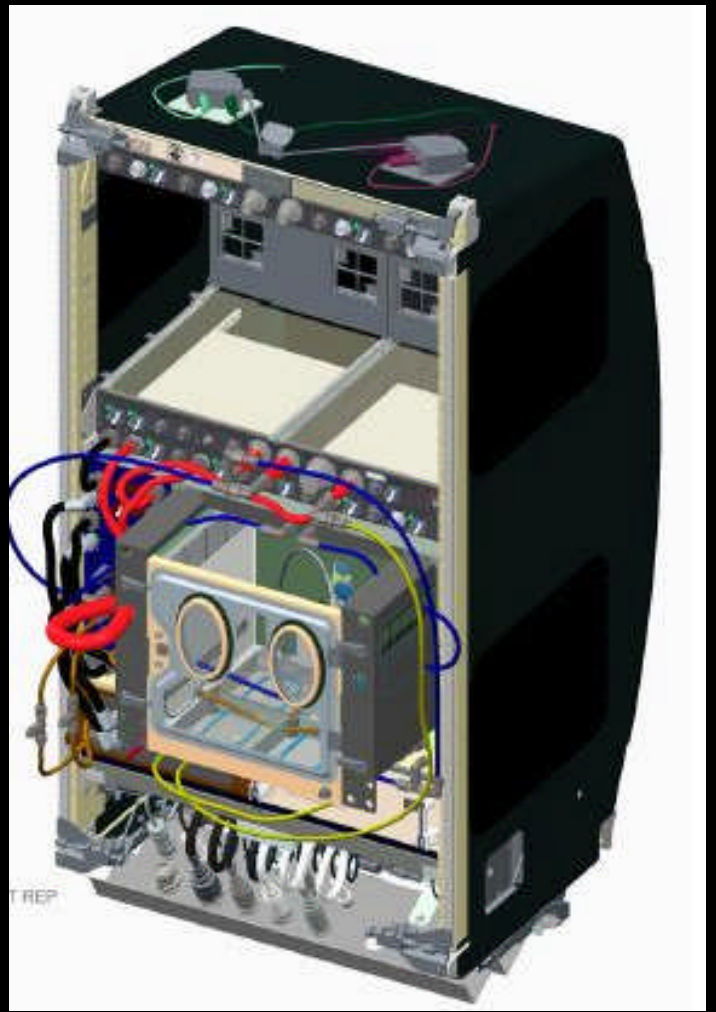
- Demonstrate hardware function on ISS
- Test procedures for Veggie setup and operation
- Demonstrate plant pillow concept
- Compare two media sizes for plant growth
- Look at microbial growth on plants, in pillows, and on surfaces
  - Gather food safety data
- Assess plant productivity and crew response
- Collect baseline data for future Veggie researchers

VEG-01 on-orbit harvest (6/10/14)

ISS Plant Habitat

Hardware Overview

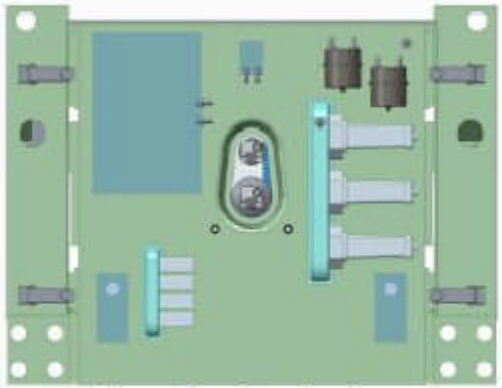




Chamber slides out 10” from main unit for viewing through the top window.

Growth Chamber

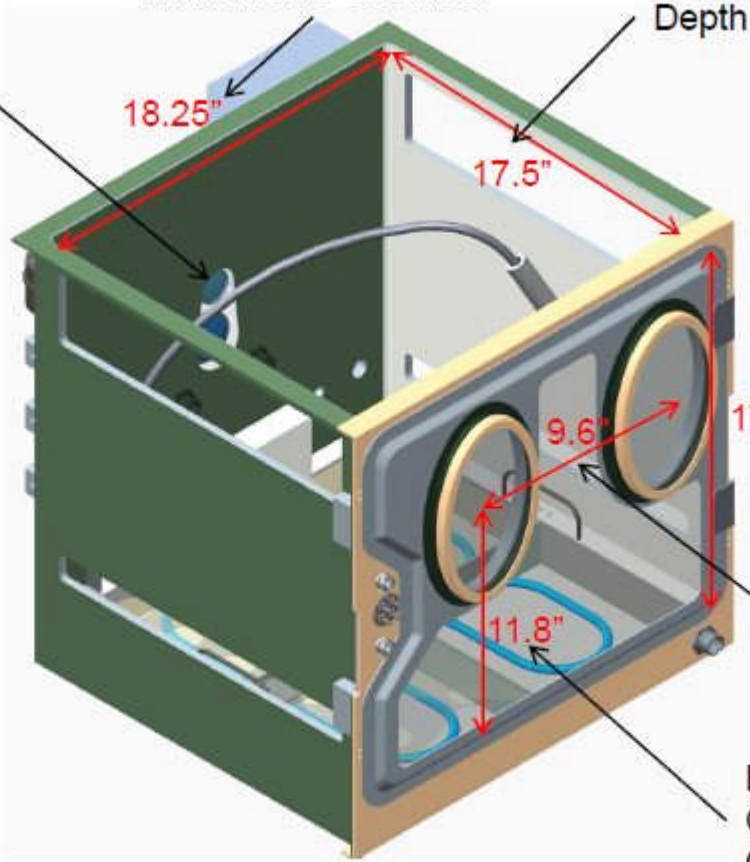
2 Cameras are mounted
On the back of the chamber for
Color and near infrared shots.



