

## Building the Reference Small Body Population Model

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### Abstract

To model the performance of any current or future Near-Earth Object (NEO) survey, an accurate population model of all Solar System objects is required. A fixed population model of this sort is essential in order for consistent comparisons of NEO survey performance to be made as engineering trades and component tests are conducted. This population model, called the Reference Small Body Population Model (RSBPM), is currently under development by the Near-Earth Object Camera (NEOCam) team. The RSBPM will contain up-to-date information on the orbital elements, size distribution and albedo distributions for each population.

The NEO population is based on the orbital element and H distributions provided by recent survey data that has been combined with diameter and albedo information from NEOWISE [1][2][3][4]. In addition to containing NEOs, which are of particular importance, the RSBPM will also have main belt asteroids, including the largest 15 asteroid families. Main belt asteroids are of particular importance to modeling NEO survey performance because they outnumber the NEOs by orders of magnitude and can thus serve as a source of false linkages between real NEO detections.

The RSBPM also incorporates other small-body populations out to outer Solar System objects as well as comets. The RSBPM provides information on the sky-plane density and magnitude distribution of all small Solar System objects in order to properly model and simulate any Solar System moving object survey and thus could be used by a number of current or future survey projects. Development of the RSBPM will be completed before the NEOCam launch, and the finished product will be peer-reviewed to ensure accuracy. As with the NEOs, the other populations incorporate orbital and H distributions from e.g. [5] with diameters and albedos from NEOWISE [6][7][8]. Because the RSBPM is a

diameter-based model, and contains albedos and H values for each entry, both optical and infrared surveys can be compared on a consistent basis for various diameter-completeness levels.

**Table 1:** Small body populations included in the RSBPM.

| Sub-Population          | Population       |
|-------------------------|------------------|
| Atira Asteroids         | NEOs             |
| Aten Asteroids          | NEOs             |
| Apollo Asteroids        | NEOs             |
| Amor Asteroids          | NEOs             |
| Earth Co-orbitals       | NEOs             |
| Mars-crossing Asteroids |                  |
| Main Belt Asteroids     | MBAs             |
| MBA Families            | MBAs             |
| Hungaria Asteroids      | MBAs             |
| Hilda Asteroids         | MBAs             |
| Thule Asteroids         | MBAs             |
| Jovian Trojans          |                  |
| Centaur                 |                  |
| Saturnian Trojan Moons  |                  |
| Jupiter Family Comets   | Comets           |
| Halley Family Comets    | Comets           |
| Long-period Comets      | Comets           |
| Interstellar Objects    | Comets/Asteroids |

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## References

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