

**NCERA-101 STATION REPORT**

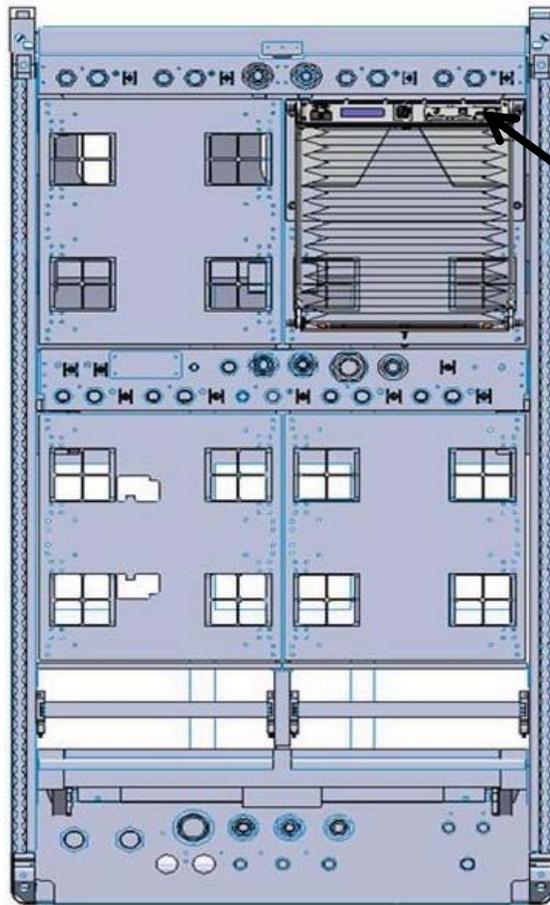
**KENNEDY SPACE CENTER**

**Large Plant Growth Hardware  
for the International Space Station**

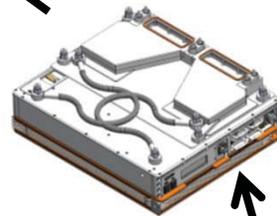
# Veggie



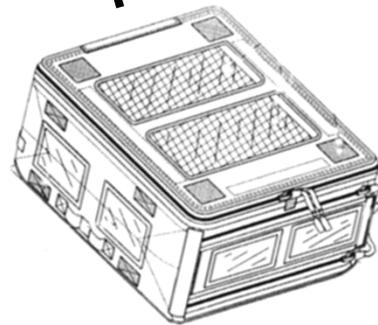
