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To: W. S. Devereux

From: S. B. Cooper

Subject: Generic SCLK Kernel Format to Support Deep Space Missions

References:

[1] "Principles of Timekeeping for the NEAR and STEREO Spacecraft," S. B. Cooper, NASA/CR-2001-209988, September 2001
[2] "Telemetry Standard Formatted Data Unit (SFDU) Interface," DSMS document 0161-Telecomm (previously TLM-3-29), November 15, 2002
[3] "SCLK Required Reading," N. J. Bachman, "Jet Propulsion Laboratory, NAIF document No. 222.02, October 6, 1999

Several deep space missions are currently in development at APL, including MESSENGER, STEREO and New Horizons. Each of these missions requires maintenance of accurate time knowledge both on the ground and on the spacecraft itself. In order to support that requirement, a common approach has been developed for timekeeping system design, implementation and test. This approach offers potential long-term benefits in the areas of system design, development of tools, operator training and timekeeping system testing.

One component of this generic approach is the use of a common file format for recording the correlation between time on the spacecraft and time on the ground. The file is called an "SCLK kernel". This note describes the common format used for all time correlation entries in the SCLK kernels.

Overview

According to Reference [1] , "The primary goal of spacecraft timekeeping is to establish knowledge of the time of an onboard reference event with respect to which the time of every other event on the spacecraft can be measured." For the current missions, that onboard reference event is the leading edge of a one-pulse-per-second ("1 PPS") signal that defines a fundamental 1 Hz or 1-second Command and Data Handling (C&DH) Subsystem timing cycle.

Downlink telemetry frames for each of these missions are transmitted to Earth without synchronization to the 1 PPS signal. When each frame is received on Earth by a NASA Deep Space Network (DSN) station, the time that frame is received will be reported as "Earth Received Time" (ERT) to APL [2]. With that knowledge, we can accurately estimate when the frame was transmitted from the spacecraft but we cannot accurately determine the time of the 1 PPS signal. However, that time is needed because the 1 PPS signal is the onboard reference event to which all other events on the spacecraft are measured, including instrument observations and Guidance and Control (G&C) Subsystem computations.

Each of the current missions addresses this problem is a similar fashion. A two-part hardware counter is used and the value of that counter is provided in the secondary header of each downlink telemetry frame[1]. One part represents a count of integer seconds since the counter started or since launch. That provides a label to represent the time of the corresponding 1 PPS reference event that occurs at the same time the integer seconds counter increments. The other part represents a count of sub-seconds since the last 1 PPS event occurred. In this note, we refer to the combined counter as "Mission Elapsed Time" or MET. The term "MET" is sometimes used by others to denote only the integer seconds component of the counter but it is not used that way here. Instead, the term "iMET" (or "integer MET") is used to represent the integer seconds component and the term "vMET" (or "vernier MET") is used to represent the sub-seconds component. Then, iMET + vMET/K is a representation of time in seconds, where K is a scaling factor that depends on the time resolution of the sub-seconds counter.

The downlink hardware latches the value of the two-part MET counter as the beginning of the downlink frame begins to be transmitted through the RF system and then out a spacecraft antenna. (The hardware and timing details differ from mission to mission and are outside the scope of this memo). Using the Earth Received Time from the receiving DSN station, knowledge of how long the frame took to travel from the spacecraft to the DSN station and knowledge of downlink time delays through the spacecraft, we can accurately estimate the time the MET counter was latched. Using the value of vMET, we can then accurately estimate the time of the last 1 PPS event before the MET was latched.

The correlation between the transmitted integer seconds iMET value that represents the time of a 1 PPS reference event and our estimate of the Earth time at which that event occurred is saved in a text file called an "SCLK kernel".

[1] For the current suite of missions, the counter value related to a frame is actually provided in the secondary header of the next downlink frame.

