

Exploration of Near-Earth Asteroids (4)
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ASTEROID EXPLORATION MISSION BY CUBESATS

Abstract

In this paper we consider a mission to explore the interior of a rubble-pile asteroid by a fleet of two 6U-CubeSats. These are transported in their dispenser by another CubeSat type of spacecraft which provides the propulsion from Earth to the target asteroid, power for electrical propulsion, communication and navigation during the cruise and will act as data-relay when the 6U exploration CubeSats have arrived at the target asteroid, they will measure the interior of the asteroid. The exploration CubeSats have as the main scientific payload a ground penetration Radar operating around 20 MHz in a bistatic mode. This Radar will map the interior of the asteroid and allows to detect and measure the size of e.g. voids inside the asteroid. This is a tomographic measurement of the interior of the asteroid and the signal processing will be performed on Earth. Communication links deliver the measured data towards the Earth using the 32 GHz deep-space frequency band. The intersatellite link operating at about 24 GHz will in addition perform precise Doppler-measurements, which allow to determine the moment-of-inertia matrix of the asteroid. This is also an inverse problem: To determine the moment of-inertia matrix of the asteroid from velocity measurements. As propulsion system electric thrusters will be used to reach the target asteroid at 20 Lunar Distances (LD). Two high-level mission concepts will be discussed: The first one will be a cargo mother ship providing mainly transportation and communication for the two CubeSats, the other concept is to send each CubeSat independently towards the asteroid using his own propulsion system. The most cost-efficient mission concept will be identified.