Obtaining SPICE Products Available from the NAIF and Horizons Servers

Emphasis on Kernels

January 2020
Overview

• Many SPICE products are available from the NAIF server
  - These are mostly SPICE products produced at JPL
  - Access is available using the https protocol
  - See the next page for URLs

• SPICE products made by other organizations are controlled by those organizations
  - Some may be available from the NAIF server
  - Some may be available at other public servers, or on restricted servers, or not at all
    » The International Planetary Data Alliance (IPDA) is working towards making large amounts of archived planetary data, including SPICE, universally available through “all” agency archives
  - Unfortunately there is no simple rule set to describe what may be found where
  - As a general rule, NAIF has no cognizance of these products
NAIF Server URLs

Navigation and Ancillary Information Facility

• NAIF home page
  https://naif.jpl.nasa.gov
    • Here you may access all official SPICE products produced by NAIF
      - kernels (generic, mission operations, and PDS archived ancillary data)
      - software (Toolkits and individual utility programs)
      - documents
      - tutorials
      - programming lessons
      - problem solving tips
      - rules about using SPICE
      - links to useful resources
      - access to the WebGeocalc tool
      - access to the Cosmographia visualization program

• SPICE announcements (by NAIF)
  https://naif.jpl.nasa.gov/mailman/listinfo/spice_announce
    For use by NAIF staff in making assorted announcements.

• SPICE discussion (by anyone)
  https://naif.jpl.nasa.gov/mailman/listinfo/spice_discussion
    For use by SPICE users who wish to communicate with other SPICE users
    (Don’t use this if you have questions for NAIF staff)
• The remaining charts discuss where to find the various categories of SPICE kernel files
  – Operational flight project kernels
    » For active flight projects, mostly those at JPL
  – PDS archived kernels
    » Those that have been delivered to and reviewed and accepted by the NAIF Node of NASA’s Planetary Data System
    » These are the most easily used, due to the existence of furnsh kernels (meta-kernels)!
    » These cover from launch to typically 6-to-9 months behind current time
  – Generic kernels
    » Not tied to any one specific mission
    » Used by many flight projects and other endeavors
    » Some of these are also available in the other two categories
  – How to generate SPKs for comets and asteroids
1 - Select the mission class of interest

2a - Select the project name to get access to the kernels folder for that project. (see next page)

- or -

2b - Select the kernel type to get access to all kernels of that type for that project. The number tells how many kernels of that type are available. (see next page)
Access to all kernels for the named project

Access to kernels of the selected type for the named project

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<thead>
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</table>

Then change to the folder containing the kind of kernels of interest to you, such as SPK.

NAIF Server
The best method for obtaining PDS archived kernels is directly from the NAIF server.

- Complete SPICE data sets exist on the NAIF server fully expanded—not bundled in a Zip or tar file
- Unless you have reason to do otherwise, download the entire archival data set using the "Archive Link"
  - That way you’ll get all the latest data, the associated “furnsh kernels”, and the best documentation.
- If the data set is large and you need only a portion of it based on start/stop time, use the “subsetter” link to obtain the smaller amount of data needed.

Pictorial examples are shown on the next two pages.
If you select “PDS SPICE Archives” on the NAIF web page you can do any of the following.

- You can copy and paste the "link" URL into the Unix "wget" or the FileZilla tool, or some equivalent tool, to download the entire data set—recommended if not too large! See the next page if data set size is an issue.

- Or you can click the "link" to display the mission's archive folder and then select specific kernels from the kernel data folders, and/or “furnsh” meta- kernels (mk) and other items from the extras folder.
<table>
<thead>
<tr>
<th>Mission Name</th>
<th>Archive Readme</th>
<th>Archive Link</th>
<th>PDS3 or PDS4</th>
<th>Data Size (GB)</th>
<th>Start Time</th>
<th>Stop Time</th>
<th>Subset Link</th>
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</table>

For “large” data sets that might take a long time to download, if you really need just a subset of the data covering a limited amount of time you should use the “Subset Link” for the data set of interest.

This process will automatically select just the kernels that fall within or overlap the time bounds you specify, construct a new “FURNSH” kernel(s) containing the names of this subset of kernels (thus making it easy for you to load the subset into your program), and create a custom wget script you may use to download these files to your computer.
• Use GNU’s `wget`, or FileZilla, or a similar utility to download the complete SPICE data set
  – Example using `wget` on the Deep Impact mission:
    » Open a terminal window
    » `wget -m -nH --cut-dirs=5 -nv` (insert the URL of the "Archive Link" for the SPICE data set here). For example:
      • `wget -m -nH --cut-dirs=5 -nv http://naif.jpl.nasa.gov/pub/naif/pds/data/di-c-spice-6-v1.0/disp_1000/`
  – FileZilla info
    » [http://filezilla-project.org/client_features.php](http://filezilla-project.org/client_features.php)
Obtaining Generic Kernels

Navigation and Ancillary Information Facility

Generic kernels are just a few clicks away...

<table>
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</tbody>
</table>

SPICE kernels that exist independent of any particular flight project are called generic kernels. These may be obtained from the Generic Kernels link of the NAIF server appearing above.
The Horizons server is an on-line ephemeris generator for natural bodies (and more)
- It is operated by JPL’s Solar System Dynamics Group, not by NAIF

Of primary interest to SPICE users is its ability to generate up-to-date SPK files for comets and asteroids
- Horizons home page:
  » http://ssd.jpl.nasa.gov/?horizons
- Horizons web interface for manual generation of small body SPKs:
  » http://ssd.jpl.nasa.gov/x/spk.html
- Horizons telnet interface for automated (programmatic) generation of small body SPKs:
  » telnet ssd.jpl.nasa.gov 6775
  » For an example script, use anonymous ftp to go to:
    • ssd.jpl.nasa.gov
  » and once there, look at:
    • /pub/ssd/SCRIPTS/smb_spk