

Software Interface Specification

Light Time File

Jet Propulsion Laboratory

California Institute of Technology

Pasadena, California

SIS Coordinator: Victor N. Legerton

## LIGHT TIME FILE

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16 November 2004

**ABSTRACT:** This interface specification provides the format and syntax for transmission of the Light Time File from the Navigation Subsystem to all users.

November 16, 2004

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Software Note:

This Software Interface Specification, like many of those comprising the set which is generated or used by the Navigation Analysis Element, documents a multi-mission file and, as such, some of the acronyms and names may have changed while the format and content of the file remains static.

In particular, the references to Central Data Base (CDB), or in some SIS(s) the Project Data Base (PDB), have tended to change in terminology from one project to another. For the Mars Exploration Rover project, the Distributed Object Manager (DOM) database will be used for disk file archival and transfer. Therefore, any reference to CDB or PDB in this document shall be considered to be DOM.

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### 1. GENERAL DESCRIPTION

#### 1.1 PURPOSE OF INTERFACE

This Software Interface Specification (SIS) contains the description of the Light Time File.

#### 1.2 SCOPE

The format and syntax specifications in this SIS apply to all phases of the mission.

#### 1.3 APPLICABLE DOCUMENTS

SFOC0038-01-09-01 1 May 90 SFOC-1-CDB-ANY-CATALOGUE2

SFOC0099-01-00 13 Jun 90 Data Dictionary

SFOC0038-00-08-01 26 Feb 88 SFOC-1-CDB-MGN-TIMESFILE

SFOC0038-01-09-03 6 Feb 90 SFOC-2-SYS-ANY-TIMEFORMS

24 Jan 00 DPTRAJ-ODP User Reference Manual,

SOM Vol. 1 and Vol. 2

24 Jan 00 DPTRAJ and ODP Interfaces and File

Format Descriptions, SOM, Vol. 3

#### 1.4 FUNCTIONAL DESCRIPTION

The Light Time file contains up and down-leg geocentric or topocentric light times for the spacecraft.

##### 1.4.1 Data Source, Destinations, and Transfer Method

Light Time data shall be created on the Navigation computer system. Users of the Light Time File are identified on the cover sheet. Transfer may be accomplished by making the Light Time file accessible to users within one of the file storage systems such as the Distributed Object Manager (DOM) system.

##### 1.4.2 Pertinent Relationships with Other Interfaces

The generation of this file is dependent upon the spacecraft ephemeris file availability spanning the time over which the Light Time file is desired.

##### 1.4.3 Labeling and Identification

Internal labeling of the Light Time file is accomplished with header records as defined in Section 4.2.

#### 1.4.4 Assumptions and Constraints

N/A.

### 2. ENVIRONMENT

#### 2.1 HARDWARE CHARACTERISTICS AND LIMITATIONS

N/A.

#### 2.2 INTERFACE MEDIUM AND CHARACTERISTICS

Navigation computer file or, at user option, magnetic tape.

#### 2.3 INPUT/OUTPUT PROTOCOLS

N/A.

##### 2.3.1 Device Addressing

N/A.

##### 2.3.2 Operating System Protocols

N/A.

##### 2.3.3 Deformatting

Users of the "SFDU wrapped" Light Time file will be required to have software to remove the SFDU data from the file retrieved from the DOM or other file storage system.

##### 2.3.4 Calling Sequence

N/A.

#### 2.4 FAILURE PROTECTION, DETECTION, RECOVERY FEATURES

##### 2.4.1 Backup Requirements

The Navigation Subsystem shall keep the Light Time file in the NAV workstation until it is confirmed as stored within the DOM or in the computer and directory where the user expects it. Backups will be maintained through normal archiving procedures.

For those using DOM, should the DOM malfunction or the network fail, customers of the Light Time File may obtain the file via the secondary method which is to receive the ASCII file directly from the NAV Subsystem.

##### 2.4.2 Security/Integrity Measures

DOM and/or NAV Team security/integrity measures will be in effect.

## 2.5 END-OF-FILE (OR MEDIUM) CONVENTIONS

The end of file is identified by an appropriate record as described in Section 4.2.

## 2.6 UTILITY PROGRAMS

The utility program KWIKNAV developed by TMOD shall be used to insert the SFDU labels into the Light Time file if required; e.g., this is not required for Galileo files.

