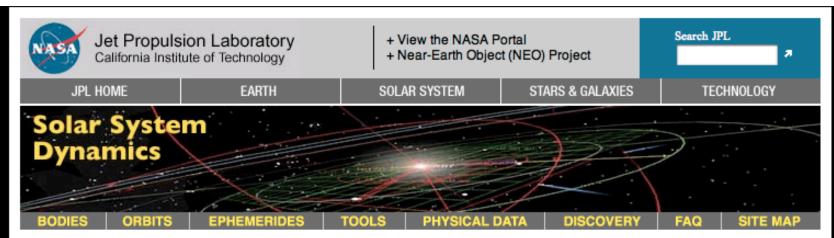
## Using the JPL Horizons Ephemeris Website <a href="http://ssd.jpl.nasa.gov/?horizons">http://ssd.jpl.nasa.gov/?horizons</a>





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:



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] : OBSERVEP
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 (folmatted 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]

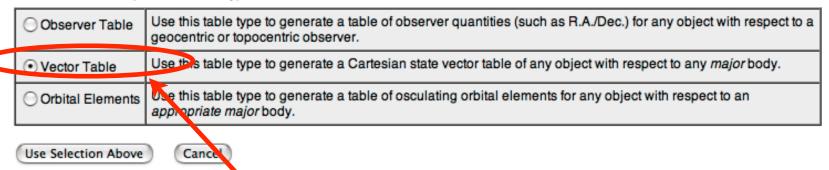
Time Span [change] : Start=2008-11-01, Stop=2008-12-01, Step=1 d

Table Settings [change] : defaults

Display/Output [change] : default (formatted HTML)

### Ephemeris/Table Type

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



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

Then hit "Use Selection Above" button.

### **Current Settings** Next change the Target Body. 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 **Current Settings** Ephemeris Type [change] : VECTORS We want the x,y,z Target Body [change]: Mars [499] Coordinate Origin [change] : Geocentric [500] position of the Sun, Time Span [change]: Start=2008-11-01, Stop=2008-12-01, Step=1 d so type in "Sun" and Table Settings [change] : defaults Display/Output [change] : default (formatted HTML) hit Search Target Body Lookup the specified body: optionally limit to all bodies (no limit) Search Sun or choose from a list of: Display List Sun and Planets

### **Current Settings**

Ephemeris Type [change] : VECTORS

Target Body [change] : Sun [Sol] [10]

Coordinate Origin [change] - Geocentric [500]

Time Span [ctange] : Start=2008-11-01, Stop=2008-12-01, Step=1 d

Table Settings [change]: defaults

Display/Output [change] : default (formatted HTML)

Generate Ephemeris

### **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.

Now change the

range of dates.

### Time Span

switch to discrete-times form

Preset: 10 day 30 day 60 day

Start Time: 2008-08-24

Stop Time: 2008-08-26

Step Size: 1 days ‡

Use Specified Times Cancel

Available time span for currently selected target body: 8 3000-Feb-23 to AD 3000-May-06 CT.

Times hay be specified as calendar dates and optionally times

(e.g. "YY rY {BC | AD}-MMM-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

VFC TORS tables.

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

### **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 [charge] : defaults Display/Output [change]: geraun (formatted HTML) Now we need to alter the Table Settings Generate Ephemeris **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 Check to make sure you've chosen these options. Optional vector-table settings: AU & AU/d 💠 -- units for most output quantities output units: -- selection of vector output quantities 2 (state vector {x,y,z,vx,vy,vz}) quantities code: reference plane : ecliptic and mean equinox of reference epoch -- reference plane for all output quantities ICRF/J2000.0 | -- reference frame for geometric and astrometric quantities reference system: -- selects level of correction to output vectors correction: NONE (geometric states) -- enable labeling of each vector component labels: -- output data in Comma-Separated-Variables (CSV) format CSV format: -- include object information/data page on output object page: 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
                                              {source: DE405}
Target body name: Sun (10)
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,.000000000 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindric: .000000000,.000000000,.00000000 {E-lon(deq),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 Equipox of Reference Epoch
JDCT
                                           These match Table 2.
  X Y Z
   VX VY
$$SOE
2454702.500000000 = A.D. 2008-Aug-24 00:00:00.0000 (CT)
  -8.849686471298301E-01 4.888489729196311E-01 -4.466373306035010E-06
  -8.044641149574972E-03 -1.499170626400302E-02 1.411935053915507E-07
2454703.500000000 = A.D. 2008-Aug-25 00:00:00.0000 (CT)
  -8.928865393438975E-01 4.737871683686950E-01 -4.402701086186261E-06
  -7.790671130677267E-03 -1.513122705847692E-02 -1.169584024494790E-08
2454704.500000000 = A.D. 2008-Aug-26 00:00:00.0000 (CT)
  -9.005490495700439E-01 4.585878955592324E-01 -4.483801584507096E-06
  -7.533882683548127E-03 -1.526661720953845E-02 -1.467292653498610E-07
$$EOE
     *********************
```