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A POSSIBLE ITALIAN CONTRIBUTION IN THE NASA ASTEROID REDIRECT ROBOTIC MISSION (ARRM)

Abstract

As part of its Journey to Mars strategy, NASA announced the Asteroid Redirect Mission (ARM) program, composed of the Asteroid Redirect Robotic Mission (ARRM) first and then the Asteroid Redirect Crew Mission (ARCM). In the ARRM the Asteroid Redirect Vehicle (ARV), powered by advanced Solar Electric Propulsion (SEP), is deployed to rendezvous with a large NEO, being 2008 EV5 the current reference asteroid target. The ARV will characterize the asteroid, descend, and capture a boulder from the asteroid surface. As written in the NASA Formulation Assessment and Support Team (FAST) report released in February 2016, based on radar imaging and size distribution power laws that have been seen in data from laboratory experiments and spacecraft observations of other asteroids, 2008 EV5 is expected to have 3,000-16,000 boulders with 1-5 m diameters and 360-1,300 boulders with 2-3 m diameters. Once the boulder is captured, the ARV will perform a planetary defense test, by applying the enhanced gravity tractor technique, and then fly back towards Earth to take the boulder in a stable Lunar Distant Retrograde Orbit (DRO), as the DRO that Orion, launched on SLS, will target in Exploration Mission 1 (EM-1) scheduled for 2018. The Italian Space Agency (ASI) is considering the opportunity to participate to the NASA ARM program, beginning with a possible Italian contribution to the ARRM. Options include payloads and instruments to be accommodated on the ARV (such as a stereo camera and VIS-NIR spectrometer, possibly integrated in a newly designed instrument able to produce 3D hyper spectral images, dedicated to the asteroid surface and asteroid boulder characterization, a drill for sampling asteroid material, a sounding radar to study the internal structure of the asteroid), space communications and tracking (such as the potential use of the 64 meter Sardinia Radio Telescope (SRT) for a spacecraft telecommunications and tracking demonstration of ARRM, supplementing and in collaboration with NASA's Deep Space Network), and trajectory analysis (to provide low thrust trajectory analysis of ARRM). In this paper all these options will be briefly described.