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 growth rooms and greenhouses.

2. New Facilities and Equipment.

ORBITEC continues to develop its short run electronics assembly capability for custom LED lighting system and other electronic board fabrication. We are looking for partners to develop large scale manufacturing capabilities to help reduce the costs of LED lighting systems further.

3. Unique Plant Responses.

We are seeing a uniform bleaching or fading of leaves of several varieties of plants (Figure 1). Possibly due to chemical work in our propulsion chemistry lab.

Figure 1. Bleaching of leaves from tobacco and basil. Also observed on lettuce, cucurbits, Chinese cabbage, Pak Choi, Nasturtium, and dwarf wheat.

4. Accomplishment Summaries.

Greenhouse lighting

ORBITEC has begun testing of solid state greenhouse photoperiod lighting systems (Figure 2). This 25m^2 arrays provides about 4-6 µmol m^{-2} s^{-1} of red (627nm) light at the plant canopy.

Figure 2. ORBITEC LED greenhouse photoperiod lighting prototype.

Space biology lighting

ORBITEC is working with 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 HELIAC lighting system (Figure 3) has been undergoing testing at Purdue and we have just implemented a set of hardware and software modifications to enhance its performance.

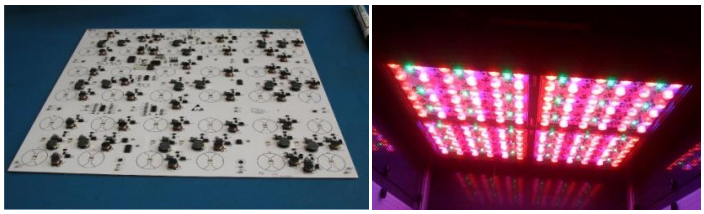

Figure 3. HELIAC lighting system. (L) Light panel. (R) Four panel array.

Environmental control systems for Bigelow Aerospace

ORBITEC conducted "contained volume, humans in the loop" testing for Bigelow Aerospace to demonstrate the life support systems for an inflatable commercial space habitation to support a crew of three for extended durations. The test included systems for pressure control, oxygen 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.
- ORBITEC will be working with Purdue University on their agricultural LED lighting Specialty Crop Research Initiative project. Part of this effort will emphasize the transfer of LED lighting technology to those working in production agriculture. This will include the development of standards to allow easier comparison of agricultural lighting systems.

6. Published Written Works.

Ma, Yonghui, N. Schmitt, B. Arneson, and R. Borchardt. 2010. Development of Plasma Air Decontamination System for Trace Contaminant Removal. 40th International Conference on Environmental Systems. Paper No. AIAA-2010-6035.

Richter, R., R. Morrow, and R. Remiker. 2010. Reconfiguration of Animal and Plant Habitat Payloads for Gravitational Biology Research. 40th International Conference on Environmental Systems. Paper No. AIAA-2010-6235.

Treichel, T.H. 2010. Environmental Test and Analysis of Ruggedized LED System Designed for Internal Vehicular Crew Lighting. 40th International Conference on Environmental Systems. Paper No. AIAA-2010-6288.

7. Scientific and Outreach Oral Presentations.

Each of the papers above was accompanied by an oral presentation. Presentations by others related to ORBITEC projects:

Massa, G.D., C.M. Bourget, R.C. Morrow, L. Poulet, C. Chun, and C.A. Mitchell. 2010. "Smart" LED Lighting for Plant Growth in Space. Presentation at 2010 ASGSB.

Mitchell, C.A., G.D. Massa,B. Riggs, K.V. Spence, J. Shephard, C.M. Bourget, R.M. Morrow, C. Chun, Y. Yang. Evolving a Novel Controlled-environment Gas-exchange System. 2010. HortScience 45(8) (Supplement)—2010 ASHS Annual Conference—August 2–5, 2010.

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 has added a line of LED bars and LED modules to its catalogue of standard products (http://www.orbitec.com/store/led_lighting.html). A controller is available to drive these bars and modules, or they can be operated using standard lab power supplies. These units are available in amber, red, blue, green, warm, neutral and cool white, UV (400nm) and far red.
- ORBITEC continues to work with the Kennedy Space Center to advance the Deployable Vegetable Production System (VEGGIE) to flight testing on ISS. A second generation prototype was delivered to KSC and a preliminary design review completed.

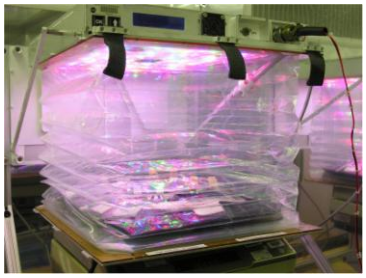

Figure 4. Vegetable production system prototype being tested at KSC.

- ORBITEC is a partner in the Midwest BioLink Commercialization and Business Center (Figure 5). The BioLink Center will offer closed BSL II greenhouses and controlled environments for plant science and commercialization. This facility has received funding and ground breaking is scheduled for this summer (2011).

Figure 5. Midwest BioLink Commercialization and Business Center.

9. Websites:

www.orbitec.com,