

PROJECT CASSINI SOFTWARE INTERFACE SPECIFICATION COVER SHEET		SIS Number: IO-EK-001 SIS Revision: Revision C Date: 29 March 2005	
SIS NAME: EKernel Files			
PURPOSE OF INTERFACE: EKernel files containing sequence and science plan data.			
DATA FLOW:			
FROM	TO	DATA OBJECT	MEDIUM
IO	GDSE	Binary File	Electronic
APPLICABLE Documents:			
Related OIAs:		IO-OIA-013 IO-OIA-040	
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Document Change Log:

Version	Change Description	Date
Initial	Initial Release	5 March 2002
Rev A.	Reflect design change that eliminates IEB description files.	8 August 2002
Rev B.	<p>Reflect design change that eliminates IEB expansion files.</p> <p>Also modified the database schema.</p> <p>Included expanded schema definitions.</p> <p>Updated based upon comments from Chuck Acton.</p>	9 September 2003
Rev C.	<p>Added Long_value column to status table</p> <p>Added additional descriptive text.</p> <p>Added filenaming conventions in 4.1.</p> <p>Updated schema diagram.</p>	23 March 2005

1. GENERAL DESCRIPTION	4
1.1. Purpose of Document	4
1.2. Scope	4
1.3. Applicable Documents.....	4
1.4. Functional Description.....	5
1.4.1. Data Source, Destination and Transfer Method	6
1.4.2. Pertinent Relationships with Other Interfaces	7
1.4.3. Labeling and Identification	7
1.4.4. Assumptions and Constraints.....	7
2. ENVIRONMENT.....	7
2.1. Hardware Characteristics and Limitations	7
2.2. Interface Medium and Characteristics	7
2.3. Input/Output Protocols	7
2.4. Failure Protection, Detection and Recovery Features	7
2.4.1. Backup Requirements.....	8
2.4.2. Security/Integrity Measures.....	8
2.5. End-of-File (or Medium) Conventions.....	8
2.6. Utility Programs.....	8
3. DATA FLOW CHARACTERISTICS.....	9
3.1. Operational Characteristics.....	9
3.1.1. Generation Method and Frequency.....	9
3.1.2. Time Span of Product	9
3.2. Data Volume	9
3.3. Flow Rate	9
4. DETAILED DATA OBJECT DEFINITION.....	10
4.1. Structure and Organization Overview.....	10
4.2. Data Format and Definition.....	19

1. GENERAL DESCRIPTION

1.1. Purpose of Document

The purpose of this document is to describe the format, content, and organization of SPICE EKernel files specific to the Cassini Project.

1.2. Scope

This document describes ESQ (Sequence), ESP (Science Plan), and ENB (notebook) components of Cassini SPICE EKernel files.

1.3. Applicable Documents

IO-OIA-040, EKernel IEB and Dictionary Input Files (EKSEQ)

IO-OIA-013, EKernel Files

Multimission Software Interface Specification (SIS) SPICE Events Kernel, NAIF Document No. 371, Version 1.0,
ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/SIS/

SPICE EKernel Tutorials found at
ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Tutorials or by contacting
Chuck Acton of the PDS NAIF node.

EKernel Required Reading, NAIF Doc. No. 368, included in the NAIF Toolkit

DAS Required Reading, NAIF Doc. No. 367, included in the NAIF Toolkit

Cassini Program SPICE Events Kernel System Design Document, D-22965

1.4. Functional Description

The SPICE EKernel is a repository for science plans, instrument and spacecraft commands, and experimenter's notebook information that can be used by scientists interpreting data returned from spacecraft instruments. The EKernel will be archived at the NAIF Node of the Planetary Data System (PDS) to preserve the mission science plan and sequence activity information. An overview of the entire EKernel system is provided in SPICE tutorials (See applicable documents).

The initial Cassini EKernel system design is documented in Cassini Program SPICE Events Kernel System Design document, D-22965. Some of the initial design changed after the system design was documented. Changes in the design are reflected in this SIS.

Mission operations teams and scientists provide EKernel data. Some EKernel data are in the form of predicts, while others consist of after-the-fact information referred to as "as-flown." The EKernel has three distinct components. For Cassini, as with other projects, the contents of these components are customized.

