SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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A DEEP SPACE INVENTORY TOUR OF THE MAIN ASTEROID BELT

Abstract

A consortium of international scientists and industry partners are proposing the Main Belt Inventory Mission as a candidate in the next forthcoming ESA medium class mission call. The inventory mission will characterise a broad range of statistically significant asteroid samples throughout the Main Asteroid Belt (MAB). A 0.5 m aperture space-based telescope will conduct a detailed spectroscopic survey, observing thousands of objects from a range of 0.1-0.5 AU, and perform basic flybys of pre-selected targets. Each flyby will target an asteroid of a different size, taxonomic (sub)classes and orbital families, where spatially resolved spectral mapping and spectroscopy will be performed. Smaller and fainter passing targets will also be discovered, through opportunistic science, with dedicated star tracker-like cameras.

Examining the compositional diversity across the asteroid population will provide a key tracer to understanding the dynamic evolution of the solar system, offer an insight into its early history and the origins of life forming material. Furthermore, by combing visible, near-infrared and thermal spectroscopy, the mission will unlock information on the major rock forming minerals, hydrated minerals, organics and primitive material found throughout the asteroid belt. Coarse UV mapping capability will search for weak OH emission bands, providing evidence of buried volatile (water) reservoirs. This will provide an additional link to fully understanding the meteorite record on Earth, and more importantly, place the returned samples from the up-and-coming Hayabusa-2 (JAXA) and OSIRIS-REx (NASA) missions in a wider geological context. The mission will provide an accurate description of the present day MAB population, and further refinements of the origins and evolution models of Near Earth Asteroids.

This paper will report on the scientific justification and focus on the (sub-)system spacecraft design to perform a detailed inventory mission of the MAB. It includes an evaluation of the different system options and architecture designs. The baseline design is then presented, and further broken down for each subsystem. The science and mission objectives have been developed within the scope of the expected

boundary conditions of the forthcoming ESA medium class mission call. It therefore necessitates a high TRL spacecraft, ready for launch within the 2028/32 timeframe on either a Vega-C (or Ariane 6) launch vehicle. The mission and system design is currently being developed through an ongoing mission study. Analysis is performed by a consortium of OHB System AG, Cranfield University and an association of scientists from different institutes and organisations. Concurrent engineering techniques are used throughout.