# Veggie Concept



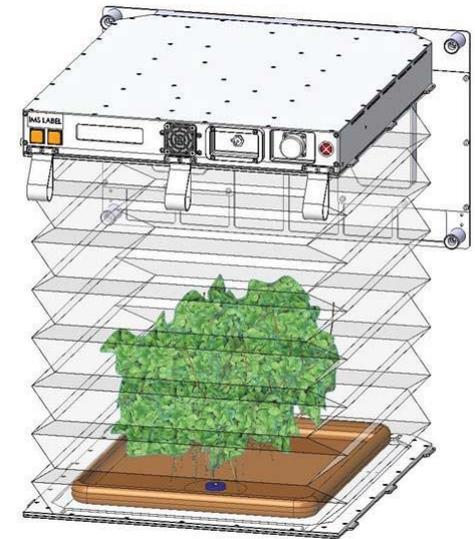
**Express Rack**



**Veggie unit**



**Cargo Transfer Bag (CTB)**

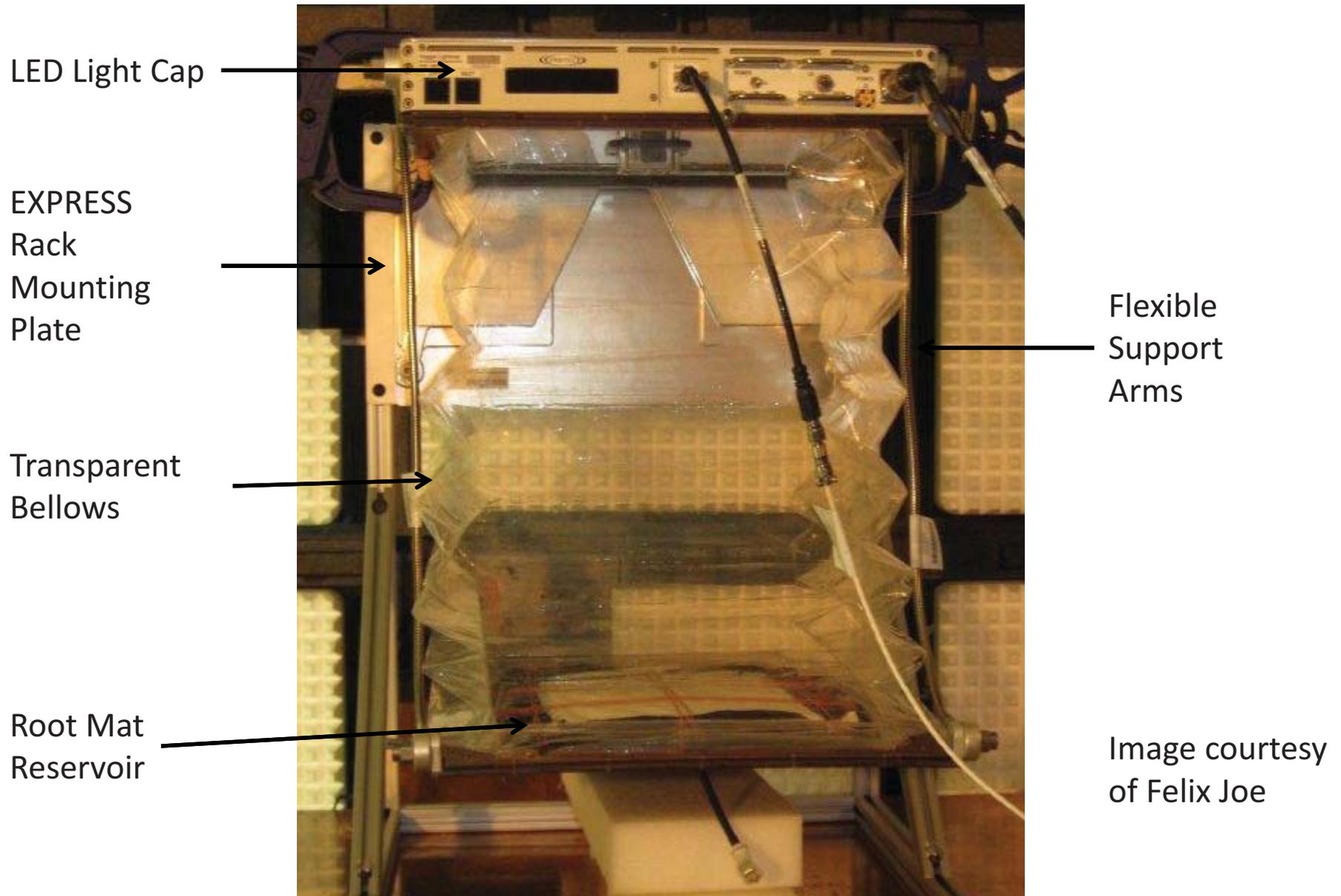


**An easily stowable, simple, low resource plant growth system capable of supporting plant growth for improving crew habitability.**