SCIENCE PLAN (ESP) Contains scientific objectives for observations scheduled over a specified period of time.

SEQUENCE (ESQ) Contains spacecraft and instrument commands intended to carry out the observation science objectives of the mission (as partly described in the ESP component), command notes, mechanical noise events, and spacecraft and instrument state information.

NOTEBOOK (ENB) Contains notes about anomalies, observations, or other after-the-fact event information that may be of interest to other scientists or project personnel.

1.4.1. Data Source, Destination and Transfer Method

EKernel files are created from a variety of data sources depending upon the component as shown in the table below.

A project repository will be used to deliver files to the NAIF provided SPICE Server as described in OIA-IO-013.

Input FILE TYPE	Input DESCRIPTION	EKernel TABLE	EKernel Component	SIS/OIAs
PEF	Predicted Events File from the sequence team. This file, along with a command dictionary EK, are used to create a background ESQ EK.	CASSINI_CMD CASSINI_STATUS CASSINI_NOTES	ESQ	OIA SVT-022 (As-flown) OIA SVT-004 (Predict)
3-291 command dictionary XML file.	The 3-291 commands XML file from SCO CORE system.	CASSINI_CMD_DICT	ESQ	OIA IO-040 SIS IO-EK-002
Noise events XML files	Currently only supplied by ISS. XML file is created by accessing MIPS operational image processing database.	CASSINI_NOISE_EVENTS	ESQ	OIA IO-040 SIS IO-EK-002
Observations and Requests	Submitted by all teams through CIMS (Cassini Information Management System) database. Records are extracted from the database containing detailed science requests and high-level observation plans.	CASSINI_SP_REQUEST CASSINI_SP_OBSERVATION CASSINI_SP_REQ_OBS	ESP	OIA IO-054 CIMS DTDs & Toolkit
Experimenter Notes	Submitted by all teams through CIMS.	CASSINI_ENB_REQUEST CASSINI_ENB_OBSERVATION CASSINI_ENB_REQ_OBS	ENB	OIA IO-054 CIMS DTDs & Toolkit

1.4.2. Pertinent Relationships with Other Interfaces

A SPICE EKernel file can be accessed using the NAIF toolkit utility INSPEKT and SPICE library subroutines.

1.4.3. Labeling and Identification

EK file SFDU K-headers will be created and stored in DOM as detached files with keyword values shown below. The SFDU header will also be included in the EKernel comment area.

<u>Keyword</u>		<u>Value Type</u>
MISSION_NAME	=	CASSINI
SPACECRAFT_NAME	=	CASSINI
DATA_SET_ID	=	EKERNEL
FILENAME	=	CHARACTER
PRODUCT_CREATION_TIME	=	UTC TIME
PRODUCER_ID	=	CHARACTER
SEQ_NUMBER	=	CHARACTER
START_TIME	=	UTC TIME
STOP_TIME	=	UTC TIME
NOTE	=	CHARACTER 256

1.4.4. Assumptions and Constraints

None.

2. ENVIRONMENT

2.1. Hardware Characteristics and Limitations

Not applicable.

2.2. Interface Medium and Characteristics

File transfer to project file repository

2.3. Input/Output Protocols

Not applicable.

2.4. Failure Protection, Detection and Recovery Features

Standard file repository procedures.

2.4.1. Backup Requirements

Standard file repository procedures.

Security/Integrity Measures

Files will be checked for format integrity using NAIF subroutines.

2.5. End-of-File (or Medium) Conventions

See NAIF Document No. 371, Version 1.0

2.6. Utility Programs

The NAIF Toolkit utility INSPEKT can be used to access information contained within EKernel files. NAIF Toolkit EKernel reader subroutines can also be utilized in a user's own program to access EKernel data. For user convenience, an INSPEKT startup file will be created and provided to users. This file will evolve as new queries are developed. A final Cassini INSPEKT startup file will be archived with the kernels at PDS.

