

Asteroid Spectral Imaging Mission (ASPECT) payload for AIM-D² spacecraft

Tomas Kohout(1,2), Antti Näsälä(3), Tuomas Tikka(4), Mikael Granvik(1), Antti Kestilä(5), Antti Penttilä(1), Janne Kuhno(4), Karri Muinonen(1,6), Kai Viherkanto(3)

(1) Department of Physics, University of Helsinki, Finland, (2) Institute of Geology, The Czech Academy of Sciences, Prague, Czech Republic, (3) VTT Technical Research Centre of Finland, Espoo, Finland (4) Reaktor Space Lab, Helsinki, Finland, (5) Aalto University, Espoo, Finland (6) Finnish Geospatial Research Institute FGI, Masala, Finland

Introduction

Asteroid Spectral Imaging Mission (ASPECT) is a part of the ESA-NASA AIDA (Asteroid Impact & Deflection Assessment) project. In 2016 it underwent preliminary design study and was down selected as the only COPIN payload (CubeSat Opportunity Payload) for European AIDA component AIM-D² (Asteroid Impact Mission – Deflection Demonstration). ASPECT is a 3U CubeSat with a visible – near infrared (VIS-NIR) spectral imager payload. The payload, avionics, and cold gas propulsion units occupy each 1U space. Its task is to characterize the surface composition of the DART (Double Asteroid Redirection Test) spacecraft impact target – the binary asteroid Didymos.

ASPECT technical objectives

ASPECT technical objectives	
AT1	Demonstration of CubeSat autonomous operations in deep space environment
AT2	Navigation in the vicinity of a binary asteroid
AT3	Demonstration of satellite survival during impact
AT4	Demonstration of joint spacecraft - CubeSat operations
AT5	Demonstration of spectral imaging of asteroid materials

ASPECT scientific objectives

ASPECT scientific objectives and results	
AS1	Map the surface composition of the Didymos system
Result	Composition and homogeneity of the Didymos asteroid, changes as a result of DART impact
Result	Information on the origin and evolution of the Didymos binary system
AS2	Photometric observations and modeling of the Didymos system under varying phase angle and distance
Result	Surface particle size distribution and composition for Didymos II and Didymos I (simultaneous modeling of photometry and spectroscopy)
AS3	Evaluate space weathering effects on Didymos II by comparing mature and freshly exposed material
Result	Information on the surface processes on airless bodies due to their exposure to the interplanetary environment
AS4	Identify local shock effects on Didymos II based on spectral properties of crater interior
Result	Information on the processes related to impacts on small Solar System bodies
AS5	Observations of the plume produced by the DART impact
Result	Evolution and composition of the DART impact plume
AS6	Map global fallback ejecta on Didymos II and Didymos I
Result	Detailed global mapping of fallback ejecta on both Didymos I and Didymos II