*Stows in small volume, but provides large growth volume*

**Images courtesy of ORBITEC**

# Veggie

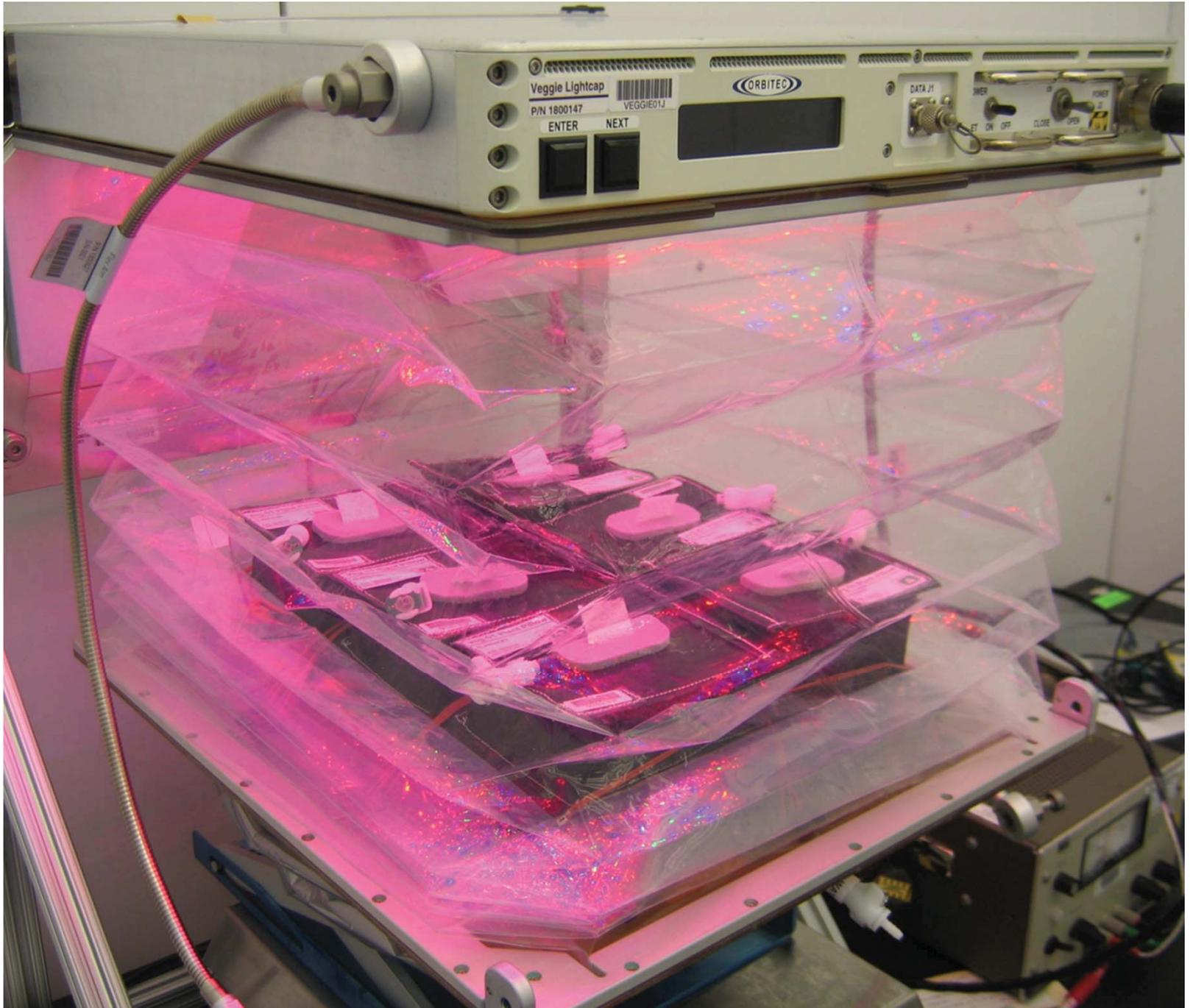


Designed and built by Orbital Technologies Corporation (ORBITEC)

# 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

Designed  
and built by  
Orbital  
Technologies  
Corporation  
(ORBITEC)





