WISE

MOS/GDS Interface Control Document

September 2009

Final

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DOCUMENT CHANGE LOG

CHANGE NUMBER	CHANGE DATE	PAGES AFFECTED	CHANGES/ NOTES	GENERAL COMMENTS
-		All	Initial release	

1 PURPOSE

The purpose of this document is to specify detailed descriptions of all the data interfaces between the different elements of the WISE Ground System (WGS). Section 4 describes the MOS/GDS architecture in terms of interface flows. Every MOS/GDS interface is depicted in Section 4. Section 5 provides a detailed description of each interface depicted in Section 4. Some interfaces will reference applicable multi-mission or Jason software interface specifications (SIS).

2 SCOPE

The interfaces described in this document support all MOS/GDS activities related to conducting flight operations for the WISE mission. The major phases of the mission which are supported are listed below:

(1) ATLO Support
(2) Operational Readiness Testing and Operational Rehearsals
(3) Launch and In Orbit Checkout Phase
(4) Survey Phase

3 References and Applicable Documents

4 MOS/GDS System Interface ARCHITECTURE

Section 4 partitions the GDS into a set of elements and then describes these elements in terms of interfaces. All interface names used in Section 4 are highlighted in **BOLD**. A detailed description of each interface is provided in Section 5.

4.1 *WISE MOS/GDS Elements*

The WISE MOS/GDS elements are depicted in Figure 4.1.1. These elements and interfaces support WISE flight operations.

4.1.1 TDRSS Terminal at White Sands

The TDRSS terminal at White Sands provides real time interfaces allowing the WISE MSA at JPL to receive both S-band and Ku-band telemetry data and to send uplink commands to the WISE spacecraft via an S-band uplink.

4.1.2 Survey Planning Center at UCLA

The Survey Planning Team located at UCLA assesses the quality and progress of the ongoing survey of the infrared universe using the WISE infrared instrument with a set of tools developed for that purpose. This team generates periodic survey plans which are translated into uplink files and sent to the spacecraft for execution.

4.1.3 Science Data Processing and Archiving Center at IPAC

The Science Data Processing Team develops the tools and performs the task of processing the high rate science data and archiving and distributing science data products. The team also generates an infrared image quality assurance report which is provided to the Survey Planning Team for accountability.

4.1.4 WISE Telemetry Command and Communications Subsystem (WTCCS)

The WTCCS is the core of the real time uplink and downlink system. It processes high rate science data utilizing a WISE high rate processor which is installed at White Sands and operated remotely from the WISE MSA at JPL. It processes low rate spacecraft engineering and instrument housekeeping data which is received over the S-band and Ku-band links.

4.1.5 WISE Test Bed at BATC

The WISE test bed at BATC may be operated remotely from the MSA at JPL to support the testing of the WISE ground data system at JPL and to train operations personnel.

4.1.6 WISE Mission Support at BATC

After Launch, the WISE MSA continues to routinely provide telemetry data and supporting information which may be utilized by on-call BATC engineering support personnel.

4.1.7 WISE Mission Support Area (MSA) at JPL

The WISE MSA at JPL hosts the WISE GDS and the operations personnel who conduct flight operations for the WISE spacecraft.

4.1.8 TDRSS Scheduling Group

The Sequence Team interacts with the TDRSS Scheduling Group via web based interface to schedule TDRSS contact support throughout the mission.

4.1.9 WISE Communications Network

The WISE Communications Network utilizes both open and closed dedicated communications lines and the open internet for communications between the elements described in this document.

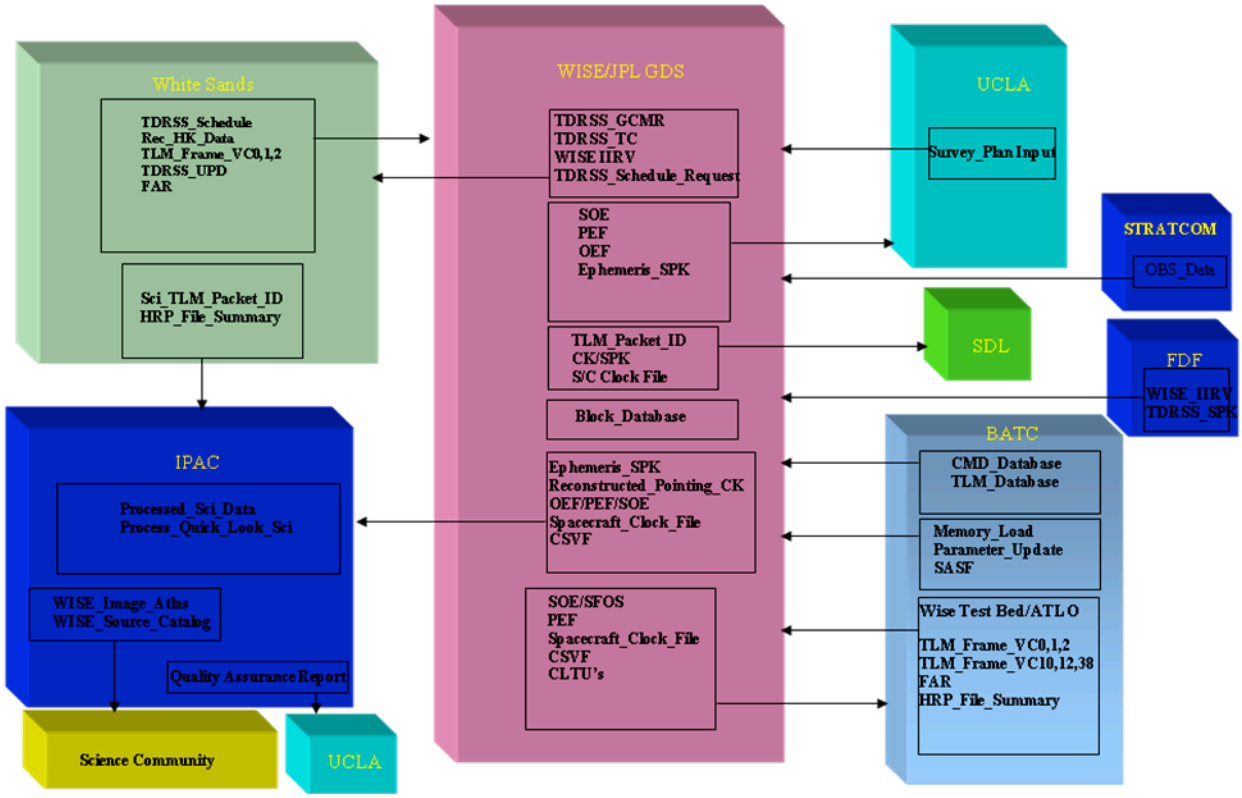


Figure 4.1.1 MOS/GDS Elements and Interfaces

4.2 High Rate Downlink Interfaces

The High Rate Downlink Interfaces are depicted in Figure 4.2.1. WISE high rate data is downlinked to the ground over the Ku-band transmitter with VC10 transfer frames (**TLM_Frame_VC10**) containing recorded engineering packets, VC12 transfer frames (**TLM_Frame_VC12**) containing CFDP processed file data and four streams of infrared instrument data (**TLM_Frame_VC38**). The transfer frames undergo convolutional decoding and are provided to the WISE high rate processor as a serial stream. The high rate processor performs Reed-Solomon decoding, frame synchronization, virtual channel splitting, and packet extraction. The extracted telemetry packets (**TLM_Packet_APID**) from each virtual channel are stored on the RAID device. All telemetry data transferred via VC12 transfer frames are in the form of CFDP processed telemetry data files. The telemetry data files are split into CFDP Protocol Data Units (PDU's) on the spacecraft. Each PDU is placed into an individual telemetry packet for transmission to the ground. File reconstruction from CFDP packets is performed by the WTCCS at JPL. Packet files (**TLM_Packet_FE1A, FE1B, FE1C, FE1D, FE2A, FE2B, FE2C, FE2D)** are generated from each of the four high rate science virtual channels. The packet files are stored on the RAID device at White Sands. The science packet files are transferred from White Sands to the IPAC facility on the Cal Tech campus. The recorded housekeeping telemetry files and the recorded engineering files are transferred to the WISE MSA at JPL. The recoded housekeeping data is processed and a daily frame accountability report

(**FAR**) is stored on the WISE external server for distribution to external users. The processed telemetry data is transferred to IPAC in support of science data processing.

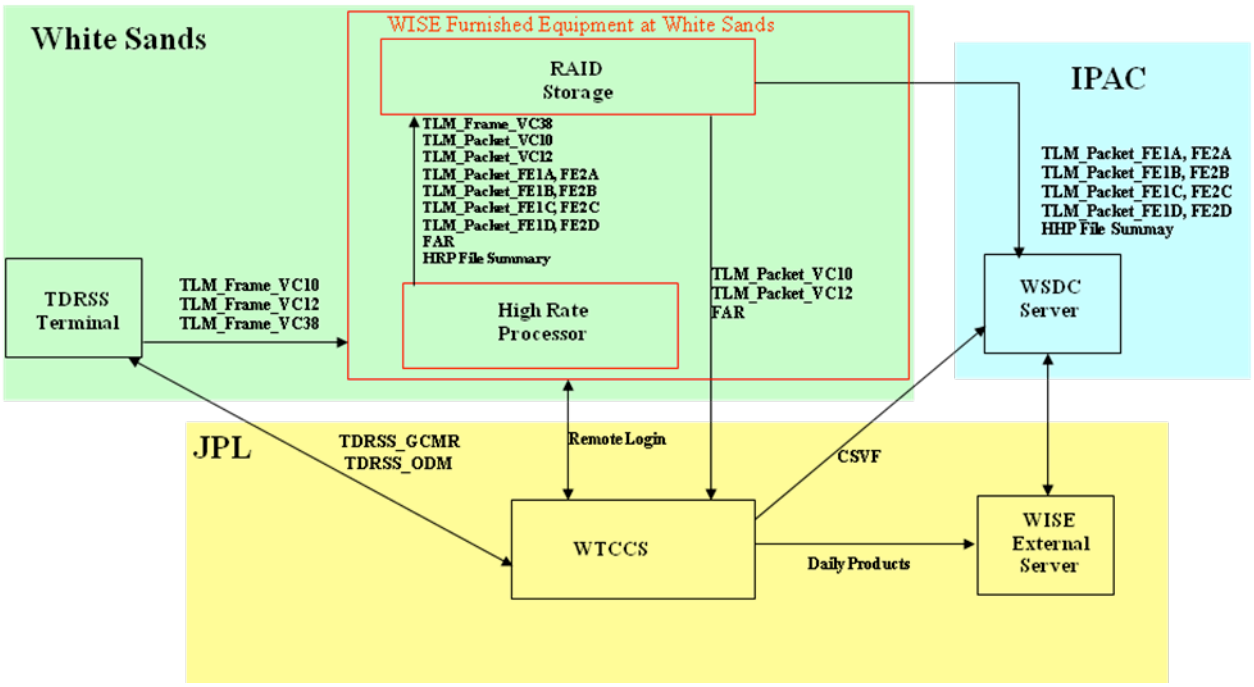


Figure 4.2.1 High Rate (Ku-Band) TLM Processing and Distribution

4.3 Low Rate Downlink Interfaces

The Low Rate Downlink Interfaces are depicted in Figure 4.3.1. The TDRSS Terminal captures the S-Band downlink from the WISE spacecraft and performs convolutional decoding and Reed_Solomon decoding and sends the decoded telemetry stream to the WISE MSA at JPL. The telemetry stream is normally comprised of VC0 transfer frames (**TLM_Frame_VC0**). However, the spacecraft can be commanded to include VC1 transfer frames (**TLM_Frame_VC1**) and/or VC2 transfer frames (**TLM_Frame_VC2**) in the S-band downlink telemetry stream. The WTCCS performs frame synchronization and packet extraction. The packets are channelized for processing and display and CFDP file data is reconstructed. The telemetry data is analyzed by the EOS and reported in the daily QQC report.

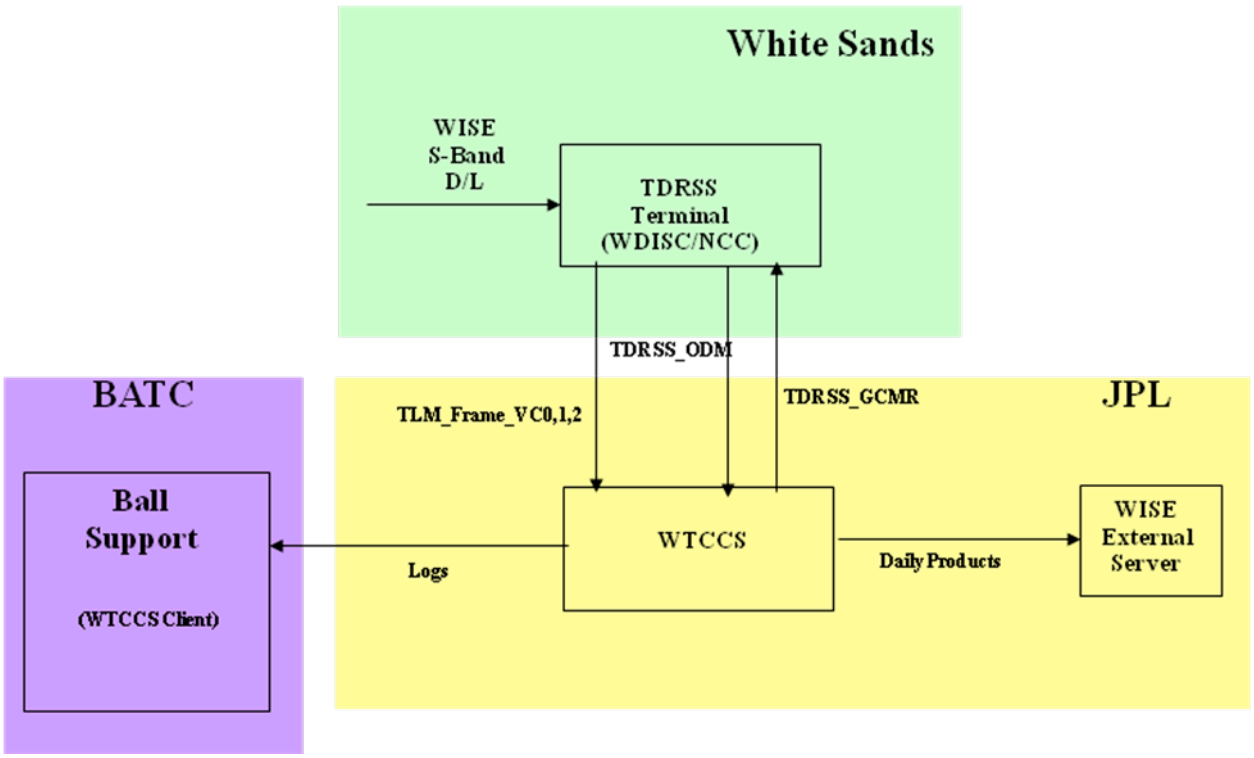
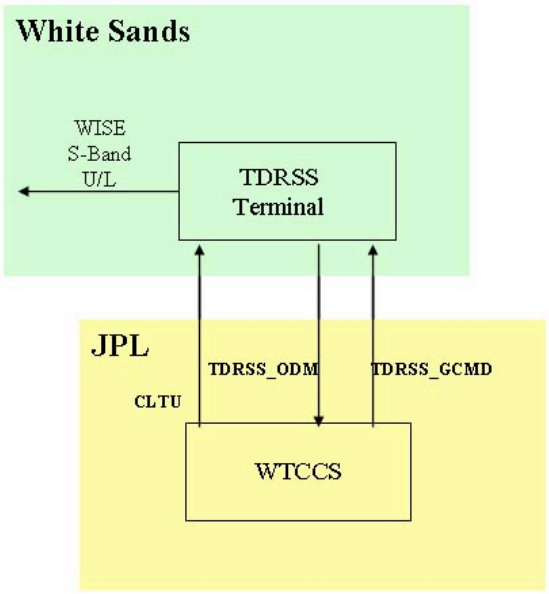


Figure 4.3.1 Low Rate (S-Band) TLM Processing and Distribution

4.4 TDRSS Uplink Interfaces

The TDRSS Uplink Process is depicted in Figure 4.4.1. The WTCCS in the WISE MSA at JPL establishes the state of the TDRSS ground station in preparation for commanding the WISE spacecraft by issuing remote control inputs (**TDRSS_GCMR**) to the station. The TDRSS ground station provides remote monitor data (**TDRSS_ODM**) specifying the state and status of the ground station. Upon establishing the proper configuration for commanding the spacecraft, command link transmission units (**CLTU**) are sent to the station uplink. The spacecraft uplink status is determined by processing VC0 telemetry transfer frames during the pass.

Figure 4.4.1 TDRSS Uplink Process



4.5 Sequence Integration and Command Generation Interfaces

The Sequence Integration and Command Generation Process is depicted in Figures 4.5.1 and 4.5.2. The command generation process receives command inputs in two forms. They are files to be uplinked using the CCSDS File Delivery Protocol (CFDP) and discrete commands. There are three types of file loads for CFDP conversion and uplink. They are Parameter Update Files, Memory Load Files, and Sequence Command Load Files. File loads are input to a "CFDP Command Processor" which converts the file load into a set of Protocol Data Units (PDU) which are in the form of a PDU command mnemonic file **(PDU_CMF)**. A log file is created for each file load converted into a PDU_CMF. The PDU_CMF is input to the Command Translator which generates a command packet (**CMD_PKT**) for each PDU. A PDU_CMF file will contain multiple PDU's.

The Sequence Integration Process receives command inputs in the form of Spacecraft Activity Sequence Files (**SASF**) which undergo an integration process putting the commands to be sequenced in time order and performing constraint checking and state tracking on the integrated sequence. Initially, the integrated sequence is in the form of a command mnemonic file. The CMF is sent to the WTCCS for command translation and conversion into command packet files (**CMD_PKT**). The command packet files are then formatted into a sequence command load. The sequence command load is input to the

CFDP command processor. The CFDP processor also converts memory load files and parameter files. CFDP converted files are then input to the WTCCS command translator for conversion into uplink command packets

Discrete commands are input to the Command Translator in the form of a Command Mnemonic File (**CMF**). A command packet is generated for each discrete command in the CMF. The CMF may contain multiple discrete commands.

The command packets are input to the Command Processor which converts the them into VC0, VC1, or VC2 command link transmission units (**CLTU**). When the ground and spacecraft status is properly configured the CLTU's are sent to the TDRSS ground station for uplink. Uplink status is derived from the spacecraft telemetry data and remote monitor data from the station.