3. DATA FLOW CHARACTERISTICS

3.1. Operational Characteristics

3.1.1. Generation Method and Frequency
Described in OIA-IO-013.

3.1.2. Time Span of Product
Described in OIA-IO-013.

3.2. Data Volume
Described in OIA-IO-013.

3.3. Flow Rate
Not applicable.

4. DETAILED DATA OBJECT DEFINITION

4.1. Structure and Organization Overview

The EKernel is a database stored in a collection of files. One or more tables may be stored in a single Ekernel file.

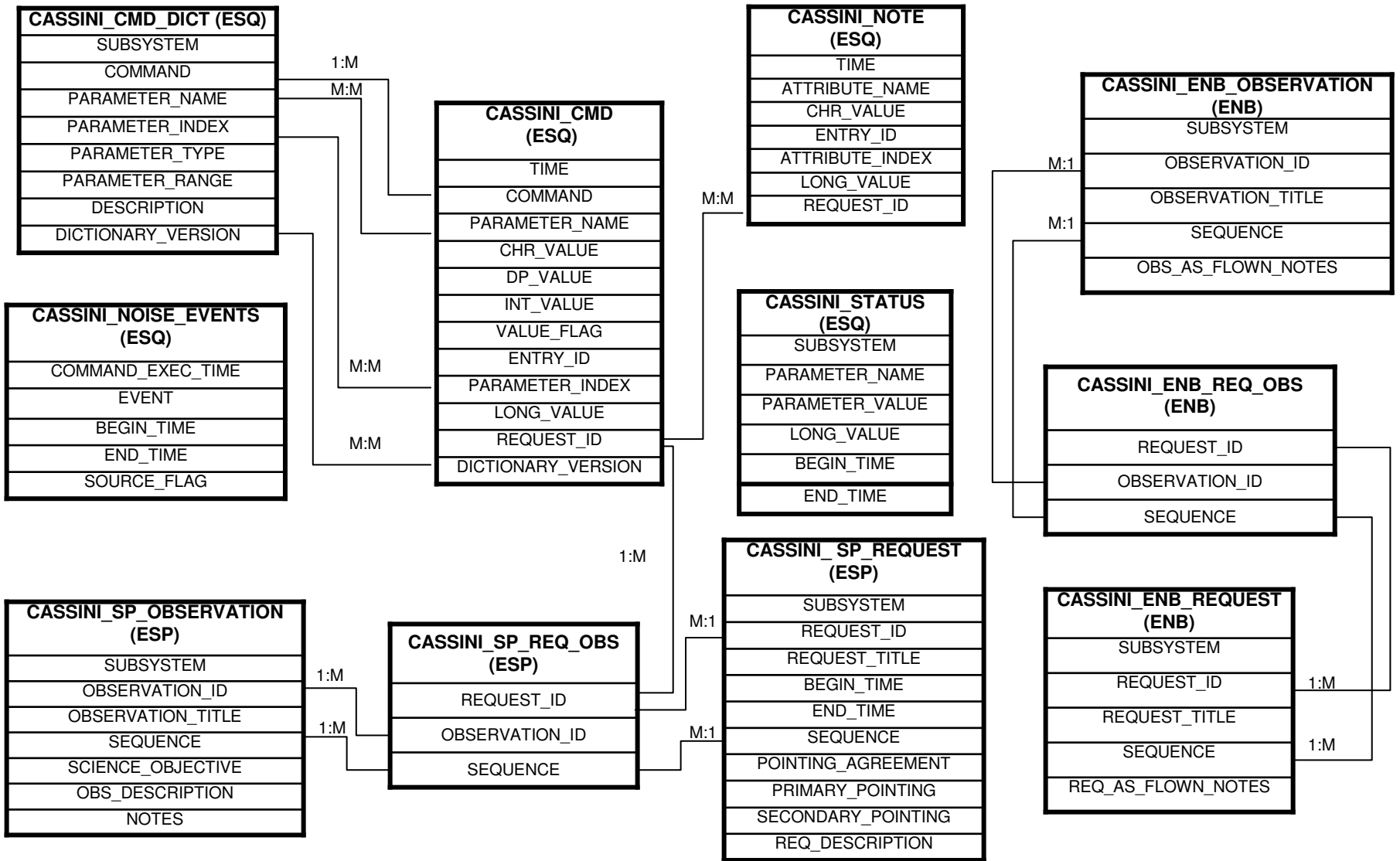
Tables are logically grouped into files if their data source is the same and if joins can be done between tables. Note that there are joins that can be made between tables that are in different files, i.e. the CASSINI_CMD and CASSINI_ENB_REQ_OBS tables can be joined by REQUEST_ID, and CASSINI_CMD and CASSINI_CMD_DICT tables can be joined by COMMAND, PARAMETER_NAME AND PARAMETER_INDEX.