# Crop Selection for VEG-01

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



**'Outredgeous'**  
red romaine lettuce

# VEG-01

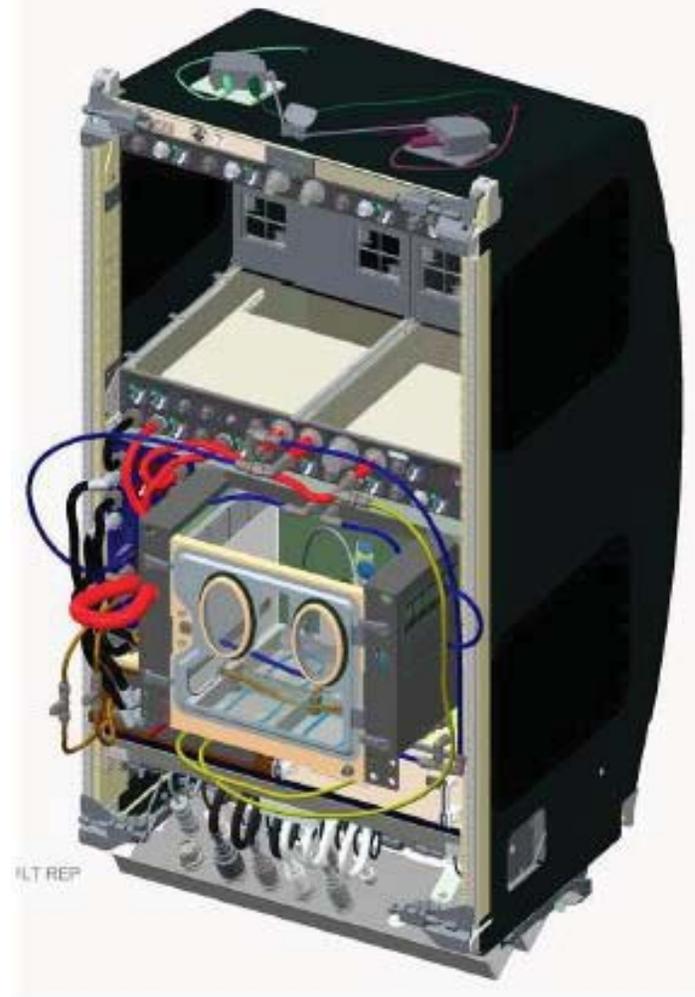
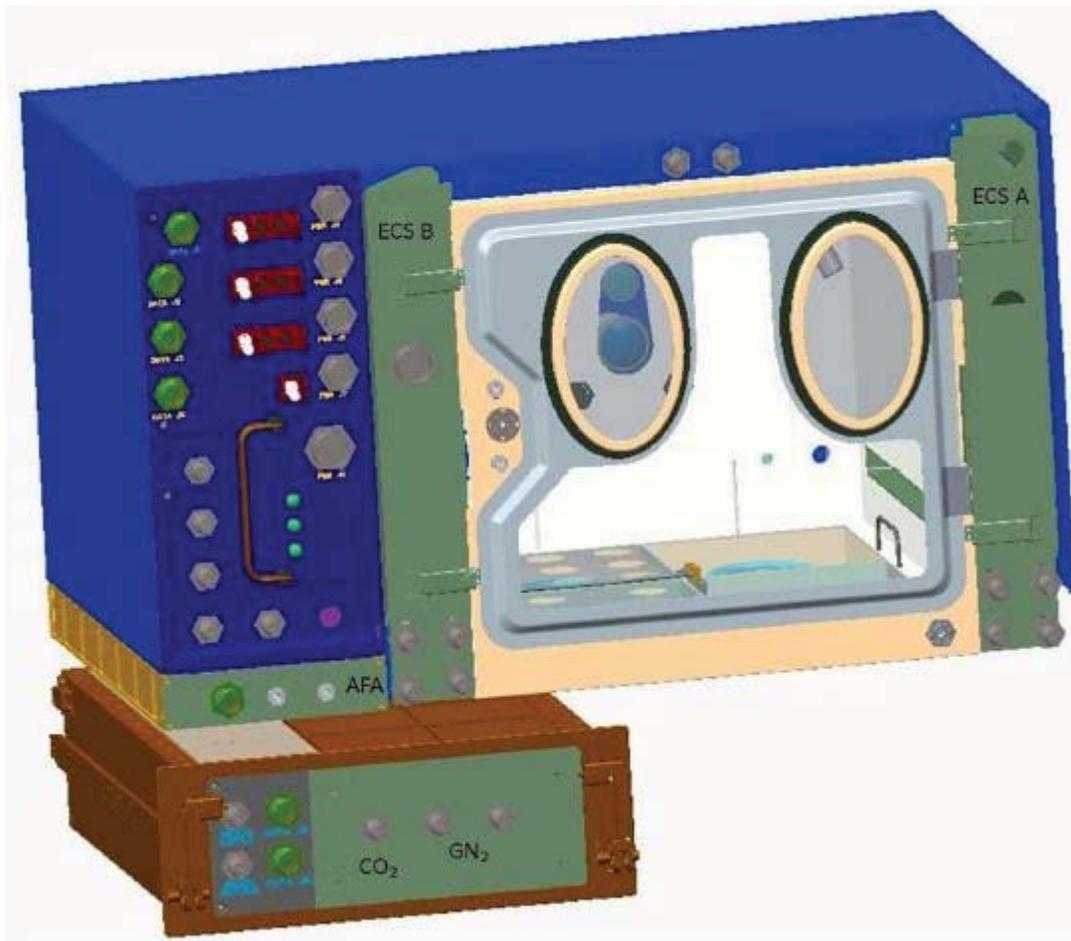
## Hardware Verification Test - Goals

