NANOSATELLITES FOR ASTROBIOLOGY RESEARCH: Wayne L. Nicholson[1]*, Catherine Conley[2], Pascale Ehrenfreund[3], Rocco Mancinelli[4], Andrew Mattioda[4], Richard Quinn[4], Antonio Ricco[5], and Orlando Santos[5]
[1]University of Florida, Kennedy Space Center, USA, [2]NASA Headquarters, Washington DC, USA, [3]Leiden University, The Netherlands, [4]SETI Institute, USA, [5]NASA Ames Research Center, USA. *Presenting author: University of Florida, Dept. of Microbiology and Cell Science, Space Life Sciences Lab, M6-1025, Room 201-B, Kennedy Space Center, FL 32899 USA. WLN@ufl.edu.

In recent years, the interest in using nanosatellites for astrobiological investigations has increased dramatically. Nanosatellites are defined as satellites with masses of less than 10 kg. Cubesats are light-weight (~1 kg) nanosatellites with dimensions of approximately 10 × 10 × 10 cm that are used for space research activities. Cubesats provide capabilities previously limited to larger, human-tended, sample-return platforms by combining recent developments in microfluidics, microsensors, nanomaterials, MEMS (micro-electromechanical systems), integrated optics, and high-density power storage. They can reach outer space via many available commercial, military, and government secondary launch opportunities for small, lightweight, self-contained payloads. Cubesat modules can be designed, built, launched and controlled with unprecedented speed and economy.

The Organism/Organics Exposure to Orbital Stresses (*O/OREOS*) nanosatellite is being designed, built, and flown under the auspices of NASA's Astrobiology Small Payloads Science Demonstration program to develop flexible, low-cost, high-return technologies for autonomous *in situ* exposure of biological organisms or organic molecules aboard free-flying nanosatellites. *O/OREOS* traces its heritage to its predecessors *GeneSat-1* and *PharmaSat*. *GeneSat-1* was constructed from 3 cubesats in a linear configuration. It was launched aboard a Minotaur I rocket on 16 December 2006 from Wallops Island VA, USA. Data returned from space by *GeneSat-1* demonstrated autonomous growth of the bacterium *Escherichia coli* in a well-controlled multi-well culture environment [1, 2]. *PharmaSat*, the successor to *GeneSat-1*, launched on 19 May 2009, also aboard a Minotaur I rocket from Wallops Island, was deployed in low Earth orbit, and began to function within hours. Cultures of the yeast *Saccharomyces cerevisiae* were grown in a total of 48 microfluidic wells; they were challenged in 12-well groups with 3 different concentrations (plus negative control) of the antifungal agent voriconazole. Growth and metabolic activity of the yeast was monitored at 3 wavelengths to provide optical density and colorimetric data [3].

For the purposes of exobiology/ astrobiology experiments, access to the radiation environment of space outside Earth's protective magnetosphere is limited. One solution is to launch a satellite on a high-inclination orbit during which the satellite makes brief excursions outside Earth's magnetic field as it passes over the north and south magnetic poles. The O/OREOS nanosatellite consists of 3 cubesat modules: (i) a control bus, and 2 experimental modules devoted to (ii) the Space Environment Viability of Organics (SEVO) experiment, and (iii) the Space Environment Survivability of Living Organisms (SESLO) experiment. The SESLO experiment will assess the long-term survival and growth responses of microorganisms exposed to the ionizing radiation and heavy ion environment outside the magnetosphere. The SESLO-A portion contains 18 wells carrying air-dried cells of the halophilic archaeon *Halorubrum chaoviatoris*. The SESLO-B experiment carries air-dried spores of 2 congenic strains of *Bacillus subtilis*, a wild-type strain and a strain carrying mutations in the *ykoU* and *ykoV* genes encoding components of the Non-Homologous End Joining (NHEJ) DNA repair system, which render the mutant spores sensitive to ionizing radiation and HZE particle bombardment [4].

Launch of *O/OREOS* from the Kodiak Launch Complex, Alaska, USA is currently scheduled for late May 2010 and will place the *O/OREOS* satellite into a 650-km, 72° inclination orbit. At 0, 3, and 6 months, SESLO-B wells will be flooded with germination medium containing the redox dye Alamar Blue and spore germination will be quantified in real time at 3 different wavelengths: 470 nm for optical density, 525 nm to monitor increase in the reduced form of Alamar Blue (pink), and 615 nm to monitor decrease in the oxidized form (blue).

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