MET counter formats

The format of MET differs for each mission, although it may be possible to standardize to one or two formats for most future missions. Table 1 summarizes the details for current APL missions:

Mission	***iMET bits***	***vMET bits***	***vMET resolution***	***vMET counts per second***	***Total MET bits***
MESSENGER	28	20	1 microsecond	1,000,000	48
STEREO	32	8	3.90625 milliseconds	256	40
New Horizons	32	16	20 microseconds	50,000	48

Table 1: Mission MET Formats

The SCLK kernel

Each SCLK kernel is a time data text file in a generic format defined by the Navigation and Ancillary Information Facility (NAIF) of NASA's Jet Propulsion Laboratory (JPL) for use with their SPICE software [3]. It provides correlations between spacecraft time and Earth time as well as the rate of change of Earth time relative to spacecraft time.

The NEAR mission timekeeping system ground component successfully used an SCLK kernel and SPICE to provide accurate time for the mission. The specific implementation of this that was used on NEAR provides the correlation between the spacecraft integer seconds MET of the reference edge of the 1 PPS signal and the ground estimate of the corresponding Earth time TDT. For reference, the final NEAR SCLK kernel is provided in Appendix A and at http://loring.jhuapl.edu/NEAR/SDC/SpiceOps/ops/sclk/. See also Reference [1].

The generic format of the SCLK kernel adopted for the MESSENGER, STEREO and New Horizons missions was established in collaboration with Dave Tillman and Scott Turner. Like NEAR, it will provide the correlation between the spacecraft integer seconds iMET of the 1 PPS reference event and the ground estimate of the Earth time TDT. The time system TDT ("Terrestrial Dynamical Time") is closely related to UTC [1]. SPICE supports the use of TDT (which does not use leap seconds) in SCLK kernels but not UTC (which does use leap seconds). Numerically,

(1) $$\text{TDT} = \text{UTC} + 32.184 \text{ seconds} + (\text{leap seconds})$$

For the past several years, the number of leap seconds has been 32, so TDT = UTC + 64.184 seconds. In other words, today at noon when the time was 12:00:00.000 UTC the time in terms of TDT was 12:01:04.184 TDT. Note that any time interval or clock drift rate is the same whether expressed in terms of either TDT or UTC since both are based on the atomic (or "SI") second.

The heart of each SCLK kernel is the "time coefficients triplet" or "time record," which is a line including "encoded SCLK" (equivalent to MET) [3], estimated TDT corresponding to that encoded SCLK and rate of change of TDT with respect to MET.

Here is an example of a MESSENGER, STEREO or New Horizons SCLK kernel time coefficients triplet:

126247369000000 @18-MAR-2006-00:33:32.495123 0.99999912345

The following are the definitions of the three columns:

Column 1: Encoded SCLK is a 15-digit integer in units of MET "ticks", right-justified and padded on the left with blanks. It is a continuously increasing representation of MET. One tick is the time interval represented by the least significant bit of the vMET component of MET. For example, MESSENGER has 1,000,000 ticks per second while STEREO has 256 ticks per second, as indicated in Table 1.

It may happen that the MET counter may be modified during the mission by command from Mission Operations (to shift the MET timeline for certain critical operations) or due to a power reset or radiation event. The MET counter may even appear to jump backwards in time due to these changes. Encoded SCLK, on the other hand, is continuously (but not uniformly) increasing and reflects what the integer seconds iMET component of MET would be if MET never jumped forward or backward in time due to the above events. Encoded SCLK is subject to clock drift (oscillator frequency offset) and oscillator frequency drift just as MET is.

When the MET timeline shifts due to the above events, we say that MET has entered a new "partition" [3]. The start and end times corresponding to each such partition are specified in the SCLK kernel.

The selection of encoded SCLK as a mapping from the integer seconds value of iMET corresponding to the time of a 1 PPS event on the spacecraft was recommended by Dave Tillman for the current missions to simplify interfaces with ground software tools that are not part of the SPICE system. There may be good reasons for changing this definition for certain future missions but that is outside the scope of this discussion.

