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Small Spacecraft for Deep-Space Exploration (8)

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ENVIRONMENTAL DESIGN IMPLICATIONS FOR DEEP SPACE SMALLSATS

Abstract

The extreme environmental challenges of deep space exploration force unique solutions to small satellite design in order to enable their use as scientifically viable spacecraft. The challenges of implementing small satellites within limited resources can be daunting when faced with radiation effects on delicate electronics that require shielding or unique adaptations for protection, or mass, power and volume limitations due to constraints placed by the carrier spacecraft, or even Planetary Protection compliant design techniques that drive assembly and testing. This paper will explore two concept studies where the environmental constraints and/or planetary protection mitigations drove the design of the Flight System.

The paper will describe the key technical drivers on the Sylph mission concept to explore a plume at Europa as a secondary free-flyer as a part of the planned Europa Mission. Sylph is a radiation-hardened smallsat that would utilize terrain relative navigation to fly at low altitudes through a plume, if found, and relay the mass spectra data back through the flyby spacecraft during its 24-hour mission. The second topic to be discussed will be the mission design constraints of the NEAScout concept. NEAScout is a 6U Cubesat that will utilize an 80 sq m solar sail as propulsion to rendezvous with a Near-Earth asteroid and help retire Strategic Knowledge Gaps for future Human Exploration. NEAScout will flyby/rendezvous and characterize one Near-Earth asteroid that is representative of Human Exploration targets and telemeter that data directly back to Earth during its roughly 2.5 year mission.