

Spacecraft Team

SDU  
ODY  
GNS

# TIME CORRELATION OPERATING PROCEDURE

SCT-0404

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## **1.0 INTRODUCTION**

### **1.1 PURPOSE**

This procedure describes the process for:

1. Computing the Clock Coefficients
2. Updating the SCLK\_SCET Time Correlation File

### **1.2 SCOPE**

This procedure identifies the activities necessary to maintain knowledge of the SDU, ORB1 and GNS spacecraft clock performance to within specified tolerance of UTC based on after the fact performance of the clock. This procedure correlates the spacecraft clock (SCLK), measured in seconds to spacecraft event time (SCET), measured in UTC.

### **1.3 APPLICABLE DOCUMENTS**

- 1) None

#### **1.3.1 Applicable Flight Rules**

- 1) None

### **1.4 INTERFACES**

- 1) Navigation Team
- 2) Project Database

### **1.5 REFERENCES**

- 1) None

## **2.0 PROCEDURE**

### **2.1 Input**

- 1) Pre-built SCLK-SCET Clock Correlation File
- 2) Navigation Topocentric Light Time File
- 3) Leap seconds Information
- 4) DSN Earth Received Time (ERT) tagged spacecraft telemetry

## 2.2 Procedure Steps

Step 001 Determine the Start and Stop time of the correlation process. The duration should encompass the last record for the previous clock correlation thought the latest time that a time packet create was issued to the spacecraft. The duration processed typically ranges from 1 day to 1 week depending on the stability of the on-board clock.

Step 002 Verify the current Topocentric Light Time file from Navigation encompasses the Start and Stop time. If it does not, issue a request to the Navigation Team to generate a new Topocentric Light Time file for DSS Stations 15, 45 and 65, with a record spacing of 30 minutes for a duration between 30 and 100 days. Place the topocentric light time in the appropriate project directory:

SCLK\_SCET/xxx\_SCLK\_SCET/LTF  
(where xxx = SDU ORB1 GNS)

Step 003 Change directory to SCLK\_SCET/xxx\_SCLK\_SCET (where xxx = SDU ORB1 GNS). Within the directory is a support script called do\_xxx\_sclk\_scet which extracts all the necessary information required to execute the SPAS msop\_corr\_sclk\_scet program. Within the do\_xxx\_sclk\_scet script are three user updateable variables which need to be verified current, they are:

\$server (Data server to query, e.g. "SDU\_CDR")  
\$sclksct (Latest operational SCLK\_SCET file)  
\$ltf (Latest operational Topocentric File)

Step 004 Execute the do\_xxx\_sclk\_scet script.

Type `do_XXX_sclk_scet <start_time stop_time>`

(e.g. `do_sdu_sclk_scet 99/012-00:00:00 99/017-00:00:00`)

Step 005 Review the output file sent to the default laser printer. The file can also be found in the DATA\_ARCHIVE directory. The last column in the data return file shows the time error in seconds from the latest active SCLK\_SCET file. If the error is approaching or has exceeded the timing accuracy tolerance (non-science operations 100ms, science operations 20ms), an update to the SCLK\_SCET file will be needed, else end procedure here.

Step 006 If the latest SCLK\_SCET coefficient file requires an update, go to the appropriate SCLK\_SCET/XXX\_SCLK\_SCET/SCLKSCET directory. Make a new file by copying the latest file to the next revision numbered file.

e.g. `cp xxx_SCLKSCET.00003 xxx_SCLKSCET.00004`

Edit the new file and modify the FILE\_NAME, the PRODUCT\_CREATION\_TIME and PRODUCT\_VERSION\_ID to be consistent with the new file generated.

Step 007 Generate a new coefficient to be added to the bottom of the new created SCLK\_SCET file. To do this you will need information from past correlations. Scan the DATA\_ARCHIVE products for the last clock correlation that had an error less than 5 ms absolute. Information from this record along with information from the latest clock correlation will be required to generate a new coefficient.

Step 008 Using information from the clock correlation DATA\_ARCHIVE products, run the SPAS program `msop_gen_sclk_scet_coef`.

## Usage:

```
msop_gen_sclk_scet_coef <scet1 sclk1 fine1
                        scet2 sclk2 fine2 dut>
```

Note: the scet sclk and fine data are the first three columns of the clock correlation file and can be cut and pasted as input to the program. The dut value is the current leapseconds count + 0.184. (Also, if a leap second is to occur (JAN-1 or JUL-1, 2 additional SCLK\_SCET records are required to be added to account for the shift in time. See file for example)

The output of the msop\_gen\_sclk\_scet\_coef program is in the SCLK\_SCET coefficient format and can be cut a pasted into the new file. The file is now ready for verification.

Step 009 To verify the newly generated SCLK\_SCET file is correct, use the diff routine to verify the only changes were the 3 header modifications and the new record addition. Following this verification, re-execute Step 004 using the same start and end times. Verify the fit errors of all records are within tolerance.

Step 010 Following verification, the file can now be placed on the project database (msopfs) and in user accessible directories. This can be done through use of the following support scripts:

```
cd SCLKSCET
put_XXX_sclkscet_2_msopfs XXX_SCLKSCET.xxxxx
copy_XXX_clock_files XXX_SCLKSCET.xxxxx
```

Verify files were placed in the correct directories.

Step 011 Notify the SCT that a new coefficient file is available for usage. Also, take steps to notify Data Control that a new coefficient is available.

### **2.3 Procedure Closeout Activities**

Notify end users of available products.

### **2.4 Outputs**

- 1) Clock Correlation Report
- 2) SCLK\_SCET File