The 15-significant-digit encoded SCLK is represented within the ground system computer software as an IEEE-754 double precision floating-point number, with a 52-bit mantissa. The 15 significant digit format is sufficient to represent MET for a mission of 30-years duration to a precision of one microsecond or for a longer duration when a coarser resolution is used. Note that MET is defined to be an unsigned value so encoded SCLK is always positive.

Column 2: TDT(G), the estimated TDT corresponding to the encoded SCLK value, 1 microsecond resolution in day-of-month, month, 4-digit year, hour:minute:second.microsecond format.

Column 3: Spacecraft clock change rate in TDT seconds per MET second, 12 significant digits. The 12-digit precision was selected to minimize computational errors in the MESSENGER After-the-fact SCLK kernel but is suitable for all STEREO, New Horizons and MESSENGER SCLK kernels. This clock change rate may be thought of as an estimate of the actual interval in TDT or UTC seconds between the leading edges of consecutive 1 PPS pulses. In that sense, it represents the length in UTC seconds of one MET second.

Summary

A generic or common approach is being used for the design, implementation and test of the timekeeping systems for current APL deep space missions. One component of this approach is the use of the “SCLK kernel” file to record the correlation between time on the spacecraft and time on the ground. This memo documents the common format used for all time correlation entries in the SCLK kernels.

Stanley B. Cooper

sbc/s

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Appendix A: The Last NEAR SCLK Kernel

```
KPL/SCLK
\begintext

LABEL_START
FILENAME ="near_171.tsc"
MISSION_NAME ="NEAR"
ORGANIZATION = "JHU/APL"
AUTHOR ="SCLK update program"
CONTACT ="david.tillman@jhuapl.edu"
TYPE ="SCLK"
CREATION_DATE ="12-Feb-2001"
TARGET ="N/A"
START_UTC ="1996-02-17T20:43:29"
END_UTC ="N/A"
END_DET_UTC ="N/A"

SOURCE_FILES ={de403.bsp,
eros9845.bsp,
near_1998356_2000045_v01.bsp,
near_2000045_2000125_v02.bsp,
near_2000121_2000189_v01_noburn.bsp,
near_2000181_2000242_v01.bsp,
near_2000223_2000270_v01.bsp,
near_2000265_2000298_v01.bsp,
near_2000294_2000309_v01_noburn.bsp,
near_2000302_2000341_v01.bsp,
near_2000336_2001028_v01.bsp,
near_2001026_2001043_v01.bsp,
near_2001035_2001043_v01.bsp,
naif0007.tls,
pck00006.tpc,
near_170.tsc}

MERGED_FILES ="N/A"

NUMBER_VERTICES ="N/A"
NUMBER_PLATES ="N/A"

DESCRIPTION ="

This kernel uses a least-squares fit to the clock data from Nov. 1996
to December 1997, using a constant drift rate of -0.0164 seconds/day.
Coefficients covering the period January 1998 through end of mission
are produced by the SCLK Kernel Update utility on an automatic basis.

This kernel also includes the effects of time changes sent to the
spacecraft clock during a test on May 30, 1997, and during the
Mathilde flyby on June 27, 1997.  All of these time changes were
cancelled by later time changes, so that the spacecraft clock was
set back to its original timeline.
```

For the final touchdown of NEAR on Eros on 12 Feb 2001, the clock was set backwards 17 seconds. A new partition was added to reflect this.

This will be the final kernel produced for the NEAR mission. "

LABEL_END
FREE FORM COMMENTS:

Specification for a type 1 SCLK...
Model the SCLK against the time system TDT (terrestrial dynamical time) TIME_SYSTEM = 2; variable names indicate NEAR (ID -93).