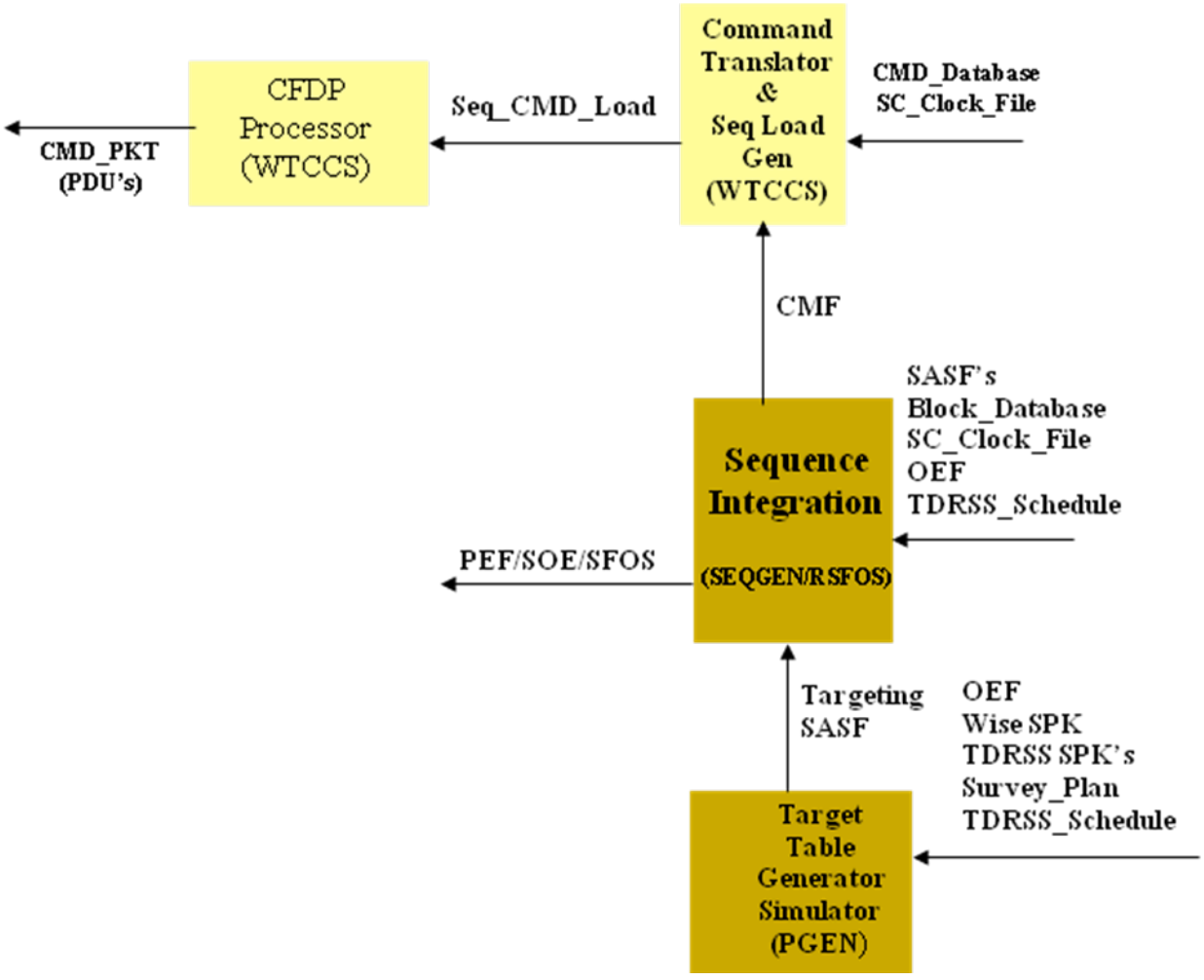


Figure 4.5.1 Sequence Integration

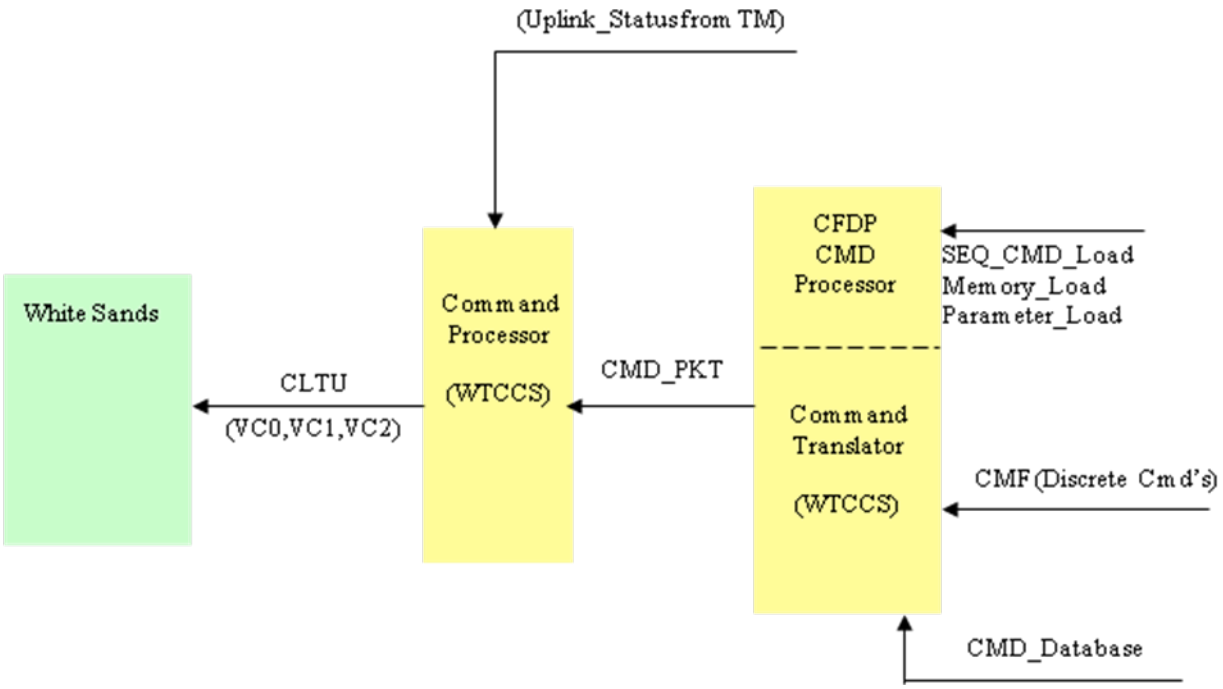


Figure 4.5.2 Command Generation

4.6 Navigation System Interfaces

The Navigation Process is depicted in Figure 4.6.1. A two line element (TLE) is provided for the WISE spacecraft by the Flight Dynamics Facility at GSFC during the launch and early operations phase (LEOP) and by NORAD during the prime science phase (PSP). The WISE TLE and TDRSS TLE's are processed to produce an Orbit Events File (**OEF**). TDRSS support is requested via internet access using the Space Network Access System (SNAS) The WISE TLE is sent to the White Sands Operations Center. The Navigation Process includes the generation of the spacecraft ephemeris in the form of an SP-kernel (**Ephemeris_SPK**), and the reconstructed attitude of the spacecraft in the form of a C-Kernel (**Reconstructed_Pointing_CK**).

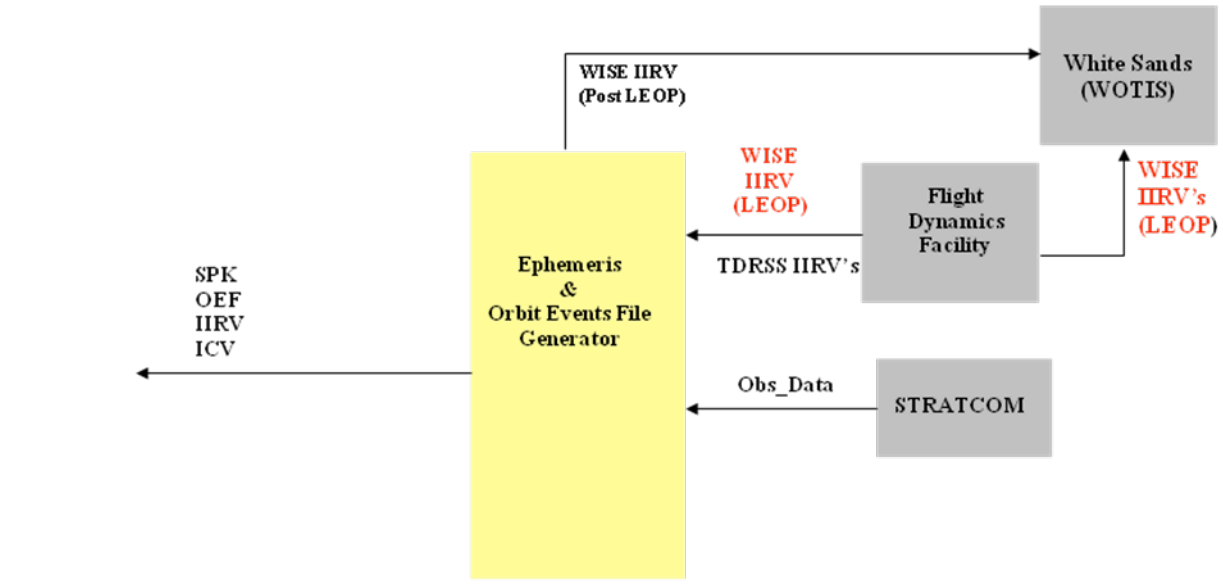


Figure 4.6.1 Navigation Process

4.7 Science Planning and Data Processing Interfaces

The survey planning task is performed by the WISE Survey Planning Team at the University of California at Los Angeles (UCLA). Figure 4.7.1 depicts the interfaces supporting the survey planning task. The science data processing task is performed by the WISE Science Data Processing Team located at the Infrared Processing and Analysis Center (IPAC). Figure 4.7.2 depicts the interfaces supporting the science data processing task.

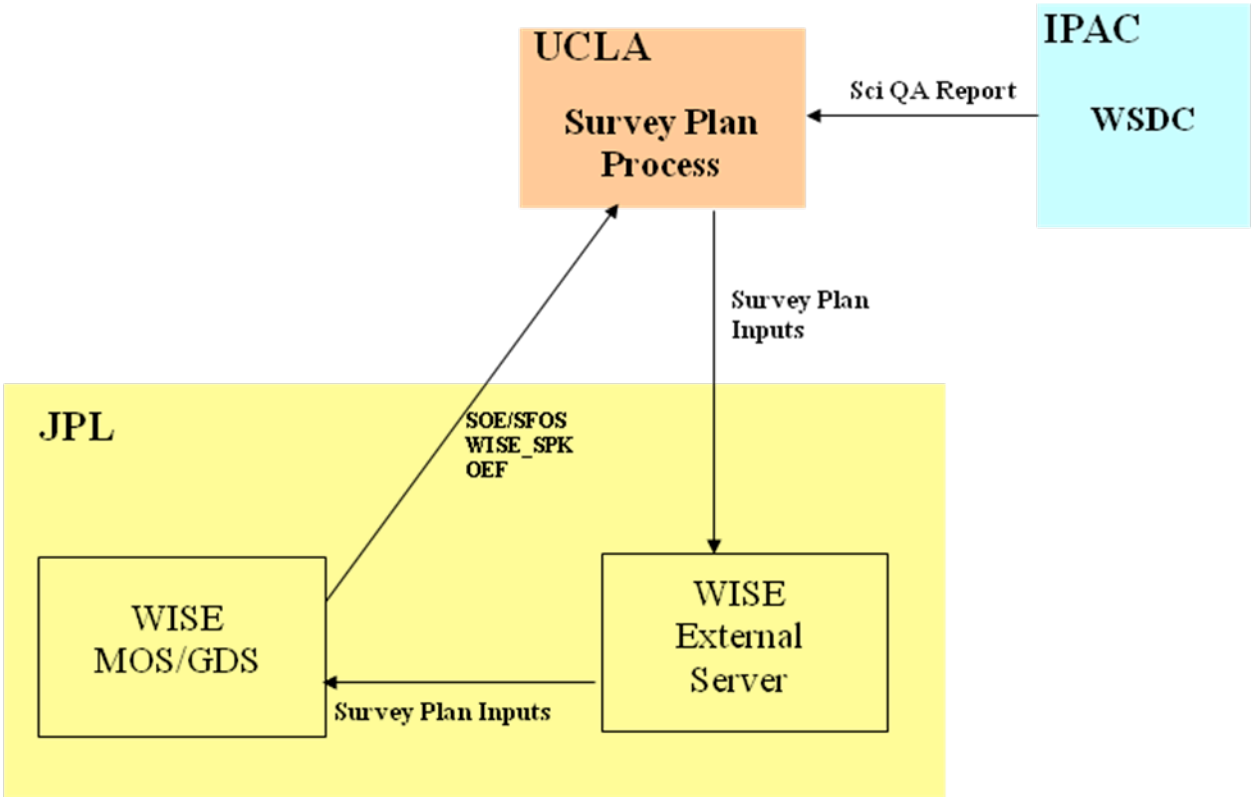


Figure 4.7.1 Survey Planning

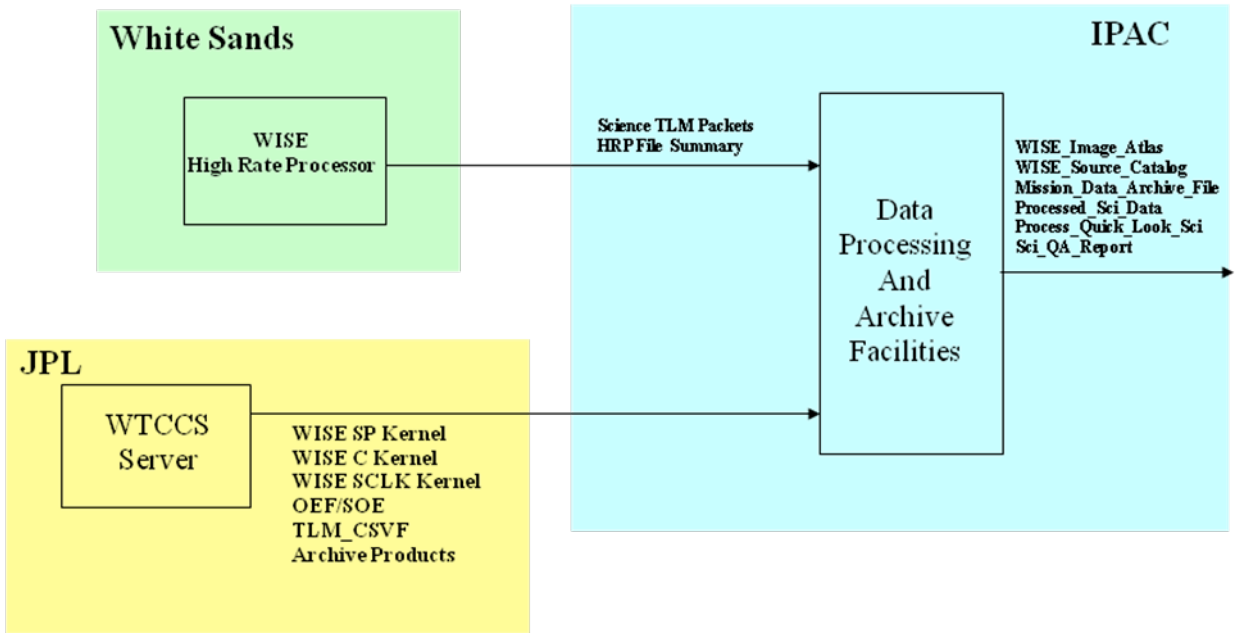


Figure 4.7.2 Science Data Processing

4.8 BATC Support Interfaces

Interfaces between the WISE MSA at JPL and WISE Support Facilities at BATC are established during the ATLO phase. In preparation for conducting Flight Operations from the WISE MSA at JPL, the interfaces between JPL and BATC undergo a reconfiguration. Figure 4.9.1 depicts the interface configuration between JPL and BATC during the ATLO campaign and in support of flight operations.

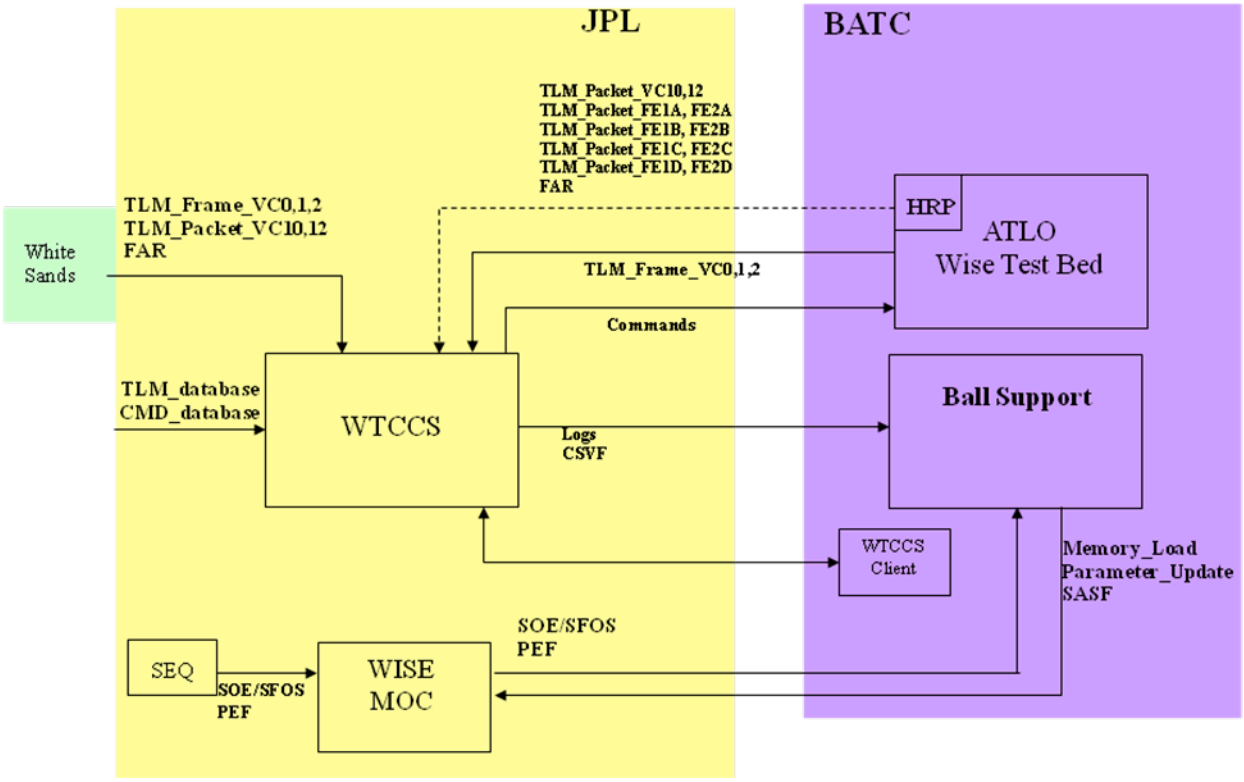


Figure 4.9.1 JPL/BATC Interfaces

4.9 MOS/GDS Interface List

GENERIC INTERFACE NAME	DESCRIPTION	PROVIDER	CUSTOMER
Alarm Report **Alarm_Report**	A listing of RED telemetry alarms incurred during a downlink session	WTCCS	EOS
Block Dictionary Database **Block_Database**	Description of each spacecraft and ground expandable block	SEQ	SEQ
CFDP Packets for Downlink **CFDP_PDU_Downlink**	Downlink Protocol Data Units (PDU's) containing either downlink metadata, end of file indication, or telemetry file data	S/C	WTCCS
CFDP Uplink Protocol Data Unit **CFDP_Uplink_PDU**	CFDP PDU's containing either uplink metadata, end of file indication, or command data	WTCCS	S/C
Command Data Base File **CMD_Database**	Data base containing the detailed characteristics of each spacecraft command mnemonic	BATC	WTCCS SEQ
Command Packet File **CMD_Packet**	ASCII file containing command packets to be processed into CLTU's for uplink	WTCCS	WTCCS
Command Mnemonic File **CMF**	File containing mnemonics and directives to the command data base to translate command mnemonics into command packets	SEQ WTCCS EOS	WTCCS

GENERIC INTERFACE NAME	DESCRIPTION	PROVIDER	CUSTOMER
WISE Ground Track **Ground_Track**	File containing the position of the sub spacecraft point on the Earth's surface while in Orbit.	NAV	WSDC
Housekeeping Data Archive File **HK_Data_Archive_File**	Housekeeping data file (compressed) for long term deep archive	WSDC	All
HRP Frame Accountability Report **HRP_FAR**	The FAR reports frame accountability and statistics for each virtual channel (VC10, VC12, VC38). This report is used for retransmitting lost frames.	HRP	WTCCS
HRP File Summary Report **HRP_File_Summary**	A listing of files produced by the HRP during a single TDRSS contact pass	EOS	WSDC
HRP Status Packet **HRP_Status_Pkt**	A periodic packet generated by the HRP providing the status of the HRP	HRP	WTCCS
Improved Inter-Range Vector **IIRV**	The IIRV is derived from a TLE and provided to WOTIS for TDRSS pointing	EOS	WOTIS
Memory Load File **Memory_File_Load**	Binary Memory Load file input to the CFDP command processor	EOS	WTCCS
Orbiter Events File **OEF**	Text file containing key spacecraft and ground events including the TDRSS pass schedule	NAV	EOS, SEQ
Parameter Update File **Parameter_File_Load**	Binary Parameter File input to the CFDP command processor	SEQ	WTCCS

GENERIC INTERFACE NAME	DESCRIPTION	PROVIDER	CUSTOMER
Pass List **Pass_List**	Test file containing a listing of scheduled TDRSS passes	SEQ	EOS, WTCCS
Spacecraft Predicted Events File **PEF**	SEQGEN output file predicting spacecraft events resulting from the nominal execution of an on-board stored sequence	SEQ	All
Recorded Housekeeping Data **Rec_HK_Data**	File containing recorded housekeeping telemetry in packet format	HRP	WTCCS
Spacecraft Activity Sequence File **SASF**	SEQGEN input request file containing timed commands for integration into an on-board stored sequence	All	SEQ
Science Telemetry Packet Files **Science_TLM_Packet_ID**	Science Telemetry Packet files segregated by APID	WTCCS/HRP	WSDC
Sequence of Events File **SOE**	Time ordered listing of scheduled spacecraft and ground events	SEQ	All
Spacecraft Clock File **Spacecraft_Clock_File**	Listing of correlated spacecraft clock and UTC data points	EOS	All
Spacecraft Sequence File **SSF**	SEQGEN output file providing a time ordered listing of all sequenced commands	SEQ	All
Sequence of Events File **SOE**	Time ordered listing of scheduled spacecraft	SEQ	All
Stratcom Raw Observation Data **STRATCOM_OBS_DATA**	Skin tracking RADAR data of the WISE S/C provided by STRATCOM	STRATCOM	NAV
Survey Plan **Survey_Plan**	Survey Plan for input to PGEN	EOS	EOS

GENERIC INTERFACE NAME	DESCRIPTION	PROVIDER	CUSTOMER
Survey Plan Input **Survey_Plan_Input**	Inputs to the Survey Planning Software	SPS	EOS
TDRSS Remote Control **TDRSS_GCMR**	Socket interface for sending TDRSS remote control directives	WTCCS	TDRSS
TDRSS Remote Monitor Data Stream **TDRSS_ODM**	Data stream via socket connection of TDRSS remote monitor status information	TDRSS	WTCCS
TDRSS Pass List **TDRSS_Pass_List**	A list of TDRSS passes	SEQ	EOS, NAV
TDRSS Tele-command Path **TDRSS_TC**	Socket interface for sending command data in the form of CLTU's to White Sands for uplink to the S/C.	WTCCS	TDRSS
TDRSS Telemetry Stream **TDRSS_TLM**	TDRSS telemetry stream either from WDISK or the Ku-band interface to the HRP	WSC	WTCCS/HRP
Telemetry Comma Separated Value Files **TLM_CSVF**	Comma Separated Value Files containing selected engineering data channels	WTCCS	All
Telemetry Data Base File **TLM_Database**	Data base containing the detailed characteristics of each spacecraft telemetry parameter	BATC	WTCCS
Telemetry Frame Stream **TLM_Frame_VCID**	Raw convolutional decoded CADU telemetry transfer frames for virtual channels 0, 1, 2, 10, 12, 38	TDRSS ATLO Testbed	WTCCS/HRP
Engineering Telemetry Extracted Packet Files **TLM_Packet_ID**	Engineering and CFDP Packet files segregated by packet type	WTCCS/HRDP	EOS

