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Plant Atrium System for Food Production in NASA's Deep Space Habitat Tests

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In preparation for future human exploration missions to space, human habitat designs and concepts need to be tested to assess integration issues, power requirements, crew operations, and technology / subsystem performance. One potential subsystem for early habitats is supplemental food production. Fresh foods, such as vegetables and small fruits, could be harvested on a continuous basis to improve the diet and quality of life. The system would need to fit conveniently into the habitat and not interfere with other components or operations. To test this concept, a plant growing "atrium" was designed to surround the lift between the lower and upper modules of the Deep Space Habitat and deployed at NASA DRATS test site in 2011 and at NASA's JSC in 2012. With this approach, un-utilized volume provided an area for vegetable growth. For the 2011 test, mizuna, lettuce, basil, radish and sweetpotato plants were grown in trays using commercially available red / blue LED light fixtures. Seedlings were transplanted into the atrium and cared for by the crew. Plants were then harvested two weeks later following completion of the test. In 2012, mizuna, lettuce, and radish plants were grown similarly but under flat panel banks of white LEDs. In 2012, the crew went through plant harvesting, including sanitizing the leafy greens and radishes, which were then consumed. Each test demonstrated successful production of vegetables within a functional hab module. The round red / blue LEDs for the 2011 test lighting cast a purple light in the hab, and were less uniformly distributed over the plant trays. The white LED panels provided broad spectrum light with more uniform distribution. Post-test questionnaires showed that the crew enjoyed tending and consuming the plants, and that the white LED light in 2012 provided welcome extra light for the main hab area.