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AN EXPLORATION OF ICY WORLD HABITABILITY: THE EUROPA CLIPPER

Abstract

Jupiter's moon Europa may be a habitable world. Galileo spacecraft data suggest that an ocean exists at a relatively shallow depth beneath Europa's icy surface, and geological activity may permit the "ingredients" necessary for life to be present within this ocean today. Because of the potential for revolutionizing our understanding of life in the solar system, future exploration of Europa has been deemed an extremely high priority for planetary science.

NASA funded the California Institute of Technology Jet Propulsion Laboratory and the Johns Hopkins University Applied Physics Laboratory to perform studies of the design and implementation of several mission concepts to explore Europa. Over the past two years, two concepts were studied in detail: an orbital mission, and a mission in Jupiter orbit that makes multiple Europa flybys that we term the "Europa Clipper." The orbiter concept is well suited to perform scientific observations that are best made from orbit, such as geophysical measurements. In comparison, the Clipper concept is best suited to measurements that can be made of local to regional areas distributed across the satellite, such as remote sensing of specific surface features. The Clipper was judged to have the greater scientific breadth and to be the more cost effective for the expected science return.

The Clipper would make at least 32 orbits of Jupiter, each time swooping 100 km or closer to Europa. This strategy minimizes the radiation exposure and decouples science acquisition from data downlink, which correspondingly decreases the power needed for the flight system operation. The resulting flight system is a compact design that minimizes radiation shielding and overall system mass while maintaining

robust technical margins. Moreover, the flight system would use a modular architecture, simplifying hardware procurements, implementation, and system integration and test. The model payload would consist of a radio subsystem for gravity science, a magnetometer, Langmuir probes, an ice penetrating radar, a shortwave infrared spectrometer, a neutral mass spectrometer, and a stereo camera. In addition, programmatic elements of the payload (a high-resolution camera capable of performing stereo imaging and a thermal imager) would determine surface characteristics of Europa at lander scales, to aid design of a future lander mission to Europa and to inform the potential for safe and scientifically compelling landing sites. It is envisioned that the Clipper mission would be launched in the 2022 timeframe. An overview of the Europa Clipper mission concept is presented in this paper.