GENERIC INTERFACE NAME	DESCRIPTION	PROVIDER	CUSTOMER
WISE C Kernel **WISE_C_Kernel**	Reconstructed or predicted spacecraft orientation in NAIF/SPICE CK format	NAV	All
WISE Spacecraft Clock Kernel **WISE_SCLK_Kernel**	Listing of correlated spacecraft clock and UTC data points in the NAIF/SPICE SCLK format	EOS	All
WISE SP Kernel **WISE_SP_Kernel**	WISE and TDRSS vector files in the NAIF/SPICE SPK format	NAV	All

5 MOS/GDS System Interface Detailed Descriptions

INTERFACE DESCRIPTION FORM

Interface name: Alarm_Report

Alarm Report - A listing of RED telemetry alarms incurred during a downlink session

EXCHANGE DESCRIPTION

Provider:	WTCCS	*Consumer:*	EOS
Server:	WISE Server	*Client:*	EOS
Protocol:	FTP	*Connection initiator:*	EOS

Schedule:	As needed
Comment:	File Naming Convention: **WIS_WTCCS_Alarm_Report_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The alarm log file is generated upon detection of a telemetry parameter which violates a specified alarm value.
An example of the Telemetry Alarm Log file is shown in below. The fields displayed are:

TimeStamp—packet time when the alarm occurred

Color—alarm state (RL, YL, YH, RH, GR)

Mnemo—mnemonic of parameter in alarm

Value—value of parameter in alarm

RL—Red Low limit

YL—Yellow Low limit

YH—Yellow Hi limit

RH—Red High limit

TimeStamp	Color	Mnemo	Value	RL	YL	YH	RH
2007-123T04:59:59	YH	Battemp	89	10	20	80	90
2007-123T05:01:01	RH	Battcur	57	10	20	30	40

INTERFACE DESCRIPTION FORM

Interface name: Block_Database

Block Database - Description of each spacecraft and ground expandable block

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	SEQ
Server:	WISE Server	*Client:*	SEQGEN
Protocol:	FTP	*Connection initiator:*	SEQ

Schedule:	As needed
Comment:	The block database is configuration controlled. File Naming Convention: **WIS_SEQ_Block_Database_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

See the following document for interface details:

Wide-field Infrared Survey Explorer (WISE) Block Dictionary Release Version 1.0, May 30, 2007
JPL D-38489

INTERFACE DESCRIPTION FORM

Interface name:	**CFDP_PDU_Downlink**

Protocol Data Units (PDU's) containing downlink metadata, end of file indication, or telemetry file data

EXCHANGE DESCRIPTION

Provider:	WTCCS	*Consumer:*	WTCCS
Server:	WTCCS	*Client:*	WTCCS
Protocol:		*Connection initiator:*	

Schedule:	
Comment:	

INTERFACE DATA DESCRIPTION

TM CCSDS File Delivery Protocol

CCSDS File Delivery Protocol (CFDP) is a protocol that takes advantage of file systems on both the ground and spacecraft to transfer large blocks of data as files. WISE will use CCSDS File Delivery Protocol CFDP for S/C file downloads as shown below. Anticipated file types to be downloaded from the WISE spacecraft are: stored state of health files, exceptions log files, command history logs (in Reset Recovery Storage), command sequence logs (in RRS) and 1553 debugging logs (in RRS).

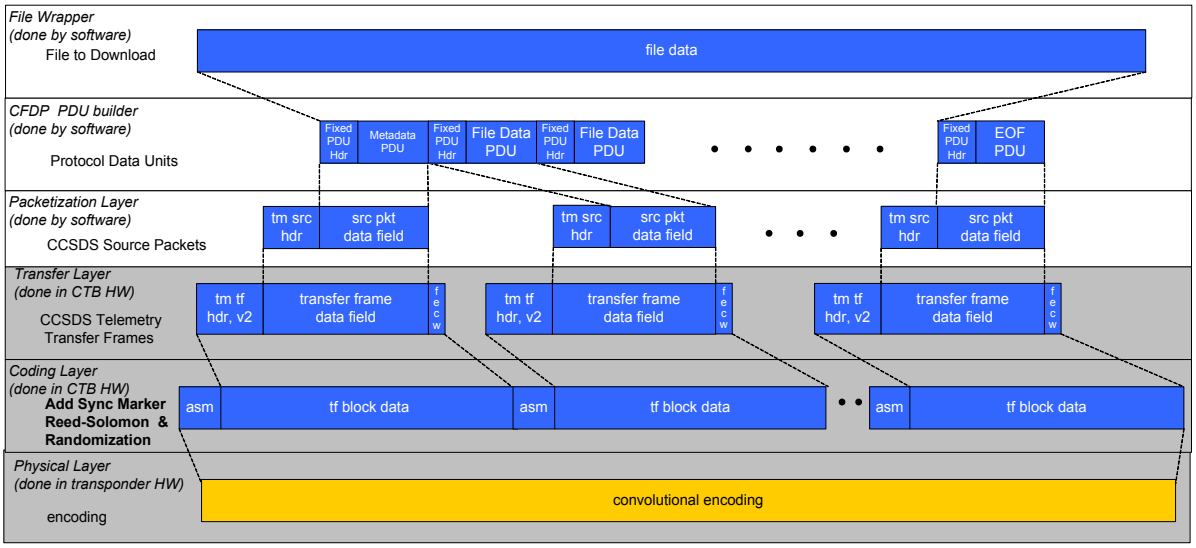


Figure 1 WISE CFDP TM Format Overview

Before transfer, files are broken into Protocol Data Units (PDUs) by the spacecraft's CFDP entity. On WISE PDUs are encapsulated into TC packets and inserted into the TC protocol stack at the Packetization Layer. The WISE CFDP Fixed PDU Headers are shown below.

Fixed PDU Header														
Version No.	PDU Type	Direction	Transmission Mode	CRC Flag	Reserved	PDU Data Field Length	Reserved	Length of Entity IDs	Reserved	Length of Transaction Sequence Number	Source Entity ID	Transaction Sequence Number	Destination Entity ID	PDU Data Field
Identifies Version	'0' - File Directive '1' - File Data	'0' – toward receiver '0' – toward sender	'1' – for unreliable mode	'0' – CRC not present '1' – CRC present	Future Use	In Octets	Future Use		Future Use					
000	1	0	1	0	0		0	0	0	0				
3 bits	1 bit	1 bit	1 bit	1 bit	1 bit	16 bits	1 bit	3 bits	1 bit	3 bits	8 bits	8 bits	8 bits	Var
1 Octet						2 Octets	1 Octet				Varies			

Figure 2 WISE CFDP Fixed PDU Header Format

CFDP may be used in unreliable mode or one of four reliable modes: immediate, deferred, prompted, or asynchronous. In unreliable mode, the communication is only one way, and no attempt is made by the receiving entity to communicate with the sender about file completeness. **WISE will use CFDP in unreliable mode only.** Therefore the Transmission mode value in the Fixed PDU Header will always be '1', unacknowledged.

The CRC flag in the Fixed PDU Header is not used on WISE. FSW has limited the Transaction Sequence Length and Entity ID Lengths to 8 bits (one octet).

Though the CFDP standard allows the transmission of multiple files simultaneously, WISE plans to operate with the restriction that files will be transferred in series. This is being done to minimize the amount of memory space that is set aside for storing outgoing file pointer information on the spacecraft.

The WISE Metadata PDU, File Data PDU and EOF PDU definitions are shown in Figure 3 below..

Metadata PDU								
Fixed PDU Header.	File Directive Code	Segmentation Control	Reserved	File Size (in octets)	Length of Source File Name	Source File Name	Length of Destination File Name	Destination File Name
	'07' Hex	'0' – record boundaries respected '1' – record boundaries not respected	Future Use			8X Length		
	07	0	0	varies	varies	varies	varies	varies
56 bits	**8 bits**	**1 bit**	**7 bits**	**32 bits**	**varies**	**varies**	**varies**	**varies**
7 octets	2 Octets			4 Octets	Varies			

Figure 3 WISE CFDP Metadata PDU Format

File Data PDU		
Fixed PDU Header.	Segment Offset (in octets)	File Data
varies	varies	varies
56 bits	**32 bits**	**Var**
7 octets	4 Octets	Varies

Figure 4 WISE CFDP File Data PDU Format

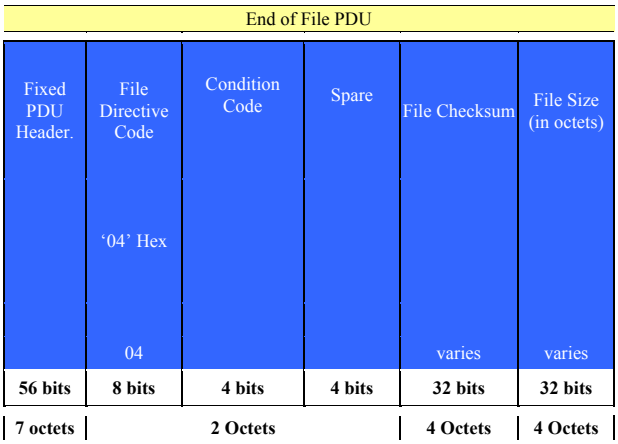


Figure 5 WISE CFDP End of File PDU Format

There will be one packet type (Appid/PacketID) for all CFDP PDUs. Packet lengths will vary with PDU length. **The maximum software generated telemetry PDU size for the WISE spacecraft will be 994 bytes to maximize OE heritage.** The PDU is sized to fit (with its 14 byte packet header) within the data field of a TM Transfer Frame. The maximum length of a PDU-data carrying space will be 1107 bytes (this does not include the M_PDU header). The PDU's will be encapsulated into telemetry packets and downlinked via VC2 or VC12 transfer frames.

INTERFACE DESCRIPTION FORM

Interface name: **CFDP_Uplink_PDU**

Uplink Protocol Data Units that contain uplink metadata, end of file indication, or command data

EXCHANGE DESCRIPTION

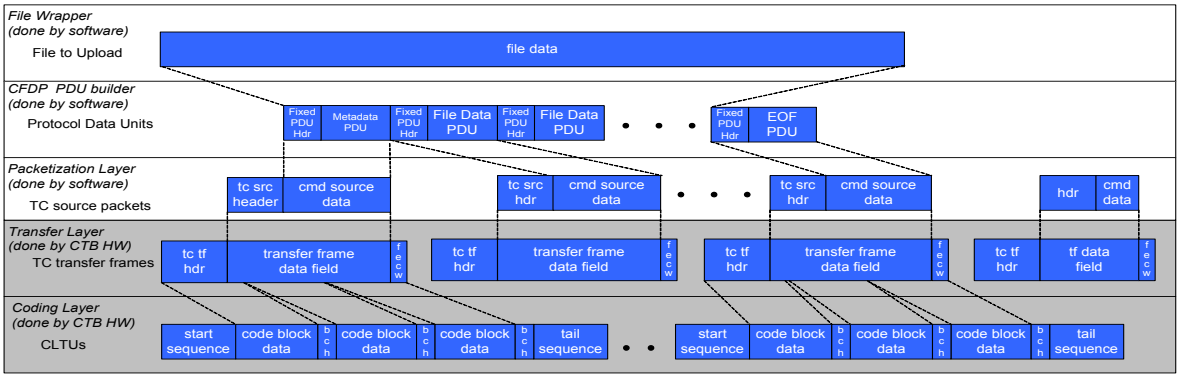
WISE CFDP TC Overview

Provider:	WTCCS	*Consumer:*	WTCCS
Server:	WTCCS	*Client:*	WTCCS
Protocol:		*Connection initiator:*	

Schedule:	
Comment:	This is a intermediate command product which continues on for packetization and CLTU generation. See the **CMD_Packet** interface description for packetization.

INTERFACE DATA DESCRIPTION

WISE plans to use the unreliable mode of CFDP, wherein the entire File Delivery Unit (FDU) is sent up to the spacecraft, then the spacecraft issues a file verification message in telemetry or a protocol error is declared.



iew

The fixed PDU TC header is shown below:

Fixed PDU Header														
Version No.	PDU Type	Direction	Transmission Mode	CRC Flag	Reserved	PDU Data Field Length	Reserved	Length of Entity IDs	Reserved	Length of Transaction Sequence Number	Source Entity ID	Transaction Sequence Number	Destination Entity ID	PDU Data Field
Identifies Version	'0' - File Directive '1' - File Data	'0' – toward receiver '1' – toward sender	'1' – for unreliable mode	'0' – CRC not present '1' – CRC present	Future Use	In Octets	Future Use		Future Use					
000	1	0	1	0	0		0	0	0	0				
3 bits	**1 bit**	**1 bit**	**1 bit**	**1 bit**	**1 bit**	**16 bits**	**1 bit**	**3 bits**	**1 bit**	**3 bits**	**Var**	**Var**	**Var**	**Var**
1 Octet						**2 Octets**	**1 Octet**				**Varies**			

Though the CFDP standard allows the transmission of multiple files simultaneously, WISE plans to operate with the restriction that files will be transferred in series. This is being done to minimize the amount of memory space that is set aside for receipt of files on the spacecraft. A file that is received will first be written into a temporary location. Upon reception of the complete file, the file will be relocated to its final destination. The reason for using a temporary file is to avoid the situation where a file is being overwritten from the ground when a communication error aborts the transaction, leaving the file partially overwritten and unusable.

The current plan for WISE is that a file uplink session monopolizes the uplink channel. In other words, there will not be any Software Commands or Level Zero Commands transmitted during a file transmission. This is acceptable due to the pre-planned nature of file uplinks to the spacecraft. There is no anticipated need to send immediate commands on an impromptu basis, but should an emergency arise, the file uplink can be cancelled to open the channel for Level Zero or Software Commands.

There will be one packet type (AppID/PacketID) defined for all CFDP PDUs. Packet lengths will vary with PDU length.

The software shall limit CFDP Protocol Data Unit telecommand source packets to a maximum data field size of 994 bytes or less, limiting the maximum Telecommand Transfer Frames PDU size to 1008 bytes.

The WISE Metadata PDU, File Data PDU and EOF PDU definitions are shown in the Figures below.

Metadata PDU								
Fixed PDU Header.	File Directive Code '07' Hex	Segmentation Control '0' – record boundaries respected '1' – record boundaries not respected	Reserved Future Use	File Size (in octets)	Length of Source File Name	Source File Name 8X Length	Length of Destination File Name	Destination File Name
	07	0	0	varies	varies	varies	varies	varies
Var	**8 bits**	**1 bit**	**7 bits**	**32 bits**	**varies**	**varies**	**varies**	**varies**
Varies	2 Octets			4 Octets	Varies			

WISE CFDP Metadata PDU Format

File Data PDU		
Fixed PDU Header.	Segment Offset (in octets)	File Data
varies	varies	varies
Var	**32 bits**	**Var**
Varies	4 Octets	Varies

WISE CFDP File Data PDU Format

End of File PDU					
Fixed PDU Header.	File Directive Code '04' Hex	Condition Code	Spare	File Checksum	File Size (in octets)
	04			varies	varies
Var	**8 bits**	**4 bits**	**4 bits**	**32 bits**	**32 bits**
Varies	**2 Octets**			**4 Octets**	**4 Octets**

WISE CFDP End of File PDU Format

INTERFACE DESCRIPTION FORM

Interface name: CMD_Database

Command Data Base File - Data base containing the detailed characteristics of each spacecraft command mnemonic

EXCHANGE DESCRIPTION

Provider:	BATC	*Consumer:*	WTCCS
Server:	WISE External Server	*Client:*	WTCCS
Protocol:	FTP	*Connection initiator:*	WTCCS

Schedule:	Whenever updated and provided by BATC
Comment:	File naming convention: **WIS_BATC_CMD_Database_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The Command Database provided by BATC is an EXCEL file which is converted to the WISE CommandDatabase format used by the WTCCS.

The Command workbook includes:

- General Command Info (mnemonic, description, etc.); worksheet name: [cmd]
- Command Parameters (subfields); worksheet name: [cmd_param]
- Command Parameter State Conversions; worksheet name: [cmd_param_conv_state]
- Command - Telemetry Responses; worksheet name: [cmd_tlm_response]

The layout of the EXCEL spreadsheets is described below:

Command Workbook

Worksheet [cmd]: General Command Info

- spacecraft [required]
  - 1-10 character string abbreviation used to indicate the spacecraft this command is associated with; abbr must match db spacecraft definition record abbr. value
    - WISE uses WISE [WS]
- external_element
  - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria

    - Value is required only for payload/instrument, otherwise value is preset by App ID association
    - WISE use limited to 2 chars [TBR]
- app_id [required]
    - The application ID or reserved number (value must be unique per spacecraft)
    - Integer values 1 – 255
        - WISE reserves 255 for the CTB
        - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
    - The packet ID (value must be unique per application)
    - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- pkt_name
    - [optional] The name of the packet; informational only
    - String; 1-80 char. max
- mnemonic [required]
    - The unique 1-12 char ground system identifier for this command (note: 12 is an OASIS limitation)
    - alpha-numeric and underscore chars are allowed, no spaces
    - naming conventions are program specific; DI uses an additional 3 char prefix to specify the OASIS ext_element within the mnemonic bringing the allowed character total to 15; this type of mnemonic is spit into its parts during exports for OASIS
- new_mnemonic
    - This is used when changing an existing mnemonic (useful for a before/after mnemonic log)
    - Any values entered here must follow the same rules as for the mnemonic field
- cmd_type [required]
    - String indicating the type of command
    - Supported values are SWC (software command), HWC (hardware command)
- export_to_ground
    - TRUE/FALSE: set to TRUE if the ground system needs to be able to send this particular command (sometimes templates are defined); automatically set to FALSE if mnemonic = 1-NOT_USED
    - Default = TRUE
- init_only
    - TRUE/FALSE: set to TRUE if this command is only valid during initialization
    - Default = FALSE
- test_only
    - TRUE/FALSE: set to TRUE if this command is only valid during test
    - Default = FALSE
- critical

    - TRUE/FALSE: set to TRUE if this is a command that is critical (definition of “critical” and the requirements for two-step or interlocked command are program-specific [TBR for WISE])
    - Default = FALSE
- hazardous
    - TRUE/FALSE: set to TRUE if this is a command that could cause damage to spacecraft or personnel
    - Default = FALSE
- delay
    - [optional] Short text field describing any delay (value and units) required after command is executed (before next command)
- required_predecessor_mnemonic
    - [optional] If the command must always follow another command, enter that command's mnemonic here
- required_predecessor_description [required]
    - [optional] one line short description describing the command predecessor (<80 chars)
- required_predecessor_notes
    - [optional] larger free-form text field used to capture any notes about this command predecessor (<3000 chars)
- required_predecessor_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- cmd_description [required]
    - A one line short description describing the command (~80 chars); up to 60 chars are included in OASIS exports
- cmd_notes
    - [optional] larger free-form text field used to capture any notes about this command (3000 chars)
- cmd_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- test_description
    - [optional] one line short description describing any test info for this command (<80 chars)
- test_notes
    - [optional] larger free-form text field used to capture any testing notes for this command (<3000 chars)
- test_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- result_state_description
    - [optional] one line short description describing any result states for this command (<80 chars)
- result_state_notes

    - [optional] larger free-form text field used to capture any result state notes for this command (<3000 chars)
- result_state_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- constraints_description
    - [optional] one line short description describing any constraints for using this command (<80 chars)
- constraints_notes
    - [optional] larger free-form text field used to capture any contraint notes for this command (<3000 chars)
- constraints_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- cmd_bit_len
    - command length including CP_PDU header in bits, calculated

Worksheet [cmd_param]: Command Parameters (Subfields)