This kernel was rebuilt on Tue Dec 8 20:22:10 1998
starting from encoded SCLK: 59023003498 as build number: 1

This kernel was rebuilt on Thu Jan 28 14:59:12 1999
starting from encoded SCLK: 92272635009 as build number: 2

```
\begindata
SCLK_KERNEL_ID            = ( @2001-02-12T19:00:03 )
SCLK_DATA_TYPE_93         = (        1 )
SCLK01_TIME_SYSTEM_93     = (        2 )


\begintext
For NEAR, Use a single field which represents milliseconds past
mission start time; moduli set well beyond end of mission.

\begindata
SCLK01_N_FIELDS_93        = (        1 )
SCLK01_MODULI_93          = (  2.0e+12 )
SCLK01_OFFSETS_93         = (        0 )
SCLK01_OUTPUT_DELIM_93    = (        1 )


\begintext
Supply the partition information.  If needed,
(e.g., switch to backup bus controller occurs), can
add additional records (lines) to following variables to
define new partitions; generally, the start of the
new partition should coincide with the end of the
previous one.

\begindata
SCLK_PARTITION_START_93   = ( 0.0000000000e+00
                              4.0409661942e+10
                              4.0429229946e+10
                              4.2793916398e+10
                              4.2808703400e+10
                              4.2831583405e+10
```

```
                       1.5741315200e+11
                      )

SCLK_PARTITION_END_93     = ( 4.0409721942e+10
                       4.0429169946e+10
                       4.2793906398e+10
                       4.2808704400e+10
                       4.2831592405e+10
                       1.5741316900e+11
                       2.0000000000e+12
                      )

\begintext
Finally, define coefficients for starting MET (millisec),
starting TDT (expressed in terms of date/time string
@dd-mmm-yyyy-HH:MM:SS) and rate of change between the
spacecraft clock and TDT, having the following property:

   rate = TDT (sec) / most significant count (millisec)

For NEAR, the most significant count corresponds to 1/1000 of
a second, giving a rate of 0.001 sec/millisec in the absence
of clock drift; in general, rate is related to the MET drift
rate of the spacecraft clock (in millisec/sec) as follows:

   rate = {1+MET drift rate (millisec/sec)/1000} / 1000

The following are preliminary data; additional records (lines) should
be added as needed to account for changes in clock drift over time;
the new records must ensure a continuous and monotonically
increasing relationship between MET and TDT.

\begindata
SCLK01_COEFFICIENTS_93     = (

0.0000000000e+00   @17-FEB-1996-20:44:30.960        9.9999980900e-04
4.0409721942e+10   @30-MAY-1997-13:39:45.184        9.9999980900e-04
4.0429229946e+10   @30-MAY-1997-19:04:53.184        9.9999980900e-04
4.2793906398e+10   @27-JUN-1997-03:56:09.184        9.9999980900e-04
4.2808694400e+10   @27-JUN-1997-08:02:37.184        9.9999980900e-04
4.2831583405e+10   @27-JUN-1997-14:24:06.184        9.9999980900e-04
6.0125985000e+10   @13-JAN-1998-18:24:04.310        9.9999979941e-04
6.0212390000e+10   @14-JAN-1998-18:24:09.280        9.9999965456e-04
6.0515927000e+10   @18-JAN-1998-06:43:06.180        9.9999967129e-04
6.0760157000e+10   @21-JAN-1998-02:33:36.105        9.9999969185e-04
6.1092948000e+10   @24-JAN-1998-23:00:07.008        9.9999970879e-04
6.1253334000e+10   @26-JAN-1998-19:33:12.956        9.9999967631e-04
6.1373467000e+10   @28-JAN-1998-04:55:25.916        9.9999966669e-04
6.1594465000e+10   @30-JAN-1998-18:18:43.841        9.9999966090e-04
6.6859033000e+10   @01-APR-1998-16:41:29.880        9.9999962751e-04
7.2308626000e+10   @03-JUN-1998-18:28:01.519        9.9999975022e-04
7.4721547000e+10   @01-JUL-1998-16:43:21.823        9.9999971165e-04
7.5132721000e+10   @06-JUL-1998-10:56:15.686        9.9999966728e-04
7.5328509000e+10   @08-JUL-1998-17:19:23.626        9.9999969335e-04
7.7738193000e+10   @05-AUG-1998-14:40:46.895        9.9999969645e-04
7.8777422000e+10   @17-AUG-1998-15:21:15.572        9.9999968889e-04
```

