SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (4)

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ESA MARCOPOLO-R: THE NEA SAMPLE RETURN MISSION CANDIDATE TO THE M-CLASS COSMIC VISION PROGRAM

Abstract

The ESA MarcoPolo-R mission is an asteroid sample return studied lead by the ESA Science Robotic Exploration directorate as part of the third medium class missions call for ideas of the Cosmic Vision program.

At the time of the 2013 International Astronomical Congress, two parallel industrial phase A will have been completed and the Preliminary Requirements Review will be underway. Upon selection among the Cosmic Vision M-Class candidates by the ESA science advisory structures in late 2013 / early 2014, MarcoPolo-R will undergo a full phases B-C-D-E targeting a launch in late 2022 (backup missions in 2023 and 2024)

MarcoPolo-R primarily aims at returning a sample from the asteroid 2008EV5 back to Earth in 2027 as well as performing a thorough characterization campaign of the complete asteroid and the sampled site(s). This will be performed by using a suite of scientific instrument selected in early 2013 following proposal received in the frame of a call for instruments held in 2012. A science team composed of leading European asteroid experts also provides support to the MarcoPolo-R by defining the mission's science objective. This same science team is also at the origin of the MarcoPolo-R mission proposal submitted during the call for mission back in 2011.

The limited budget imposed by ESA Cosmic Vision M-Class mission (ie. 480 MEuro cost at completion) led to the development of a cost-driven mission profile and system design. The main characteristics of the MarcoPolo-R spacecraft are therefore as follow:

- Maximization of the re-use of existing equipment
- Soyuz launch (from French Guyana) into interplanetary transfer
- Round-trip transfer using electrical propulsion based on the proven ESA-Smart 1 lunar mission thruster (SNECMA PPS1350)
- Asteroid proximity phase limited to 180 days and using a heritage monopropellant system, enough to fully characterize the body and account for sampling rehearsals and multiple sampling attempts
- Sample acquisition using a touch and go approach
- Delivery of the collected samples by a parachute-free and cost-efficient Earth Re-entry Capsule (ERC) at the Woomera Test Range (Australia)

Various technology developments are also currently on-going in order to support the mission such as:

- Heat shield material for the ERC

- Vision-based Guidance Navigation and Control for the descent and Touch Go phase
- Design and testing of sampling tools in parabolic flight
- Design and testing of the touchdown arm on microgravity simulated facilities