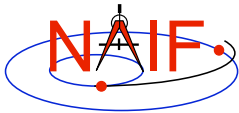


# SPICE Conventions

A summary of many “standards,” lingo  
and common usage within SPICE

March 2006



## SPICE Lexicon - 1

**SPICE**

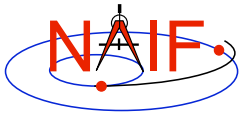
- The name of this ancillary information system

**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).

**Satellite**

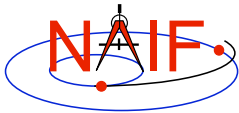
- Refers only to a natural satellite of a planet—not a spacecraft



## SPICE Lexicon - 2

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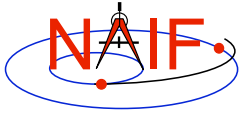
- |   |  |
|---|--|
| <b>SPICE Toolkit</b><br><b>NAIF Toolkit</b><br><b>The Toolkit</b> | <ul style="list-style-type: none"><li>• Names that refer to the principal collection of software produced by JPL's NAIF Team as part of the SPICE information system. May include mission- or domain-specific augmentations.</li></ul> |
| <b>Generic Toolkit</b>  | <ul style="list-style-type: none"><li>• A Toolkit that for sure contains no mission-specific or enterprise-specific augmentations. This is what is available from NAIF's website.</li></ul>  |
| <b>SPICELIB</b>   | <ul style="list-style-type: none"><li>• The principal user library found within FORTRAN versions of the Toolkit.</li></ul>   |
| <b>CSPICE</b>   | <ul style="list-style-type: none"><li>• The principal user library found within C versions of the Toolkit. Also used to refer to the entire C Toolkit.</li></ul>   |
| <b>Icy</b>  | <ul style="list-style-type: none"><li>• The IDL version of the Toolkit (which interfaces to CSPICE)</li></ul>  |



## 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, CR+LF, or line length parameter)
  - Text kernel types are FK, IK, text PcK, LSK, SCLK, FURNISH, MK
  - Any and all text kernels could be combined (carefully) in a single file. (But this is certainly not recommended!)
- **Binary kernel**
  - Any kernel type containing predominately numeric data using the local binary representation
    - » These files also contain some ASCII information
  - Binary types are SPK, binary PcK, CK and ESQ
  - Different binary kernel types may not be combined together in a single file
- **Transfer format kernel**
  - A hexadecimal (ASCII) version of a binary kernel, used ONLY for porting a kernel between incompatible computers.
  - No longer as important as it was prior to the addition of so-called "binary kernel run-time translation" capability in N0052.

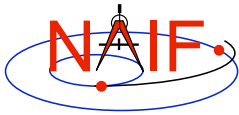


## SPICE Lexicon - 4

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- **Database Kernel (DBK)**
  - A SPICE kernel that, in conjunction with Toolkit DBK software, provides a self-contained SQL-like database capability.
- **“Command file”**
  - Many SPICE application and utility programs either require, or optionally accept, an input file containing program directives and sometimes input data. Unfortunately NAIF has not used a consistent approach for referring to such files. The following names have been used:
    - » Setup, preferences, command, specifications, definitions

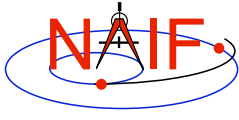


## SPICE Lexicon - 5

Navigation and Ancillary Information Facility

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- **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
    - » (But, for your convenience, we won't remove it from the Toolkit packages) 😊



## SPICE Lexicon - 6

Navigation and Ancillary Information Facility

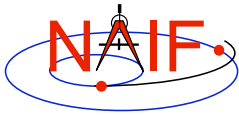
### Names used synonymously

- Kernel, SPICE file, SPICE kernel, SPICE kernel file
- Metadata, comments
- Time, Epoch
- Frame, Reference Frame\*
- Ephemeris time (ET), Barycentric Dynamical Time (TDB)
- Attitude and orientation
- International Celestial Reference Frame (ICRF) and Earth Mean Equator and Equinox of 2000 (J2000) reference frame
- Meta kernel and Furnsh kernel
- Setup file, Preferences file, Command file
- Specifications file, Definitions file

\* Note: the term “coordinate system” is often used synonymously with “frame” or “reference frame.” NAIF believes this is incorrect usage. We prefer to use that term in the sense of describing how coordinates are measured (e.g. cylindrical coordinate system, or Cartesian coordinate system).