7.8952916000e+10	@19-AUG-1998-16:06:09.527	9.9999974263e-04
7.9588468000e+10	@27-AUG-1998-00:38:41.368	9.9999975051e-04
8.0154353000e+10	@02-SEP-1998-13:50:06.221	9.9999974042e-04
8.1317059000e+10	@16-SEP-1998-00:48:31.925	9.9999974566e-04
8.1805260000e+10	@21-SEP-1998-16:25:12.798	9.9999973960e-04
8.2139807000e+10	@25-SEP-1998-13:20:59.695	9.9999969034e-04
8.2432241000e+10	@28-SEP-1998-22:34:53.609	9.9999970785e-04
8.3004321000e+10	@05-OCT-1998-13:29:33.450	9.9999972196e-04
8.3637554000e+10	@12-OCT-1998-21:23:26.279	9.9999972994e-04
8.4815021000e+10	@26-OCT-1998-12:27:52.954	9.9999972383e-04
8.5429701000e+10	@02-NOV-1998-15:12:32.778	9.9999971380e-04
8.5598364000e+10	@04-NOV-1998-14:03:35.735	9.9999974401e-04
8.6208312000e+10	@11-NOV-1998-15:29:23.584	9.9999975251e-04
8.6810662000e+10	@18-NOV-1998-14:48:33.426	9.9999973864e-04
8.7836239000e+10	@30-NOV-1998-11:41:30.153	9.9999973342e-04
8.8228097000e+10	@05-DEC-1998-00:32:28.043	9.9999971986e-04
8.8438735000e+10	@07-DEC-1998-11:03:05.977	9.9999968567e-04
8.8723522000e+10	@10-DEC-1998-18:09:32.894	9.9999970990e-04
8.9167446000e+10	@15-DEC-1998-21:28:16.770	9.9999972121e-04
8.9826627000e+10	@23-DEC-1998-12:34:37.577	9.9999970657e-04
9.0351015000e+10	@29-DEC-1998-14:14:25.418	9.9999969656e-04
9.0508753000e+10	@31-DEC-1998-10:03:23.364	9.9999965725e-04
9.0804879000e+10	@03-JAN-1999-20:18:49.254	9.9999963003e-04
9.0891284000e+10	@04-JAN-1999-20:18:54.125	9.9999850403e-04
9.1051108000e+10	@06-JAN-1999-16:42:38.180	1.0000003417e-03
9.1137521000e+10	@07-JAN-1999-16:42:51.150	9.9999965120e-04
9.1643374000e+10	@13-JAN-1999-13:13:43.967	9.9999963823e-04
9.2098885000e+10	@18-JAN-1999-19:45:34.837	9.9999971539e-04
9.2272972000e+10	@20-JAN-1999-20:07:01.780	9.9999967241e-04
9.2989875000e+10	@29-JAN-1999-03:15:24.550	9.9999967956e-04
9.3630426000e+10	@05-FEB-1999-13:11:15.352	9.9999969096e-04
9.3889558000e+10	@08-FEB-1999-13:10:07.278	9.9999971539e-04
9.4235104000e+10	@12-FEB-1999-13:09:13.188	9.9999974051e-04
9.4507432000e+10	@15-FEB-1999-16:48:01.123	9.9999975952e-04
9.5913077000e+10	@03-MAR-1999-23:15:25.732	9.9999972150e-04
9.6661855000e+10	@12-MAR-1999-15:15:03.495	9.9999968374e-04
9.7087768000e+10	@17-MAR-1999-13:33:36.369	9.9999970449e-04
9.7259103000e+10	@19-MAR-1999-13:09:11.324	9.9999973601e-04
9.8124119000e+10	@29-MAR-1999-13:26:07.102	9.9999974347e-04
9.8740823000e+10	@05-APR-1999-16:44:30.949	9.9999975168e-04
9.9332844000e+10	@12-APR-1999-13:11:31.797	9.9999974315e-04
1.0115632000e+11	@03-MAY-1999-15:42:47.324	9.9999974035e-04
1.0192592400e+11	@12-MAY-1999-13:29:31.118	9.9999973302e-04
1.0270511600e+11	@21-MAY-1999-13:56:02.905	9.9999972622e-04
1.0330746400e+11	@28-MAY-1999-13:15:10.735	9.9999971703e-04
1.0357738900e+11	@31-MAY-1999-16:13:55.653	9.9999969744e-04
1.0428957000e+11	@08-JUN-1999-22:03:36.432	9.9999968955e-04
