SUMMARY AND STATUS OF THE HORIZONS EPHEMERIS SYSTEM

J. GIORGINI
Jet Propulsion Laboratory/California Institute of Technology
4800 Oak Grove Drive, Pasadena, CA 91109, USA
e-mail: jon.d.giorgini@jpl.nasa.gov

ABSTRACT

Since 1996, the Horizons system has provided searchable access to JPL ephemerides for all known solar system bodies, several dozen spacecraft, planetary system barycenters, and some libration points. Responding to 18,400,000 requests from 300,000 unique addresses, the system has recently averaged 420,000 ephemeris requests per month.

Horizons is accessed and automated using three interfaces: interactive telnet, web-browser form, and e-mail command-file.

Asteroid and comet ephemerides are numerically integrated from JPL's database of initial conditions. This small-body database is updated hourly by a separate process as new measurements and discoveries are reported by the Minor Planet Center and automatically incorporated into new JPL orbit solutions. Ephemerides for other objects are derived by interpolating previously developed solutions whose trajectories have been represented in a file. For asteroids and comets, such files may be dynamically created and transferred to users, effectively recording integrator output. These small-body SPK files may then be interpolated by user software to reproduce the trajectory without duplicating the numerically integrated n-body dynamical model or PPN equations of motion.

Other Horizons output is numerical and in the form of plain-text observer, vector, osculating element, or close-approach tables, typically expected be read by other software as input. About one hundred quantities can be requested in various time-scales and coordinate systems. For JPL small-body solutions, this includes statistical uncertainties derived from measurement covariance and state transition matrices. With the exception of some natural satellites, Horizons is consistent with DE405/DE406, the IAU 1976 constants, ITRF93, and IAU2009 rotational models.