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EUROPA PLUME CHASER A NOVEL APPROACH FOR LOW COST EXPLORATION OF THE
POTENTIAL PLUME OF EUROPA

Abstract

The Europa Plume Chaser mission concept is a novel approach for low cost exploration of the solar system. The primary objective is the search for evidence of life in the plume detected on Europas South Pole, under the assumption that the plume phenomenon is, as with Enceladus, a reoccurring event. The mission aims to understand the habitability of Europa by investigation of the composition and chemistry of the expelled material. The 2012 Decadal Survey identified planetary habitats as a primary question: Beyond Earth, are there contemporary habitats elsewhere in the solar system with necessary conditions, organic matter, water, energy, and nutrients to sustain life, and do organisms live there now? and identified Europa exploration as an important step toward addressing said question, The search for evidence of life is an emerging science priority for the moons of the outer solar system. This mission aims to fulfill this priority in the most cost efficient way. The mission concept considers two scenarios: a Europa Direct Flyby and a Jupiter Capture Flyby. In the first scenario, two or more spacecraft travel directly to Europa from Earth for a single flyby from a highly elliptical heliocentric orbit. In the second scenario, a single spacecraft will be captured by Jupiters gravity and perform three passes of Europa. To achieve the scientific objective in both scenarios, the spacecraft will flyby Europas South Pole to characterize the ejected plume material. Both mission scenarios will use electric propulsion in order to reach Europa and will be launched as an auxiliary payload into a Geosynchronous Transfer Orbit to reduce the cost of the overall mission. The instrument payload consists of a mass spectrometer, an IR spectrometer and a visualnear-IR camera. The Plume Chaser spacecraft concept falls in the microsatellite category for both scenarios, having a total mass of less than 190 kg, which gives the flexibility of being mounted in a cantilevered position or vertical orientation while also increasing the number of launch opportunities as a secondary payload. This mission concept does not present only the achievement of a Europa mission, but to set a baseline for an accessible and easy exploration of the Solar System. Standardization is needed for this ambitious goal and the same approach can be potentially used for many other mission concepts. Therefore, this scenario paves the way for a new era; low-cost interplanetary exploration.