

NCERA-101 Station Report Orbital Technologies Corporation, Madison WI

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1. New Facilities and Equipment. ORBITEC has built two 15 square foot red/blue LED arrays (Figure 1). These arrays can produce over $1600 \mu\text{mol m}^{-2} \text{s}^{-1}$ at 10 cm. The arrays are water cooled so they remain at room temperature and can be operated very close to the plant canopy. We are beginning to assemble a third array and plan to make a total of six this year and another six next year. We have also made a number of submersible LED arrays that are cooled using heat pipes (Figure 2). These arrays were built for use in algal culture systems.



Figure 1. Two ORBITEC built 15 square foot LED arrays.

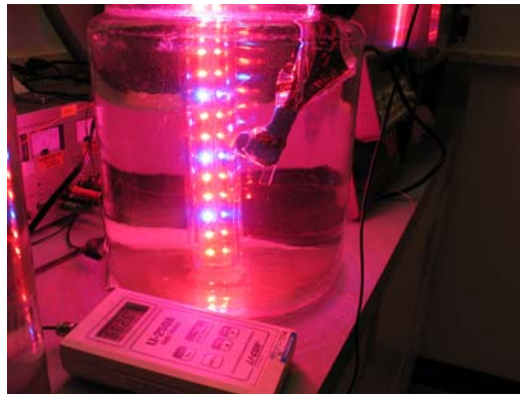


Figure 2. Submersible red/blue LED array for algal culture.

2. Unique Plant Responses.

Nothing to report at this time.

3. Accomplishment Summaries.

ORBITEC developed an LED lighting system that incorporates adaptive control, sensing plant location and powering only those LEDs that are adjacent to plant tissue. This system was recently delivered to Purdue University for testing.

4. Impact Statements.

The large scale LED units developed by ORBITEC will advance LED lighting technology for use in horticultural applications including growth chamber lighting, tissue culture lighting, and supplemental greenhouse lighting. These arrays will be used to develop design refinements, hopefully leading to the production of affordable large LED lighting systems.

5. Published Written Works.

- Morrow, R. 2006. Life Sciences Year in Review. Aerospace America, December 2006. (for AIAA Life Sciences Technical Committee).
- Gustafson, R., M. Gustafson, R. French, J. Carter. 2006. Simulants for Testing and Verifying Exploration Surface Activity. AIAA-2006-7513.
- Hunter, J.B., R.C. Morrow, and W. Butrymowicz. 2006. Energy Efficient Closed Loop Heat Pump Dryer for Solid Waste Stabilization on Long Duration Space Missions. SAE Technical Paper Series 2006-01-2088.
- Iverson, J., B. Butrymowicz and T. Crabb. 2006. Advantages of Distributed Humidity and Environmental Control. AIAA-2006-7332.
- Johnson, J. and T. Crabb. 2006. Resource Recovery: Optimizing the Architecture over the Vehicle. AIAA-2006-7200.
- Morrow, R.C., L.K. Tuominen, D.J. Smith, M.J. Mischnick, and R.W. Remiker. 2006. Vegetable production using a flat, capillary-based water delivery system. *Habitation* 10(3/4): 167 (abstract).
- Morrow, R.C. and T.M. Crabb. 2006. Controlled Environment Systems for Biosecure and High Productivity AgManufacturing. Poster A16, Bio2006. <http://www.bio.org/events/2006/poster/online/index.asp>.
- Tuominen, L.K., D.J. Smith, A.G. Vermaak, J.C. Vignali, M.J. Mischnick, and R.C. Morrow. 2006. Miniature sensors and LED lighting for advanced in vitro experimentation. *In Vitro Cellular and Developmental Biology* 42: 39-A (abstract).

6. Scientific and Outreach Oral Presentations.

R. Morrow chaired the 2006 International Conference on Environmental Systems session entitled "Bio Support Hardware/Plant Growth Systems Technology" for the AIAA Life Sciences & Systems Technical Committee.

7. Any other relevant accomplishments and activities.

ORBITEC delivered two small plant growth systems (Astro Gardens™) as part of the Education Payload Operations (EPO) Kit C that is expected to be flown from STS-118 to the International Space Station in June of 2007.

Planet LLC (the commercial arm of ORBITEC) is offering JSC-1AF lunar mare regolith simulant as a commercial product.