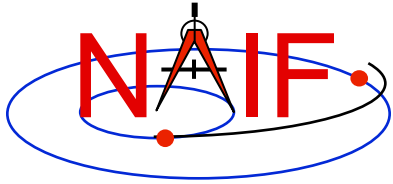


Navigation and Ancillary Information Facility

Summary of Key Points

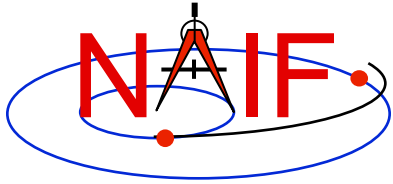
January 2012



Which Pieces of SPICE Must I Use?

Navigation and Ancillary Information Facility

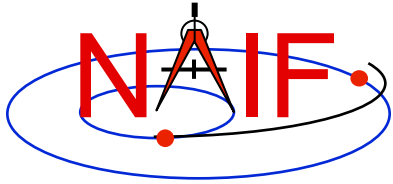
- **There's not a simple answer**
 - Depends on what task you wish to accomplish
 - Depends on what mission you are working on
- **Don't feel overwhelmed**
 - Many complex calculations can be made using just a few SPICE APIs
- **The next several charts highlight some key points**
 - We assume you have already looked at the major SPICE tutorials, or already have some familiarity with SPICE
 - We assume you have successfully downloaded and installed the SPICE Toolkit
- **Consider printing this tutorial and keeping it near your workstation**



Reminder of Key Subsystems

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- **SPK: Position (and velocity) of things**
- **PCK: Size/shape/orientation of target bodies**
 - For binary PCKs, only orientation is provided; use a text PCK to obtain size/shape
- **IK: Instrument field-of-view geometry**
- **CK: Orientation of spacecraft or spacecraft structures that move**
- **FK: Definition/specification of non-core reference frames, including instrument mounting alignments**
- **LSK: UTC (SCET) \longleftrightarrow ET (TDB) time conversions**
- **SCLK and LSK: SCLK \longleftrightarrow ET (TDB) time conversions**



Primary Kernel Interfaces - 1

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Which SPICE modules are most commonly called to use data obtained from a given kernel type?

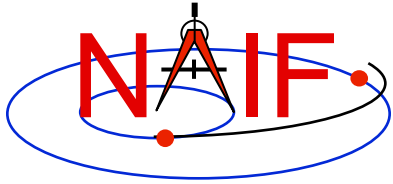
SPK	SPKEZR, SPKPOS, SPKCOV, SPKOBJ
PCK	SXFORM, PXFORM, SPKEZR, SPKPOS, BODVRD
IK	GETFOV, G*POOL
CK	SXFORM, PXFORM SPKEZR, SPKPOS, CKCOV, CKOBJ (CKGPAV, CKGP)

FK	SXFORM, PXFORM, SPKEZR, SPKPOS
LSK	STR2ET, TIMEOUT, SCE2C, SCT2E, SCE2S, SCS2E
SCLK	SCS2E, SCE2S SXFORM, PXFORM, SPKEZR, SPKPOS
EK/ESQ	EKFIND, EKG*

Notes: FURNISH is used to load (provide access to) all SPICE kernels.

API names shown are for FORTRAN versions:

- use lower case and add an “_c” when using C
- use lower case and prepend “cspice_” when using Icy (IDL) and Mice (MATLAB)



Primary Kernel Interfaces - 2

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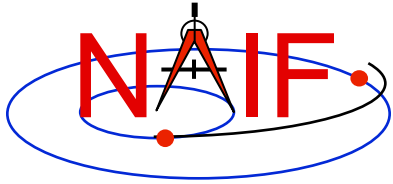
For a given high-level module, which kind(s) of kernel(s) will or may be needed?

