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Author: Mr. Brent Buffington
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States

Mr. Try Lam
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States
Dr. Stefano Campagnola
Caltech/JPL, United States

EVOLUTION OF TRAJECTORY DESIGN REQUIREMENTS ON NASA'S PLANNED EUROPA CLIPPER MISSION

Abstract

Europa is one of the most scientifically intriguing targets in planetary science due to its potential suitability for extant life. As such, NASA has funded the California Institute of Technology Jet Propulsion Laboratory and the Johns Hopkins University Applied Physics Laboratory to jointly develop the planned Europa Clipper mission—a multiple Europa flyby mission architecture aimed to thoroughly investigate the habitability of Europa and provide reconnaissance data to determine a landing site that maximizes the probability of both a safe landing and high scientific value for a potential future Europa lander. The trajectory design—the major enabling component for this Europa Clipper mission concept—was developed to maximize science from a set of eight model payload instruments determined by a NASA-appointed Europa Science Definition Team (SDT) between 2011-2015. On May 26, 2015, NASA officially selected 10 instruments from 6 different U.S. research facilities and universities. With the selection of instruments have come the development of new science measurement requirements on the trajectory design, as well as a rich set of requirements stemming from project policies, the flight system's evolving capability, mission operability, mission robustness, and planetary protection. This paper will discuss the evolution of all requirements levied on the trajectory design, and will focus on strategies and solutions to the multidimensional optimization problem of designing high fidelity end-to-end trajectories that maximize Europa science per unit time while mitigating mission risk, complexity and cost.