- 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



# ISS Plant Habitat

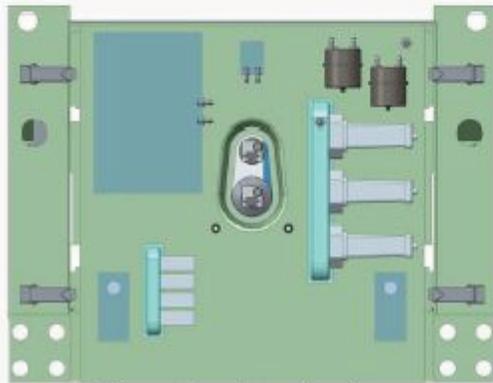
# Hardware Overview



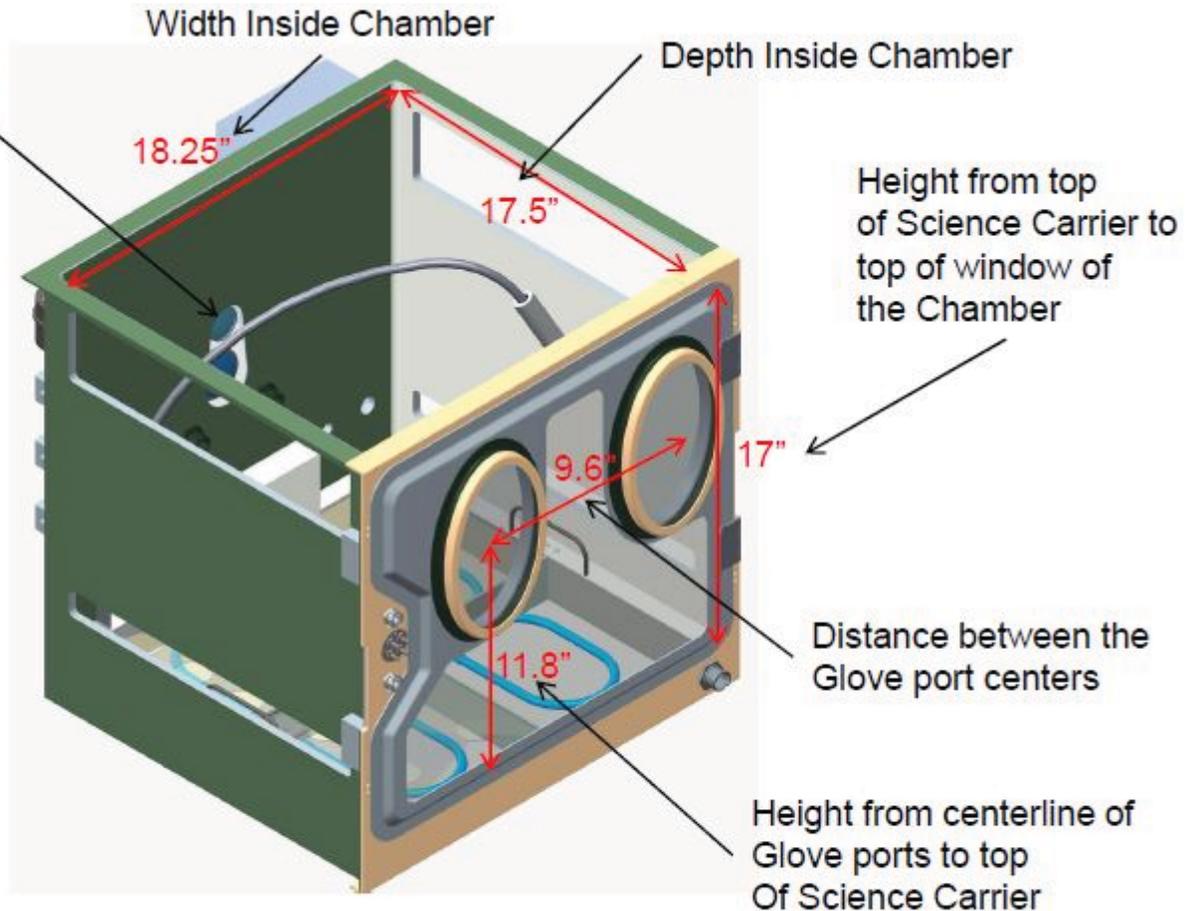
Chamber slides out 10" from  
The main unit for viewing  
Through the top window.