Chamber back view
(with ECS installed)

Width Inside Chamber

Depth Inside Chamber



Height from top
of Science Carrier to
top of window of
the Chamber

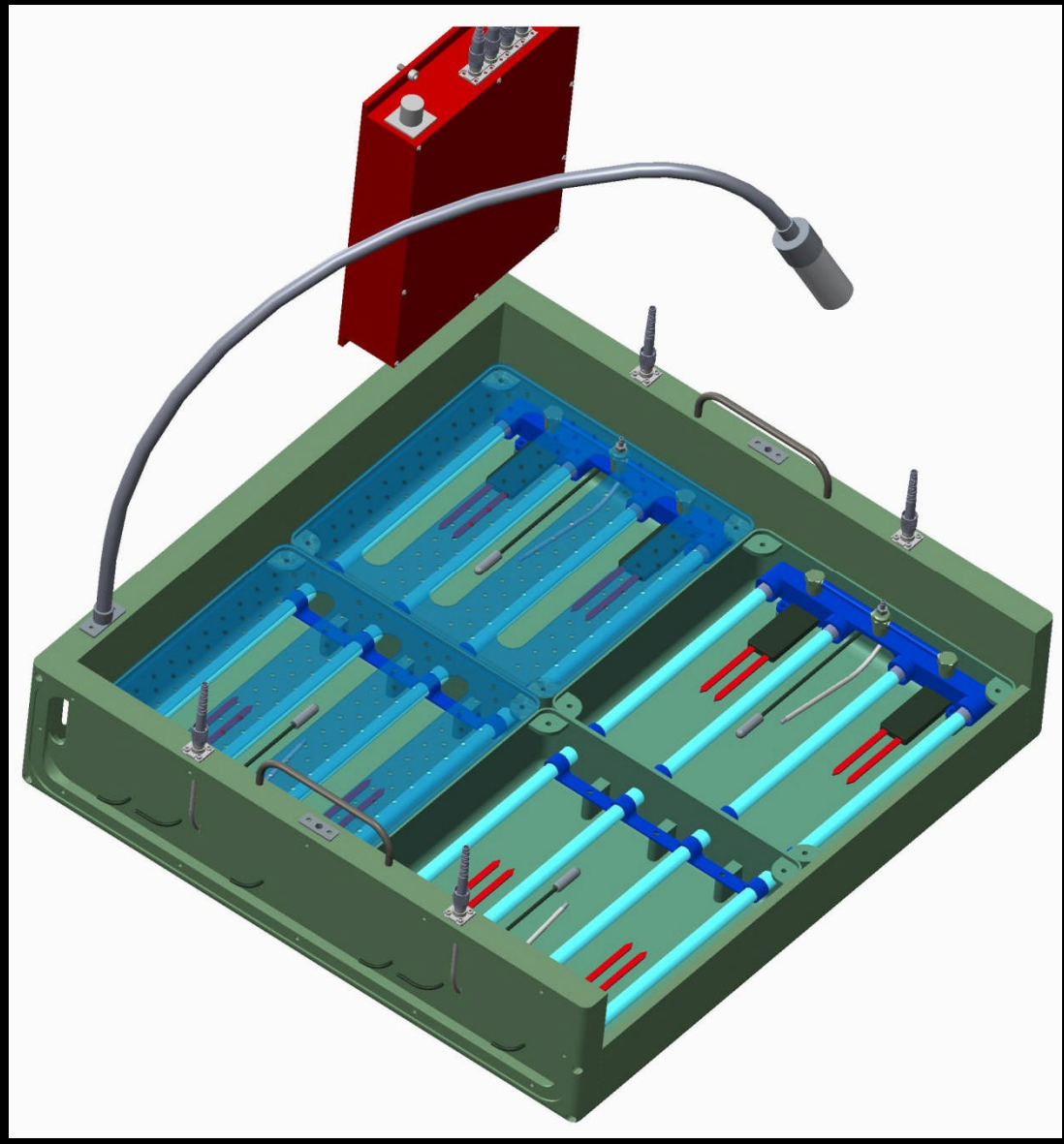
Distance between the
Glove port centers

Height from centerline of
Glove ports to top
Of Science Carrier

Glove Port Ovals are
Each 7.5" tall and 4.5" wide.