1.0495320300e+11	@16-JUN-1999-14:24:09.232	9.9999969796e-04
1.0563745000e+11	@24-JUN-1999-12:28:16.031	9.9999970644e-04
1.0615676900e+11	@30-JUN-1999-12:43:34.873	9.9999969499e-04
1.0759866100e+11	@17-JUL-1999-05:15:06.407	9.9999967686e-04
1.0931735300e+11	@06-AUG-1999-02:39:57.784	9.9999963727e-04
1.0988321800e+11	@12-AUG-1999-15:51:02.573	9.9999962675e-04
1.1160191700e+11	@01-SEP-1999-13:16:00.888	9.9999960134e-04
1.1274866800e+11	@14-SEP-1999-19:48:31.393	9.9999956861e-04
1.1444949000e+11	@04-OCT-1999-12:15:32.636	9.9999955513e-04

```
1.1661321300e+11    @29-OCT-1999-13:17:34.680        9.9999955809e-04
1.1989633300e+11    @06-DEC-1999-13:16:13.361        9.9999959823e-04
1.2007520000e+11    @08-DEC-1999-14:57:20.294        9.9999962694e-04
1.2076756000e+11    @16-DEC-1999-15:16:40.048        9.9999964471e-04
1.2301577300e+11    @11-JAN-2000-15:46:52.289        9.9999966231e-04
1.2378214600e+11    @20-JAN-2000-12:39:45.036        9.9999966955e-04
1.2474293600e+11    @31-JAN-2000-15:32:54.713        9.9999966406e-04
1.2593273100e+11    @14-FEB-2000-10:02:49.319        9.9999966865e-04
1.2855638600e+11    @15-MAR-2000-18:50:23.455        9.9999967057e-04
1.3043917100e+11    @06-APR-2000-13:50:07.829        9.9999966756e-04
1.3118129200e+11    @15-APR-2000-03:58:48.577        9.9999966077e-04
1.3285501400e+11    @04-MAY-2000-12:54:10.014        9.9999966383e-04
1.3328877800e+11    @09-MAY-2000-13:23:33.874        9.9999967655e-04
1.3414737700e+11    @19-MAY-2000-11:53:32.591        9.9999967025e-04
1.3458302500e+11    @24-MAY-2000-12:54:20.442        9.9999965803e-04
1.3527066600e+11    @01-JUN-2000-11:55:01.201        9.9999965024e-04
1.3630773500e+11    @13-JUN-2000-11:59:29.843        9.9999965527e-04
1.3761435000e+11    @28-JUN-2000-14:56:24.387        9.9999965118e-04
1.3933430600e+11    @18-JUL-2000-12:42:19.795        9.9999965580e-04
1.3970032500e+11    @22-JUL-2000-18:22:38.674        9.9999966990e-04
1.4036837700e+11    @30-JUL-2000-11:56:50.448        9.9999966240e-04
1.4096962100e+11    @06-AUG-2000-10:57:34.240        9.9999965383e-04
1.4165723100e+11    @14-AUG-2000-09:57:43.997        9.9999964633e-04
1.4469710800e+11    @18-SEP-2000-14:22:19.927        9.9999964801e-04
1.4625519300e+11    @06-OCT-2000-15:10:24.373        9.9999964470e-04
1.4869368300e+11    @03-NOV-2000-20:31:53.512        9.9999964684e-04
1.4935705700e+11    @11-NOV-2000-12:48:07.273        9.9999963914e-04
1.5033180800e+11    @22-NOV-2000-19:33:57.927        9.9999964463e-04
1.5385793000e+11    @02-JAN-2001-15:02:38.679        9.9999964612e-04
1.5473045800e+11    @12-JAN-2001-17:24:46.375        9.9999965195e-04
1.5579406100e+11    @25-JAN-2001-00:51:29.000        9.9999964722e-04
1.5682978300e+11    @06-FEB-2001-00:33:30.629        9.9999964217e-04
)
```