- spacecraft [required]
    - 1-10 character string abbreviation used to indicate the spacecraft this command is associated with; abbr must match db spacecraft definition record abbr. value
        - WISE uses WISE [WS]
- external_element
    - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
    - Value is required only for payload/instrument, otherwise value is preset by App ID association
    - WISE use limited to 2 chars [TBR]
- app_id [required]
    - The application ID or reserved number (value must be unique per spacecraft)
    - Integer values 1 – 255
        - WISE reserves 255 for the CTB
        - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
    - The packet ID (value must be unique per application)
    - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- cmd_mnemonic [required]
    - The mnemonic of the command this parameter is associated with
- fsw_var_name [required]
    - The variable name corresponding to this command parameter's packet variable name; [if the packet variable was an array, this name is used in

conjunction with the next two array dimension index values to specify the exact packet variable in question]
    - If this is a flight software packet, this name is the actual fsw variable name
    - In order for a command parameter to be succesfully imported into the database, the fsw_var_name (in conjunction with any array indexes) MUST match up with a packet variable; otherwise the spreadsheet row will be rejected
- array_d1_index
    - An integer indicating the corresponding packet variable's first dimensional array index (if applicable)
    - (all packet variables that are arrays must be "unwound" in command parameter definitions; one command parameter per array item)
- array_d2_index
    - An integer indicating the corresponding packet variable's second dimensional array index (if applicable)
    - (all packet variables that are arrays must be "unwound" in command parameter definitions; one command parameter per array item)
- data_type
    - [optional] The packet variable's primitive data type: accepted values are BIT, BOOL8, INT8, INT16, INT32, FLT32, FLT64, STRING, UINT8, UINT16, UINT32
    - The data type will be automatically determined from the packet variable definition
- bit_length
    - [optional] This integer provides additional bit size information for BIT and STRING data types
- param_order
    - [optional] An integer representing the order of the command parameter within the command packet; numbering starts at one
    - The order is determined from the packet variable definition order
- param_name [required]
    - (a.k.a. command subfield) String identifying this command parameter; the name must be unique among parameters for the specified command
    - Length may be limited by ground systems (OASIS limits value to 1-16 char)
    - Alpha-numeric and underscore chars are allowed, no spaces
    - Naming conventions are program specific
    - OASIS has a special convention for a parameter named "TO", avoid using this name
- new_param_name
    - This is used when changing an existing command parameter name (useful for a before/after log)
    - Any values entered here must follow the same rules as for the param_name field
- value

    - [optional] Any value entered here will be considered a hard-coded parameter value; the parameter will not be available when specifying the command but will instead be automatically included in the command default bit pattern; i.e. it will be sent as part of the command but the operater cannot modify the parameter value
    - Included in C&T Database export
- default_value
    - [optional] This default value will be used if the parameter value is not provided when specifying the command
    - Included in the C&T Database export
- min_value
    - [optional] Minimum command parameter value; if not specified, the data type default is used
    - Decimal and hexadecimal values are allowed; specify hex values with a "x" prefix, ex: xF5CF
- max_value
    - [optional]Maximum command parameter value; if not specified, the data type default is used
    - Decimal and hexadecimal values are allowed; specify hex values with a "x" prefix, ex: xF5CF
- eu
    - [optional] Engineering units for the command parameter; valid EU list is project/ground system specific (SEC, V, C, etc.)
    - Whenever EU units are supplied, the ground system requires a polynomial conversion definition. For command parameters, the database will ALWAYS automatically provide an identity conversion.
- param_description [required]
    - A one line short description describing the command parameter (<80 chars)
- param_notes
    - [optional] larger free-form text field used to capture any notes about this command parameter (<3000 chars)
- param_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference

Worksheet [cmd_param_conv_state]: Command Parameter State Conversions

- spacecraft [required]
    - 1-10 character string abbreviation used to indicate the spacecraft this command is associated with; abbr must match db spacecraft definition record abbr. value
        - WISE uses WISE [WS]
- external_element
    - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria

    - Value is required only for payload/instrument, otherwise value is preset by App ID association
    - WISE use limited to 2 chars [TBR]
- app_id [required]
    - The application ID or reserved number (value must be unique per spacecraft)
    - Integer values 1 – 255
        - WISE reserves 255 for the CTB
        - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
    - The packet ID (value must be unique per application)
    - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- cmd_mnemonic [required]
    - The mnemonic of the command associated with the command parameter associated with this state conversion
- param_order
    - [optional] An integer representing the order of the command parameter within the command; numbering starts at one
    - The order is determined from the packet variable definition order
- param_name [required]
    - The name of the commmand parameter this state conversion applies to.
- state_value [required]
    - An integer representing command parameter value for this state (note that if the integer is stored as text in Excel, the import of this conversion will fail)
    - Valid range may be limited by ground system (currently no ground system limitations are set); otherwise range is based on user specified command parameter range or data type defaults
- state_name [required]
    - A string representing the name of this state (note that Excel assigns a numeric value to the strings "True" and "False"; left-justify these strings to avoid this)
    - The state_name must be unique per command parameter
    - Max string length is limited by ground systems (OASIS limits to 1-16 char); alphanumeric, no spaces, naming conventions are program specific

Worksheet [cmd_tlm_response]: Command – Telemetry Responses

- spacecraft [required]
    - 1-10 character string abbreviation used to indicate the spacecraft this command is associated with; abbr must match db spacecraft definition record abbr. value
        - WISE uses WISE [WS]
- external_element

    - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
    - Value is required only for payload/instrument, otherwise value is preset by App ID association
    - WISE use limited to 2 chars [TBR]
- app_id [required]
    - The application ID or reserved number (value must be unique per spacecraft)
    - Integer values 1 – 255
        - WISE reserves 255 for the CTB
        - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
    - The packet ID (value must be unique per application)
    - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- cmd_mnemonic [required]
    - The mnemonic of the command associated with this telemetry response
- tlm_mnemonic
    - The mnemonic of the telemetry item associated with this response
- expected_tlm_value
    - A text field (<80 char) to record any expected telemetry response values
- response_description
    - [optional] one line short description describing the command-telemetry response (<80 chars)
- response_notes
    - [optional] larger free-form text field used to capture any notes about this command-telemetry response (<3000 chars)
- response_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference

INTERFACE DESCRIPTION FORM

Interface name: **CMD_Packet**

Command Packet File - ASCII file containing command packets to be processed into CLTU's for uplink

EXCHANGE DESCRIPTION

Provider:	WTCCS	*Consumer:*	WTCCS
Server:	WTCCS	*Client:*	WTCCS
Protocol:	File exchange	*Connection initiator:*	WTCCS

Schedule:	As required
Comment:	The command packet is an interface product internal to WTCCS

INTERFACE DATA DESCRIPTION

The TC Source Packet maximum size is 1008 bytes. The APP ID is the command destination (internal software component) and the PACKET ID is the command identifier or OPCODE. Level 0 and software telecommands use the same TC header & Packet formats. Upon receipt, the flight software changes the source packet header to the internal packet format, adding a time stamp. The TC source packet format is as follows:

PACKET PRIMARY HEADER									PACKET SECONDARY HEADER	PACKET DATA FIELD
VERSION NO.	PACKET IDENTIFICATION					PACKET SEQUENCE CONTROL		PACKET DATA LENGTH	PACKET ID	APPLICATION DATA
	TYPE INDI-CATOR	PCKT. SEC. HDR. FLAG	APPLICATION PROCESS IDENTIFIER			GROUPING FLAGS	SOURCE SEQUENCE COUNT			
			SCU ID	SPARE	APP.ID					
Version 1	0=TLM 1=TC		0=SCU-A 1=SCU-B		Command Destination				Command Destination	
000	1	1								
3 bits	1 bit	1 bit	1 bit	2 bits	8 bits	2 bits	14 bits	16 bits	8 bits	Flexible
2 Octets						2 Octets		2 Octets	1 Octet	1 to 994 Octets

TC Source Packet Fields

Version Number (bits 0 through 2)	The Version Number occupies the three most significant bits of the TC Packet Primary Header. The Version-1 TC Packet is specified by setting the Bits 0 through 2 to value "000", and is the version described herein.
Type (bit 3)	This single bit is used to identify that this is a Telecommand Packet rather than a Telemetry Packet. A Telemetry Packet has this bit set to value "0": therefore, for all Telecommand Packets bit 3 shall be set to 1.
Secondary Header Flag (bit 4)	This one bit flag signals the presence or absence of a Secondary Header data structure within the TC Packet. WISE always uses a secondary header, so this bit shall be set to 1.
Application Process Identifier (bits 5 through 15)	This 11 bit field uniquely identifies the individual "receiving" application process in a particular space vehicle to which the application data encapsulated within the TC Packet are to be sent. The first bit identifies the spacecraft processor; for OE WISE , this bit shall be set to 0. The next two bits are spares and shall be set to 00b. The remaining 8 bits shall be set to the appropriate Application ID.
Packet Sequence Control (2 octets)	This 16 bit field is divided into two subfields:
Sequence Flags (bits 0,1)	The Sequence Flags, which occupy the two most-significant bits of the 16 bit Packet Sequence Control Field, provide a method for defining whether this packet is a first, last or intermediate component of a higher layer data structure, such as a set of packets which are addressed to one particular Application Process. For instance, this packet may contain data to load one location of a memory, and may be followed by several more related packets which together load a complete subroutine. The Sequence Flags therefore may be used to delimit this higher-layer data structure. The assignment of the Sequence Flags is as follows: (a) Last Sequential Component (bit 0) When Bit 0 is set to value "1", it indicates that this packet is the last component of a higher-layer data structure which is addressed to one particular spacecraft Application Process. (b) First Sequential Component (bit 1) When Bit 1 is set to value "1", it indicates that this packet is the first component of a higher layer data structure which is addressed to one particular spacecraft Application Process.

	Based on the above assignments, the Sequence Flags may be interpreted as follows: Bit 0 Bit 1 Interpretation 0 0 Continuation component of higher data structure 0 1 First component of higher data structure 1 0 Last component of higher data structure 1 1 Standalone Packet With the exception of CFDP file uploads, commands accepted by WISE will be unsegmented, and the sequence flag bits shall be set to 11.
Packet Name or Sequence Count (bits 2 through 15)	This 14 bit subfield allows a particular TC Packet to be identified by name or number. OE is using this field as an incrementing roll-over sequence counter for each virtual channel.
Packet Length (2 Octets)	This field contains a sequential 16 bit binary count of the length (in octets) of the remainder of the data structure which is enclosed between the first bit of the Secondary Header and the last bit of the Packet (i.e., the last bit of the Application Data field). This field is calculated as the length in octets – 1. WISE restricts the TC application data field to 994 bytes.
Secondary Header	The optional Secondary Header field is used by WISE for the 8 bit Packet ID.
Application Data	The Application Data field contains the user telecommand information to be transported to the CTB or FSW. The total length must be an integral number of octets equal to or less than the maximum field length of 994 bytes.

INTERFACE DESCRIPTION FORM

Interface name: CMF

Command Mnemonic File - File containing mnemonics and directives to the command data base to translate command mnemonics into command packets

EXCHANGE DESCRIPTION

Provider:	EOS, SEQ, WTCCS	*Consumer:*	WTCCS
Server:	WISE Server	*Client:*	WTCCS
Protocol:	File exchange	*Connection initiator:*	WTCCS

Schedule:	As needed, usually daily

Comment:	File naming convention: **WIS_SEQ_SEQID_YYYY_DDD_HH_MM_SS.pef** **Where: SEQID is the sequence identified assigned to this sequence** **Standard command files for routine use by the ACE:** **WIS_zzzz_xxxx...xxxx_v.cmf** **Where zzzz = subsystem generating the file: FCT, WSEQ, EOST, ...** **xxxx...xxxx = function performed** **v = version number** **Express commands:** **Z_WIS_zzzz_xxxx...xxxx_v.cmf** **(In order to have them sorted at the bottom of the TC Catalog)** **Automation Generated commands:** **WIS_zzzz_xxxx...xxxx_v_yyyy_dd_mm_hh_mm_ss.cmf** **(yyyy_dd_mm_hh_mm_ss = time of file generation)** **e.g.** **WIS_AUTO_TMPBK_1_2009_11_11_22_33_44.cmf for the minisequence to download data** **WIS_AUTO_TMPBK_EXE_1_2009_11_11_22_33_44.cmf to execute the mini sequence**

INTERFACE DATA DESCRIPTION

Structure and Organization Overview

Command mnemonics files will be in ASCII text form with a structure as follows:
Header lines describing source, time of generation, transmit window, etc.

Body containing commands in mnemonic form that are to be executed immediately or else are to be stored on board the satellite for execution at its specified time-tag value. Each command may also specify a delay time or period which the command transmission software is to take into account prior to sending the command to the earth terminal for transmission to the spacecraft.

End of file

Comments may be placed throughout the command mnemonics file and will be designated as specified below.

Data Format and Definition

The command mnemonic files will be ASCII files containing comma-separated values. The definition of the types of record identifiers and format of records is described below.

Format

The file will be in the form of comma-separated values (CSV).

Data Representation Conventions

All data elements are in ASCII. Upper and lower case ASCII characters are allowable. However, all command and parameter mnemonics contained in the command mnemonics file must exactly match the mnemonics stored in the satellite database with respect to case.

Elements shown below in braces ("{" and "}") are optional.

End-of-File Conventions

The last record in the file will contain:

*ENDCMD

starting in column one.

Data Description

The file consists of variable length ASCII text records. The length of each record shall not exceed 512 bytes.

Comment Record Specification

Comment records are specified in two ways. The first is by the use of an asterisk (*) in column one. The significance of the asterisk is that it identifies the comment record as one that contains information necessary for the command translation function to be properly performed. Comment records of this type include header records and the *ENDCMD record at the end of the command mnemonic file.

Other comment records are specified by the use of a pound sign (#) in column one. The pound sign specifies a comment which is to be passed through the command translator "as is" and will appear as a comment record in the report file produced by the command translator.

File Header Format

Command mnemonics file header records are identified by an asterisk (*) in column one. The file header records are required to precede any command records. The following fields are contained in the header (one field per record) and are required to be in the command mnemonics file. The data in these fields are used when processing the command mnemonics file in order to produce the binary file:

Parameter	Description
*FILENAME= *specific-name*	The filename itself may be up to 70 characters long so that it may be contained in a

	single 80 character record following the "*FILENAME=" text.
*DTG=YYYY-DDDThh:mm:ss	This is the date/time of creation of the file.
*TEAM=XXXXXX	This is the originating team identification (FCT, SEQ, etc.). It may be a maximum of six characters.
*PROJ=WISE	This is the project identification for the WISE project.
*BEGIN=YYYY-DDDThh:mm:ss *END=YYYY-DDDThh:mm:ss	(Optional) Transmit Time Window - the transmit time window denotes the earliest time that the command file should be transmitted and the latest time that it should be transmitted.
*SEQUENCE_FILE= Destinationpath	(Optional) This parameter identifies the file as a Sequence File. WTCCS will perform special formatting of the translated commands and will produce a CFDP file for transmission. The "destinationpath" field is used by CFDP to specify where the file is to be stored on the spacecraft.
*PARAMETER_FILE= Destinationpath	(Optional) This parameter identifies the file as a Parameter Load File. WTCCS will perform special formatting of the translated commands and will produce a CFDP file for transmission. The "destinationpath" field is used by CFDP to specify where the file is to stored on the spacecraft.
*BINARY_FILE=inputpathname, Destinationpath	(Optional) This parameter tells the translator to read a binary "inputpathname" file, and generate a CFDP upload file to send to "destinationpath" on the spacecraft. If this parameter is present, no commands are expected in the mnemonic file
*SINGLE_STEP=REQUIRED	(Optional) This file must be transmitted in real-time using the "Single-Step" transmission mode.
*FORCE_TM_VALIDATION	(Optional) This directive enables real-time telemetry validation directives that determine when each command has been successfully executed onboard prior to executing the next command.
Translator Processing Directives – These directives may appear one or more times in the body of the command file.	
*VERIFY {parameters}	(Optional) This directive is placed after

	each command where telemetry validation is desired. (See WTCCS SOM for parameters and usage)
*SEQUENCE_WINDOW= nn	(Optional) This directive resets the "command window" parameter in sequence files. The "window" value is set to "nn" milliseconds (default is "0"). The window value is used until another window directive is specified.

In addition, comments may appear at any record within the command mnemonics file after the file header records to provide additional descriptive information for a specific command. Comment records begin with a pound sign (#) in column one.

Blank lines may also be inserted within the command mnemonics file at any time and will be treated as comment lines.

Data Format

The body of the command mnemonics file consists of ASCII records. Each record may contain the following variable length fields (the braces indicate optional fields):

{Time}, CommandMnemonic{, Parameters} {; Comment}

Or

{Time}, CommandMnemonic{, Paramname1=Value1, Paramname2=Value2, … } {; Comment}

Each command in the file must use only one of these methods of parameter specification: positional parameters or mnemonic parameters.

The field descriptions are:

Time

The format of the time field is dependent on what type of command is being specified. If the time field is specified, it will include year characters. The options are as follows:

Real-Time commands:

Blank field or '0' - Transmit immediately

{mm:}ss{.fff}D - Prior to transmitting the command, delay the specified period of time relative to the previous command. The minutes and fractional seconds fields are optional. Example: "5D" – Delay 5 seconds after previous command.

Sequence File commands:

Blank field or '0' - Execute immediately after previous command

{mm:}ss{.fff}D - Prior to executing the command, delay the specified period of time relative to the previous command. The minutes and fractional seconds fields are optional. Example: "5D" – Delay 5 seconds after previous command.

YYYY-DDDThh:mm:ss{.fff} - Execute command at specified UTC time on the spacecraft.

Command Mnemonic and Parameters

The format of these fields is dependent on the command type as follows:

Spacecraft Commands - Positional Parameters

, mnemonic1 {, parameter1}{, parameter2} …

In this example, mnemonic1, parameter1, and parameter2 are as specified in the satellite database (SDB). Parameter1 may be:

Keyword
Value

As specified in the SDB. The format of data items is one of the following:

nnnnnn	- Decimal number
nnn.nnn	- Floating number
nnnn.nnnExx	- Floating number
‘xxxxxxxx’H	- Hexadecimal number

The parameter values themselves are optional. The SDB holds fixed values for some parameters and variable specifiers for other parameters. In the command mnemonics file, only the variable parameters may be specified. The command translator will be responsible for retrieving the fixed field values and placing them in the appropriate binary file record for the command mnemonic being translated. When the command translator is translating a command mnemonic and encounters a variable parameter, the next parameter value from the command mnemonics file record for the mnemonic being translated will be used for the required value. Care must be taken when specifying a variable parameter to consider the number of bits the value must fit into as defined by the SDB. For instance, if the parameter has been defined in the SDB to allow only five bits then a value of 32 or greater would be invalid. Likewise, if the parameter has been defined to take 64 bits, then all bits must be specified with a value like ‘8A33FF216C553DE1’H.

For some commands, all parameters may be fixed, in which case the command mnemonic entry may contain just the mnemonic without parameters:

, mnemonic3 ; Mnemonic3 params are filled from the SDB

Spacecraft Commands – Mnemonic Parameters

, mnemonic {, Paramname1=Value1, Paramname2 = Value2, …} {; Comment}

An alternate command format is to name each command parameter and provide the parameter value. Parameters may be input in any order. Any parameters not input will be given the default value from the SDB. For example:

, mnemonic4, mode=1, bias=-.123456e4 ; Comment

Comments

This optional field contains any desired text relating to the command.

INTERFACE DESCRIPTION FORM

Interface name: Ground_Track

Ground Track File – File containing the position of the sub spacecraft point on the Earth's surface while in Orbit.

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WSDC
Server:	WSDC INGEST	*Client:*	WSDC
Protocol:	SFTP	*Connection initiator:*	EOS

Schedule:	
Comment:	File naming convention: WIS_NAV_WGT_YYYY_DOY_HH_MM_SS.txt

INTERFACE DATA DESCRIPTION

WISE Ground Track (WGT) will be run as part of Nav product generation following orbit determination, which nominally will occur M-W-F not counting special requests. The WGT output cover seven days, and that the data record frequency will be 4 seconds per data record. For a week's coverage that is 151,200 data records. The quantity GCD2SAA is the angular distance from the WISE S/C to the nearest SAA boundary. The format of the file is provided in the following example.

Ground Track Example

```
*-------------------------------------------------------------------------------------------------
* Records of Geocentric Latitude / East Longitude / Great Circle Distance to SAA / Geodetic Height
* computed by WGT, Version 1.0.5 linked 15-May-2009.
*-------------------------------------------------------------------------------------------------
* Start time of the run:  2009-306T00:00:00.000000
* End   time of the run:  2009-307T00:00:00.000000
*-------------------------------------------------------------------------------------------------
* Input Files:
*    /nav/wise/import/tdrs/test/wise180_9tdrs_nutatedj2000.bsp
*    /nav/wise/import/ephem/de421.bsp
*-------------------------------------------------------------------------------------------------
*      Date and Time      Geocentric Latitude   East Longitude      GCD2SAA      Geodetic Height
*        (UTC)                (deg)               (deg)             (km)
*-------------------------------------------------------------------------------------------------
  2009-306T00:00:00.0000      0.095700        266.019663        27.731580       524.997067
  2009-306T00:00:04.0000      0.345470        265.969904        27.961261       524.997844
  2009-306T00:00:08.0000      0.595242        265.920142        28.190926       524.999391
  2009-306T00:00:12.0000      0.845011        265.870378        28.420570       525.001758
  2009-306T00:00:16.0000      1.094783        265.820609        28.650196       525.004944
```

INTERFACE DESCRIPTION FORM

Interface name: **HK_Data_Archive_File**

Housekeeping Data Archive File - Housekeeping data file (compressed) for long term deep archive

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WSDC
Server:	WSDC INGEST	*Client:*	WSDC
Protocol:	SFTP	*Connection initiator:*	EOS

Schedule:	
Comment:	File naming convention: WIS_MOS_ARCHIVE_yyyy_mm_dd_hh_mm_ss.zip

INTERFACE DATA DESCRIPTION

Periodically, telemetry data products are placed in a zip archive and sent to the WSDC for long term storage.

INTERFACE DESCRIPTION FORM

Interface name: HRP_FAR

HRP Frame Accountability Report (FAR) - The FAR reports frame accountability and statistics for each virtual channel (VC10, VC12, VCC8). This report is used for retransmitting lost frames.

