

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
New missions enabled by Extra-large launchers (8)

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A CREWED 180-DAY MISSION TO ASTEROID APOPHIS IN 2028-2029

Abstract

This paper presents a conceptual design of advanced space systems architectures for near-Earth object (NEO) missions [1-4] enabled by new extra-large launch vehicles such as Ares V. The concept of a crewed mission to a NEO has been studied since the Apollo program, and it is getting much attention nowadays because of the availability of the Orion Crew Exploration Vehicle (CEV) in the near future through NASA's Constellation program. The Ares V, planned to be available in 2020, will be able to launch a 55,000-kg payload into an interplanetary trajectory with $C_3 = 25 \text{ (km/s)}^2$, while a Delta IV Heavy can launch a 6,000 kg payload with $C_3 = 25 \text{ (km/s)}^2$. This paper describes a crewed exploration mission to asteroid Apophis during its close Earth encounter in April 2029 as well as a post-keyhole deflection mission employing standoff nuclear explosions prior to its possible collision with the Earth in 2036. The technological advances required for such technically challenging NEO missions enabled by the Ares V are also further discussed. In this paper, asteroid Apophis is used as an illustrative target NEO to demonstrate the performance, modularity, and operational flexibility of the proposed space systems architectures enabled by the Ares V.

[1] Adams, R. B. et al., "Survey of Technologies Relevant to Defense from Near-Earth Objects," NASA-TP-2004-213089, NASA-MSFC, July 2004.

[2] Barrera, M. J., "Conceptual Design of an Asteroid Interception for a Nuclear Deflection Mission," AIAA Paper 2004-1481, 2004 Planetary Defense Conference: Protecting Earth from Asteroids, Orange County, February 2004.

[3] Adams, R. B. et al., "Near Earth Object (NEO) Mitigation Options Using Exploration Technologies," presented at 2007 Planetary Defense Conference, Washington, DC, March 2007.

[4] Abell, P. A. et al., "Exploration of Near-Earth Objects via the Orion Crew Exploration Vehicle: A Planetary Defense Rationale," to be presented at 1st IAA Planetary Defense Conference, Granada, Spain, April 2009.