Sentry: An Automated Close Approach Monitoring System for Near-Earth Objects.

Alan B. Chamberlin, Steven R. Chesley, Paul W. Chodas, Jon D. Giorgini, Michael S. Keesey, Ravenel N. Wimberly, and Donald K. Yeomans (JPL/Caltech)

In response to the international concern about potential asteroid impacts on Earth, NASA's Near-Earth Object (NEO) Program Office has implemented a new system called "Sentry" to automatically update the orbits of all NEOs on a daily basis, as new astrometry becomes available, and compute Earth close approaches up to 100 years into the future. Results will be published on our web site (http://neo.jpl.nasa.gov/) and updated orbits and ephemerides made available via the JPL Horizons ephemeris service (http://ssd.jpl.nasa.gov/horizons.html).

The Sentry system collects new and revised astrometric observations from the Minor Planet Center (MPC) via their electronic circulars (MPECs) in near real time as well as radar and optical astrometry sent directly from observers. NEO discoveries and identifications are detected in MPECs and processed appropriately. New identifications result in merging astrometric data for all identified NEOs into a single observation file while erroneous identifications result in extracting the relevant NEO's astrometric data from the primary NEO observation file. In addition to these daily updates, Sentry synchronizes with each monthly batch of MPC circulars using new software developed specifically for automating this task. New numbered asteroids, new asteroid names, and new NEOs are processed. Astrometry from the MPC monthly database is used to update all NEO observation files. The software detects corrected data, adds new data, and removes observations deleted from the MPC monthly database.

Daily and monthly processing of NEO astrometry produces a list of NEOs requiring new orbits. This list is maintained using a queuing system which allows for manual intervention of selected NEOs without interfering with the automatic system. At the heart of Sentry is a fully automatic orbit determination program which handles outlier rejection and ensures convergence in the new solution. Updated orbital elements and their covariances will be published via Horizons and our NEO web site, typically within 24 hours. A new version of Horizons, in development, will allow computation of ephemeris uncertainties using covariance data.

The positions of NEOs with updated orbits are numerically integrated up to 100 years into the future and each close approach to any perturbing body in our dynamic model (all planets, Moon, Ceres, Pallas, and Vesta) is recorded. Significant close Earth approaches are flagged for extended analysis including Monte Carlo studies of selected NEOs ("Automated Detection of Potentially Hazardous near-Earth Object Encounter", AAS/AIAA Astrodynamics Specialist Conference, 2001). Results from the close approach analysis, future Earth impact probabilities, and minimum distances between the orbits of the NEO and each close perturber, will be published on our web site (http://neo.jpl.nasa.gov/).