## 3. DATA FLOW CHARACTERISTICS

### 3.1 OPERATIONAL CHARACTERISTICS

#### 3.1.1 Generation Method and Frequency

The Light Time data shall be created using the NAV DPTRAJ program LITIME. The start and end dates and times, and the record frequency interval for the LITIME file are controlled by the User. Frequency of generation is a project procedural requirement, usually agreed upon through the Operational Interface Agreement (OIA).

#### 3.1.2 Time Span of Product

The time span of the file is controlled by the span of the spacecraft ephemeris input to LITIME and by user input.

### 3.2 DATA VOLUME

The size of the file depends on the length of the trajectory and upon the user input data interval for which Light Time records are desired.

### 3.3 FLOW RATE

Flow rate will be limited by the data transfer rate of the Local Area Network (LAN).

## 4. DETAILED DATA OBJECT DEFINITION

### 4.1 STRUCTURE AND ORGANIZATION OVERVIEW

The Light Time File is an ASCII file which, for some projects, consists of the SFDU header, the Light Time File headers, and Light Time File data. Each will be described in the following sections. For Galileo, the Light Time File contains no SFDU information. The file description for Galileo begins with Section 4.2.2 below.

### 4.2 DATA FORMAT AND DEFINITION

#### 4.2.1 SFDU Data Description

The SFDU information and structure, for the Light Time file, (DDID = 0351) in diagrammatic representation is as follows:

```
CCSD3ZS00001AAAAAAAAANJPL3KS0L015BBBBBBBB
```

```
MISSION_NAME=*;
```

MISSION\_ID=\*\*;  
SPACECRAFT\_NAME=\*\*\*;  
SPACECRAFT\_ID=82;  
DATA\_SET\_ID=LIGHTTIME;  
FILE\_NAME=litime.sfd;  
PRODUCER\_ID=NAV;  
APPLICABLE\_START\_TIME=2000-345T00:00:00.000;  
APPLICABLE\_STOP\_TIME=2001-010T00:00:00.000;  
PRODUCT\_CREATION\_TIME=2000-074T14:44:20;  
CCSD3RE00000BBBBBBBBBNJPL3IS00351CCCCCCCC

Where \* denotes the Mission ID, \*\* the Spacecraft ID, and \*\*\* the Mission Name.

In the actual Light Time File, the following SFDU data is located at the end of the file, following the non-SFDU data which is described in Section 4.2.2.

CCSD3RE00000CCCCCCCCCSD3RE00000AAAAAAAAA

Notice that the start and stop times in the SFDU headers are Day-of-Year times with a T separator before hh:mm:ss.fff. These times are constructed by the TMOD software KWIKNAV that places the SFDU headers onto the file.

#### 4.2.2 Non-SFDU Data Description

Following is a description of each text record on the file. The Type Flag indicates whether each item is required (R) or optional (O).

##### **Header Record 1**

Header record 1 identifies file type/delimits start of header.

Columns Content Description Type Flag

1-2 "\$\$" Control characters signifying R

major control card

3-11 Mission Name The mission name, e.g., Cassini, or R

abbreviation, e.g., MGS.

This name must be input.

13-27 "LIGHT TIME FILE" Identifies the file. Not an input R

- always "LIGHT TIME FILE".

80 "1" Record Sequence number O

### **Header Record 2**

Header record 2 identifies file element name.

Columns Content Description Type Flag

1 "\*" Header character R

2-7 "LITIME" Identifies program used to create R  
the file. Not an input.

80 "2" Record Sequence number O

### **Header Record 3**

Header record 3 specifies name and extension of person preparing file.

Columns Content Description Type Flag

1 "\*" Header character R

2-5 "PREP" Name "PREP" used to indicate line R  
for file preparer's name, phone, etc.

13-72 Name/ext. Name and extension of the preparer, O  
not to exceed 60 characters. User  
input. Default is blank.

80 "3" Record Sequence number O

### **Header Record 4**

Header record 4 specifies the title of the LITIME File.

Columns Content Description Type Flag

1 "\*" Header character R

2-6 "TITLE" Name "TITLE" used to indicate line R  
describing what file is for, e.g.,  
"Light time file for Cassini  
Jupiter encounter".

13-72 Title Description of file. User input. O

Default is blank.

80 "4" Record Sequence number O

### **Header Record 5**

Header record 5 specifies the spacecraft ID.

Columns Content Description Type Flag

1 "\*" Header character R

2-5 "SCID" Name "SCID" used to indicate line R

for identifying spacecraft.

