THE NEAR EARTH OBJECT SURVEILLANCE SATELLITE (NEOSSat) MISSION WILL CONDUCT AN EFFICIENT SPACE-BASED ASTEROID SURVEY AT LOW SOLAR ELONGATIONS.
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Introduction: The discovery rate of near-Earth objects (NEO's) is maximized by observing as much sky as practical at an efficient resampling interval (typically at least twice a month) to as faint as practical. Surveys with coverage limitations concentrate on the most prospective regions of sky, typically on and near the ecliptic plane. However, Aten-class (and interior-to-Earth-orbit/IEO) objects may be found over much of the sky excepting when relatively far from the Earth and consequently at low solar elongations. Although ground-based surveys may search near-Sun regions briefly each night (e.g., 9 IEO's known to date) near-Sun regions are most efficiently searched from space. Various combinations of ground-based and space-based sensors have been considered [e.g., 1] with space-based sensors comparing favourably in cost to ground-based systems, and matching or exceeding the latter in cataloguing and warning capabilities. The near-Sun observing available from space is also complementary to ground-based surveys through the routine capability of extending arcs during discovery apparitions for orbit refinement.

The NEOSSat microsatellite is expected to be the first space-based asteroid search telescope with launch currently scheduled for 2010.

NEOSSat Microsatellite: The NEOSSat spacecraft will be used by the Near-Earth Space Surveillance (NESS) project to discover and track NEO's [2]. NEOSSat will be a dual use mission, also observing artificial satellites in Earth orbit. Much of the microsatellite derives its technology from the MOST asteroseismology microsatellite [3] now finishing its fifth year of operation. NEOSSat will be ~75 kg deploying a telescope similar to the 15-cm aperture f5.88 Maksutov on MOST. The spacecraft will be 3-axis stabilized with pointing stability of ~2 arcseconds in a ~100 second exposure. The NEOSSat mission has completed Phase B with launch currently anticipated in 2010. The spacecraft will be deployed into a Sun – synchronous orbit similar to that of the MOST spacecraft.

Advantages of space for near-Sun surveying: This near-Sun sky can only be routinely accessed from space, and this region must be searched to efficiently discover Atens, IEO's, and Apollos with long synodic periods. However, the near-Sun ecliptic region (where NEO's of all orbital classes are concentrated [e.g., 4]) suffers from zodiacal light sky brightness that can result in as much as one magnitude loss in detection limit depending upon pixel scale vs. point source characteristics. As near-Sun search angles are tangential through the NEO orbital distribution, a much larger volume of prospective space is covered per search field for all NEO classes than for an opposition search, and the near-Sun region has a relatively long path length where asteroids are above a given brightness due to the asteroid – Sun distance remaining relatively constant while the increasing asteroid – Earth distance is compensated by the increasingly illuminated phase of the asteroid with decreasing phase angle. Deployment in Earth orbit results in parallax determinations for all objects discovered within the orbit of Mars, thereby discriminating asteroids of interest/NEO's from Main Belt detections, and providing distances to aid initial orbit determinations.

Modelled survey completeness for IEO's, assuming limiting V magnitudes of 19 and 20 is 29% and 39%, respectively, for >1 km diameter in a 3-year survey assuming full time use of the spacecraft.

References: [1] Stokes, G.H., Yeomans, D.K., et al./Near-Earth Object Science Definition Team, 2003, NASA, Office of Space Science, Solar System Exploration Division, 154 pp. [2] Hildebrand, A.R. et al. (2004). *Proc. 55th Int. Astronautical Cong.*, Vancouver, B.C., Paper IAC-04-!AA.4.11.2.08 [3] Walker, G. et al. (2003). *PASP*, *115*, 1023-1035 [4] Masi, G., 2003, *Icarus* 163, 389-397.