SEVO (Space Environment Viability of Organics) Preliminary Results from Orbit

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Introduction: SEVO (Space Environment Viability of Organics) is one of two astrobiology experiments onboard the NASA Organism/Organics Exposure to Orbital Stresses (O/OREOS) cubesat, launched in November 2010. The satellite is still operational with nominal performance and records data on a regular basis. In the SEVO experiment, four astrobiologically relevant organic thin films are exposed to radiation in low-earth orbit, including the unfiltered solar spectrum from ~ 120 – 2600 nm. The thin films are contained in each of four separate micro-environments: an atmosphere containing CO_2, a low relative humidity (~2%) atmosphere, an inert atmosphere representative of interstellar/interplanetary space, and a SiO_2 mineral surface to measure the effects of surface catalysis. The UV/Vis spectrum of each sample is monitored *in situ*, with a spectrometer onboard the satellite.

SEVO Design: The SEVO experiment is a 10-cm (1U) cube, housing a high-resolution UV/Vis/NIR spectrometer and a carousel containing 22 sample cells. Light from the Sun passes through each sample, serving as both an irradiation source, and a light source for transmission spectroscopy. Each sample cell was constructed from a stainless steel spacer ring, one MgF_2 window, and one sapphire window. The spacer ring, which is sealed against the MgF_2 window, creates a small cavity in the cell for gases to reside in contact with the film deposited on the MgF_2 window. The sapphire window seals gases into the cell, and prevents solarization of optical components on the opposite side of the sample where spectral collection occurs.

Data: Our preliminary mission data includes time-evolved spectra of two of the four organic molecules onboard the SEVO experiment: the polycyclic aromatic hydrocarbon (PAH) isoviolanthrene (IVA; a 9-ringed PAH), and the quinone anthrarufin. PAHs have been detected ubiquitously in astronomical observations of dust clouds and represent the largest reservoir of organic carbon in interstellar space. In the presence of water and ionizing radiation, PAHs have been shown to produce various astrobiologically relevant organic photoproducts, including quinones.

Raw spectral data from the satellite has been successfully telemetered to ground stations, and data analysis has begun. We will present the results of our initial analysis, particularly on the IVA and Anthrarufin sample cells. This will include

presentation of flight spectra, indicating changes in the organic films over the duration of the mission.

To aid in the interpretation of flight results, we are performing laboratory control studies of additional sample cells exposed to simulated Solar radiation. We will touch on the design of the laboratory experiment and compare the results to flight data.

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