With the exception of the ESQ_COMMAND file type, each file type is created for every sequence. The ESQ_COMMAND file type is created for each command database version delivered to the project.

The below table shows the file types, the tables they contain, and their filenaming convention.

EKernel File Type	Table(s)	Filenaming
ESQ Commands and Notes	CASSINI_CMD CASSINI_NOTE	[Sequencenumber]_cmd_[state][v].[ext] Where: [Sequencenumber]: SVT sequence number [state] p: Predicted Events based upon completed sequence f: Flown events with RT changes incorporated [v]: Version letter from a - z [ext]: xes for transfer format bes for IEEE binary format
ESQ Subsystem Status	CASSINI_STATUS	[Sequencenumber]_status_[state][v].[ext] Where: [Sequencenumber]: SVT sequence number [state] p: Predicted Events based upon completed sequence f: Flown events with RT changes incorporated [v]: Version letter from a - z [ext]: xes for transfer format bes for IEEE binary format
ESQ Mechanical noise events	CASSINI_NOISE_EVENTS	[Sequencenumber]_[subsystemid]noise_[v].[ext] Where: [Sequencenumber]: SVT sequence number [subsystemid]: subsystem id (2 digit number) [v]: Version letter from a - z [ext]: xes for transfer format bes for IEEE binary format

EKernel File Type	Table(s)	Filenaming
ESQ Command Dictionary	CASSINI_CMD_DICT	[cmddbVersion].[ext] Where: [cmddbVersion]: command database version [ext]: xbd for transfer format bdb for IEEE binary format
ESP Science Plan	CASSINI_SP_REQUEST CASSINI_SP_OBSERVATION CASSINI_SP_REQ_OBS	[Sequencenumber]_[source][phase][v].[ext] Where: [Sequencenumber]: SVT sequence number [source]: CIMS, or XML file [phase]: Sequence Phase (SSUP is the latest) [v]: Version letter from a - z [ext]: xep for transfer format bep for IEEE binary format
ENB Experimenter's Notebook	CASSINI_ENB_REQUEST CASSINI_ENB_OBSERVATION CASSINI_ENB_REQ_OBS	[Sequencenumber]_[source][phase][v].[ext] Where: [Sequencenumber]: SVT sequence number [source]: CIMS, or XML file [phase]: Sequence Phase (SSUP is the latest) [v]: Version letter from a - z [ext]: xen for transfer format ben for IEEE binary format



Expanded Schema Definition:

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
CASSINI_CMD_DICT	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem
	COMMAND	String of Length 32	N	Y	Name of command
	PARAMETER_NAME	String of Length 32	N	Y	Name of the parameter
	PARAMETER_INDEX	Integer	N	Y	Index of the parameter (Specifies order of parameter_names)
	PARAMETER_TYPE	String of Length 32	Y	N	Describes the data type for each parameter. Case sensitive standard values allowed for this element are: <u>Unsigned Integer</u> - an unsigned integer number (abbreviated in the table as Unsign Integer) <u>Signed Integer</u> - a signed integer number <u>String</u> - A string of characters to be translated into binary either directly or via a user hook <u>Hex</u> - Hex value <u>Absolute Time</u> - Absolute time in the form yyyy- dddThh:mm:ss.fff where yyyy = the year ddd = the day of the year (January 1 = 001) hh = hours mm = minutes ss = seconds .fff = fraction of seconds <u>Relative Time (Duration)</u> - Relative time in the form hh:mm:ss.fff where hh = hours mm = minutes ss = seconds

