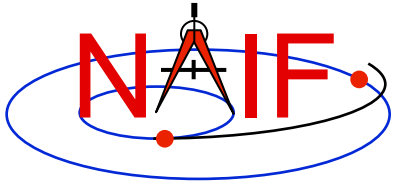


Navigation and Ancillary Information Facility

SPICE Conventions

**A summary of standards, lingo and
common usage within SPICE**

April 2016



SPICE Lexicon - 1

Navigation and Ancillary Information Facility

SPICE

- The name of this ancillary information system

NAIF

- The name of the team of people at JPL who lead development of the SPICE system.
- Also the name of the ancillary data node of NASA's Planetary Data System (PDS).



SPICE Lexicon - 2

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SPICE Toolkit
The Toolkit

- Names that refer to the principal collection of software produced by JPL's NAIF Team as part of the SPICE information system.

Toolkit

- The Fortran 77 version of the Toolkit.

SPICELIB

- The principal user library found within Fortran versions of the Toolkit.

CSPICE

- Used to refer to the entire C Toolkit, and also to the principal user library found within C versions of the Toolkit.

Icy

- An IDL interface to CSPICE

Mice

- A MATLAB interface to CSPICE

Kernel

- A SPICE data file

Sorry for this rather confusing terminology!



SPICE Lexicon - 3

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- **Text kernel**
 - Any kernel type consisting entirely of ASCII information, with each line terminated using the local operating system convention (CR, LF, or CR+LF)
 - Text kernel types are FK, IK, text PcK, LSK, SCLK, MK (“Furnsh”)
 - Any set of text kernels, excepting MKs, could be combined in a single file.
 - » But this is certainly not recommended!

- **Binary kernel**
 - Any kernel type using a binary file format
 - Binary types are SPK, binary PcK, CK, DBK and DSK
 - Different binary kernel types cannot be combined together



SPICE Lexicon - 4

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- **“Command file”**
 - Many SPICE application and utility programs either require or optionally accept, an input file containing program directives, and sometimes input data
 - The following names are used:
 - » **setup file**
 - » **preferences file**
 - » **command file**
 - » **specifications file**
 - » **definitions file**
- **“Found flag”**
 - A Boolean output (“True” or “False”) from a SPICE kernel reader that informs your program whether or not data were found that match your request



SPICE Lexicon - 5

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- **Coverage**
 - The period(s) of time for which a time-based kernel contains data
- **Deprecated software**
 - Code that, while still useable, has been superseded with a newer and presumably better version
 - We encourage you to not use deprecated SPICE software
 - Deprecated modules are so marked in their headers
- **Toolkit version naming**
 - "Nxxxx" e.g. N0065 is Version 65
 - » Often shortened to just Nxx (e.g. N65)
 - Used for all instances of a given toolkit release
 - » Fortran ("Toolkit"), C ("CSPICE"), IDL ("Icy"), MATLAB ("Mice")
- **"Satellite" is used to refer only to a natural satellite, never to a spacecraft.**
- **"Run-time" occurs when you execute a program**



SPICE Lexicon - 6

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Names used synonymously

- Kernel, SPICE file, SPICE kernel, SPICE kernel file
- Meta-kernel, Furnsh Kernel
- Module, routine, subroutine, procedure, function, application program interface (API)
- Application, program, utility, executable
- Metadata, comments
- Time, Epoch
- Encoded SCLK, ticks*
- Frame, Reference Frame**
- Ephemeris, trajectory
- Rectangular coordinates, Cartesian coordinates**
- Geodetic, Planetodetic (coordinate system)
- Ephemeris time (ET), Barycentric Dynamical Time (TDB)
- Attitude, orientation
- International Celestial Reference Frame (ICRF) and Earth Mean Equator and Equinox of 2000 reference frame (J2000)
- “Body”, “solar system object,” “ephemeris object”

* Encoded SCLK always refers to absolute time; “ticks” is used to refer to both durations and absolute times.

** Outside of SPICE the term “coordinate system” is often used synonymously with “frame” or “reference frame.” We prefer to use “coordinate system” in the sense of describing how coordinates are measured (e.g. cylindrical coordinate system, rectangular coordinate system, polar coordinate system, etc) within a frame, and to use “frame” in the sense of a set of three orthogonal vectors that define an orientation.