13-18 S/C ID 6 characters left justified to O

identify spacecraft, usually by

number, e.g., this is 82 for

Cassini. User input. Default is blank.

80 "5" Record Sequence number O

### **Header Record 6**

Header record 6 specifies the run ID of the program creating the file.

Columns Content Description Type Flag

1 "\*" Header character R

2-6 "RUNID" Name "RUNID" is used to indicate R

line to identify run-time data of

program LITIME.

13-72 RUN ID 60 characters available to contain O

LITIME fingerprint, i.e., date/time

of LITIME execution and date/time

when LITIME program was generated.

stored by program LITIME automatically.



80 "6" Record Sequence number O

### **Header Record 7**

Header record 7 specifies the JPL local file creation time.

Columns Content Description Type Flag

1 "\*" Header character R

2-9 "CREATION" Key Word - identifies record type R

13-15 "JPL" Denotes that file is a JPL O

generated file. Program generates

and writes time. Not a user input.

17-18 Year Last two digits of the year O

19 "-" Separator O

20-22 Day of year Integer O

23 "/" Separator O

24-25 Hours Integer (24-hour clock) O

26 ":" Separator O

27-28 Minutes Integer O

29 ":" Separator O

30-31 Seconds Integer O

80 "7" Record Sequence number O

### **Header Record 8**

Header record 8 specifies the SCE and ERT start time of file coverage.

Columns Content Description Type Flag

1 "\*" Header character R

2-6 "BEGIN" "BEGIN" signifies that this time R

corresponds to the first time in

the LITIME file data records.

13-15 "SCE" Defines time base. The date and R

time specified in the next 5 fields

represents the spacecraft event

time (SCE or T2) converted to

Broadcast Universal Time (UTC).

17-18 Year Last two digits of the year R

19 "-" Separator R

20-22 Day of year Integer R

23 "/" Separator R

24-25 Hours Integer (24-hour clock) R

26 ":" Separator R

27-28 Minutes Integer R

29 ":" Separator R

30-35 Seconds Seconds (Decimal with fractions R

to millisecond precision)

38-40 "ERT" Defines time base. The time in the R

following fields represents the

Earth received time (ERT or T3)

In Ephemeris Time (ET) form.

42-60 ERT time Time in same format as columns 17-35 R

80 "8" Record Sequence number O

### **Header Record 9**

Header record 9 specifies the SCE cutoff time of file coverage.

Columns Content Description Type Flag

1 "\*" Header character R

2-7 "CUTOFF" "CUTOFF" signifies that this time R

corresponds to the last time in

the LITIME file data records.

13-35 See record 8 SCE time (UTC) of the last data R

on the file in the same format

as described above for Record 8.

80 "9" Record Sequence number O

### **Header Record 10**

Header record 10 specifies the trajectory data base for the run.

Columns Content Description Type Flag

1 "\*" Header character R

2-6 "PFILE" "PFILE" is used to indicate the R

spacecraft ephemeris file (P file)

name.

13-24 Trajectory 12 characters available to place R

the name of the P file input to

LITIME. User input. Default is blank.

79-80 10 Record Sequence number O

Note: Beginning with record 11, all record sequence numbers are

Right justified and blank filled.

### **Header Record 11 to N**

Header records 11 to N are additional optional records provided to

permit for user header comments (N<14).

Columns Content Description Type Flag

1 "" Header character R

2-67 Comments Any alphanumeric data O

73-80 RSN Record Sequence number O

### **Column Header Record**

The column header record provides a line with the title for each

Column of the data records which follow. This could be record 11 if there are no comment records.

Columns Content Description Type Flag

1 "" Header character R

7-9 "SCE" Header for column in data records R containing data record time.

31-38 "DOWN-LEG" Header for column in data records R containing one way down-leg light time.

47-52 "UP-LEG" Header for column in data records R containing one way up-leg light time.

56-58 "STA" Header for column in data records R containing topocentric tracking station number or 03 for Earth centered.

73-80 RSN Record Sequence number O

**Last Header Record**

The last header record delimits the end of the header/start of data records.

Columns Content Description Type Flag

1-2 "\$\$" Characters signifying major R control card

3-5 "EOS" Key Word - identifies end of header R

73-80 RSN Record Sequence number O

**Data Records**

Data records specify the spacecraft event time (SCE), in Broadcast Universal Time (UTC) representation, and the corresponding upleg

and downleg times in seconds.

