Trajectory Coordinate System Information

We have calculated the New Horizons trajectory and full state vector information in 11 different coordinate systems. Below we describe the coordinate systems, and in the next section we describe the trajectory file format.

Heliographic Inertial (HGI)

This system is Sun centered with the X-axis along the intersection line of the ecliptic (zero longitude occurs at the +X-axis) and solar equatorial planes. The Z-axis is perpendicular to the solar equator, and the Y-axis completes the right-handed system. This coordinate system is also referred to as the Heliocentric Inertial (HCI) system.

Heliocentric Aries Ecliptic Date (HAE-DATE)

This coordinate system is heliocentric system with the Z-axis normal to the ecliptic plane and the X-axis pointes toward the first point of Aries on the Vernal Equinox, and the Y-axis completes the right-handed system. This coordinate system is also referred to as the Solar Ecliptic (SE) coordinate system. The word "Date" refers to the time at which one defines the Vernal Equinox. In this case the date observation is used.

Heliocentric Aries Ecliptic J2000 (HAE-J2000)

This coordinate system is heliocentric system with the Z-axis normal to the ecliptic plane and the X-axis pointes toward the first point of Aries on the Vernal Equinox, and the Y-axis completes the right-handed system. This coordinate system is also referred to as the Solar Ecliptic (SE) coordinate system. The label "J2000" refers to the time at which one defines the Vernal Equinox. In this case it is defined at the J2000 date, which is January 1, 2000 at noon.

Heliographic (HG)

This system is similar to the Heliographic Inertial one except the zero longitude is fixed on the surface of the Sun and rotates with a period of 25.38 days. Specifically, the zero was defined as the longitude at the ascending node of the equator in the ecliptic plane on January 1, 1854 at 12 UT. This system is also known as the Carrington system and is an intrinsic system to Spacecraft Planet Instrument C-matric Events (SPICE) toolkit denoted as IAU_SUN where IAU stands for International Astronomical Union.

Heliocentric Earth Ecliptic (HEE)

This is a Sun centered ecliptic coordinate system where the X-axis is the Sun-Earth line, and Z-axis is the North pole for the ecliptic of the given date of observation.

Heliocentric Earth Equatorial (HEEQ)

This is a Sun centered equatorial system where the Z-axis is the solar rotation axis, and X-axis is in the plane containing the Z-axis and Earth, at the intersection of the solar central meridian, and the heliographic equator. It is also know as Stonyhurst heliographic coordinates.

J2000

This is an Earth centered equatorial system where the X_axis points toward the first point of Aries (i.e. the vernal equinox), the Z-axis is aligned with the geographic north pole.

When expressed in terms of longitude and latitude it is the standard celestial coordinate system of right ascension and declination. The common name of the system "J2000" refers to the time at which one defines the Vernal Equinox. In this case it is defined at the J2000 date, which is January 1, 2000 at noon.

Pluto J2000

The J2000 coordinate system with the origin translated to the center of Pluto.

Jupiter J2000

The J2000 coordinate system with the origin translated to the center of Jupiter.

Pluto International Astronomical Union (Pluto-IAU)

This is a cartographic coordinate system centered on Pluto where the frame is fixed and does not move with respect to the surface of the planet. The International Astronomical Union (IAU) defines the orientation of the frame.

Jupiter International Astronomical Union (Jupiter-IAU)

This is a cartographic coordinate system centered on Jupiter where the frame is fixed and does not move with respect to the surface of the planet. The International Astronomical Union (IAU) defines the orientation of the frame.

Trajectory File Format

Each extension of the trajectory file contains information for a different coordinate system. Table 1 provides the extensions and naming information for each coordinate system. Each extension is a table of 12 columns where the columns in order are the mission elapse time (MET), the UTC date and time, ephemeris time (ET), the X, Y, and Z position, the Vx, Vy, and Vz vector components, the latitude, longitude, and the magnitude of the position vector (X, Y, Z). Distance (position) information is in astronomical units (AU), and the velocity components are in km/s. Here 1 AU was defined as 1.495978706137E+08 km.

Table 1: Each extension in the trajectory file contains a table with a different coordinate system . There the extension number, name, coordinate system common abbreviation, coordinate system name, alternate name, and coordinate system center are provided.

Extension Number	Extension Name	Coordinate System Abbreviation	Coordinate System Name	Alternate Coordinate System. Name	Center
1	NH_HGI_	HGI	Heliographic Inertial	Heliocentric Inertial (HCI)	Sun
2	NH_HAE_DATE_	HAE Date	Heliocentric Aries Ecliptic Date	Solar Ecliptic (SE) Date	Sun
3	NH_HAE_J2000_	HAE J2000	Heliocentric Aries Ecliptic J2000	Solar Ecliptic (SE) J2000	Sun
4	NH_HG_	HG	Heliographic	Carrington; Sun International Astronomical Union	Sun
5	NH_HEE_	HEE	Heliocentric Earth Ecliptic		Sun
6	NH_HEEQ_	HEEQ	Heliocentric Earth Equatorial	Stonyhurst heliographic coordinates.	Sun
7	NH_J2000_	J2000	J2000	Geocentric Equatorial Inertial	Earth
8	NH_PLUTO_J2000_	Pluto J2000	Pluto J2000		Pluto
9	NH_JUPITER_J2000_	Jupiter J2000	Jupiter J2000		Jupiter
10	NH_PLUTO_IAU_	Pluto IAU	Pluto International Astronomical Union		Pluto
11	NH_JUPITER_IAU_	Jupiter IAU	Jupiter International Astronomical Union		Jupiter