Kernel File Names

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- **SPICE imposes some restrictions on kernel file names**
 - No white space allowed within a name
 - Maximum length of a name (including any path specifications) is 255 characters
 - » See the tutorial “Intro_to_kernels” for limitations on file name specifications contained within meta-kernels (“furnsh kernels”)
- **NAIF suggests names conform to the PDS3 standard: “36.3”**
 - <1 to 36 alphanumeric characters>.<1 to 3 chars>
- **Common usage within NAIF for SPICE kernel file name extensions is listed on the next page, with the following general style used:**
 - t* text format (e.g. pck00010.tpc)
 - b* binary format (e.g. de430.bsp)



Common SPICE Kernel File Name Extensions

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SPK:

.bsp **binary SPK file**

PCK:

.tpc **text PCK file**
(The most common type Pck)
.bpc **binary PCK file**
(Very few instances of this)

IK:

.ti **text IK file**

FK:

.tf **text FK file**

LSK:

.tls **text LSK file**

CK:

.bc **binary CK file**

SCLK:

.tsc **text SCLK file**

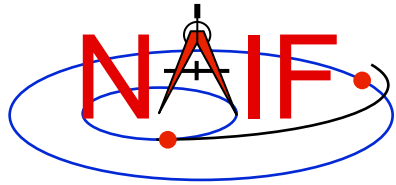
MK:

.tm **text meta-kernel file ("FURNISH kernel")**

DSK:

.bds **binary DSK file**

These are strong suggestions but not requirements



Common Document Name Extensions

Navigation and Ancillary Information Facility

- **These extensions are used for plain ASCII documents included with each Toolkit delivery**
 - .ug** **User's Guide**
 - .req** **“Required Reading” technical reference document**
 - .txt** **Used for a few miscellaneous documents**
 - .idx** **Used only for the permuted index document**
- **All HTML documents included in the Toolkit have extension .html**



Public and Private Modules

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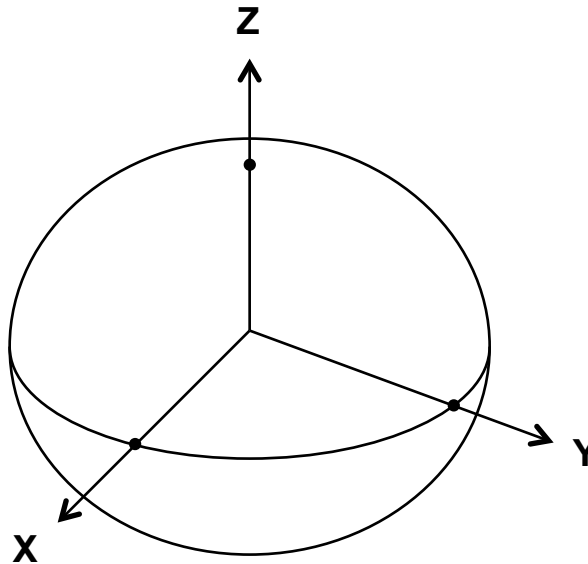
- **All Toolkits include public and private modules**
- **Public modules are for you to use**
 - Names of public APIs are different in the four SPICE library implementations. For example, the top level SPK reader SPKEZR has the following names
 - » in SPICELIB (FORTRAN) **SPKEZR**
 - » In CSPICE (C) **spkezt_c**
 - » ICY (IDL) **cspice_spkezt**
 - » MICE (MATLAB) **cspice_spkezt** and **mice_spkezt**
- **Private modules are for NAIF staff use only**
 - Names of private modules start with “ZZ”
 - They are present in the Toolkit only to support operations of “public” modules
 - Do not use “private” modules in your code – they may be changed by NAIF without notice

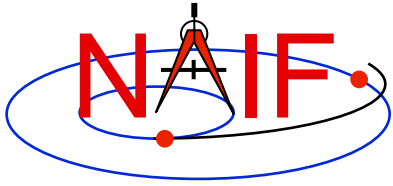


Reference Frame Conventions

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- **All reference frames used within SPICE are right handed systems: this means $X \text{ cross } Y = Z$**





Names and IDs

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- **Many items within SPICE have assigned names (text strings) and IDs (integer numbers)**
- **The rules, standards, practices and exceptions regarding these names and IDs are discussed in a separate tutorial (“NAIF IDs and Names”)**