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Author: Dr. Catharine Conley
National Aeronautics and Space Administration (NASA), United States, Cassie.Conley@nasa.gov

Dr. Pascale Ehrenfreund
Space Policy Institute, George Washington University, United States, pehren@gwu.edu
Dr. Wayne Nicholson
University of Florida, United States, WLN@ufl.edu
Mr. David Squires
National Aeronautics and Space Administration (NASA), Ames Research Center, United States, ddsquires@aol.com
Dr. Orlando Santos
National Aeronautics and Space Administration (NASA), Ames Research Center, United States, Orlando.Santos@nasa.gov
Dr. Antonio J. Ricco
National Aeronautics and Space Administration (NASA), United States, ajricco@alum.mit.edu
Dr. Richard Quinn
National Aeronautics and Space Administration (NASA), Ames Research Center, United States, rquinn@mail.arc.nasa.gov
Dr. Andrew Mattioda
National Aeronautics and Space Administration (NASA), Ames Research Center, United States, Andrew.L.Mattioda@nasa.gov
Dr. Rocco Mancinelli
SETI Institute, United States, rmancinelli@seti.org

AN ASTROBIOLOGY SMALL PAYLOADS DEMONSTRATION NANOSATELLITE: ORGANISM/ORGANICS EXPOSURE TO ORBITAL STRESSES (O/OREOS)

Abstract

Astrobiology Small Payloads (ASP) is an element of NASA's Astrobiology program, which funds the construction and launch of small (¡5kg) satellites to perform automated research on subjects of relevance to Astrobiology. O/OREOS is a demonstration project that is intended to develop and demonstrate autonomous, in-situ biological organism and organic specimen exposure-and-detection technologies aboard free-flying nanosatellites in support of ASP objectives. The O/OREOS Sat mission is scheduled to launch in early summer 2010 from Kodiak, Alaska on a Minotaur IV rocket. O/OREOS Sat carries two experimental payloads exposed to the space environment: (i) dormant biological specimens and (ii) four types of reaction cells containing organic molecules. These experiments investigate the survival, adaptation, and biological evolution of life and the stability of organic material in space. The SESLO experiment involves launching dry Halorubrum chaoviatoris and Bacillus Subtilis spores, each as wild-type and mutant. During space flight, nutrient media will be added to sub-groups of organism-containing microwells at several timepoints over the 6-month course of the mission. Biological samples are monitored by time-resolved optical density and colorimetry of a metabolic indicator dye to quantitatively measure the effects upon biological organism survival, growth, and metabolism resulting from the combined exposure to ionizing

space radiation and microgravity. The SEVO experiment exposes four classes of organic molecules to the space environment: amino acids, quinone, polycyclic aromatic hydrocarbons and metallo-porphyrin. One of each specimen will be maintained in each of four self-contained sample environments representing star-forming regions, airless bodies, Mars, and the bodies of the outer solar system. Changes in UV and visible absorption spectra will be used to measure quantitatively the effects of exposure to the full spectrum of space radiation, including solar UV and visible light, on organic specimens in several space environments. The recent explosion in nano-, micro-, and miniature technologies enables the development of remarkably capable autonomous instruments to accomplish remote autonomous experimentation. Small satellites provide an opportunity to address astrobiological questions, human exploration challenges, and planetary protection issues by accessing a range of relevant space environments.