

“A Low Risk Strategy for the Exploration of Near-Earth Objects”

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ABSTRACT

The impetus for asteroid exploration is scientific, political, and pragmatic. The notion of sending human explorers to asteroids is not new. Piloted missions to these primitive bodies were first discussed in the 1960s, pairing Saturn V rockets with enhanced Apollo spacecraft to explore what were then called “Earth-approaching asteroids.” Two decades ago, NASA’s Space Exploration Initiative (SEI) also briefly examined the possibility of visiting these small celestial bodies. Most recently, the U.S. Human Space Flight Review Committee (the second Augustine Commission) suggested that near-Earth objects (NEOs) represent a target-rich environment for exploration via the “Flexible Path” option. However, prior to seriously considering human missions to NEOs, it has become clear that we currently lack a robust catalog of human-accessible targets. The majority of the NEOs identified by a study team across several NASA centers as “human-accessible” are probably too small and have orbits that are too uncertain to consider mounting piloted expeditions to these small worlds. The first step in developing such a catalog is, therefore, to complete a space-based NEO survey. The resulting catalog of candidate NEOs would then be transformed into a matrix of opportunities for robotic and human missions for the next several decades. This initial step of a space-based NEO survey first is the linchpin to laying the foundation of a low-risk architecture to venture out and explore these primitive bodies. We suggest such a minimalist framework architecture from 1) extensive ground-based and precursor spacecraft investigations (while applying operational knowledge from science-driven robotic missions), 2) astronaut servicing of spacecraft operating at geosynchronous Earth orbit to retain essential skills and experience, and 3) applying the sum of these skills, knowledge and experience to piloted missions to NEOs.