# Growth Chamber

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



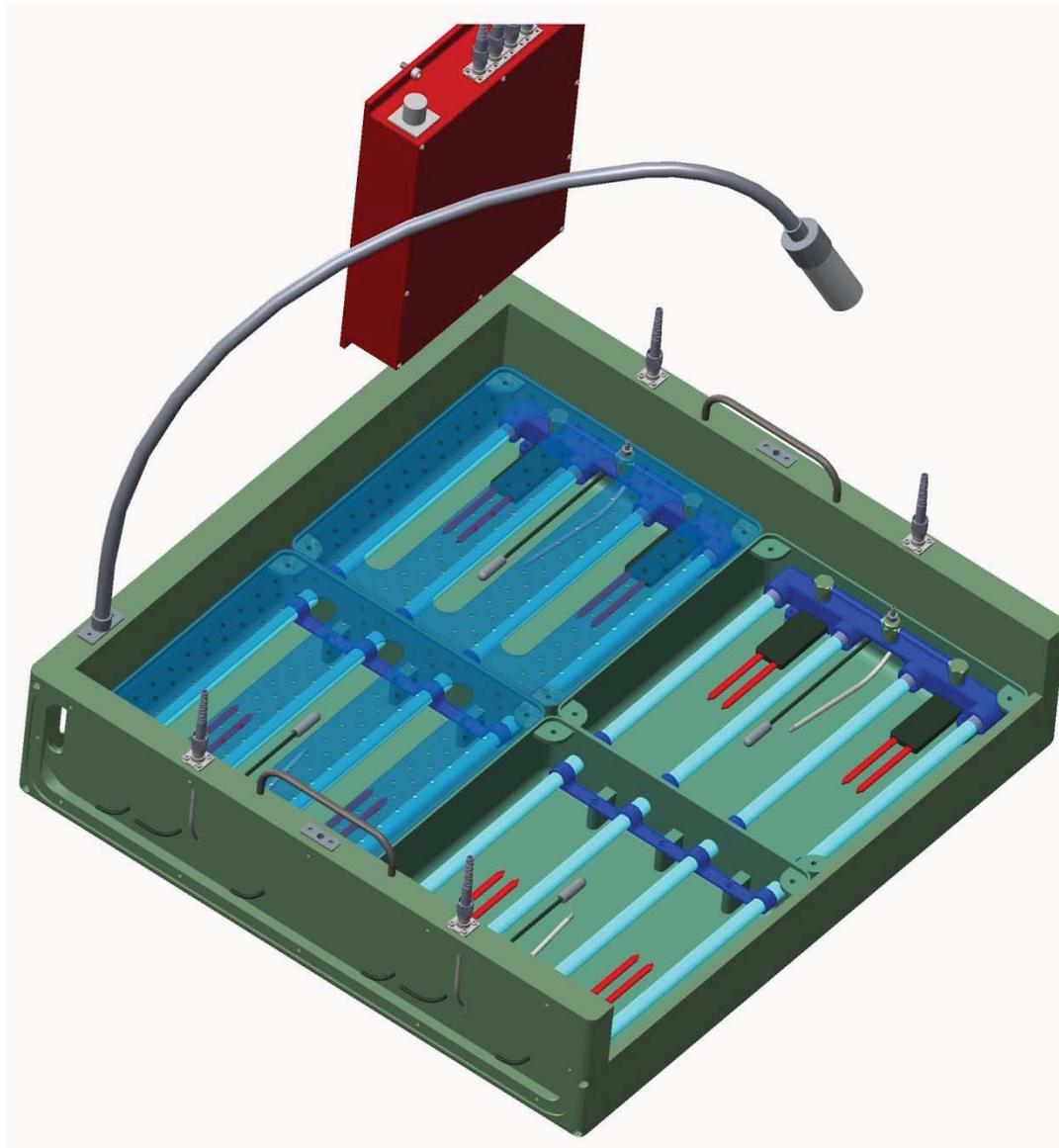
Chamber back view  
(with ECS installed)