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
					.fff = fraction of seconds
					<p><u>List</u> – The number of items in the list may or may not be a fixed number. The values for parameters of this type are enclosed in braces “[]” in the PEF.</p> <p><u>Enumerated</u> - these data are typically sets of discrete values. For example, {0,10,100} is an enumerated data set as opposed to {0..100}, which is a set of continuous data.</p> <p><u>Real</u> – Real number.</p>
	PARAMETER_RANGE	Variable array of Strings of length 80.	Y	N	Range of valid values for the parameter.
	DESCRIPTION	Variable array of Strings of length 80.	N	N	Subsystem/Command/Parameter description
	DICTIONARY_VERSION	String of Length 32	N	Y	Command dictionary version.
CASSINI_CMD	TIME	Time	N	Y	Command time tag from Predicted Events File (PEF).
	COMMAND	Variable Length String	N	Y	Command name.
	PARAMETER_NAME	Variable Length String	N	Y	Parameter name. Parameter names are taken from the command dictionary
	CHR_VALUE	Variable Length String	Y	Y	Value of the parameter as a character string.
	DP_VALUE	Double	Y	Y	Value of the parameter as a double precision number (if character string can be parsed as a double precision number).
	INT_VALUE	Integer	Y	Y	Value of the parameter in integer number (if character string can be parsed as an integer number).
	VALUE_FLAG	Char	N	Y	Single character flag showing which values are present for current parameter. It can be set to 'C', 'D', 'I' or 'A'. These values stand for: 'C' -- only character value is available. 'D' -- character and DP values are available. 'I' -- character, DP and INT values are available. 'A' -- only "long value" is available.

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
	ENTRY_ID	Variable Length String	N	Y	Character string which has the same value for all EK table records representing a single command record from PEF file. Constructed as <PEF SEQ ID>:<CMD line number in PEF file>. If <PEF SEQ ID> string wasn't available from PEF file header, it's replaced with some random string that will be the same for all records from a single PEF file.
	PARAMETER_INDEX	Integer	N	Y	Index of the parameter for a command which specifies the order of parameters for a specific command.
	LONG_VALUE	Variable array of Strings of length 80.	Y	N	Values that do not fit into CHR_VALUE field.
	REQUEST_ID	Variable Length String	N	Y	The command request id string from the PEF.
	DICTIONARY_VERSION	String of Length 32	N	Y	Version of the command dictionary used to create this table.
CASSINI_NOTE	TIME	Time	N	Y	Time of the entry from PEF file.
	ATTRIBUTE_NAME	Variable Length String	N	Y	Attribute names are set to some fixed values defined by PEF specification. These values are: PROCESSOR_ID,SEQUENCE_ID, and NOTE_TEXT
	CHR_VALUE	Variable Length String	Y	Y	Value of the attribute in character string.
	ENTRY_ID	Variable Length String	N	Y	Character string which has the same value for all EK table records representing a single command record from PEF file. Constructed as <PEF SEQ ID>:<CMD line number in PEF file>. If <PEF SEQ ID> string wasn't available from PEF file header, it's replaced with some random string that will be the same for all records from a single PEF file.
	ATTRIBUTE_INDEX	Integer	N	Y	Index of the attribute in a note record from PEF file.
	LONG_VALUE	Variable array of Strings of length 80.	Y	N	Character string array containing an "80 characters" wrapped long character value that couldn't fit into CHR_VALUE. To get real parameter value from this array all array elements must be concatenated together.
	REQUEST_ID	Variable Length String	N	Y	The command request id string from the PEF.

