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14th HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)
Going beyond the Earth-Moon system: Human Missions to Mars, Libration points, and NEO's (4)

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APOPHIS EXPRESS, A UNIQUE OPPORTUNITY FOR A HUMAN VISIT TO A NEO IN 2029

Abstract

The asteroid Apophis, discovered in 2004, is a 250 meter wide asteroid that will come back very close to the Earth on April 13, 2029.

During its 2029 pass, Apophis will be easily visible from the Earth and it can be expected that its geometry and thermal properties will be well determined from ground based observations. However, the characterization of its interior will not be achievable from purely terrestrial observations. Such a characterization is essential for planning any mitigation operation, should it be necessary in the future.

This can be done only through a dedicated space mission where a set of instruments for probing the interior of Apophis will be softly laid down on its surface. A purely robotic mission cannot pretend to provide a complete understanding of the asteroid core. A human presence for a systematic characterization of the asteroid is needed for doing the job.

The mission scenario that is proposed in the paper is based on a twofold mission:

- in May 2028, launch of a robotic mission on a traditional heliocentric orbit that will reach Apophis in February 2029. This module will make a first survey of the asteroid surface and finally land scientific and logistics payload. Part of this payload will consist in a navigation support system that can be used from the Earth to improve the Apophis ephemerides and by the visiting crew to secure its final approach and landing.

- in March 2029, just a few weeks before Apophis is coming close to the Earth, launch of a man tended mission into a highly eccentric orbit. The trajectory of this mission will be an interception type, the direction of the launch being towards the incoming asteroid. A ΔV of about 6 km/s will have to be delivered for the crew to land on Apophis. On the other hand, only a few tens of meter per second ΔV is required to come home, when leaving Apophis in early April. The astronauts will spend only a few days on Apophis, using the equipments that will have been laid down by the pathfinder mission and be back on the Earth on April 13.

The safety of the mission will be quite high for a human mission of this type, since the GO/NOGO decision of launching the crew can be made after the landing of the science payload has been confirmed.