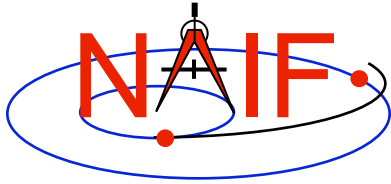


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# Summary of Key Points

September 2009

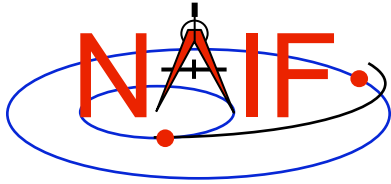


# Which Pieces of SPICE Must I Use?

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- **There's not a simple answer**
  - Depends on what task you wish to accomplish
  - Depends on what mission you are working on
- **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**

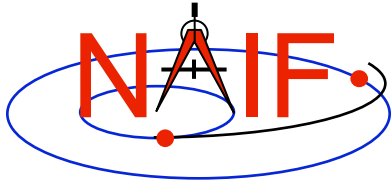


# Reminder of Key Subsystems

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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 time conversions
- **SCLK and LSK:** SCLK  $\longleftrightarrow$  ET time conversions



# Primary Kernel Interfaces - 1

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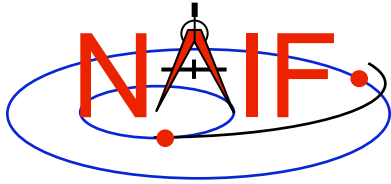
**Which SPICE interface modules are most commonly called to use data obtained from a given kernel type?**

<div>SPK</div> <div>SPKEZR, SPKPOS, SPKCOV, SPKOBJ</div>	<div>FK</div> <div>SXFORM, PXFORM, SPKEZR, SPKPOS</div>
<div>PCK</div> <div>SXFORM, PXFORM, SPKEZR, SPKPOS, BODVRD</div>	<div>LSK</div> <div>STR2ET, TIMEOUT, SCE2C, SCT2E, SCE2S, SCS2E</div>
<div>IK</div> <div>G*POOL, GETFOV</div>	<div>SCLK</div> <div>SCS2E, SCE2S SXFORM, PXFORM, SPKEZR, SPKPOS</div>
<div>CK</div> <div>SXFORM, PXFORM SPKEZR, SPKPOS, CKCOV, CKOBJ (CKGPAV, CKGP)</div>	<div>EK/ESQ</div> <div>EKFIND, EKG*</div>

**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

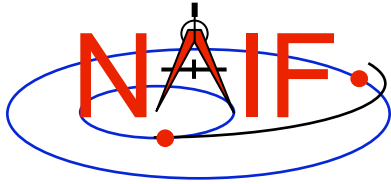
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**For a given module, which kind(s) of kernel(s) will or may be needed?**

Module Name	Kernel Type(s) Needed						
	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

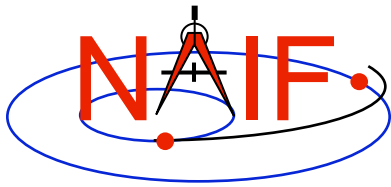


# Kernel “Coverage” Cautions

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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
  - 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

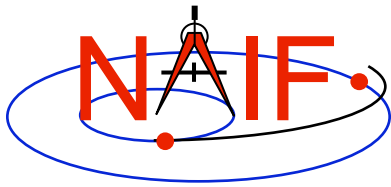


# What Kernels are Available?

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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
    - » Note that appropriate 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.

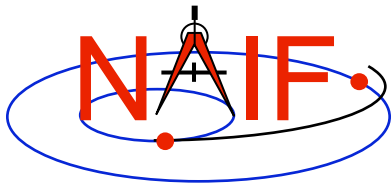


# How Can I Find Possibly Useful Toolkit Modules?

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- Review the previous charts
- Look at the appropriate SPICE tutorial(s)
- Look at the “Most Useful SPICELIB Subroutines” 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” 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



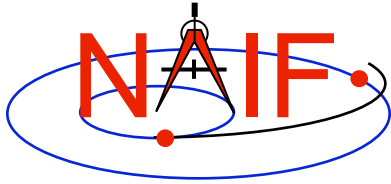


# How Can I Understand How To Use Those Modules?

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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?

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- **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**
- **Four tutorials offer programming examples**
- **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/](ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Lessons/)**