

Using the JPL Horizons Ephemeris Website

<http://ssd.jpl.nasa.gov/?horizons>

The screenshot shows the top section of the JPL Horizons website. On the left is the NASA logo and the text "Jet Propulsion Laboratory California Institute of Technology". To the right is a search bar labeled "Search JPL" with a magnifying glass icon. Below this is a horizontal navigation bar with buttons for "JPL HOME", "EARTH", "SOLAR SYSTEM", "STARS & GALAXIES", and "TECHNOLOGY". A large banner image titled "Solar System Dynamics" shows various orbital paths in the solar system. Below the banner is another navigation bar with buttons for "BODIES", "ORBITS", "EPHEMERIDES", "TOOLS", "PHYSICAL DATA", "DISCOVERY", "FAQ", and "SITE MAP".



- Documentation
- Web Interface
- Telnet Method
- E-mail Method
- System News

HORIZONS System

The JPL HORIZONS *on-line* solar system data and *ephemeris* computation service provides access to key solar system data and flexible production of highly accurate *ephemerides* for solar system objects (430662 asteroids, 2966 comets, 168 planetary satellites, 8 planets, the Sun, L1, L2, select spacecraft, and system barycenters). HORIZONS is provided by the Solar System Dynamics Group of the [Jet Propulsion Laboratory](#).

The HORIZONS system can be accessed using any of the following methods:

- [telnet](#) (instructions)
- [email](#) (instructions)
- [web-interface](#) (see note below)

Choose the web-interface

NOTE: Although the [web-interface](#) to HORIZONS provides *nearly* all capabilities of the primary [telnet](#) interface (and [email](#) interface), it does not provide the following:

- Small-body PARAMETER-MATCHING population searches (use the [small-body search engine](#) as an alternative)
- Integration of USER-INPUT ORBITS
- SPK BINARY FILE production
- CLOSE-APPROACH TABLES

This example will show you how to reproduce the coordinates listed for the Earth-Sun vector in Table 2 of the lab handout.

Current Settings

Ephemeris Type **[change]** : **OBSERVER**
Target Body [change] : Mars [499]
Observer Location [change] : Geocentric [500]
Time Span [change] : Start=2008-11-01, Stop=2008-12-01, Step=1 d
Table Settings [change] : defaults
Display/Output [change] : default (formatted HTML)

Generate Ephemeris

First choose "change" next to Ephemeris Type

Current Settings

Ephemeris Type [change] : **OBSERVER**
Target Body [change] : **Mars** [499]
Observer Location [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-11-01**, Stop=**2008-12-01**, Step=**1 d**
Table Settings [change] : *defaults*
Display/Output [change] : *default* (formatted HTML)

Ephemeris/Table Type

Select the desired ephemeris/table type from the list below.

<input type="radio"/> Observer Table	Use this table type to generate a table of observer quantities (such as R.A./Dec.) for any object with respect to a geocentric or topocentric observer.
<input checked="" type="radio"/> Vector Table	Use this table type to generate a Cartesian state vector table of any object with respect to any <i>major</i> body.
<input type="radio"/> Orbital Elements	Use this table type to generate a table of osculating orbital elements for any object with respect to an <i>appropriate major</i> body.

Use Selection Above

Cancel

We want the Cartesian vectors (x,y,z) so choose the “Vector Table” option.

Then hit “Use Selection Above” button.

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Mars [499]**
Coordinate Origin [change] : **Geocentric [500]**
Time Span [change] : Start=**2008-11-01**, Stop=**2008-12-01**, Step=**1 d**
Table Settings [change] : *defaults*
Display/Output [change] : *default* (formatted HTML)

Generate Ephemeris

Next change the Target Body.

We want the x,y,z position of the Sun, so type in "Sun" and hit Search

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Mars [499]**
Coordinate Origin [change] : **Geocentric [500]**
Time Span [change] : Start=**2008-11-01**, Stop=**2008-12-01**, Step=**1 d**
Table Settings [change] : *defaults*
Display/Output [change] : *default* (formatted HTML)

Target Body

Lookup the specified body:

Sun

optionally limit to

all bodies (no limit)

Search

or choose from a list of:

Sun and Planets

Display List

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Sun [Sol]** [10]
Coordinate Origin [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-11-01**, Stop=**2008-12-01**, Step=**1 d**
Table Settings [change] : *defaults*
Display/Output [change] : *default* (formatted HTML)

Generate Ephemeris

Now change the range of dates.