Kernel Type(s) Needed

Module Name	SPK	PCK	IK	CK	FK	LSK	SCLK
SPKEZR, SPKPOS	Y	M		M	M	M	M
SXFORM, PXFORM	M	M		M	M	M	M
CKGP, CKGPAV		M		Y	M	M	M
GETFOV			Y				
G*POOL		M	M				
STR2ET, TIMOUT						Y	
SCS2E, SCE2S						Y	Y
CHRONOS (time conversion app.)	M	M		M	M	Y	M

Yes = the indicated kernel type is needed

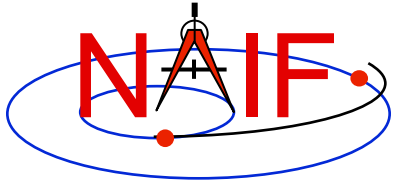
Maybe = the indicated kernel type may be needed



Kernel “Coverage” Cautions

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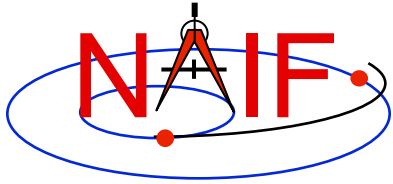
- **Your set of kernels must:**
 - contain data for all “objects” of interest
 - » Sometimes you must include intermediary objects that provide a connection (recall the chaining discussion in the SPK tutorial)
 - contain data covering the time span of interest to you
 - » Watch out for data gaps within that time span
 - » Watch out for the difference of ~66 seconds between ET and UTC
 - contain all the kernel types needed by SPICE to answer your question
 - » As the previous charts allude, you may need one or more kernels that are not obvious
 - be managed (loaded) properly if there are overlapping (competing) data within the set of files you are using



What Kernels are Available?

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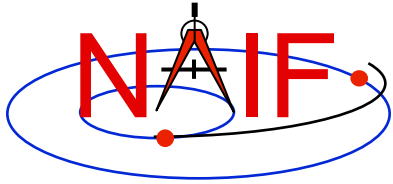
- It depends on the mission or task you are working on...
- If you're working with JPL mission data, there are three categories of kernel data available to you.
 - **Mission operations** kernels – those used by the flight teams to fly the mission and prepare the archival science products
 - **Archived** kernels – those that have been selected from (or made from) the mission ops kernels, and then are well organized and documented for the permanent PDS archive
 - **Generic** kernels – those that are used by many missions and are not tied to any one mission
 - » Relevant generic kernels are usually included in the PDS SPICE archived kernels data sets mentioned above
- The situation may be very similar for non-JPL missions, but this is really up to whatever agency/institution is producing the kernels.



How Can I Find Possibly Useful Toolkit Modules?

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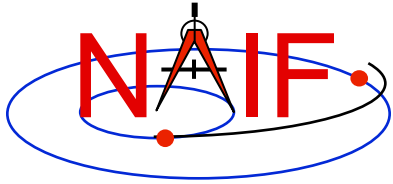
- Review the previous charts
- Look at the appropriate SPICE tutorial(s)
- Look at the “Most Used xxx APIs” document `.../doc/html/info/mostused.html`
- Search the permuted index:
 - `spicelib_idx` for the FORTRAN toolkits `.../doc/html/info/spicelib_idx.html`
 - » This index also correlates entry point names with source code files.
 - `cspice_idx` for the C toolkits `.../doc/html/info/cspice_idx.html`
 - `icy_idx` for the IDL toolkits `.../doc/html/info/icy_idx.html`
 - `mice_idx` for the MATLAB toolkits `.../doc/html/info/mice_idx.html`
- Read relevant portions of a SPICE “required reading” technical reference document (e.g. “`spk.req`”)
 - `.../doc/html/req/spk.html` for the hyperlinked html version (best)
 - `.../doc/spk.req` for the plain text version



How Can I Understand How To Use Those Modules?

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- **The primary user-oriented documentation about each module is found in the “header” located at the top of each source code file and in the module’s HTML page in the API reference guide.**
 - (More documentation is found at the additional entry points for those FORTRAN modules that have multiple entry points.)
- **Reference documentation for major subsystems is found in like-named “required reading” documents (e.g. spk.req, ck.req, etc.)**
- **The SPICE tutorials contain much helpful information.**
- **See “SPICE Documentation Taxonomy” in the tutorials collection for additional reading suggestions.**



Does NAIF Provide Any Examples?

Navigation and Ancillary Information Facility

- **Nearly all module headers contain one or more working examples**
- **“Most Useful SPICELIB Subroutines” has code fragments**
.../doc/html/info/mostused.html
- **The “required reading” reference documents often contain examples** **.../doc/html/req/index.html**
- **Some simple “cookbook” programs are found in the Toolkit**
.../src/cookbook/...
- **Make use of the SPICE Programming Lessons available from the NAIF server**
 - **ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Lessons/**