EXCHANGE DESCRIPTION

Provider:	HRP	*Consumer:*	WTCCS
Server:	HRP	*Client:*	WTCCS
Protocol:	SFTP	*Connection initiator:*	HRP

Schedule:	After every TDRSS pass
Comment:	File naming convention: **WIS_HRP_FAR_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

WISE Frame Accountability Report (FAR) Generated by the High Rate Processor

The WISE High Rate Processor (HRP) is installed at White Sands and processes transfer frames downlinked via the Ku-Band transmitter. The data stream will contain transfer frames from three virtual channels (VC10, VC12, VC38). For each downlink session, a FAR will be generated. The FAR will be used to identify missed transfer frames and assess overall data completeness.

The FAR will be a comma separated value text file containing the parameters shown below in the table. A FAR will be opened when a non-idle frame is received and processed by the HRP. A line in the FAR is generated for the first appearance of a VC10 or VC12 or VCC8 transfer frame. A line in the FAR will also be generated on the reception of every 10000th or so frame. A line in the FAR will be generated upon receipt of the last non-idle transfer frame. The FAR will be terminated when a specified number of contiguous idle frames is received (5000 or so). The HRP will insert entries into the FAR table for "Total number of frames received and then the current values of the three VCFC for "VC10 VCFC", "VC12 VCFC", "VC38 VCFC", and then the "Number of missing frames", and then the "Cumulative number of missing frames".

Frame Accountability Report

Total Number of Frames Received	VC10 VCFC	VC12 VCFC	VC38 VCFC	Number of missing frames	Cumulative Number of missing frames
1	-	-	50000	-	-
4800	5900	-	54799	0	0
10000	6000	-	59903	4	4
15000	6000	10000	64902	0	4
20000	6000	11000	68902	0	4
30000	6100	11000	77802	0	4
40000	6200	12000	86702	0	4

Summary Statistics:

Total number of missing frames =
Percentage of received frames =

HRP_FAR CSVF example

File Name: WIS_HRP_FAR_yyyy-dddThh:mm:ss

File Type=HRP_FAR
Spacecraft=WIS
Creation Time= yyyy-dddThh:mm:ss
1,,50000,,
4800,5900,,64799,0,0
10000,6000,,59903,4,4
15000,6000,10000,64902,0,4
20000,6000,11000,68902,0,4

Total number of missing frames = 4
Percentage of received frames = 99.99

INTERFACE DESCRIPTION FORM

Interface name: **HRP_File_Summary**

HRP File Summary Report - A listing of files produced by the HRP during a single TDRSS contact pass

EXCHANGE DESCRIPTION

Provider:	HRP	*Consumer:*	WSDC
Server:	HRP	*Client:*	WSDC
Protocol:	File Transfer	*Connection initiator:*	HRP

Schedule:	Following every Ku-Band TDRSS pass
Comment:	File naming convention: **WIS_HRP_SUM_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The HRP File Summary contains a list of the filenames and file sizes for all files to be FTPed from the HRP to WSDC for particular set of FTP sessions (one pass). This file is FTPed to WSDC as the first file of the set of files to be Ftped. WSDC will use this as a FTP manifest to ensure that all files have been FTPed successfully.

File Format:

#BEGIN_FILE
{filename1},{file size1 in bytes}
{filename2},{file size2 in bytes}
…
#END_FILE

Sample File Summary File:

#BEGIN_FILE
WIS_HRP_PKT_FE1A_2007_089_02_33_17.bin,1234567890WIS_HRP_PKT_FE1B_2
007_089_02_33_17.bin,2345678901
WIS_FAR_2007_089_02_33_17.txt,22222
#END_FILE

INTERFACE DESCRIPTION FORM

Interface name: **HRP_Status_Pkt**

A periodic packet generated by the HRP providing the status of the HRP.

EXCHANGE DESCRIPTION

Provider:	HRP	*Consumer:*	WTCCS
Server:	HRP	*Client:*	WTCCS
Protocol:	TCP/IP Socket	*Connection initiator:*	WTCCS

Schedule:	During every Ku-Band TDRSS pass
Comment:	

INTERFACE DATA DESCRIPTION

Status Packet Format for WISE HRP System

7/12/07 Note: Strings are blank filled with no “C” style terminators

Mnemonic	*Byte offset*	*Length (bytes)*	*Format*	*Description*
XDR Block Header	0	4	Integer	Hex - “80 00 00 FC” (252 byte block}
XDR Msg Header	4	4	Integer	Hex – “00 00 00 F8” (248 byte message)
Prime HRP	8	4	String	"HRP1" or "HRP2"
HRPIdentifier	12	4	String	"HRP1" or "HRP2"
UTC	16	17	String	UTC in string format YYYY-DDDThh:mm:ss
InputDataStatus	33	1	String	H=high, L=low, C=Data Is changing (bit transitions)
FrameLock	34	1	String	L=Lock, U=unlock
FrameVCID	35	2	String	Hex VCID for latest frame received
FramesRxd	37	8	String	Data Frames received during this pass (right justified – zero fille
RSCorrections	45	8	String	Number of corrected Reed-Solomon errors during this pass
RSUncorrected	53	8	String	Number of uncorrectable Reed-Solomon errors during this pass
FrameSyncLosses	61	8	String	Number of frame sync lock transitions during this pass
PercentDiskAvailable	69	3	String	Percentage (001-100) of disk space available
SysErrors	72	1	String	Number of error messages (described in error text fields below)
ErrorText1	73	40	String	String describing HRP system errors/warnings/problems (blank
ErrorText2	113	40	String	String describing HRP system errors/warnings/problems (blank
ErrorText2	153	40	String	String describing HRP system errors/warnings/problems (blank
Spare	193	55	String	Blanks for Future Expansion

Total Message Size: **248** **Total Block Size (including headers): 256**

INTERFACE DESCRIPTION FORM

Interface name: IIRV

Improved Inter-Range Vector- The IIRV is derived from STRATCOM observation data and provided to WSC for TDRSS pointing

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WSC
Server:	SNAS	*Client:*	WSC
Protocol:	File exchange	*Connection initiator:*	EOS

Schedule:	As required
Comment:	File naming convention: WIS_NAV_IRV_YYYY_DOY_HH_MM_SS.txt

INTERFACE DATA DESCRIPTION

The Improved Inter-Range Vector (IIRV) message is a standard message from Goddard Space Flight Center (GSFC). The message contains six (6) lines. This document contains the format and description of the Improved Inter-Range Vector message.

Each of the six lines in the message is terminated by two (2) carriage returns followed by two (2) line feeds. There are no spaces between fields on a line.

If there are multiple vectors being sent in the same message, the following will be repeated for each subsequent vector:

- the last three fields of line 1 (starting with "GIIRV")
- lines 2 through 6 in their entirety

```
03uuuuuuu010GIIRV MANY
1111736801nnnddhhmmssssccc
sxxxxxxxxxxxxsyyyyyyyyyyyyszzzzzzzzzzzzccc
sxxxxxxxxxxxxsyyyyyyyyyyyyszzzzzzzzzzzzccc
mmmmmmmmaaaaakkkksrrrrrrrccc
ITERM GAQD
```

Line No.	No. of Bytes	Format	DESCRIPTION
1	2	03	Message Type (Operations Data Message)
	7	uuuuuuu	Message ID, 0000000 to 9999999

	1	0	Message source (Flight Dynamics Facility)
	2	10	Message class (nominal)
	5	"GIIRV"	Message start
	1	ASCII space	Originator of message (GSFC)
	4	"MANY"	Routing indicator (multiple destinations)
2	1	1	Vector type (free flight, routine on-orbit)
	1	1	Data source (nominal/ planning)
	1	1	Transfer type (Interrange)
	1	1	Coordinate system (Geocentric true-of-date rotation)
	4	7368	Support Identification Code
	2	01	Vehicle Identification Code
	3	nnn	Sequence number incremented for each vector in a set of vector data, 000 to 999
	3	ddd	Day of year, 001 to 366
	9	hhmmssss	Vector epoch in UTC, hh = 00 to 23, mm = 00 to 59, ssss = 00000 to 59999 (milliseconds, implied decimal point three places from right)
	3	ccc	Checksum for line 2; calculated by summing the decimal equivalent of the preceding characters in the line, counting spaces as 0 and negative signs as 1
3	13	sxxxxxxxxxxxx	X component of the position vector in meters. s = "-" for negative sign or ASCII space for positive sign
	13	syyyyyyyyyyyy	Y component of the position vector in meters
	13	szzzzzzzzzzzz	Z component of the position vector in meters
	3	ccc	Checksum for line 3
4	13	sxxxxxxxxxxxx	X component of the velocity vector in meters per second, with a resolution to the nearest millimeter per second; assumed decimal point is three places from the right.
	13	syyyyyyyyyyyy	Y component of the velocity vector in meters per second, with a resolution to the nearest millimeter per second; assumed decimal point is three places from the right.
	13	szzzzzzzzzzzz	Z component of the velocity vector in meters per second, with a resolution to the nearest millimeter per second; assumed decimal point is three places from the right.

	3	ccc	Checksum for line 4
5	8	mmmmmmmm	Mass of the satellite in kilograms with a resolution to the nearest tenth of a kilogram; assumed decimal point is one place from the right. Must contain all zeros if not used.
	5	aaaaa	Average satellite cross-sectional area in square meters with a resolution to the nearest hundredth of a square meter; assumed decimal point is two places from the right. Must contain all zeros if not used.
	4	kkkk	Dimensionless drag coefficient; assumed decimal point is two places from the right. Must contain all zeros if not used.
	8	srrrrrrr	Dimensionless solar reflectivity coefficient; s = "-" for negative sign or blank for positive sign, assumed decimal point is six places from the right. May contain all zeros if not used.
	3	ccc	Checksum for line 5
6	5	"ITERM"	Indicates end of message
	1	ASCII blank	
	4	"GAQD"	Originator routing
7	10	"GIIRV MANY"	Identifies message start, originator and routing indicator for second vector set
8-12		same as lines 2-6 for a second vector set	Second vector set
13-		repeat lines 7-12 for each subsequent vector set	Additional vector sets

INTERFACE DESCRIPTION FORM

Interface name: **Memory_File_Load**

Memory Load File - Binary Memory Load file input format to the CFDP command processor

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WTCCS
Server:	WISE Server	*Client:*	WTCCS
Protocol:	File exchange	*Connection initiator:*	EOS

Schedule:	As required
Comment:	

INTERFACE DATA DESCRIPTION

The memory load file is a binary file provided for CDFP processing and uplink. This file does not have a definable format as provided to the EOS. This binary file is partitioned into CFDP PDU's as described under interface **CFDP_UPLINK_PDU.**

INTERFACE DESCRIPTION FORM

Interface name:	**OEF**

Orbit Events File - Text file containing key spacecraft and ground events including the TDRSS pass schedule

EXCHANGE DESCRIPTION

Provider:	NAV	*Consumer:*	SEQ, EOS
Server:	WISE Server	*Client:*	SEQ,EOS
Protocol:	FTP	*Connection initiator:*	SEQ,EOS

Schedule:	Weekly
Comment:	File naming convention: **WIS_NAV_OEF_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The WISE Orbit Events File consists of a series of header records followed by a series of data records. Section 2.2 describes the header records in detail. Section 2.3 defines all the data in the data records. Section 2.4 describes the format of the data records in detail, and Section 2.5 contains a sample file.

5.1 *Header Records*

The header records on the WISE Orbit Events File contain all of the input data used in the WOE run that wrote the file. WOE writes this information as a series of lines of ASCII text with an asterisk (*) always appearing in column 1. The lines are free form; i.e., no particular format is assumed. The header records contain the following information:

- The name and version of the program
- A list of paths to the input files used (orbit number file, leapseconds kernel, and ephemeris files for the spacecraft, TDRS satellites, Earth, and Moon).
- The start and end times of the WOE run that wrote the file as character data of the form yyyy-dddThh:mm:ss.ffff (UTC).
- A copy of the Defaults File. The Defaults File contains default values for all of WOE's namelist input variables. For details, see the WOE User's Guide.

In addition, other information (e.g., comments) may appear on the file.

Data Record Definitions

Each line of data in the WISE Orbit Events File contains the following information:

- An event number and an event mnemonic, given in the table below.
- The event time in the form yyyy-dddThh:mm:ss.ffff (UTC).
- The orbit number.
- The spacecraft latitude and longitude.

In the table below, 'TID' is a TDRS identification, which contains the longitude of the TDRS and, optionally, a character identification. 'ANT' is an antenna ID ('S+', 'S-', or 'Ku'). Events with numbers greater than 500 do not normally appear on the Orbit Events File; their purpose is to assist in troubleshooting should the need arise.

Table of Event Times and Mnemonics

Event Number	**Event Mnemonic**	**Description**
11	VP_TID_START	TDRS view period start
12	VP_TID_END	TDRS view period end
13	VP_TID_SAFE_START	TDRS view period start – safe mode
14	VP_TID_SAFE_END	TDRS view period end – safe mode
21	ORBSTART_POLE	Spacecraft orbit start given by pole crossing
22	ORBSTART_NODE	Spacecraft orbit start given by ascending node crossing
31	EARTH_OCC_START	Sun occulted by Earth start
32	EARTH_OCC_END	Sun occulted by Earth end
33	MOON_OCC_START	Sun occulted by Moon start
34	MOON_OCC_END	Sun occulted by Moon end
41	MOON_ORBPLANE_START	Moon near orbit plane start
42	MOON_ORBPLANE_END	Moon near orbit plane end
51	SAA_ENTRY	South Atlantic Anomaly entry
52	SAA_EXIT	South Atlantic Anomaly exit
61	SUN_NOON	Sun time noon
62	SUN_6PM	Sun time 6 p.m.
63	SUN_MIDNIGHT	Sun time midnight
64	SUN_6AM	Sun time 6 a.m

71	LAT_CROSS_EQUATOR	Latitude crossing measured from equator
72	LAT_CROSS_POLE	Latitude crossing measured from pole
81	CONJUNC_TID_START	Spacecraft-TDRS-Sun conjunction start
82	CONJUNC_TID_END	Spacecraft-TDRS-Sun conjunction end
511	SUN_AVOID_TID_START	Sun avoidance constraint start
512	SUN_AVOID_TID_END	Sun avoidance constraint end
513	EARTH_AVOID_TID_START	Earth avoidance constraint start
514	EARTH_AVOID_TID_END	Earth avoidance constraint end
521	SUN_YAW_TID_START	Sun yaw constraint start
522	SUN_YAW_TID_END	Sun yaw constraint end
531	TDRS_OCC_TID_START	TDRS occulted by Earth start
532	TDRS_OCC_TID_END	TDRS occulted by Earth end
541	NADIR_TID_START	Nadir constraint start
542	NADIR_TID_END	Nadir constraint end
551	CONE_TID_ANT_START	Antenna cone angle constraint start
552	CONE_TID_ANT_END	Antenna cone angle constraint end
561	LAT_START	Latitude constraint start
562	LAT_END	Latitude constraint end

TDRS Identifications

The following identifications consist of the ID letter (A – J) followed by the West longitude in degrees. The longitudes come from the GFSC Products Web site.

TDRS-1 (A)	TDRS-3 (C)	TDRS-4 (D)	TDRS-5 (E)	TDRS-6 (F)	TDRS-7 (G)	TDRS-8 (H)	TDRS-9 (I)	TDRS-10 (J)
A049W	C275W	D046W	E171W	F174W	G150W	H271W	I062W	J041W

Data Record Format

Below is a description of the format of the data on each data record. See Section 2.5 for an example.

Description of Data Record Format

Column number	Contents
1-3	Event number in the form NNN, right justified
4	Blank
5-26	Event time in the form yyyy-dddThh:mm:ss.ffff (UTC)
27	Blank
28-31	Orbit number in the form NNNN, right justified
32	Blank
33-38	Longitude in the form XXX.XX
39	Blank
40-45	Latitude in the form +/-XX.XX
46	Blank
47-72	Event mnemonic, left justified

Sample File

The following is an example of what the WOE Orbit Events file will look like. This example is for illustration only and does not represent actually output from WOE. An actually output file will be provided when one is available.

```
*-------------------------------------------------------------------------------
* WISE Orbit Events computed by WOE, Version 1.0
*-------------------------------------------------------------------
* SPK ephemeris files used:
* /home/ear/woe/data/wise_tdrs_j_f.bsp
* Leapseconds kernel:  /home/ear/woe/data/leapseconds
* All times in this file are in UTC
* Start time of the run:   2009-337T00:00:00.000000
* End   time of the run:  2009-355T00:00:00.000000
* (Multiple lines containing a copy of the Defaults File - TBS)
*-------------------------------------------------------------------
*
*NO    EVENT TIME          ORB  LON    LAT    MNEMONIC
*----   ------------------------  -----  --------  ------   ------------------
 11 2009-337T07:32:32.2868  125 203.56 -66.01 VP_190.4_START
 21 2009-339T08:12:29.2314  125 175.02 -30.14 EARTH_OCC_START
 52 2009-353T09:12:34.6578  125 191.33 -42.24 SAA_EXIT
```

INTERFACE DESCRIPTION FORM

Interface name: Parameter_File_Load

Parameter Update File - Binary Parameter File input to the CFDP command processor

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WTCCS
Server:	WISE Server	*Client:*	WTCCS
Protocol:	File exchange	*Connection initiator:*	WTCCS

Schedule:	As required
Comment:	File naming convention: As provided by BATC

INTERFACE DATA DESCRIPTION

The Parameter Update File is a binary file which is partitioned into CFDP PDU's as described in the **CFDP_UPLINK_PDU** description. This file does not have a definable format as provided to the EOS

FORM1 **INTERFACE DESCRIPTION FORM**

Interface name: **Pass List**

TDRSS Pass List – Derived from SEQ/SNAS providing a listing of scheduled S-Band and Ku-Band passes

EXCHANGE DESCRIPTION

Provider:	SEQ	*Consumer:*	EOS, WTCCS
Server:	WISE Server	*Client:*	EOS,WTCCS
Protocol:	FTP	*Connection initiator:*	EOS,WTCCS

Schedule:	Weekly, but may be updated as required
Comment:	File naming convention: **WIS_SEQ_PASS_LIST_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The pass list is a comma separated file with the following layout:

Field 1 = Pass ID (blank - This information is not available in the SNAS output)
Field 2 = Project Name
Field 3 = TDRS ID
Field 4 = Sband Start
Field 5 = Sband End
Field 6 = TDRS_Code (This is blank since there are 4 codes per pass)
Field 7 = Rev Number (Currently info is not available in the SNAS output, set to xxx)
Field 8 = SSA ID
Field 9 = KUBand Start
Field 10 = KUBand End

Sample File

,WISE,D046W,2010-175T01:58:47,2010-175T02:12:53,SK,xxx,SA1,2010-175T02:03:33,2010-175T02:12:53
,WISE,E171W,2010-175T09:54:30,2010-175T10:08:25,SK,xxx,SA2,2010-175T09:59:34,2010-175T10:08:25
,WISE,F174W,2010-175T11:29:39,2010-175T11:43:39,SK,xxx,SA2,2010-175T11:33:43,2010-175T11:43:39
,WISE,J041W,2010-176T01:45:57,2010-176T01:59:37,SK,xxx,SA1,2010-176T01:50:58,2010-176T01:59:37

,WISE,J041W,2010-173T02:24:28,2010-173T02:38:05,SK,xxx,SA2,2010-173T02:29:09,2010-173T02:38:05
,WISE,J041W,2010-174T02:11:37,2010-174T02:25:16,SK,xxx,SA2,2010-174T02:16:24,2010-174T02:25:16
,WISE,J041W,2010-174T03:46:46,2010-174T03:59:27,SK,xxx,SA2,2010-174T03:51:28,2010-174T03:59:27
,WISE,D046W,2010-174T16:39:30,2010-174T17:05:38,S,xxx,SA1,,
,WISE,J041W,2010-175T03:33:56,2010-175T03:46:56,SK,xxx,SA2,2010-175T03:38:30,2010-175T03:46:56
,WISE,F174W,2010-175T13:04:48,2010-175T13:17:26,SK,xxx,SA1,2010-175T13:09:20,2010-175T13:17:26
,WISE,D046W,2010-175T16:27:03,2010-175T16:56:04,S,xxx,SA1,,
,WISE,J041W,2010-176T03:21:05,2010-176T03:34:19,SK,xxx,SA2,2010-176T03:25:37,2010-176T03:34:19
,WISE,F174W,2010-176T09:41:40,2010-176T09:54:57,SK,xxx,SA1,2010-176T09:47:25,2010-176T09:54:57
,WISE,F174W,2010-176T11:16:49,2010-176T11:30:55,SK,xxx,SA1,2010-176T11:20:59,2010-176T11:30:55
,WISE,J041W,2010-176T16:10:55,2010-176T16:26:34,S,xxx,SA2,,

TDRS ID Specification

The following identifications consist of the ID letter (A – J) followed by the West longitude in degrees. The longitudes come from the GFSC Products Web site.