SPICE Conventions

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## Kernel File Names

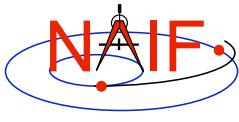
Navigation and Ancillary Information Facility

- **SPICE imposes only one restriction on kernel file names**
  - No white space allowed within a name
- **NAIF suggests names conform to the PDS standard: “27.3”**
  - <1 to 27 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. leapseconds.tls)
  - b\* binary format (e.g. de405.bsp)
  - x\* transfer format (e.g. de405.xsp)

Note: transfer format is used **ONLY** for porting binary kernels between computers with incompatible binary standards. It is an ASCII file using hexadecimal representations for data.

SPICE Conventions

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## Common SPICE Kernel File Name Extensions

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### SPK:

**.bsp** binary SPK file  
**.xsp** transfer format SPK file

### PcK:

**.tpc** text format PcK file  
(This is the most common type PcK)  
**.bpc** binary PcK file  
(few instances of this)  
**.xpc** transfer format PcK file  
(few instances of this)

### IK:

**.ti** text format IK file

### FK:

**.tf** text format FK file

### LSK:

**.tls** text format LSK file

### CK:

**.bc** binary format CK file  
**.xc** transfer format CK file

### SCLK:

**.tsc** text format SCLK file

### EK Family (ESP, ESQ, ENB)

#### ESP:

**.tep** text format Science Plan EK file

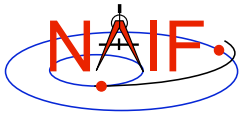
#### ESQ:

**.bes** binary Sequence Component EK file  
**.xes** transfer Sequence Component EK file

#### ENB:

n/a (www interface)

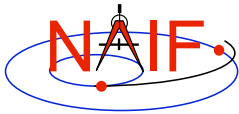
These are suggestions, not requirements



## Common Document Name Extensions

Navigation and Ancillary Information Facility

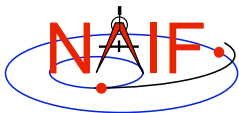
- **These extensions are used for plain ASCII documents included with each Toolkit delivery**
  - .ug** User's Guide
  - .req** "Required Reading" reference document
  - .txt** Used for a few miscellaneous documents
  - .idx** Used only for the permuted index document
- **Alternate formats of the complete Toolkit document collection are available from the NAIF anonymous ftp server**
  - .html** (contains no links... this is simply html format)
  - .pdf**



## SPICE Library Modules

Navigation and Ancillary Information Facility

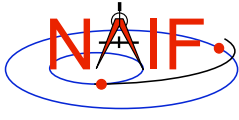
- **Public modules:** \*.for or \*.f, and \*\_c.c
  - These are provided for your use (most Toolkit modules are public)
- **Private modules:** modules named like zz\*\*\*\*\*
  - These are “private” modules, present in the Toolkit only to support operations of “public” SPICELIB and CSPICE modules
    - » Do not use “private” modules in your code—they may change
- **Support modules**
  - Modules found in the “support” and “csupport” libraries exist only for use by Toolkit programs
    - » Do not use support modules in your code—they may change
- **CSPICE “wrapper” modules**
  - Modules with a name style of <name>\_c.c are native C-language interface modules created to provide you with true C-style interfaces to the underlying code created by using the f2c translator on SPICELIB
  - They don’t yet exist for all SPICE modules, but where these do exist, use them
    - » Example: use spekrz\_c.c instead of spekrz.c



## Reference Frame Conventions

Navigation and Ancillary Information Facility

- **All Cartesian reference frames used within SPICE are right handed systems**
  - $X \text{ cross } Y = Z$
- **In planetocentric frames the +Z axis always points to the north side of the invariable plane (the plane whose normal vector is the angular momentum vector of the solar system)**
  - Planetocentric longitudes increase positively eastward
  - Planetocentric latitudes increase positively northward
- **For planetographic frames:**
  - longitude is defined such that the sub-observer longitude increases with time as seen by a distant, fixed observer in an inertial reference frame
  - latitude is defined in the same way as for planetocentric systems, increasing positively northward



## Names and IDs

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Navigation and Ancillary Information Facility

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