Not Shown: Cabin light cover. There will be a removable fabric cover to block cabin light from entering the Growth Chamber.

Base Science Carrier



Specifications

- Growth Light : Assembly — 0-1000 µmol m^{-2} s^{-1} PAR in increments of 50
  Red (630-660 nm); Blue (450±10 nm); Green (525±10 nm); White (LED); Far Red (730 nm)
- Uniformity — ±15% (15 cm below GLA, 5 cm in from wall)
- Temperature: — 18°C-30°C (±1°C)
- RH — Controlled / monitored: 50-90% (±5%)
- CO_2: — Controlled / monitored: 400 ppm-5000 ppm (±50 ppm or 3%)

Specifications (Cont.)

- Ethylene: Scrubbed to below 20 ppb
- Air Flow: Controlled between 0.3-1.5 m/s
- Leak Rate: ≤10% by volume a day
- Root Zone Moisture: Monitored 25%-100%(±10%) Controlled by flow rate

Growth Chamber

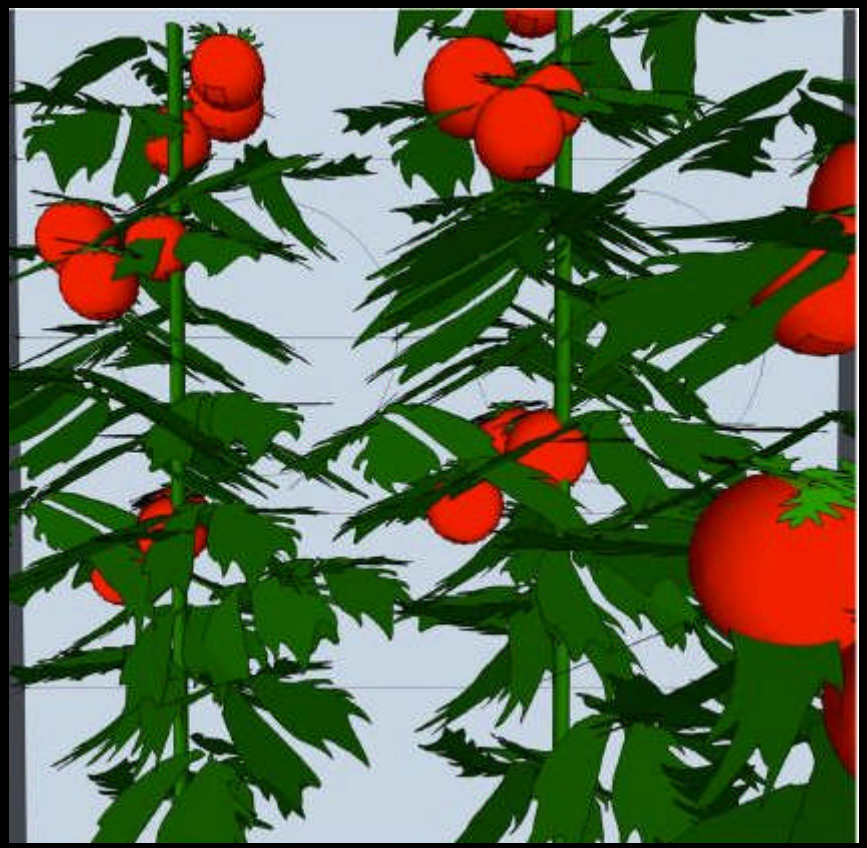
- Shoot area: ≥1708 cm^2
- Height: 48 cm total

Cameras

- Top Down and Side Viewing
- Light and Dark Cycle (IR) Imaging

Side view, color, wide angle

Side view, near IR, narrow angle



PH Additional Features

- Plant experiments up to 135 days
- Removable Science Carrier Tray – base design – 5 cm
- Door plus sleeve ports
- Window
- PAR sensor
- O_2 Sensor-Root & shoot
- CO_2 Sensor
- CO_2 draw-down capability
- Leaf Temperature Sensor
- Air pressure monitored and maintained
- RH condensate recycling
- Condensate measuring
- Air filtration
- Ionizing radiation measurements
- Water and nutrient delivery
  - Porous tubes, solid media
  - Liquid NDS or solid fertilizer
- Sample ports- air, water

Thank you!