TDRS-1 (A)	TDRS-3 (C)	TDRS-4 (D)	TDRS-5 (E)	TDRS-6 (F)	TDRS-7 (G)	TDRS-8 (H)	TDRS-9 (I)	TDRS-10 (J)
A049W	C275W	D046W	E171W	F174W	G150W	H271W	I062W	J041W

INTERFACE DESCRIPTION FORM

Interface name: PEF

Spacecraft Predicted Events File - SEQGEN output file predicting spacecraft events resulting from the nominal execution of an on-board stored sequence

EXCHANGE DESCRIPTION

Provider:	SEQ	*Consumer:*	All
Server:	WISE Server	*Client:*	All
Protocol:	FTP	*Connection initiator:*	All

Schedule:	Usually weekly or whenever a SEQGEN run is made.
Comment:	File naming convention: **WIS_SEQ_SEQID_YYYY_DDD_HH_MM_SS.pef** **Where: SEQID is the sequence identified assigned to this sequence**

INTERFACE DATA DESCRIPTION

Refer to the latest version of the multi-mission SIS for the Predicted Events File, 0289-SEQ-SEQ Rev. J currently dated 15 April 2003.

INTERFACE DESCRIPTION FORM

Interface name: **Rec_HK_Data**

Recorded Housekeeping Data File - File containing recorded housekeeping telemetry in packet format

EXCHANGE DESCRIPTION

Provider:	WTCCS-HRP	*Consumer:*	WTCCS
Server:	HRP-RAID	*Client:*	WTCCS
Protocol:	Secure file transfer	*Connection initiator:*	WTCCS

Schedule:	Following each TDRSS pass
Comment:	Packet files are pushed via secure file transfer to the WISE POC for processing. File naming convention: **WIS_HRP_PKT_VC10_YYYY_DDD_HH_MM_SS.bin**

INTERFACE DATA DESCRIPTION

Recorded housekeeping data files are generated by the High Rate Data Processor installed at White Sands. Packets are extracted from VC10 transfer frames and stored in file format. Refer to the interface data description for the **TLM_Packet_APID.**

INTERFACE DESCRIPTION FORM

Interface name: **SASF**

Spacecraft Activity Sequence File - SEQGEN input request file containing timed commands for integration into an on-board stored sequence

EXCHANGE DESCRIPTION

Provider:	All	*Consumer:*	SEQ
Server:	WISE Server	*Client:*	SEQ
Protocol:	FTP	*Connection initiator:*	SEQ

Schedule:	Provided per the Sequence Development Schedule
Comment:	File naming convention: **WIS_SEQ_SEQID_YYYY_DDD_HH_MM_SS.sasf** Where **SEQID** is the Sequence Identifier for this sequence product.

INTERFACE DATA DESCRIPTION

Refer to the latest version of the multi-mission SIS for the Spacecraft Activity Sequence File, 0290-SEQ-SEQ Rev. J currently dated 30 November 2002.

WISE EXAMPLE

FILE NAME: *.SASF

```
CCSD3ZF0000100000001NJPL3KS0L015$$MARK$$;
MISSION_NAME = WISE;
SPACECRAFT_NAME = WISE;
DATA_SET_ID = SPACECRAFT_ACTIVITY_SEQUENCE;
FILE_NAME = WSEQ0601A.sasf;
APPLICABLE_START_TIME = 2005-360T00:00:00.000;
APPLICABLE_STOP_TIME = 2006-002T23:59:59.000;
PRODUCT_CREATION_TIME = 2005-353T18:19:41;
PRODUCER_ID = smalloy;
SEQ_ID = WSEQ0601;
HOST_ID = pinkie;
CCSD3RE00000$$MARK$$NJPL3IF0M01300000001;
$$WISE    SPACECRAFT ACTIVITY SEQUENCE FILE
```

```
**********************************************************
*PROJECT    WISE
*SPACECRAFT
*OPERATOR   Sophia O Malloy
*FILE_CMPLT TRUE
*DATE       Mon Dec 19 18:19:41 2005
*SEQ_GEN    V23.2 Mon Jan 25 14:35:58 PST 1999
*BEGIN      2005-360T00:00:00.000
*CUTOFF     2006-002T23:59:59.000
*TITLE      WEEKLY
*EPOCHS_DEF
*EPOCHS_END
*Input files used:
*File Type  Last modified            File name
*CONTEXT    Thu Mar 22 09:31:27 2001  /home/MPST/OPS/WISE_ATs/WIS.cvf
*SC_MODEL   Mon Apr 29 12:50:06 2002
/home/MPST/OPS/WISE_ATs/WISE_SDB_93.smf
*SC_MODEL   Tue Nov 11 16:04:54 2003
/home/MPST/OPS/WISE_ATsWIS_EVENTS.smf
*CATALOG    Tue Nov 11 16:04:35 2003
/home/MPST/OPS/WISE_ATs/WIS_BLKS.satf
*CATALOG    Fri Oct 17 15:51:41 2003
/home/MPST/OPS/WISE_ATs/WIS_NOTES.satf
*RULES      Fri Oct 17 15:52:01 2003
/home/MPST/OPS/WISE_ATs/WIS_RULES.fmrf
*CLOCK      Fri Oct 22 12:01:54 1999  /home/MPST/OPS/WISE_ATs/WISE.sclk
*LEGENDS    Mon Apr  1 12:00:24 2002  /home/MPST/OPS/WISE_ATs/legend.lf
*SEQUENCE   Mon Dec 19 10:15:32 2005
/home/MPST/wis_seq_dirs/WSEQ0601/0601_BASELINE.SEQ_01.sasf
*SEQUENCE   Mon Dec 19 10:15:34 2005
/home/MPST/wis_seq_dirs/WSEQ0601/JSEQ0601_cmd_file_1.sasf
*CONDITIONS Mon Dec 19 10:15:26 2005
/home/MPST/wis_seq_dirs/WSEQ0601/JSEQ0552.cond
*ALLOCATION
*BG_SEQUENCE
*DEFINITION
*DEP_CONTEXT
*EVENTS
*LIGHTTIME
*MASK
*OPTG_FD
*GEOMETRY
*REDUNDANT
*REQUESTS
*RESOLUTION
*SCRIPT
```

```
*TELEMETRY
*TYPEDEF
*VIEWPERIOD
*VIEW_FD
************************************************************
$$EOH
$$EOD
request(WSEQ_START,
            START_TIME, 2005-360T00:00:00,
            TITLE, "JSEQ_START",
            REQUESTOR, "smalloy",
            DESCRIPTION, "WSEQ_START",
            PROCESSOR, "NOTE",
            KEY, "SCE",
            LOWER_LABEL, "WSEQ_START",
            WORKGROUP,"MPS")

      activity(WSEQ_START,
            SCHEDULED_TIME,\0:0:0\,FROM_ACTIVITY_START,
            DRAW, STANDARD,
            BLOCK(JSEQ_START,"0601")
      ),
end;
note(1,
            SCHEDULED_TIME,\0:0:0\,FROM_ACTIVITY_START,
            TEXT,\"STORED CMD FILE:
ja1_tc_tch_01_p1_2005_12_13_07_47_59.tcg"\
      ),
      note(1.1,
            SCHEDULED_TIME,\0:0:0\,FROM_ACTIVITY_START,
            TEXT,\"START WISE CALIBRATION"\
      ),
      command(1,
            SCHEDULED_TIME,\00:00:00\,FROM_ACTIVITY_START,
            POS1TCSTOP("24
1809C0000011A900054B0001966800000000822000AFFF5")
      ),
      command(2,
            SCHEDULED_TIME,\00:00:10\,FROM_PREVIOUS_START,
            POS1TCCAL1("36
1809C000001DA900054B000196720000000008280004C8000400400070100FC007E2
B40")
      ),

$$EOF
```

INTERFACE DESCRIPTION FORM

Interface name:	**Science_TLM_Packet_ID**

Interface Description: Science Telemetry Packet files segregated by APID/PKTID (Band)

EXCHANGE DESCRIPTION

Provider:	HRP	*Consumer:*	WSDC
Server:	HRP	*Client:*	WSDC
Protocol:	Secure FTP (push)	*Connection initiator:*	HRP

Schedule:	Following each TDRSS pass, nominally 4 times daily
Comment:	File naming convention: Packet file for a single ID (Band): **WIS_HRP_PKT_ID_YYYY_DDD_HH_MM_SS.bin** Where **ID** is the concatenation of the application process ID (APID) and packet ID of the packet in the file (e.g. ID = FE1A for band 1 compressed). The time field in the file name is the file creation time.

INTERFACE DATA DESCRIPTION

Science Payload TM Source Packet Format

The MUB creates payload instrument data TM source packets.

The Application ID (source) is used to identify that the packets were created by the MUB. The Packet ID (source) is used to identify which band (1 – 4) the instrument data is from and whether the data is compressed or uncompressed. See **Error! Reference source not found.** below for definitions of Application ID and Packet ID.

The Source Sequence Count increments with each successive source packet created from data from each of the instrument bands. The Source Sequence Count is reset to zero for each new image cycle and is counted separately for each band.

The Grouping Flags are used to designate each group of packets that comprises an image.

The timestamp is constant for each group of packets that comprises an image.

The Valid User Data Bytes field of the Secondary Header is populated according to how many bytes of science data are contained in the packet. All packets will be of fixed length. The final packet (i.e. Grouping Flags value is 10b) for a given image on a given band will be padded with fill bytes as necessary to complete the packet. The fill byte value is 0x5A.

Figure 1 below defines the WISE Payload Instrument TM Science Data Source Packet Format. The user data size has been chosen to minimize the CCSDS source packet header overhead while providing for efficient storage of CADUs to the 128-bit wide memory of the Flash Memory Card.

		Groundlink Science Data Telemetry Packet Format	Bytes	Bits	Default Bits	Comment
TM Source Packet	Primary Header	Version Number	1	3	000b	Version-1 TM source packet
		Type Indicator		1	0b	Telemetry packet
		Packet Secondary Header Flag		1	1b	Secondary header present
		SCU ID		1	0b	Single WISE SCU
		Spare		2	00b	Spare
		Application ID (source)	1	8	0xFE	All MUB-generated packets have APID 254
		Grouping Flags	2	2	varies	Designates grouped packets (01b - first, 00b cont., 10b last Pc
		Source Sequence Count		14	varies	Counted separately for each Packet ID. Increments each Sour Packet (resets to "0" for each new image cycle)
		Packet Length	2	16	0x043D	Secondary header + User Data -1 (1100)
	Sec. Hdr	Time Stamp	5	40	varies	Vehicle Time Counter (Upper 40 bits)
		Packet ID (source)	1	8	varies	see **Error! Reference source not found.** for assignments
		Valid User Data Bytes	2	16	varies	# of Valid User(Science) Data Bytes (excludes fill data)
	User Data		1078	8624	varies	WISE Compressed Raw Pixel Data (Bands 1-4) and fill bytes necessary to complete the last packet for a given image on a g band.
		Total	1092	8736		

Figure 1, WISE Payload Instrument TM Science Data Source Packet Format

Table 1 Science Data Telemetry Source Application and Packet Identifiers

Channel	Compressed/Uncompressed	Application ID (APID) (Telemetry Source)	Packet ID (Telemetry Source)
Pixel Data Band 1	Compressed	0xFE	0x1A
Pixel Data Band 2	Compressed	0xFE	0x1B
Pixel Data Band 3	Compressed	0xFE	0x1C
Pixel Data Band 4	Compressed	0xFE	0x1D
Pixel Data Band 1	Uncompressed	0xFE	0x2A
Pixel Data Band 2	Uncompressed	0xFE	0x2B
Pixel Data Band 3	Uncompressed	0xFE	0x2C
Pixel Data Band 4	Uncompressed	0xFE	0x2D

INTERFACE DESCRIPTION FORM

Interface name: SOE

Sequence of Events - Time ordered listing of scheduled spacecraft and ground events

EXCHANGE DESCRIPTION

Provider:	SEQ	*Consumer:*	All
Server:	WISE Server	*Client:*	All
Protocol:	FTP	*Connection initiator:*	All

Schedule:	Delivered per the Sequence Development Schedule
Comment:	File naming convention: **WIS_SEQ_SEQID_YYYY_DDD_HH_MM_SS.soe** **Where: SEQID is the sequence identified assigned to this sequence**

INTERFACE DATA DESCRIPTION

See the multi-mission document “Reengineered Spaceflight Operations Schedules (RSFOS) Version 3.0” for a description of the format of an SOE.

INTERFACE DESCRIPTION FORM

Interface name: **Spacecraft_Clock_File**

Spacecraft Clock File - Listing of correlated spacecraft clock and UTC data points

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WSDC,SEQ,EOS
Server:	WISE Server	*Client:*	WSDC,SEQ,EOS
Protocol:	FTP	*Connection initiator:*	WSDC,SEQ,EOS

Schedule:	Weekly or as required depending on clock drift rate
Comment:	File naming convention: **WIS_SCLK_SCET_YYYY_DDD_HH_MM_SS.NNNNN.tsc** SCLKSCET.NNNNN where NNNNN is five characters in length, right justified and zero filled on the left. It contains the alphanumeric version ID in ASCII. The version number field is initially '00000' and increments by one per version. Numbers may be replaced with letters if versions beyond 99999 are needed.

INTERFACE DATA DESCRIPTION

```
1.0  DATA FORMAT AND DEFINITION

1.0.1 SFDU Labelling

The SCLKSCET file is constructed using the version 3 SFDU labelling
convention as described in applicable document SFOC-1-DPS-ANY-SCLKvSCET M4
SFOC0038-04-25-02. The label for the K-object is the standard AMMOS K-object
label, where the ADI is NJPL-L015. The data object uses the registered ADI of
NJPL-0613.

1.0.2 File Format

The SCLKSCET file is divided into four parts: the SFDU label, the Kclass
header, the data internal header, and the data portions. The SCLKSCET file
is encapsulated in an aggregate SFDU that also contains a K-type SFDU
containing catalog information describing the data. The field-value-names used
in Table 4-1 are described below.

Column#   Field
=========================================================================
1         blank
2-17      Effective Spacecraft Clock (SCLK0) formatted as an integer with
          ending decimal point.
```

```
18-19     blank
20-40    Effective Spacecraft Event Time (SCET0) yyyy-dddThh:mm:ss.sss
41       blank
42-47    Delta-UT (DUT) in atomic seconds formatted ss.sss. Delta UT is the
         difference between UTC and Ephemeris Time (ET) at SCET0.
 48      blank
49-60    Effective SCLK rate (SCLKRATE) in atomic seconds per SCLK count
         floating point, blank filled.
61       blank
62       Carriage Return
63       Linefeed
```

EXAMPLE

FILENAME: WIS_SCLKSCET.NNNNN

WISE Example:

CCSD3ZS00001$$sclk$$NJPL3KS0L015$$scet$$
MISSION_NAME=WISE;
SPACECRAFT_NAME=WISE;
DATA_SET_ID=SCLK_SCET;
FILE_NAME=WIS_SCLKSCET.00020;
PRODUCT_CREATION_TIME=2005-07-01T17:11:57;
PRODUCT_VERSION_ID=20;
PRODUCER_ID=SCT;
APPLICABLE_START_TIME=1980-001T00:00:00;
APPLICABLE_STOP_TIME=2010-001T00:00:00;
MISSION_ID=XX;
SPACECRAFT_ID=XX;
CCSD3RE00000$$scet$$NJPL3IS00613$$data$$
*____SCLK0_______ ____SCET0_____________ _DUT__ _SCLKRATE___
 0000000000000.   1980-001T00:00:00.000 51.184 01.000000000
 0747185000000.   2003-247T23:23:07.000 64.184 00.999996741
 0804634543000.   2005-181T21:32:22.843 64.184 00.999996731
CCSD3RE00000$$data$$CCSD3RE00000$$sclk$$

INTERFACE DESCRIPTION FORM

Interface name: SSF

Spacecraft Sequence File - SEQGEN output file providing a time ordered listing of all sequenced commands

EXCHANGE DESCRIPTION

Provider:	SEQ	*Consumer:*	PGEN
Server:	WISE Server	*Client:*	PGEN
Protocol:	FTP	*Connection initiator:*	PGEN

Schedule:	Delivered per the Sequence Development Schedule
Comment:	File naming convention: **WIS_SEQ_SEQID_YYYY_DDD_HH_MM_SS.ssf** **Where: SEQID is the sequence identified assigned to this sequence**

INTERFACE DATA DESCRIPTION

See the multimission SIS Spacecraft Sequence File 0292-SEQ-SEQ for a description of the WISE SSF.

INTERFACE DESCRIPTION FORM

Interface name: STRATCOM_OBS_DATA

Stratcom Raw Observation Data - Skin tracking RADAR data of the WISE S/C provided by STRATCOM

EXCHANGE DESCRIPTION

Provider:	STRATCOM	*Consumer:*	NAV
Server:	STRATCOM	*Client:*	NAV
Protocol:	File Transfer	*Connection initiator:*	NAV

Schedule:	Available daily from STRATCOM
Comment:	

INTERFACE DATA DESCRIPTION

A complete description of the interface between STRATCOM and NAV is provided in the LAMOD User's Guide, Version 3.1 dated 27 September 2000. A description of an observation data line is provided below:

B-3 Observation Format Line:

Column	Range	Format	Description
1	U,C,S	A1	Classification, where U = Unclass C = Confidential S = Secret
2-6	1-99999	I5	Satellite number
7-9	1-998	I3	Station number
10-23	YYDDDHHMMSSSSS		Time of observation, where YY = last 2 digits of year DDD = day of year HH = hours MM = minutes

			SSSSS = seconds (decimal implied between col 20 & 21)
24-29	1-90000	I6	Elevation or declination (deg) (decimal implied between col 25 & 26) Col 24 overpunched (11 punch) for negative quantities. Ob types 1-5 only.
31-37	1-3600000	I7	Azimuth in degrees (decimal implied between col 33 & 34). Ob types 1-4 only.
OR			
31-37	HHMMSSS		Right Ascension in hours, minutes, and seconds of arc (decimal implied between col 36 & 37). Ob type 5 only.
39-45	1-9999999	I7	Slant range base (kilometers) (decimal implied between col 40 & 41).
46	0-5	I1	Slant range exponent. Ob types 2, 3, 4 & 6 only.
48-54	1-9999999	F7.5	Slant range rate (km/sec); col 48 overpunched (11 punch) for negative quantities; decimal implied between col 49 & 50. Ob types 0, 3 & 4 only.
56-60	1-99999	F5.4	Elevation rate (deg/sec) (not used)
62-66	1-99999	F5.4	Azimuth rate (deg/sec) (not used)
68-72	1-99999	F5.4	Range acceleration (km/sec^2) (not used)
75	0-9,P,V	A1	Observation type
76	0-3	I1	Equinox indicator, where 0 = date of observation 1 = 0 Jan Year of Date 2 = 0 Jan 2000 3 = 0 Jan 1950

Note that one of two possible formats may be used in columns 31-37, depending on observation type. The slant range defined in columns 39-46 has a decimal implied between columns 40 and 41 if the exponent is zero. The decimal is shifted one column to the right for each successive value of the exponent. The observation type defined in column 75 may be

0 = range-rate only
1 = azimuth & declination
2 = azimuth, elevation, & range
3 = azimuth, elevation, range, & range-rate
4 = azimuth, elevation, range, range-rate, azimuth-rate, & elevation-rate
5 = right-ascension & declination
6 = range only
7 = EFG (earth-centered rotating) vector
8 = azimuth & elevation (& orbiting sensor EFG)
9 = right-ascension & declination (& orbiting sensor EFG)
V = ECI vector (position & velocity, or V-ob)
P = ECI position vector (P-ob)
M = (same as 8, but with range)
O = (same as 9, but with range)

INTERFACE DESCRIPTION FORM

Interface name: Survey_Plan

Survey Plan - Strategy for conducting the infrared survey derived from inputs from UCLA

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	EOS
Server:	WISE Server	*Client:*	EOS
Protocol:	FTP	*Connection initiator:*	EOS

Schedule:	Weekly or as required
Comment:	File naming convention: **WIS_SURVEY_PLAN_YYYY_DDD_HH_MM_SS.txt** **Date/Time is file creation time**

INTERFACE DATA DESCRIPTION

The Survey Plan is a text file the input parameters from the Survey Plan Input file as comments followed by the following parameters for each half orbit. Each data line has the following parameters:

TIME	Start times: the number of elapsed seconds since 24 May 1968, UT 00:00:00, which was JD 2440000.5
SCAN QUATERIONS	Scan quaternions: the first three components are the vector part (measured in arcmin/sec); the fourth component is the scalar part.
SCAN RATES	Scan rates: measured in arcmin/sec

EXAMPLE

FILE NAME:
WIS_SURVEY_PLAN_2010_026_12_00_00
.TXT

```
#TOGGLE        0.2200
#MOONAVOID     1.2300
#ECLIPSEBIAS   0.0000
#BIAS          0.0000
```

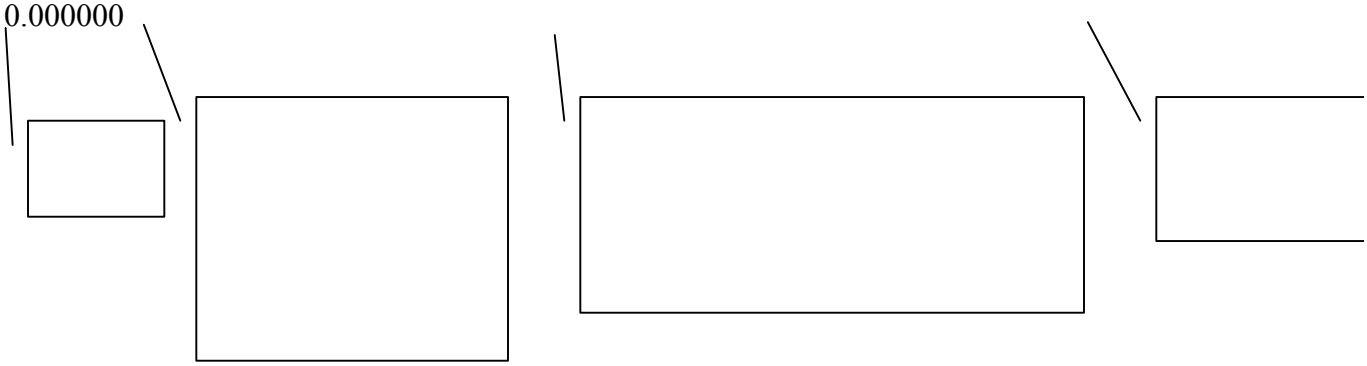
Orbit index

Start times: the number of elapsed seconds since 24 May 1968, UT 00:00:00, which was JD 2440000.5

Scan quaternions: the first three components are the vector part (measured in arcmin/sec), the fourth component is the scalar part.