Columns Content Description Type Flag

1-2 Year Last two digits of the year R

3 "-" Separator R

4-6 Day of year Integer R

7 "/" Separator R

8-9 Hours Integer (24-hour clock) R

10 ":" Separator R

11-12 Minutes Integer R

13 ":" Separator R

14-15 Seconds Integer R

30-39 Downleg (DLT) Decimal seconds (millisecond R

precision, right justified,

blank filled)

45-54 Upleg (ULT) Decimal seconds (millisecond R

precision, right justified,

blank filled

57-58 Station # DSN Station number for this record R

(03 for geocentric)

73-80 RSN Record Sequence number O

**Last File Record**

The last file record delimits the end of file.

Columns Content Description Type Flag

1-2 "\$\$" Characters signifying R

major control card

3-5 "EOF" Key Word - identifies end of file R

73-80 RSN Record Sequence number O

ls

## Appendix: SAMPLE WRAPPED FILE

A sample wrapped Light Time File is provided in order to show the expected format of the data. The user should not code specifically to the real numbers as printed.

CCSD3ZS00001AAAAAAAAANJPL3KSOL015BBBBBBBB

MISSION\_NAME=MARS\_RECONNAISSANCE\_ORBITER;

MISSION\_ID=74;

SPACECRAFT\_NAME=MARS\_RECONNAISSANCE\_ORBITER;

SPACECRAFT\_ID=74;

DATA\_SET\_ID=LIGHTTIME;

FILE\_NAME=ltf\_psp\_svt\_071205\_071210\_p-v1;

PRODUCER\_ID=NAV;

APPLICABLE\_START\_TIME=2007-339T00:01:05.000;

APPLICABLE\_STOP\_TIME=2007-340T04:01:05.000;

PRODUCT\_CREATION\_TIME=2004-159T16:25:30;

CCSD3RE00000BBBBBBBBBNJPL3IS00351CCCCCCCC

\$\$MRO LIGHT TIME FILE 1

\*LITIME 2

\*PREP Stacia Long, Stacia.M.Long@jpl.nasa.gov 3

\*TITLE 2005 Mars Reconnaissance Orbiter: LITIME File 4

\*SCID M05 5

\*RUNID LITIME 7-JUN-2004 16:25:30 linked 14-APR-2004 L-3.5.2 6

\*CREATION JPL 04-159/16:25:30 7

\*BEGIN SCE 07-339/00:01:05.000 ERT 07-339/00:07:12.995 8

\*CUTOFF SCE 07-345/05:01:00.000 9

\*PFILE 10

'GEOCENTRIC OWLT FOR MRO (12/05/2007 PSO for SVT) 11

' SCE DOWN-LEG UP-LEG STA 12

\$\$EOS 13

07-339/00:01:05 303.811 303.839 03 14

07-339/01:01:05 303.777 303.805 03 15

07-339/02:01:05 303.702 303.729 03 16

07-339/03:01:05 303.663 303.690 03 17

07-339/04:01:05 303.595 303.622 03 18

07-339/05:01:05 303.548 303.575 03 19

07-339/06:01:05 303.489 303.516 03 20

07-339/07:01:05 303.432 303.459 03 21

07-339/08:01:05 303.384 303.411 03 22

07-339/09:01:05 303.318 303.345 03 23

07-339/10:01:05 303.279 303.306 03 24

07-339/11:01:05 303.205 303.232 03 25

07-339/12:01:05 303.172 303.199 03 26

07-339/13:01:05 303.096 303.122 03 27

07-339/14:01:05 303.065 303.092 03 28

07-339/15:01:05 302.988 303.015 03 29

07-339/16:01:05 302.955 302.982 03 30

07-339/17:01:05 302.884 302.911 03 31

07-339/18:01:05 302.845 302.871 03 32

07-339/19:01:05 302.782 302.808 03 33

07-339/20:01:05 302.733 302.760 03 34

07-339/21:01:05 302.680 302.707 03 35

07-339/22:01:05 302.623 302.649 03 36

07-339/23:01:05 302.580 302.606 03 37

07-340/00:01:05 302.513 302.539 03 38

07-340/01:01:05 302.478 302.505 03 39

07-340/02:01:05 302.406 302.432 03 40

07-340/03:01:05 302.376 302.402 03 41

07-340/04:01:05 302.301 302.327 03 42

\$\$EOF 43

CCSD3RE00000CCCCCCCCCSD3RE00000AAAAAAAAA