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A SMALL LOW-COST NANO SATELLITE SWARM FOR A FLY-BY MISSION OF APOPHIS IN 2029

Abstract

As part of internal study efforts for a low-cost fast-schedule small spacecraft mission to take benefit of the close approach of Near-Earth Object (99942) Apophis in April 2029, graduate-level students from various space degree programs of Luleå University of Technology's Kiruna Space Campus were tasked to contribute with a study on a fly-by mission concept utilising nano satellite technologies as part of a one-semester spacecraft design project course.

The resulting mission – Utilisation of Nanosatellite Network for Apophis Measurements Exploration and Discoveries (UNNAMED) – aims to send four 16U CubeSat satellites to Apophis to map its surface in high resolution in both the optical and thermal spectrum. The mission is required to take place before and during the close approach of Apophis in April of 2029 and would provide an unique opportunity for European space science and research. The study concluded in the decision to utilise four nano satellites: each fully equipped with identical instruments and set up in order to reduce complexity. A small swarm of four satellite is proposed as a way to increase the redundancy level of the mission. The mission plans to employ mainly European Commercial Off The Shelf (COTS) components with Technology Readiness Level (TRL) 7+. It is designed to use a European launcher, with both dedicated and rideshare options assessed. In addition, European and in particular Nordic partners are planned as the operations providers.

The paper will discuss the proposed mission and spacecraft design as well as the current planned scientific payload and launcher, cost, and schedule considerations.