Scan rates: measured in arcmin/sec

```
#BIASMAX      0.0000
#DIHEDRAL     0.0000
#SCANRATE     0.0000   3.8000   0.0000
# Time now:  06/26/2007  15:41:27
#  Start time: 11/01/2009  00:00:00
#   End time: 11/08/2009  00:00:00
 1 1307751474.517  0.012577 -0.976983 -0.202735  0.065156  0.000000  3.800000
0.000000
 1 1307754316.336 -0.234341 -0.846398  0.301190  0.371456  0.000000  3.800000
0.000000
 2 1307756918.156 -0.144582  0.211048 -0.879284 -0.401765  0.000000  3.800000
0.000000
 2 1307759759.976 -0.335075 -0.627816  0.182635  0.678393  0.000000  3.800000
0.000000
 3 1307762841.796 -0.028669  0.154924 -0.887517 -0.433001  0.000000  3.800000
0.000000
 3 1307765683.615  0.098152 -0.807696  0.368778 -0.449441  0.000000  3.800000
0.000000
 4 1307771127.256 -0.340733 -0.605843  0.171847  0.698086  0.000000  3.800000
0.000000
 4 1307774209.076 -0.029734  0.154184 -0.885440 -0.437423  0.000000  3.800000
0.000000
 5 1307777050.896 -0.366621  0.031050 -0.105922  0.923799  0.000000  3.800000
0.000000
 5 1307779652.717 -0.145897  0.210811 -0.875650 -0.409279  0.000000  3.800000
0.000000
 6 1307782494.537  0.366345 -0.033450  0.106874 -0.923716  0.000000  3.800000
0.000000
 6 1307785576.358 -0.029494  0.154351 -0.885911 -0.436426  0.000000  3.800000
0.000000
```



INTERFACE DESCRIPTION FORM

Interface name: **Survey_Plan_Input**

Survey Plan Inputs - Strategy for conducting the infrared survey with inputs provided by UCLA

EXCHANGE DESCRIPTION

Provider:	SPS	*Consumer:*	SEQ
Server:	WISE Server	*Client:*	SEQ
Protocol:	FTP	*Connection initiator:*	SEQ

Schedule:	Weekly or as required
Comment:	File naming convention: **WIS_SPS_INPUT_YYYY_DDD_HH_MM_SS.txt** **Date/Time is file creation time**

INTERFACE DATA DESCRIPTION

The Survey Plan Input file is an ASCII text file containing the following parameters.

Start at: MM/DD/YYYY HH:MM:SS
Finish at: MM/DD/YYYY HH:MM:SS
TOGGLE = Parameter
MOONAVOID = Parameter
ECLIPSEBIAS = Parameter
BIAS = Parameter
BIASMAX = Parameter
DIHEDRAL = Parameter
SCANRATE = Parameter

Note: The eclipsebias parameter will be set according to the following table:

Start	End	ECLIPSEBIAS
12/2/09	5/1/10	0.00
5/1/10	5/8/10	-0.25
5/8/10	5/15/10	-0.50
5/15/10	5/22/10	-0.75
5/22/10	5/29/10	-1.00
5/29/10	6/5/10	-1.25
6/5/10	6/12/10	-1.50
6/12/10	6/19/10	-1.75
6/19/10	6/26/10	-2.00

```
6/26/10  7/3/10  -1.75
7/3/10   7/10/10 -1.50
7/10/10  7/17/10 -1.25
7/17/10  7/24/10 -1.00
7/24/10  7/31/10 -0.75
7/31/10  8/7/10  -0.50
8/7/10   8/14/10 -0.25
8/14/10  12/2/10  0.00
```

EXAMPLE

FILE NAME:
WIS_SPS_INPUT_2007_056_06_07_08.TXT

Start at: 6/26/2007 15:35:45
Finish at: 6/26/2007 15:35:45
TOGGLE = 0.22
MOONAVOID = 1.23
ECLIPSEBIAS = 0.00
BIAS = 0.00
BIASMAX = 0.00
DIHEDRAL = 0.00
SCANRATE = 0.00 3.80 0.00

INTERFACE DESCRIPTION FORM

Interface name: TDRSS_GCMR

TDRSS Remote Control - Socket interface for sending TDRSS remote control directives

EXCHANGE DESCRIPTION

Provider:	WTCCS	*Consumer:*	TDRSS-WSISK
Server:	WTCCS	*Client:*	TDRSS-WSISK
Protocol:	TCP-IP Socket	*Connection initiator:*	WTCCS

Schedule:	Nominally four times daily during each TDRSS pass
Comment:	

INTERFACE DATA DESCRIPTION

The format Ground Control Message Request (GCMR) is described in the document ICD Between the NCCDS and the Mission Operations Centers (451-ICD-NCCDS/MOC).

INTERFACE DESCRIPTION FORM

Interface name: TDRSS_ODM

TDRSS Remote Monitor Data Stream - Data stream via socket connection of TDRSS remote monitor status information

EXCHANGE DESCRIPTION

Provider:	TDRSS	*Consumer:*	WTCCS
Server:	WDISK	*Client:*	WTCCS
Protocol:	TCP/IP socket	*Connection initiator:*	WTCCS

Schedule:	During each TDRSS pass
Comment:	

INTERFACE DATA DESCRIPTION

The format of the ODM is described in the document ICD Between the NCCDS and the Mission Operations Centers (451-ICD-NCCDS/MOC).

INTERFACE DESCRIPTION FORM

Interface name: **TDRSS_Pass_List**

TDRSS Pass List - A list of TDRSS passes derived from the TDRSS Integrated Schedule

EXCHANGE DESCRIPTION

Provider:	SEQ	*Consumer:*	EOS, NAV
Server:	WISE Server	*Client:*	EOS, NAV
Protocol:	FTP	*Connection initiator:*	EOS, NAV

Schedule:	Nominally weekly
Comment:	File naming convention: **WIS_SEQ_Pass_List_YYYY_DDD_HH_MM_SS.txt**

INTERFACE DATA DESCRIPTION

The TDRSS pass list is a comma separated ascii text file where each line in the file contains ten fields defined as follows:

Field 1 = Pass ID (blank - This information is not available in the SNAS output)
Field 2 = Project Name
Field 3 = TDRS ID
Field 4 = S band Start time (UTC in YYYYDDDHHMMSS format)
Field 5 = S band End time (UTC in YYYYDDDHHMMSS format)
Field 6 = TDRS_Code (This is blank since there are 4 codes per pass)
Field 7 = Rev Number (As of now this info is not available in the SNAS output)
Field 8 = SSA ID
Field 9 = Ku Band Start time (UTC in YYYYDDDHHMMSS format)
Field 10 = Ku Band End time (UTC in YYYYDDDHHMMSS format)

EXAMPLE

FILE NAME:WIS_SEQ_PASS_LIST_2008_313_01_00_00.TXT

```
,WISE,TDS,2008313063000,2008313064809,,,SA1,2008313063500,2008313064309
,WISE,TDW,2008313143000,2008313144622,,,SA1,2008313143500,2008313144122
```

INTERFACE DESCRIPTION FORM

Interface name: TDRSS_TC

TDRSS Tele-command Path - Socket interface for sending command data in the CLTU format to White Sands for uplink to the S/C.

EXCHANGE DESCRIPTION

Provider:	TDRSS	*Consumer:*	WTCCS
Server:	WDISK	*Client:*	WTCCS
Protocol:	TCP/IP socket	*Connection initiator:*	WTCCS

Schedule:	
Comment:	

INTERFACE DATA DESCRIPTION

WISE Telecommand Format shown in Figure 1 below identifies the telecommand layering and format of Telecommands on WISE. **While the 10-bit length field supports a 1024 byte Transfer Frame length, due to software considerations the maximum telecommand Transfer Frame length shall be 1008 bytes.** Ground station and GSE telecommand support should use the telecommand format and limitations identified in Figure 1 below.

- Telecommand Transfer Frame maximum length is 1008 bytes
- Telecommand Packet data field maximum length is 994 bytes
- Telecommand Transfer Frame Header is 5 bytes
- Telecommand Transfer Frame Frame Error Control Word (FECW) is 2 bytes
- Telecommand Source Packet Header is 7 bytes
- BCH encoding (supports heritage board design) (1 byte per codeblock)
- Uses Codeblock counter and command Accept/Reject counters in telemetry stream for command receipt verification on the spacecraft
- Not using CCSDS COP-1 Protocol
- Telecommand Start Sequence = 55h, 55h, 55h, 55h, 55h, 55h, EBh, 90h
- Telecommand Tail Sequence = C5h, C5h, C5h, C5h, C5h, C5h, C5h, 79h

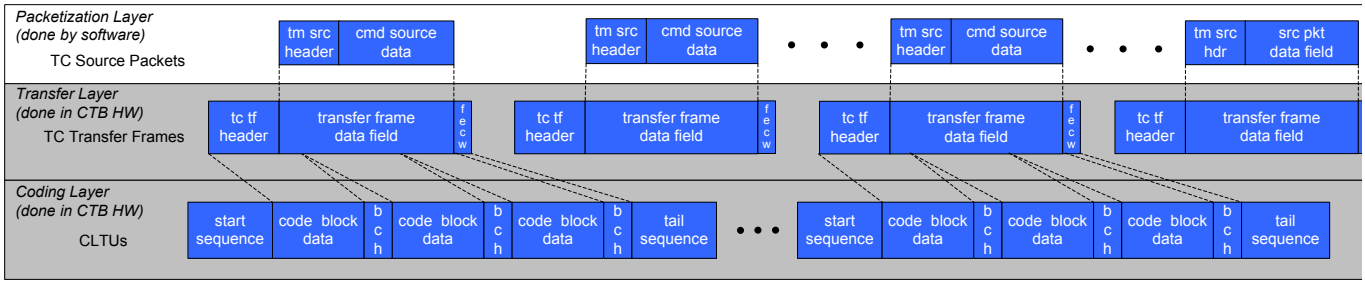


Figure 1, WISE Telecommand Layer Overview

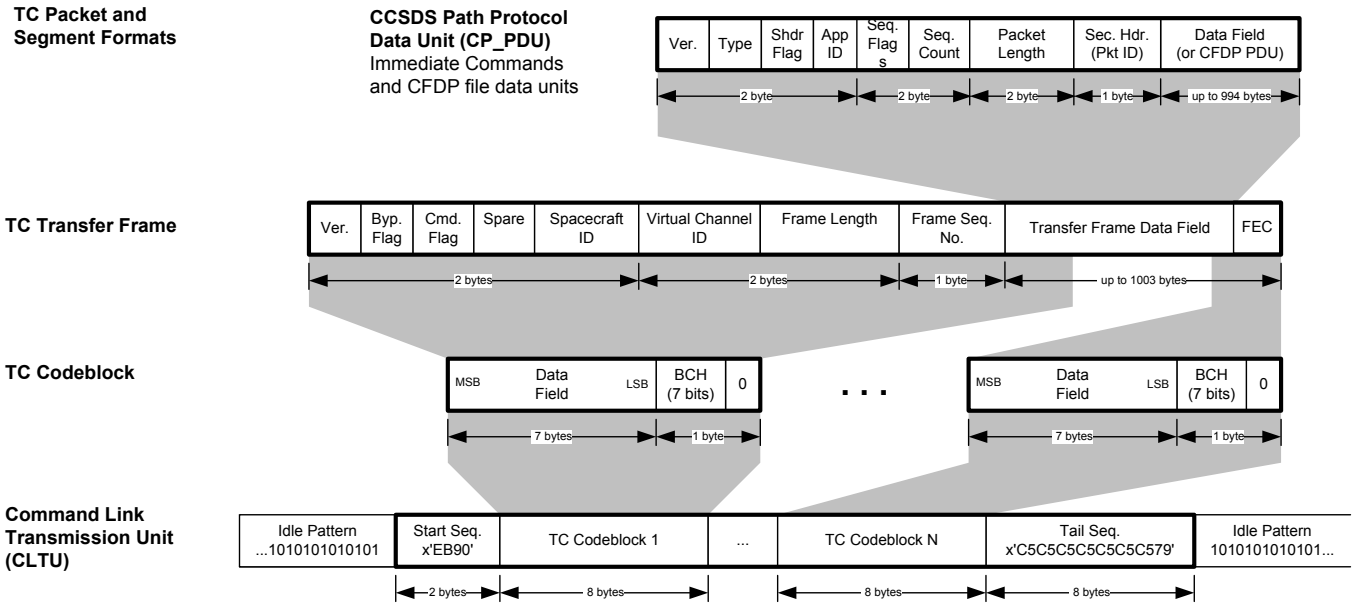
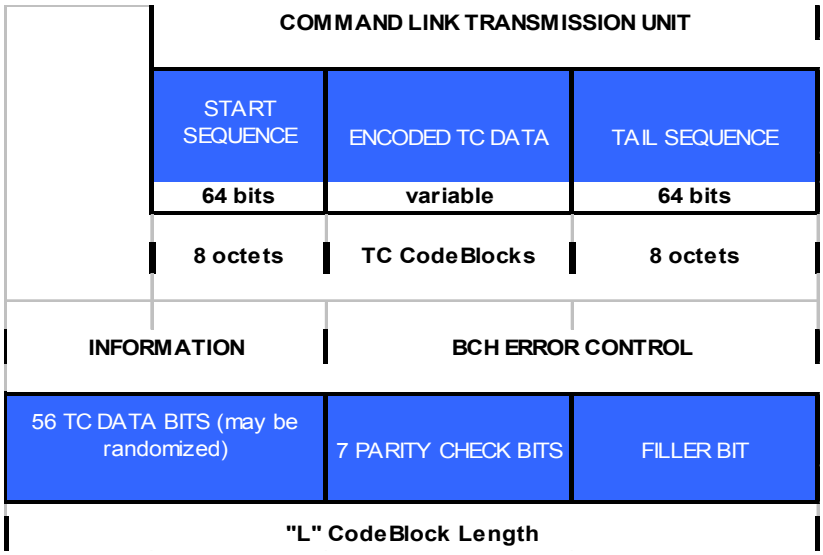


Figure 2 WISE Telecommand Layer Details

Prior to uplinking a Command Link Transmission Unit (CLTU) to the spacecraft, the ground BCH encodes sequential 56 bit data blocks of the Transfer Frame into 64 bit codeblocks. The CLTU and BCH formats are shown below. If the bits in the Transfer Frame do not total up to an even multiple of 56, the final codeblock of the CLTU is filled with alternating ones and zeros starting with a zero. The complete set of codeblocks is prepended with the CLTU Start Sequence and appended with the Tail Sequence. The CLTU is then transferred to the Physical Layer (WDISK interface) for radiation to the spacecraft at the 2000 bps uplink data rate.



CLTU and BCH formats

INTERFACE DESCRIPTION FORM

Interface name: TDRSS_TLM

TDRSS Telemetry – TDRSS telemetry stream either from WDISK or the Ku-band interface to the HRP

EXCHANGE DESCRIPTION

Provider:	WSC	*Consumer:*	WTCCS/HRP
Server:	WSC	*Client:*	WTCCS/HRP
Protocol:	TCP/IP or ECL	*Connection initiator:*	WTCCS/HRP

Schedule:	During each scheduled S-band and Ku-band pass
Comment:	

INTERFACE DATA DESCRIPTION

TDRSS provides telemetry frames as Channel Access Data Units as described in the section titled **TLM_Frame_VCID.**

INTERFACE DESCRIPTION FORM

Interface name: **TLM_CSVF**

Telemetry Comma Separated Value File - Comma Separated Value Files containing selected engineering data channels

EXCHANGE DESCRIPTION

Provider:	EOS	*Consumer:*	WSDC,SDL
Server:	WISE Server	*Client:*	WSDC,SDL
Protocol:	FTP	*Connection initiator:*	WSDC,SDL

Schedule:	Following each TDRSS pass
Comment:	File naming convention: **WIS_WTCCS_TYPE_YYYY_DDD_HH_MM_SS.csv** Where **TYPE** identifies the data set being converted into CSV format. Time in the file name is file creation time.

INTERFACE DATA DESCRIPTION

Housekeeping telemetry parameters are extracted from housekeeping telemetry packets, converted from raw values to converted values and provided to users in the form of comma separated value files (CSVF). The file contains no header. Each line in the CSVF has four values separated by commas. The values are specified in the following table:

Position	Value	Description
First	Time	Time tag from the telemetry packet from which the telemetry parameter was extracted. The time format is the CCSDS ASCII Time Code B: YYYY-DDDThh:mm:ss.ddd
Second	TLM Mnemonic	Telemetry mnemonic as specified in the TLM data base
Third	Raw Value	Raw telemetry value in decimal including floating point decimal values
Fourth	Converted value	Converted raw value from the telemetry data base. The converted value may be in engineering units or a text string. If no conversion algorithm is specified in the TLM data base, the raw value is repeated.

EXAMPLE

FILE NAME: WIS_WTCCS_SSOH_YYYY_DDD_HH_MM_SS.csv

```
2007-003T00:00:57.127,rtrs2,1,off
2007-003T00:00:57.127,rjmr2,1,off
2007-003T00:00:57.127,rjmr1,1,off
2007-003T00:00:57.127,rtrs1,1,off
2007-003T00:00:57.127,itrs1,2,+5.095541e+000
2007-003T00:00:57.127,ijmr1,4085,-2.802548e+001
```

INTERFACE DESCRIPTION FORM

Interface name: TLM_Database

Telemetry Data Base File - Data base containing the detailed characteristics of each spacecraft telemetry parameter

EXCHANGE DESCRIPTION

Provider:	BATC	*Consumer:*	EOS
Server:	NA	*Client:*	EOS
Protocol:	File Transfer via E-mail	*Connection initiator:*	EOS

Schedule:	As updated
Comment:	File naming convention: WIS_BATC_TLM_Database_YYYY_DDD_HH_MM_SS.txt

INTERFACE DATA DESCRIPTION

The telemetry workbook is an EXCEL file containing telemetry information to be converted to the WISE telemetry format used by the WTCCS.