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Sun [Sol]** [10]
Coordinate Origin [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-11-01**, Stop=**2008-12-01**, Step=**1 d**
Table Settings [change] : *defaults*
Display/Output [change] : *default* (formatted HTML)

Put in the range of dates you want and click "Use Specified Times" button.

Time Span

switch to discrete-times form

Preset: 10 day 30 day 60 day

Start Time:

Stop Time:

Step Size:

Available time span for currently selected target body:
BC 3000-Feb-23 to AD 3000-May-06 CT.

Times may be specified as calendar dates and optionally times (e.g. "YYYY{BC|AD}-MM-DD {hh:mm}", where items in curly braces {} are optional) or Julian dates (e.g. "JD DDDDDDD.DDDD"). For years earlier than 1000, be sure to append 'AD' (or 'BC' as appropriate). All times are CT for VECTORS tables.

See the [HORIZONS documentation](#) for accepted formats and advanced capabilities. Allowable time-spans for all bodies are available on a [separate page](#).

Use Specified Times

Cancel

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Sun [Sol]** [10]
Coordinate Origin [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-08-24**, Stop=**2008-08-26**, Step=**1 d**
Table Settings [change] : **defaults**
Display/Output [change] : **default** (formatted HTML)

Generate Ephemeris

Now we need to alter the Table Settings

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Sun [Sol]** [10]
Coordinate Origin [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-08-24**, Stop=**2008-08-26**, Step=**1 d**
Table Settings [change] : **defaults**
Display/Output [change] : **default** (formatted HTML)

Table Settings

Optional vector-table settings:

Check to make sure you've chosen these options.

output units :	AU & AU/d -- units for most output quantities
quantities code :	2 (state vector {x,y,z,vx,vy,vz}) -- selection of vector output quantities
reference plane :	ecliptic and mean equinox of reference epoch -- reference plane for all output quantities
reference system :	ICRF/J2000.0 -- reference frame for geometric and astrometric quantities
correction :	NONE (geometric states) -- selects level of correction to output vectors
labels :	<input type="checkbox"/> -- enable labeling of each vector component
CSV format :	<input type="checkbox"/> -- output data in Comma-Separated-Variables (CSV) format
object page :	<input checked="" type="checkbox"/> -- include object information/data page on output

Use Settings Above

Default Optional Settings

Cancel

Final input parameters,
feel free to change the display/output settings to
suit your needs

Current Settings

Ephemeris Type [change] : **VECTORS**
Target Body [change] : **Sun [Sol]** [10]
Coordinate Origin [change] : **Geocentric** [500]
Time Span [change] : Start=**2008-08-24**, Stop=**2008-08-26**, Step=1 d
Table Settings [change] : quantities code=2
Display/Output [change] : *default* (formatted HTML)

Generate Ephemeris

```

*****
Ephemeris / WWW_USER Fri Oct 31 19:59:31 2008 Pasadena, USA / Horizons
*****
Target body name: Sun (10) {source: DE405}
Center body name: Earth (399) {source: DE405}
Center-site name: BODY CENTER
*****
Start time : A.D. 2008-Aug-24 00:00:00.0000 CT
Stop time : A.D. 2008-Aug-26 00:00:00.0000 CT
Step-size : 1440 minutes
*****
Center geodetic : .000000000,.000000000,.00000000 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindrical: .000000000,.000000000,.00000000 {E-lon(deg),Dxy(km),Dz(km)}
Center radii : 6378.1 x 6378.1 x 6356.8 km {Equator, meridian, pole}
Output units : AU-D
Output format : 02
Reference frame : ICRF/J2000.0
Output type : GEOMETRIC cartesian states
Coordinate systm: Ecliptic and Mean Equinox of Reference Epoch

```

```

*****
JDCT
  X      Y      Z
  VX     VY     VZ
*****
$$SOE
2454702.500000000 = A.D. 2008-Aug-24 00:00:00.0000 (CT)
-8.849686471298301E-01  4.888489729196311E-01 -4.466373306035010E-06
-8.044641149574972E-03 -1.499170626400302E-02  1.411935053915507E-07
2454703.500000000 = A.D. 2008-Aug-25 00:00:00.0000 (CT)
-8.928865393438975E-01  4.737871683686950E-01 -4.402701086186261E-06
-7.790671130677267E-03 -1.513122705847692E-02 -1.169584024494790E-08
2454704.500000000 = A.D. 2008-Aug-26 00:00:00.0000 (CT)
-9.005490495700439E-01  4.585878955592324E-01 -4.483801584507096E-06
-7.533882683548127E-03 -1.526661720953845E-02 -1.467292653498610E-07
$$EOE
*****

```

These match Table 2.