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  $\mu\text{mol m}^{-2} \text{s}^{-1}$  PAR in increments of 50  
Red (630-660 nm); Blue (450 $\pm$ 10 nm); Green (525 $\pm$ 10 nm); White (LED); Far Red (730 nm)
- Uniformity  $\pm$ 15% (15 cm below GLA, 5 cm in from wall)
- Temperature: 18°C-30°C ( $\pm$ 1°C)
- RH Controlled / monitored: 50-90% ( $\pm$ 5%)
- CO<sub>2</sub>: Controlled / monitored: 400 ppm-5000 ppm ( $\pm$ 50 ppm or 3%)

# Specifications (Cont.)

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

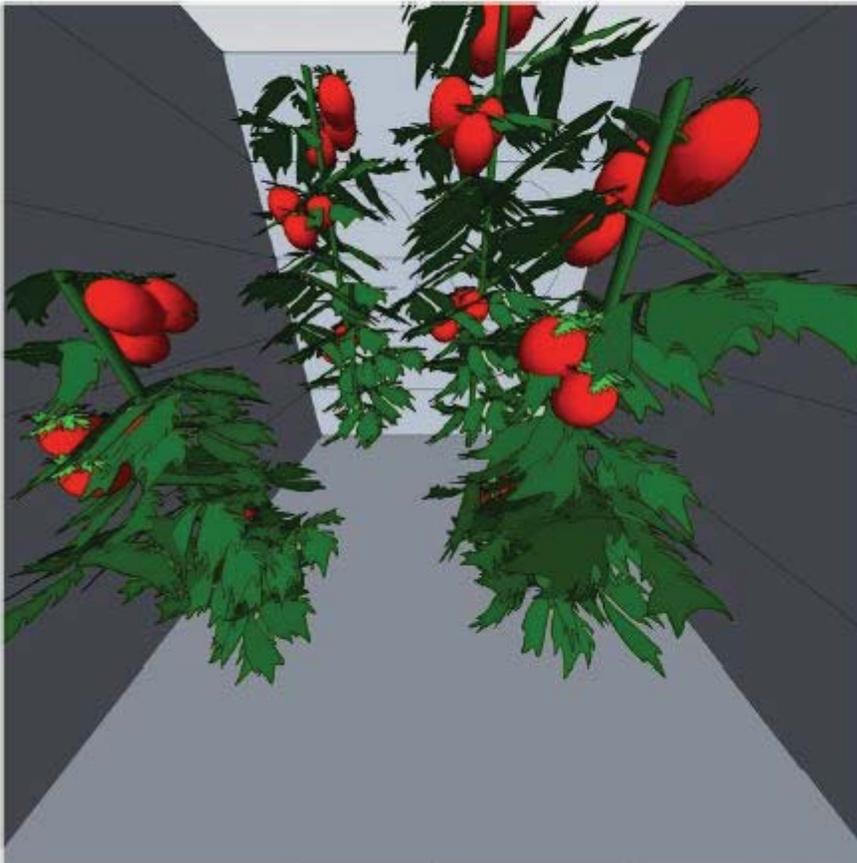
## Growth Chamber

- Shoot area:  $\geq 1708 \text{ cm}^2$
- Height: 48 cm total

# Cameras

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

Side-view, Color, Wideangle



Side-view, Near IR, Narrowangle



# 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<sub>2</sub> Sensor-Root & shoot
- CO<sub>2</sub> Sensor
- CO<sub>2</sub> 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!