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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 1) (4A)

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1I/2017 U1 ‘OUMUAMUA EXPLORATION CONCEPT WITH CURRENT TECHNOLOGY

Abstract

The object that would eventually be designated 1I/2017 U1 by the International Astronomical Union was first observed on October 19th 2017 by Robert Weryk using the Pan-STARRS telescope. On October 25th 2017, after a request for observation to NASA's Minor Planet Center, the trajectory of 1I/2017 U1 was confirmed to be on a solar system escape trajectory that would take it out into deep space. The observation campaign for this object, which was subsequently nicknamed ‘Oumuamua, indicated that it was the first ever observed asteroid to come from interstellar space. The discovery and the posterior study of the object generated valuable data regarding the formation and composition of other planetary systems. Its dimensions and surface composition remain, however, a mystery that, if solved, could further our understanding of our galaxy's formation and composition. Thorough study of ‘Oumuamua's trajectory combined with the known dynamics of our solar system, and the movements of other nearby systems, astronomers now estimate that possibly 30,000 interstellar asteroids are present in our Solar System at any given time. New information about the frequency of these visitors increases the feasibility of actually flying an exploratory mission to one of these objects, which could result in valuable scientific return about the composition of other solar systems, the formation of the Milky Way, and possible signs of life. In this work, a mission analysis to ‘Oumuamua was explored using current technology and reasonable mission parameters. Although a mission to this particular object is unlikely, our primary goal is to show that missions to these objects are feasible. The notional mission considered in this work features a three tonne spacecraft launched with a C3 of approximately 35 km^2/s^2 capable of delivering nearly 800 kg to the target in 50 years using two Earth and two Jupiter swing-bys. The vehicle uses an electric thruster with a nominal thrust of 110 mN powered by a radioisotope thermal generator and generates a total deterministic Δv of 38.27 km/s. The particular solution examined was locally optimized to deliver maximum mass to the target. A minimum time solution would reach the target faster, but of course consume more propellant.