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
CASSINI_STATUS	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem
	PARAMETER_NAME	String of Length 32	N	Y	Parameter names are taken from corresponding PEF status records.
	PARAMETER_VALUE	Variable Length String	N	Y	Value of the attribute in character string.
	LONG_VALUE	Variable array of Strings of length 80.	Y	N	Values that do not fit into the PARAMETER_VALUE field.
	BEGIN_TIME	Time	N	Y	The time when this parameter obtained the value specified in the PARAMETER_VALUE field.
	END_TIME	Time	N	Y	The time when this parameter lost the value specified in the PARAMETER_VALUE field.
CASSINI_NOISE_EV ENTS	COMMAND_EXEC_TIME	Time	N	Y	The execution time of the command that caused a mechanical noise event.
	EVENT	Variable Length String	N	N	Type of mechanical noise event.
	BEGIN_TIME	Time	N	Y	The time when the noise event started to occur.
	END_TIME	Time	N	Y	The time when the noise event ended.
	SOURCE_FLAG	Variable Length String	N	N	Indicates whether the source data is predict or actual/as- flown data.
CASSINI_SP_OBSE RVATION	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem.
	OBSERVATION_ID	Variable Length String	N	Y	An EK unique internal identifier that created by concatenating a sequence and a number.
	OBSERVATION_TITLE	Variable Length String	N	Y	Observation title.
	SEQUENCE	String of Length 32	N	Y	Sequence identifier string.
	SCIENCE_OBJECTIVE	Variable array of Strings of length 80.	Y	N	Science objectives for this observation.
	OBS_DESCRIPTION	Variable array of Strings of length 80.	Y	N	General description of this observation.
	NOTES	Variable array of Strings of length	Y	N	Additional notes for this observation.

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
		80.			
CASSINI_SP_REQUEST	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem.
	REQUEST_ID	Variable Length String	N	Y	The ID that uniquely identifies the request within the CIMS system. It has the format: <team>_<period><target>_<requestName><requestInstance>_<primeTeam>
	REQUEST_TITLE	Variable Length String	Y	Y	Title of the request.
	BEGIN_TIME	Time	N	Y	The start time of a request.
	END_TIME	Time	N	Y	The end time of a request.
	SEQUENCE	String of Length 32	N	Y	Sequence name string.
	POINTING_AGREEMENT	Variable array of Strings of length 80.	Y	N	Spacecraft agreements that were made during the science planning process.
	PRIMARY_POINTING	String of Length 32	Y	Y	Primary pointing requirement for this request.
	SECONDARY_POINTING	String of Length 32	Y	Y	Secondary pointing requirement for this request.
	REQ_DESCRIPTION	Variable array of Strings of length 80.	Y	N	Request description.
CASSINI_SP_REQUEST_OBS	REQUEST_ID	Variable Length String	N	Y	The request id of the request associated with the observation specified in the OBSERVATION_ID field.
	OBSERVATION_ID	Variable Length String	N	Y	The observation id of the observation associated with the request specified in the REQUEST_ID field.
	SEQUENCE	String of Length 32	N	Y	Sequence name string.
CASSINI_ENB_OBSERVATION	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem.
	OBSERVATION_ID	Variable Length String	N	Y	An EK unique internal identifier that is made up of a sequence and a number concatenated together.
	OBSERVATION_TITLE	Variable Length String	Y	Y	Observation title.
	SEQUENCE	String of Length	N	Y	Sequence name string.

TABLE	COLUMNS	TYPE	NULLS OK	INDEXED	DESCRIPTION
		32			
	OBS_AS_FLOWN_NOTES	Variable array of Strings of length 80.	Y	N	Information about the execution of the observation onboard the spacecraft (E.g., name of as-flown PEF, indication of change in execution from what was planned, problems with the execution, brief results)
CASSINI_ENB_REQUEST	SUBSYSTEM	String of Length 32	N	Y	Name of subsystem.
	REQUEST_ID	Variable Length String	N	Y	The ID that uniquely identifies the request within the CIMS system. It has the format: <team>_<period><target>_<requestName><requestInstance>_<primeTeam>
	REQUEST_TITLE	Variable Length String	Y	Y	Request title.
	SEQUENCE	String of Length 32	N	Y	Sequence name string.
	REQ_AS_FLOWN_NOTES	Variable array of Strings of length 80.	Y	N	Information about the execution of the request onboard the spacecraft (e.g., name of as-flown PEF, indication of change in execution from what was planned, problems with the execution, brief results)
CASSINI_ENB_REQUEST_OBS	REQUEST_ID	Variable Length String	N	Y	The request id of the request associated with the observation specified in the OBSERVATION_ID field.
	OBSERVATION_ID	Variable Length String	N	Y	The observation id of the observation associated with the request specified in the REQUEST_ID field.
	SEQUENCE	String of Length 32	N	Y	Sequence name string.

4.2. Data Format and Definition

Please see:

Multimission Software Interface Specification (SIS) SPICE Events Kernel, NAIF Document No. 371, Version 1.0,