Predicted Discovery of Low ΔV Targets Among the Near-Earth Object Population by the *NEO Surveyor* Mission

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NASA's *Near-Earth Object (NEO) Surveyor* mission is an infrared observatory planned to launch no earlier than September 2027 that is designed to discover and characterize asteroids and comets. Its main objective is to identify those objects that are large enough (>140 m in effective spherical diameter) to cause severe regional damage from impact. The observatory will operate at the Sun-Earth L1 Lagrange point and conduct a survey to within 45° of the Sun in order to identify objects in the most Earth-like orbits [1]. During the length of the survey, *NEO Surveyor* is estimated to discover ~200,000 to 300,000 new objects (some as small as ~10 m) and thousands of comets. These discoveries will provide a more comprehensive understanding of the orbital and size frequency distribution of the NEO population, and also provide insights into the relative probability of an Earth impact during the next 100 years.

NEO Surveyor's ability to observe regions close to the Sun increases the likelihood that it will detect objects in very Earth-like orbits. These objects tend to have the lowest minimum orbit intersection distances (MOIDs), and thus pose the greatest risk of Earth impact. This attribute of *NEO Surveyor's* operation is not only important for planetary defense considerations, but it also provides an opportunity to identify low ΔV spacecraft mission targets, which are of interest to the in-situ resource utilization, exploration, and science communities.

The *NEO Surveyor* team has developed a model reference population of NEOs and other Solar System objects (e.g., main belt asteroids, comets, etc.) called the Reference Small Body Population Model (RSBPM). The RSBPM combines both a separate NEO model and a background object model to mimic the moving objects that the observatory will "see" during the operation of the survey. This model is combined with the *NEO Surveyor* Survey Simulator (NSS) which simulates the planned operations of the spacecraft to measure the effectiveness of the survey over its designed operational lifetime [2]. Based on the RSBPM, and the NSS, *NEO Surveyor* will be able to identify objects that are particularly accessible for both one-way and round-trip rendezvous missions and span a range of NEO diameters. The majority of these low ΔV objects will likely be Aten NEOs, but will also include a significant number of Apollo NEOs.

In this study, astrodynamics techniques are applied to estimate the distribution of ΔV and flight time requirements for both one-way and round-trip rendezvous missions to the population of NEOs that *NEO Surveyor* is expected to discover. The algorithms utilized for these analyses come from the Near-Earth Object Human Space Flight Accessible Targets Study (NHATS) [3], heuristics derived from the current NHATS data, and other techniques specific to one-way rendezvous trajectory calculations. The results demonstrate how the number of known low ΔV NEO mission targets may increase during *NEO Surveyor's* survey operations over a 10-year period, and suggests that a significant number of NEOs larger than 100 m in diameter may be attractive for rendezvous operations and future sample-return missions.

References

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