NEO Surveyor Cadence and Simulations. S. Sonnett[1], A. Mainzer[2], T. Grav[2], T. Spahr[3], J. Masiero[4], E. Lilly[1]
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Introduction: The Near-Earth Object (NEO) Surveyor is a planned space-based infrared mission that will nominally launch in 2026 and librate at the Earth-Sun L1 Lagrange point. The NEO Surveyor mission was formulated to address the need to detect, catalog, and characterize NEOs to support informed decision making for any potential mitigation activity. NEO Surveyor detects NEOs, obtains high quality orbits for them, provides physical characterization of the NEOs and their source populations, and provides more detailed physical characterization for individual targets with significant impact probabilities. Specifically, NEO Surveyor will detect, track, and characterize 2/3 of potentially hazardous asteroids (PHAs) larger than 140m - large enough to cause potentially significant regional damage [1]. NEO Surveyor is expected to detect thousands of comets, hundreds of thousands of NEOs and millions of main belt asteroids. Since moving objects, in particular NEOs, are the main focus of NEO Surveyor, the survey can be optimized for maximum discovery rate by adjusting the survey cadence to ensure efficient and reliable linking of observations into tracklets, which are position-time sets of a minor planet. It is also important for the survey cadence to provide self-follow-up that yields orbits with quality similar to that of the known NEOs today.

The NEO Surveyor Investigation Software Suite (NISS) is a set of tools being developed to support the efforts to optimize the survey and verify the ability of the designed mission to meet its scientific objectives. The NISS consists of a comprehensive representation of the mission performance, including the flight system hardware, mission operations, and ground data system processing. The NISS takes as its input a reference population of solar system bodies, the NEO Surveyor Reference Small Body Population Model (RSBPM), and performs a frame-by-frame simulation of the survey over the course of its entire operational lifetime. It has been shown that a completeness of 90% of objects with $H < 23$ mag is needed in order to ensure that 90% of objects larger than 140 m are found [2]. We present here our ongoing work on mission architecture trades and the optimization of the survey cadence for NEO discovery and tracking. We will present the latest NEO Surveyor cadence and its expected performance. We will present the completeness rate after the baseline 5-year mission and a possible extended mission (Fig. 1). Studies have previously shown that the 90% goal can be achieved by a combination of a space mission like NEO Surveyor and a ground-based survey like the Vera Rubin Observatory [3]. We will also present how the survey cadence provides self-follow-up of the NEO population and ensures orbital quality on par with the current NEO population.

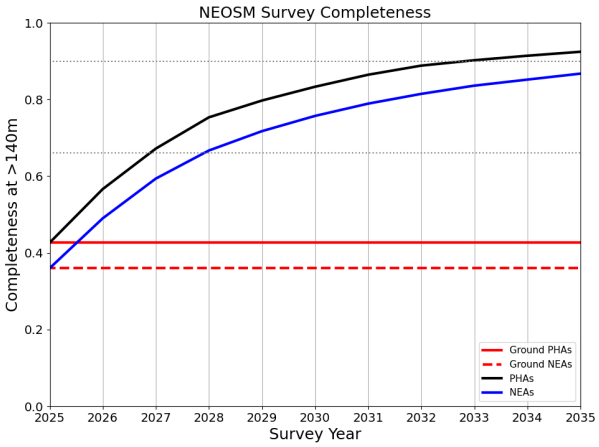

Figure 1: Cumulative fraction of synthetic asteroids recovered by survey year, assuming a 2025 launch date. The working launch date has been nominally changed to 2026 since generating this plot.

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References:

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