

NCERA-101 Station Report
Orbital Technologies Corporation, Madison WI

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1. Impact Nugget:

ORBITEC continues to develop solid state lighting systems for biological research applications. Systems have been developed for research, growth rooms, and greenhouses.

2. New Facilities and Equipment.

ORBITEC has been developing a short run electronics assembly capability for LED lighting system and other electronic board fabrication. The equipment includes a solder paste applicator, reflow oven, manual pick & place, a UV curing system for applying coatings and a variety of custom assembly fixtures. This capability will help reduce the costs of LED bars and panels along with associated electronics.



Figure 1. (L) Curing protective coating on LED bar as final step in assembly process. (R) A run of far red LED bars undergoing burn-in testing.

3. Unique Plant Responses.

Nothing to report.

4. Accomplishment Summaries.

Greenhouse lighting

ORBITEC has begun testing of solid state greenhouse supplemental lighting systems (Figure 2). These are bar type LED arrays that allow sunlight to pass through. The arrays provide about 200-250 $\mu\text{mol}/\text{m}^2/\text{s}$ of lighting at the plant canopy. The arrays allow a mix of both red (627nm) and blue (450nm) LEDs.

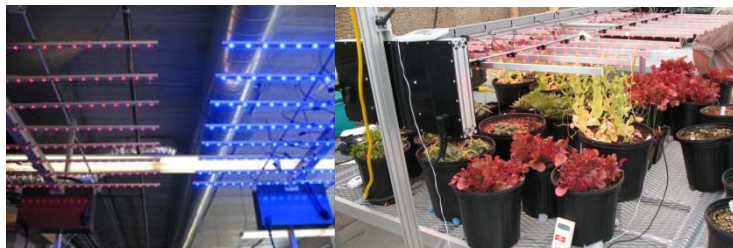


Figure 2. ORBITEC LED greenhouse supplemental lighting prototypes.

Space biology lighting

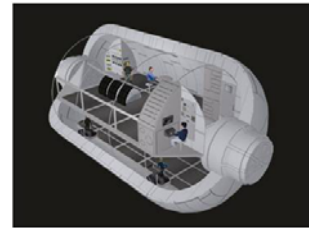
ORBITEC is working as a subcontractor to Purdue University on a NASA NRA grant entitled “Maturing Technology for Major Reductions in Energy, Mass, and Crew Time for Plant Lighting in Space”. The lighting system for this project is based on ORBITEC’s HELIAC LED lighting control system and will allow for 16 separate control zones per square foot of lighting, allowing light to be added incrementally as the plants grow.

Environmental control systems for Bigelow Aerospace

ORBITEC is working with Bigelow Aerospace to develop and integrate environmental control and life support systems, subsystems, and components for inflatable commercial space habitations, including systems for pressure control, oxygen production and supply, hydrogen supply, temperature and humidity control, ventilation, thermal transport, water processing, gas contaminant removal, carbon dioxide removal, and atmospheric composition monitoring.

5. Impact Statements.

ORBITEC is testing LED lighting configurations and control strategies with the goal of providing plant lighting with 50 to 60% less power than is currently required.



6. Published Written Works.

Gustafson, R.J., B.C. White, and M.J. Fidler. 2009. Oxygen Production via Carbothermal Reduction of Lunar Regolith. SAE Technical Paper Series No. 2009-01-2442.

Gustafson, R.J. and B.C. White. 2009. Development of a Lunar Dust Simulant. SAE Technical Paper Series No. 2009-01-2336.

Ma, Y., N. Schmitt, and R. Remiker. 2009. Results of Multifunctional Condensing Heat Exchanger for Water Recovery Applications. SAE Technical Paper Series No. 2009-01-2383.

Morrow, R.C. & R.W. Remiker. 2009. A Deployable Salad Crop Production System for Lunar Habitats. SAE Technical Paper Series No. 2009-01-2382.

Morrow, R.C. & C. M. Bourget. 2009. Use of Tinted Reflectors to Eliminate False Positives in Adaptive Lighting Control Systems. SAE Technical Paper Series No. 2009-01-2380.

Remiker, R.W., A. M. Marten, B.C. Zelle. 2009. Development of an Enhanced Brine Dewatering System. SAE Technical Paper Series No. 2009-01-2486.

Treichel, T.H. and R. J. Gustafson. 2009. Environmental Testing for the Reliability Effects of Lunar Dust. SAE Technical Paper Series No. 2009-01-2378.

7. Scientific and Outreach Oral Presentations.

Each of the papers above was accompanied by an oral presentation.

8. Other relevant accomplishments and activities.

- ♦ ORBITEC continues to be a vendor for Space Gardens (an outreach/education plant growth system) and lunar and mars regolith simulant materials.
- ♦ ORBITEC is adding a line of LED bars to its catalogue of standard products. A controller is available to drive these bars, or they can be operated using standard lab power supplies. The bars will be available in red, blue, white, green, and far red.
- ♦ ORBITEC is a major partner in the Midwest BioLink Commercialization and Business Center (Figure 3), one of the facilities that are part of the “BioAg Gateway” project being developed in Madison as a regional centerpoint for sustainability, and bio, ag, and food science commercialization. The proposed Phase I would include 5000 square feet of office, conference, and laboratory space, 17,000 square feet of flex space, 5,000 square feet of controlled environment space, 3000 square feet of head house, and 6000 square feet of greenhouse space. The site would allow expansion to ~60,000 square feet.



Figure 3. 2.6 acre central site in BioAg Gateway Campus.

9. Websites:

www.orbitec.com,