

## Veggie Hardware Validation Test Preliminary Results and Lessons Learned

G.D. Massa, N.F. Dufour, T.M. Smith

The Veggie hardware validation test, VEG-01, was conducted on the International Space Station during Expeditions 39 and 40 from May through June of 2014. The Veggie hardware and the VEG-01 experiment payload were launched to station aboard the SpaceX-3 resupply mission in April, 2014. Veggie was installed in an Expedite-the-Processing-of-Experiments-to-Space-Station (ExPRESS) rack in the Columbus module, and the VEG-01 validation test was initiated. Veggie installation was successful, and power was supplied to the unit. The hardware was programmed and the root mat reservoir and plant pillows were installed without issue. As expected, a small amount of growth media was observed in the sealed bags which enclosed the plant pillows when they were destowed. Astronaut Steve Swanson used the wet/dry vacuum to clean up the escaped particles. Water insertion or priming the first plant pillow was unsuccessful as an issue prevented water movement through the quick disconnect. All subsequent pillows were successfully primed, and the initial pillow was replaced with a backup pillow and successfully primed. Six pillows were primed, but only five pillows had plants which germinated. After about a week and a half it was observed that plants were not growing well and that pillow wicks were dry. This indicated that the reservoir was not supplying sufficient water to the pillows via wicking, and so the team reverted to an operational fix which added water directly to the plant pillows. Direct watering of the pillows led to a recovery in several of the stressed plants; a couple of which did not recover. An important lesson learned involved Veggie's bellows. The bellows tended to float and interfere with operations when opened, so Steve secured them to the baseplate during plant tending operations. Due to the perceived intensity of the LED lights, the crew found it challenging to both work under the lights and read crew procedures on their computer. Although the lights are not a safety hazard, for visual comfort crewmembers were advised to wear sunglasses when working with the plants and then they can lift glasses to read procedures. Steve Swanson had already trail-blazed this procedure when he initiated VEG-01. The temperature and humidity data logger was relocated mid-experiment to provide measurements on both sides of the unit. Images of the plants were downlinked weekly, and videos of installation and harvest were recorded. This imaging frequency was not sufficient to monitor and respond to changes in plant growth. Plants, samples, and data loggers will be returned on SpaceX-4, scheduled to return the fall of 2014. Lessons learned will be translated into hardware and operational modifications for future Veggie payloads.