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**Near-Earth Object (NEO) Discovery**

**PREDICTED DISCOVERY OF LOW-DELTA V TARGETS AMONG THE NEO  
POPULATION BY NEO SURVEYOR**

**Paul A. Abell<sup>(1)</sup>, Timothy B. Spahr<sup>(2)</sup>, Brent W. Barbee<sup>(3)</sup>, Dar W. Dahlen<sup>(4)</sup>, Amy  
K. Mainzer<sup>(5)</sup>, and Joseph R. Masiero<sup>(6)</sup>**

<sup>(1)</sup>*NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX, 77058 USA,  
paul.a.abell@nasa.gov*

<sup>(2)</sup>*NEO Sciences, L.L.C., tspahr44@gmail.com*

<sup>(3)</sup>*NASA Goddard Spaceflight Center, 8800 Greenbelt Road, Greenbelt, MD, 20771  
USA, brent.w.barbee@nasa.gov*

<sup>(4)</sup>*Infrared Processing and Analysis Center, 1200 East California Boulevard,  
Pasadena, CA, 91125 USA, ddahlen@ipac.caltech.edu*

<sup>(5)</sup>*University of California Los Angeles, Box 951567, Los Angeles, CA, 90095 USA,  
mainzer@epsu.ucla.edu*

<sup>(6)</sup>*Infrared Processing and Analysis Center, 1200 East California Boulevard,  
Pasadena, CA, 91125 USA, jmasiero@ipac.caltech.edu*

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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. NEOs on more Earth-like orbits are also more difficult to deflect, all else being equal. This attribute of NEO Surveyor's operation is not only important for planetary defense considerations, but it also provides an opportunity to identify low-

delta V spacecraft mission targets, which are of interest to the science, in situ resource utilization, and exploration communities.

The NEO Surveyor team has developed a model reference population of NEOs and other Solar System objects (e.g., mainbelt asteroids) in which to measure the effectiveness of the survey over its designed operational lifetime. This Reference Small Body Population Model (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. Based on the RSBPM, 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-delta V objects will likely be Atens, but will also include a significant number of Apollos.

In this paper, we will apply astrodynamics techniques to estimate the distribution of delta V 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. We will utilize the algorithms for the Near-Earth Object Human Space Flight Accessible Targets Study (NHATS)<sup>1</sup> [2], heuristics derived from the current NHATS data, and other techniques specific to one-way rendezvous trajectory calculations. The results will show us how the number of known attractive NEO mission targets may increase during NEO Surveyor’s survey operations.

## References

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## Comments:

*(This is best suited to the NEO Discovery topic, but could fit into others. Oral presentation is preferred).*

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<sup>1</sup> Center for Near-Earth Object Studies, “Accessible NEAs,” <https://cneos.jpl.nasa.gov/nhats/>, accessed 2024-12-14.