National Aeronautics and Space Administration

Veggie

Vegetable Production System (Veggie)

The Vegetable Production System (Veggie) was developed by Orbital Technologies Corp. to be a simple, easily stowed, and high growth volume yet low resource facility capable of producing fresh vegetables on the International Space Station (ISS). In addition to growing vegetables in space, Veggie can support a variety of experiments designed to determine how plants respond to microgravity, provide real-time psychological benefits for the crew, and conduct outreach activities. Currently, Veggie provides the largest volume available for plant growth on the ISS.

Veggie provides lighting, water and nutrient delivery for plant growth. It utilizes the cabin environment for temperature control and a source of carbon dioxide for photosynthesis. Veggie contains a large adjustable light emitting diode (LED) light bank and a reservoir that supplies water via capillary action to root pillows containing substrate, nutrients and seeds. Water is administered on-orbit to initiate seed germination and periodically added throughout the growth cycle until the vegetables are harvested.

Specifications:

Light Provision

- 100-500 µmol m^{-2} s-1 photosynthetic photon flux density (PPFD)
- Red (630 nm), Blue (455 nm) and Green (530 nm)

Cabin Air Fan Settings: Low / High / Off

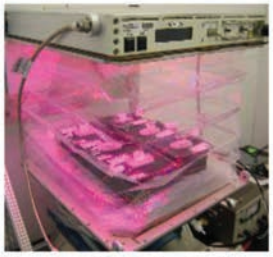
Baseplate Footprint: 29.2 cm x 36.8 cm

Maximum Height: 47.0 cm empty; 41.9 cm with root mat

Veggie Configured for Growth of Lettuce

Veggie LED light bank.

Veggie plant pillow with quick disconnect fitting for adding water.



Veggie with 6 plant pillows contained within adjustable bellows.

Astronaut Steve Swanson harvesting lettuce grown on ISS.

Astronauts Kjell Lindgren (left) and Scott Kelly (right) enjoying freshly harvested lettuce grown on ISS.

Astronaut Steve Swanson basking in the glow of Veggie.

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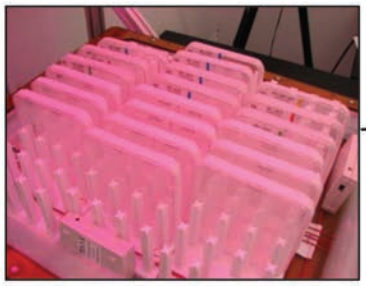
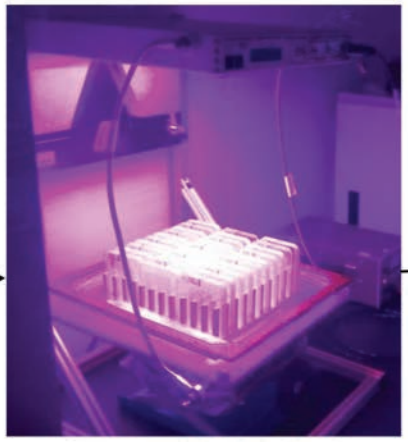
Veggie has also supported Petri plate based science experiments as part of the Kennedy Space Center Advanced Plant Experiments on-orbit (APEX) payload series. APEX missions have included monocot and dicot plant species that were grown for a pre-defined duration, photographed, harvested, and preserved for return to Earth. In some instances, Petri plates have undergone fluorescent microscopy within the Light Microscopy Module (LMM).

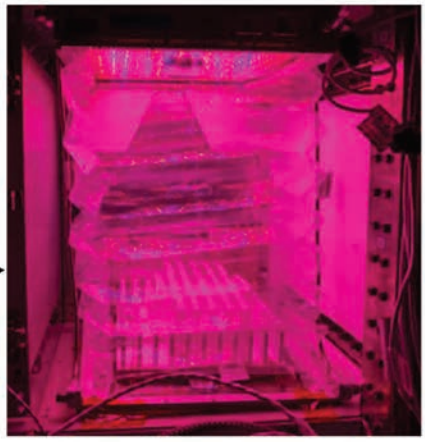
Veggie Configured for Petri Plate Science Experiments



Petri plate holder concept containing up to 30 plates.



Plates containing *Arabidopsis thaliana* in Veggie (bellows open).



Plates containing *Arabidopsis thaliana* in Veggie (bellows closed).

Plant fixation

Astronaut Butch Wilmore fixing plants on the ISS using a Kennedy Space Center Fixation Tube (KFT).

Plant imaging

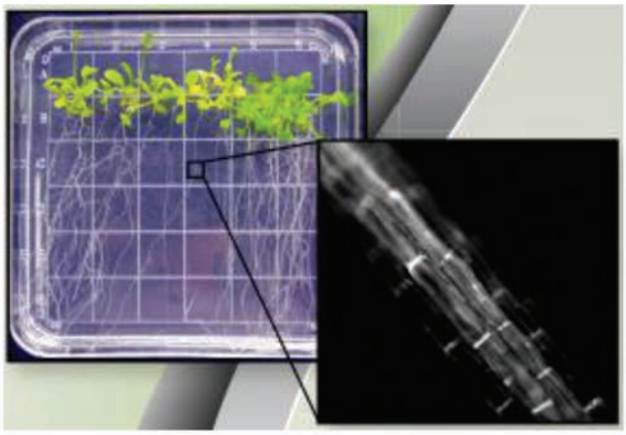


Image of an *Arabidopsis thaliana* root taken in the Light Microscopy Module (LMM).