27th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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THE MILO SPACE SCIENCE INSTITUTE: ENABLING NEW, SCIENCE-FOCUSED DEEP SPACE SMALLSAT MISSIONS

Abstract

Presently, more than 20,000 Near-Earth Objects (NEOs) have known orbital characteristics. About 10

To that end, the MILO Space Science Institute , a non-profit deep space mission collaboration between Arizona State University, Lockheed Martin, and GEOShare, is planning two smallsat missions; Apophis Pathfinder and NEOshare. Both missions would explore Near-Earth Objects (NEOs) to support both scientific and planetary defense objectives.

The first, Apophis Pathfinder, would focus on performing the first-ever close flyby of the 370-meter diameter Potentially Hazardous NEO (99942) Apophis, which occasionally comes extremely close to Earth (e.g., on April 13, 2029, it will pass Earth's center of mass at a distance of only about 31,000 km – roughly five Earth radii above the surface and well within Earth's geosynchronous satellite ring). MILO's Apophis Pathfinder mission would conduct a flyby precursor investigation of that asteroid several years or more in advance of its 2029 Earth flyby, using a pair of smallsats to provide initial reconnaissance data to inform and influence planning for additional flyby or encounter missions to (99942) Apophis in 2029 and beyond. The mission will aim to increase orbit knowledge, estimate the mass and density, and provide initial geologic and compositional data to enhance advance planning for future missions and future Planetary Defense strategies. The pathfinder mission allows for payload, and spacecraft teaming opportunities, data processing and analytics, and Principal Investigator training.

The second potential mission, called NEOshare, would launch a cluster of six smallsats that would each perform a close flyby of a different NEO when close to Earth. Each smallsat would be equipped with cameras, spectrometers, and other heritage instrumentation, and include propulsion and communications. Because some of the smallsats could fly past multiple objects, we would plan to characterize at least eight new NEOs during that mission.

Apophis and NEOshare will be conducted by a consortium of U.S. and international universities and space agencies that join the MILO Institute's membership-based model for deep space exploration.