Appendix B: Glossary of acronyms

1 PPS	"1-Pulse-Per-Second" signal occurring at 1 Hz rate on I/F board
C&DH	Command and Data Handling Subsystem
Clock change rate	The number of UTC (or TDT) seconds per MET second
Clock drift rate	A measure of MET drift relative to UTC defined as clock drift rate = (1/clock change rate) – 1
DSMS	Deep Space Mission System organization of JPL
DSN	NASA Deep Space Network, part of DSMS
Encoded SCLK	Continuous mission timeline in the SCLK kernel, mapped from possibly discontinuous MET (cf. SCLK)
ERT	Earth Received Time
Extended clock	A clock consisting of an oscillator, MET counter value and an SCLK kernel, providing a clock readout in terms of TDT or UTC
G&C	Guidance and Control Subsystem
GRT	Ground Received Time, used on NEAR mission
IEM	Integrated Electronics Module
iMET	Integer seconds component of MET
JHU/APL	The Johns Hopkins University Applied Physics Laboratory
JPL	NASA's Jet Propulsion Laboratory, managed by the California Institute of Technology
MESSENGER	"Mercury Surface, Space Environment, Geochemistry, and Ranging" mission to Mercury
MET	Mission Elapsed Time counter on the spacecraft (cf. encoded SCLK). An alternative meaning sometimes used in a MOC is the time elapsed since launch. Context will generally distinguish between these meanings.

MOC	Mission Operations Center
NAIF	Navigation and Ancillary Information Facility of JPL
NEAR	Near Earth Asteroid Rendezvous Shoemaker mission
OWLT	One Way Light Time
SCLK	A SPICE text representation of time on a spacecraft generally in the form “partition/<time string>”, where <time string> may be “iMET” or “iMET:vMET” or various similar forms [3].
SCLK kernel	Spacecraft clock data file containing correlations between encoded SCLK (cf. MET) and TDT(G)
SFDU	Standard Formatted Data Unit provided by DSN
Spacecraft clock	This is an ambiguous term that can refer to various representations of time on a spacecraft such as MET, iMET, SCLK or other forms.
SPICE	“Spacecraft Planet Instrument C-matrix Events” system of software tools developed by NAIF at JPL
STEREO	“Solar Terrestrial Relations Observatory” mission
TDB	Terrestrial Barycentric Time
TDT	Terrestrial Dynamical Time
TDT(G)	Ground estimate of the TDT of the 1 PPS reference edge
TDT(S)	Onboard estimate of the TDT of the 1 PPS reference edge
UTC	Coordinated Universal Time
UTC(NIST)	The UTC supplied by the National Institute of Standards and Technology (NIST), to which DSN station time is referenced
vMET	Sub-seconds component of MET