

**NCR-101 STATION REPORT, ORBITAL TECHNOLOGIES CORPORATION,  
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***New Facilities:***

Remodeled unused space into biology laboratory primarily for sterile culture related work.

***Equipment/Sensors/Control Systems:***

Builds:

In canopy lighting system test unit for Purdue University  
Six wavelength LED lighting system test unit for KSC  
Deployable vegetable production systems

Interesting devices we are using:

1. Hygrometrix, Inc.'s RH/Temp sensor (part number 2K-T-4-P12).
  - 0 to 100% RH full range
  - High linearity ( $R^2 > 0.998$ )
  - Low power, low current
  - Fast response (< 5 sec)
  - Condensation can occur without sensor failure
  - Up to 120C temperature range

The price per sensor is \$75.00 each but the cost is reduced when purchase in quantities. For example, 50 pieces cost \$23.00. The sensor acts as both a temperature and RH sensor. ORBITEC developed a signal conditioning PCB that outputs a 0-10VDC signal for the RH channel and also a 0-10VDC signal for the temperature channel. Therefore, temperature compensation can easily be accomplished. The 0-10VDC signal is then processed to give an accurate temperature in Celsius and RH in percentage. A second order polynomial achieves a more accurate result.

2. RMT Ltd. DX6100-01 and DX6200-01 CO2 sensor (<http://www.rmtltd.ru>)  
DX6200-01 contains custom mods requested by ORBITEC for flight use.

Specifications:

NDIR, dual channel

Range: 0 to 20,000 ppm

Accuracy +/- 50 ppm or +/- 5% (whichever is greater)

Dimensions: 100x80x40 mm

Weight : 0.6 kg

Operation conditions-

Temperature: -10 to +50 C

Humidity: 5 to 95% RH

Internally thermostabilized

Hardened for vibration

Temperature and pressure compensated

High reliability

3. UV LEDs

We are beginning to evaluate several UV LEDs that are becoming available. The wavelengths we are testing include 300 nm, 320 nm, 340 nm, 365 nm, 375 nm, 385 nm, 400 nm. We have received several of the devices but have not started testing yet.

***CE Related Projects:***

- Deployable Vegetable Production Unit – Plant growth unit that expands to 10 times its stowage volume. (NASA)
- Aseptic Plant Culture System – Environmental control systems for use at culture vessel level in sterile plant systems. (NASA)
- DRYER II - Closed Loop Biomass Dryer. (NASA)
- DMP - Dense Medium Plasma Water Purification Reactor. (NASA)
- BPSe and SpaceGarden – Education/outreach plant growth systems. (Commercial)
- Heliac II- Advanced control systems for LED lighting. (NASA)
- SLLP -Submersible LED Lighting for Photobioreactors. (USDA)
- Improved Lunar and Martian Regolith Simulant Production. (NASA)
- JSC-1a Lunar Regolith Simulant Production, Distribution. (Commercial)

***Unique Plant Responses:***

We have had reasonable growth of several vegetable crop plants on Nomex fabric wicking out from a reservoir across a sealed seam. We are looking at this for very thin root zones for stowable on-orbit plant growth systems.

***Committees/Panels:***

- ASHS CE Working Group (Morrow)
- ASGSB Education Committee (Morrow, Tuominen)
- AIAA Life Sciences & Systems Technical Committee (Morrow)
- AIAA Microgravity & Space Processes Technical Committee (Gustafson)
- AIAA Space Colonization Technical Committee (Rice, Gustafson, White)

***Recent Papers:***

Musgrave, M.E., A. Kuang, L.K. Tuominen, L.H. Levine, and R.C. Morrow. 2005. Seed storage reserves and glucosinolates in Brassica rapa L. grown on the International Space Station. Journal of the American Society for Horticultural Science, 130: 848-856.

Massa, G.D., C.A. Mitchell, J.C. Emmerich, and R.C. Morrow. 2005. Development of a reconfigurable LED plant-growth lighting system for equivalent system mass reduction in an ALS. SAE Technical Paper Series 2005-01-2955

Morrow, R.C., R.W. Remiker, M.J. Mischnick, L.K. Tuominen, M.C. Lee, and T.M. Crabb. 2005. A low equivalent system mass plant growth unit for space exploration. SAE Technical Paper Series 2005-01-2843.

***Websites:***

[www.orbitec.com](http://www.orbitec.com)

[www.planet-llc.com](http://www.planet-llc.com)

[www.hypercosm.com](http://www.hypercosm.com)

<http://www.lunarmarssimulant.com>