The Telemetry workbook includes:

- General Telemetry Info (mnemonic, description, etc.); worksheet name: [tlm]
- Polynomial Conversions; worksheet name: [tlm_conv_poly]
- State Conversions & Alarms; worksheet name: [tlm_conv_state]
- Ground Limits; worksheet name: [tlm_gnd_limit]

The layout of the EXCEL pages is described below:

Telemetry Workbook

Worksheet [tlm]: General Telemetry Info

- spacecraft [required]
  - 1-10 character string abbreviation used to indicate the spacecraft this telemetry item is associated with; abbr must match db spacecraft definition record abbr. value
    - WISE uses WISE [WI]
- external_element
  - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
  - Value is required only for payload/instrument telemetry
    - WISE use limited to 2 chars [TBR]

- app_id [required]
  - The application ID or reserved number (value must be unique per spacecraft)
  - Integer values 1 – 255
    - WISE reserve 255 for the CTB
    - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
  - The packet ID (value must be unique per application)
  - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- pkt_name
  - [optional] The name of the packet; informational only
  - String; 1-80 char. max
- fsw_var_name [required]
  - The variable name corresponding to this telemetry item's packet variable name; [if the packet variable was an array, this name is used in conjunction with the next two array dimension index values to specify the exact packet variable in question]
  - If this is a flight software packet, this name is the actual fsw variable name
  - In order for a telemetry item to be successfully imported into the database, the fsw_var_name (in conjunction with any array indexes) MUST match up with a packet variable; otherwise the spreadsheet row will be rejected
- array_d1_index
  - An integer indicating the corresponding packet variable's first dimensional array index (if applicable)
  - (all packet variables that are arrays must be "unwound" in telemetry definitions; one telemetry item per array item)
- array_d2_index
  - An integer indicating the corresponding packet variable's second dimensional array index (if applicable)
  - (all packet variables that are arrays must be "unwound" in telemetry definitions; one telemetry item per array item)
- data_type
  - The packet variable's primitive data type: accepted values are BIT, BOOL8, INT8, INT16, INT32, FLT32, FLT64, STRING, UINT8, UINT16, UINT32
  - The data type will be automatically determined from the packet variable definition, unless this is a header tlm item; in which case it must be specified
- bit_length
  - This integer provides additional bit size information for BIT and STRING data types
  - The value will be automatically determined from the packet variable definition for BIT and STRING data types, unless this is a header tlm item; in which case it must be specified for BIT and STRING header tlm
- order

    - [optional] An integer representing the order of the telemetry item within the packet; numbering starts at zero
    - The order is determined from the packet variable definition order
- mnemonic [required]
    - The unique 1-12 char ground system identifier for this telemetry point (note: 12 is an OASIS limitation)
    - alpha-numeric and underscore chars are allowed, no spaces
    - naming conventions are program specific; DI uses an additional 3 char prefix to specify the OASIS ext_element within the mnemonic bringing the allowed character total to 15; this type of mnemonic is spit into its parts during exports for OASIS
- new_mnemonic
    - This is used when changing an existing mnemonic (useful for a before/after mnemonic log)
    - Any values entered here must follow the same rules as for the mnemonic field
- channel_id
    - [optional] Not used on WISE
- start_bit
    - [optional] An integer representing the start bit location within the packet for this telemetry item
    - Only required for decommutating data out of the packet header, all other start bit values are automatically calculated by the db based on tlm order and data type
    - For header tlm, use the program's packet header implementation definition to determine the start bit location of the data you wish to decom; also determine the size of the data type you need to store this header data and enter an appropriate data type in the data_type field
- min_value
    - [optional] Minimum tlm value; if not specified, data type default is used
    - If a polynomial conversion is supplied, applies to the converted range
    - Decimal and hexadecimal values are allowed; specify hex values with a "x" prefix, ex: xF5CF
- max_value
    - [optional] Maximum tlm value; if not specified, data type default is used
    - If a polynomial conversion is supplied, applies to the converted range
    - Decimal and hexadecimal values are allowed; specify hex values with a "x" prefix, ex: xF5CF
- eu
    - [optional] Engineering units for the telemetry item; valid EU list is project/ground system specific (SEC, V, C, etc.)
    - Whenever EU units are supplied, the ground system will also need a polynomial conversion definition to convert from the raw DN value to the EU value; if not specified, the default identity conversion is used
- display_format

    - [optional] Fortran-style format used to display telemetry values on the ground systems
    - If not specified, a default based on data type will be used
- export_to_ground
    - TRUE/FALSE: set to TRUE if the ground system needs to be able to decom this particular telemetry item (sometimes spares are defined); automatically set to FALSE if mnemonic = 1-NOT_USED
    - With the current implementation, EVERY telemetry packet variable needs a telemetry item definition, even if it is not currently going to be used by the ground system. These "dummy" tlm ensure that the start bit in packet locations for all subsequent tlm items are calculated correctly.
    - Default = TRUE
- flight_conv_dn_to_eu (DI only, not used on Kepler, OE or WISE)
    - TRUE/FALSE: set to TRUE if the telemetry value will be converted onboard; otherwise any conversions will be handled by the ground system
    - When TRUE, a polynomial conversion definition must also be supplied. The associated polynomial conversion definitions will be automatically added to a conversion *.sasf file for each application that requires onboard conversion of raw DN values into EU values
    - Default = FALSE
- tlm_description [required]
    - A one line short description describing the telemetry item (~80 chars); up to 60 chars are included in OASIS exports
- tlm_notes
    - [optional] larger free-form text field used to capture any notes about this telemetry measurement (3000 chars)
- tlm_hyperlink
    - [optional] text field used to store the URL of an online document that would be a useful reference
- test_notes
    - [optional] text field used to store testing notes
- 1553_address
    - [optional] text field for storing a 1553 address

Worksheet [tlm_conv_poly]: Polynomial Conversions

- spacecraft [required]
    - 1-10 character string abbreviation used to indicate the spacecraft this telemetry item is associated with; abbr must match db spacecraft definition record abbr. value
        - WISE uses WISE [WI]
- external_element
    - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
    - Value is required only for payload/instrument telemetry
        - WISE use limited to 2 chars [TBR]

- app_id [required]
  - The application ID or reserved number (value must be unique per spacecraft)
  - Integer values 1 – 255
    - WISE reserve 255 for the CTB
    - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
  - The packet ID (value must be unique per application)
  - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- TLM_order
  - An integer representing the order of the telemetry item within the packet; numbering starts at zero
  - The order is determined from the packet variable definition order
- TLM_mnemonic [required]
  - The unique 1-12 char ground system identifier for this telemetry point (note: 12 is an OASIS limitation)
  - alpha-numeric and underscore chars are allowed, no spaces
  - naming conventions are program specific; DI uses an additional 3 char prefix to specify the OASIS ext_element within the mnemonic bringing the allowed character total to 15; this type of mnemonic is spit into its parts during exports for OASIS
- segment_number [required]
  - An integer (starting with 1) representing a tlm value graph segment over which this polynomial conversion Is applicable (if only one segment is defined, use default of 1)
  - WISE allows only one segment to be defined per tlm item.
- lower_bound
  - Float value indicating lower boundary of segment (only required for multi-segmented polynomial conversions)
- upper_bound
  - Float value indicating upper boundary of segment (only required for multi-segmented polynomial conversions)
- c0 - c5
  - Float values representing the coefficients of up to a 5th order polynomial equation
  - c0 and c1 are required; other coefficients must be provided up to highest order being defined
  - The DN to EU conversion equation: EU = c0 + c1(DN) + c2(DN^2) + c3(DN^3) + c4(DN^4) + c5(DN^5)

Worksheet [tlm_conv_state]: State Conversions and Alarms

- spacecraft [required]
  - 1-10 character string abbreviation used to indicate the spacecraft this telemetry item is associated with; abbr must match db spacecraft definition record abbr. value

        - WISE uses WISE [WI]
- external_element
    - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
    - Value is required only for payload/instrument telemetry
        - WISE use limited to 2 chars [TBR]
- app_id [required]
    - The application ID or reserved number (value must be unique per spacecraft)
    - Integer values 1 – 255
        - WISE reserve 255 for the CTB
        - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
    - The packet ID (value must be unique per application)
    - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- TLM_order
    - An integer representing the order of the telemetry item within the packet; numbering starts at zero
    - The order is determined from the packet variable definition order
- TLM_mnemonic [required]
    - The unique 1-12 char ground system identifier for this telemetry point (note: 12 is an OASIS limitation)
    - alpha-numeric and underscore chars are allowed, no spaces
    - naming conventions are program specific; DI uses an additional 3 char prefix to specify the OASIS ext_element within the mnemonic bringing the allowed character total to 15; this type of mnemonic is spit into its parts during exports for OASIS
- state_value [required]
    - An integer representing telemetry item value for this state; unique per tlm item (note that if the integer is stored as text in Excel, the import of this conversion will fail)
    - Valid range may be limited by ground system, otherwise range is based on user specified tlm range or data type defaults (note that Excel assigns a numeric value to the strings "True" and "False"; left-justify these strings to avoid this)
- state_name [required]
    - A string representing the name of this state
    - Max length is limited by ground systems, alphanumeric, no spaces, naming conventions are program specific
- state_alarm
    - [optional] Used by ground systems to specify what (if any) alarm to associate with recieving this state
    - Valid values are GOOD (green), CAUTION (yellow), BAD (red)
    - If not specified, default is GOOD (no alarm)

Worksheet [tlm_gnd_limits]: Ground Limits

- spacecraft [required]
  - 1-10 character string abbreviation used to indicate the spacecraft this telemetry item is associated with; abbr must match db spacecraft definition record abbr. value
    - WISE uses WISE [WI]
- external_element
  - An OASIS concept, this 1-16 char string allows groups of command and telemetry data to be divided up internally to OASIS, following somewhat arbitrary criteria
  - Value is required only for payload/instrument telemetry
    - WISE use limited to 2 chars [TBR]
- app_id [required]
  - The application ID or reserved number (value must be unique per spacecraft)
  - Integer values 1 – 255
    - WISE reserve 255 for the CTB
    - WISE reserves 254 for the MUB [TBR]
- pkt_id [required]
  - The packet ID (value must be unique per application)
  - Integer values 1 – 255; blocks are reserved for monitor and monitor agent packets
- TLM_order
  - An integer representing the order of the telemetry item within the packet; numbering starts at zero
  - The order is determined from the packet variable definition order
- TLM_mnemonic [required]
  - The unique 1-12 char ground system identifier for this telemetry point (note: 12 is an OASIS limitation)
  - alpha-numeric and underscore chars are allowed, no spaces
  - naming conventions are program specific; DI uses an additional 3 char prefix to specify the OASIS ext_element within the mnemonic bringing the allowed character total to 15; this type of mnemonic is spit into its parts during exports for OASIS
- ground_system [required]
  - A string representing the abbr. of the ground system this limit applies to
  - Valid values are OASIS
- limit_type [required]
  - A string indicating when this limit is applicable. This allows groups of limits to be defined that are applicable at different times.
  - Valid values are FLIGHT,INIT,TEST (default is FLIGHT)
  - WISE only uses FLIGHT
- yellow_limit_type | red_limit_type
  - A string indicating how to interpret the tlm range values
  - Only EXCLUSIVE is currently supported: (.. RL .. YL .. YH .. RH ..)

- yellow_low | red_low
    - For the EXCLUSIVE case, everything < value will be flagged by ground system as yellow | red alarm
- yellow_high | red_high
    - For the EXCLUSIVE case, everything > value will be flagged by ground system as yellow | red alarm

INTERFACE DESCRIPTION FORM

Interface name: **TLM_Frame_VCID**

RAW Telemetry Frames - Ku-band CADU transfer frames or S-Band VCDU frame files

EXCHANGE DESCRIPTION

Provider:	BATC	*Consumer:*	EOS
Server:	BOIS	*Client:*	EOS
Protocol:	TCP/IP socket connection	*Connection initiator:*	EOS

Schedule:	As requested
Comment:	File naming convention: **WIS_HRP_CADU_YYYY_DDD_HH_MM_SS.bin** for CADU's stored by the HRP **WIS_WTCCS_FRM_VCXX_YYYY_DDD_HH_MM_SS.bin** where **VCXX** is the virtual channel ID for the frames in the file.

INTERFACE DATA DESCRIPTION

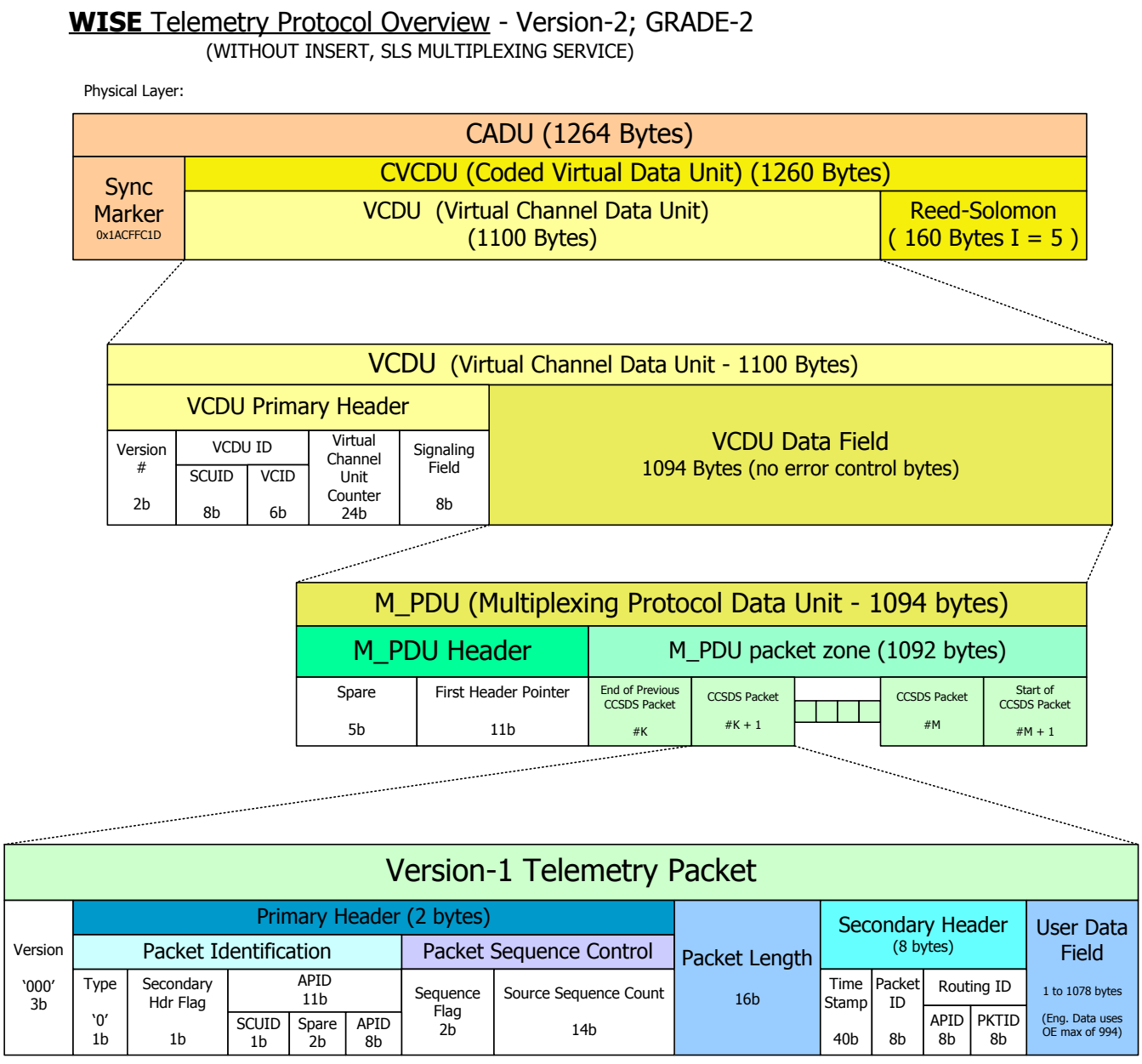


Figure 5.1-2, WISE Telemetry Layer Details

The WISE CADU is sized so that it is a multiple of 16 bytes (128 bits) to facilitate storage of data to the Flash Memory Card (FMC), which is 128-bit wide (144 bits with EDAC) flash memory. This requires that the technique of "Virtual Fill" be used when generating Reed-Solomon Check Bytes. WISE uses version-2, grade-2 CCSDS TM Transfer Frames (VCDUs) with Multiplexing Protocol Data Units (M-PDUs). Version-2 allows up to 64 virtual channel IDs. WISE is using Reed-Solomon encoding and randomization. WISE limits the Version-1 TM source packet user data field size to 1078 bytes so that there is always a packet header in the M_PDU packet zone. This is done to

minimize data loss should an outage occur in the downlink data stream. WISE uses CCSDS File Delivery Protocol (CFDP) for file storage downloads and uploads.

CCSDS TM Source packets on WISE are Version 1[1], comprised of a 6 byte primary header (which includes the APID and packet length), an 8 byte secondary header (packet time-tag & APID and pkt ID routing fields), and a data field. The CCSDS protocol permits the data field to be up to 65,528 bytes in length, but **the WISE program will limit the software generated telemetry data field to 994 (to maximize OE heritage) bytes.** The hardware generated transfer frames will always have 1078 bytes of User Data field.

Summary of WISE CCSDS Coding layer processing:

- Reed-Solomon Encoding
- Randomization
- Using Attached Sync Marker (ASM) 4 bytes = 1ACFFC1Dh
- No Encryption in transponder hardware
- Using TM "Fill" Transfer Frames

CCSDS source packets are used internal to the flight software to pass information between flight software applications. Telemetry source packets sent to the ground use the same format as internal messages. Telecommand source packets get converted to the internal source packet format on arrival by the flight software and are time stamped with the most significant 40 bits of the 52 bit Vehicle Time Code. The time stamp field resolution is 10 milliseconds. The time stamp references when the telemetry packet is assembled by the sending SW application and when a telecommand is received by the flight software. Expanded addressing is provided by additional packet and application ID fields located in the secondary header. Source and destination application and packet IDs are 8 bits long, providing up to 256 applications, 256 packet definitions per application.

[1] CCSDS 701.0-B-3 BLUE BOOK - p 5.3.8.2.2.2.a

INTERFACE DESCRIPTION FORM

Interface name: **TLM_Packet_ID**

Telemetry Extracted Packet Files – Non-Science telemetry packets extracted from KU-band telemetry stream by the high rate processor and by WTCCS for the S-band telemetry link. .

EXCHANGE DESCRIPTION

Provider:	WTCCS/HRDP	*Consumer:*	WTCCS
Server:	WTCCS/HRDP	*Client:*	WTCCS
Protocol:	Secure File Transfer	*Connection initiator:*	WTCCS

Schedule:	During each TDRSS pass
Comment:	File naming convention: Packet file for a single ID packet: **WIS_WTCCS_PKT_ID_YYYY_DDD_HH_MM_SS.bin** **WIS_HRP_PKT_ID_YYYY_DDD_HH_MM_SS.bin** Where **ID** is the concatenation of the application process ID (APID) and packet ID of the packet in the file. Packet file for all packets from a single virtual channel: **WIS_WTCCS_PKT_VCXX_YYYY_DDD_HH_MM_SS.bin** **WIS_HRP_PKT_VCXX_YYYY_DDD_HH_MM_SS.bin** Where **VCXX** is the virtual channel ID of the transfer from which the packets were extracted.

INTERFACE DATA DESCRIPTION

Telemetry packets are extracted from transfer frames and stored in a file format. There may be a single ID packet in a file or a file of all the packets from a virtual channel.

A Telemetry Source Packet is a data unit which encapsulates a block of observational data which may include ancillary data and which may be directly interpreted by the receiving end application process. This layer is also referred to as a CCSDS Path Protocol Data Unit (CP_PDU). WISE defines the Application Process Identifier and Secondary Header in the version-1 telemetry source packet format as shown below. This applies to both WISE spacecraft telemetry and the WISE payload science telemetry.

TM SOURCE PACKET													
PACKET PRIMARY HEADER									PACKET SECONDARY HEADER				PACKET DATA FIELD
VERSION NO.	PACKET IDENTIFICATION					PACKET SEQUENCE CONTROL		PACKET DATA LENGTH	TIME STAMP	PACKET ID	ROUTING ID		SOURCE DATA
	TYPE INDI-CATOR	PCKT. SEC. HDR. FLAG	APPLICATION PROCESS IDENTIFIER			GROUPING FLAGS	SOURCE SEQUENCE COUNT				APP. ID	PACKET ID	
	0=TLM 1=TC		SCU ID	SPARE	APP.ID								
			0=SCU-A 1=SCU-B		Telemetry Source				Vehicle Time Code	Telemetry Source	Telemetry Destination	Telemetry Destination	1 - 994 Bytes for FSW generated packets or 1078 bytes for Science Data
Default:													
000	0	1	0	0	varies	11	varies	varies	varies	varies	varies	varies	varies
3 bits	1 bit	1 bit	1 bit	2 bits	8 bits	2 bits	14 bit	16 bits	40 bits	8 bits	8 bits	8 bits	Flexible
2 Octets						2 Octets		2 Octets	5 Octets	1 Octet	1 Octet	1 Octet	1 to 1078 Octets

WISE TM Source Packet Format

TM Source Packet Fields

Packet Identification	
Version Number (bits 0-2)	This sub-field explicitly indicates the version of the formatted packet, and its length of three bits allows eight different versions to be identified. The three Version bits shall be set to "000", signifying the Version-1 CCSDS packet used by WISE (OE heritage).
Type (bit 3)	This sub-field indicates whether a packet is a telecommand or telemetry packet. Telemetry packets will have a value of '0' in this field.
Secondary Header Flag (bit 4)	The Secondary Header flag indicates if a Secondary Header is present in the CP_PDU. Set to value "1" to signify that a Secondary Header is present in WISE TM packets.
Application Process ID (bits 5 through 15)	Uniquely identify the originating source packet application process. Eleven bits are allocated to the Application Process ID. WISE reserves the upper-most 3 bits of the application process ID field as spare bits. Normally the upper bit is used to identify the source electronic box or processor when used in a redundant configuration. WISE is single string spacecraft and does not use these bits; this field shall be set to "000b". WISE reserves the lower 8 bits of the primary header Application ID for identifying the "source" software application that sent the message.
Packet Sequence Control	
Grouping Flags (bits 16,17)	Provides for a logical representation of four types of grouping status. These flags identify whether the source data field contains the first, continuing or last segment of a source packet, or if it contains no segment (meaning it contains a complete set of source application data). 00 = contains a continuation segment of User Data. 01 = contains the first segment of User Data. 10 = contains the last segment of User Data. 11 = contains unsegmented User Data. With the exception of CFDP file downloads, telemetry generated by WISE will be unsegmented. See below for how the Grouping Flags are used for science data packets.
Source Sequence Count (bits 18 through 31)	Each packet is numbered in a sequential manner, thus providing a method of checking the order of source application data at the receiving end of the system. It is normally used for ground accounting purposes to measure the quantity, continuity and completeness of the data received from the source. The field provides a straight

	sequential count to modulo 16,384. WISE uses the packet sequence control fields for retrieving stored state of health data from non-volatile memory and reassembly on the ground. The memory and data manager software application are responsible for populating these fields.
Packet Length (bits 32 through 47)	The last major field of the primary header delimits the boundaries of the packet. The 16 bit Packet Length field contains a sequential binary count “C” which expresses the length (in octets) of the remainder of the CP_PDU that follows this field. The value of “C” is the number of remaining octets minus one.
Secondary Header	The secondary header must appear in every frame transmitted through a physical data channel, and its length must also be fixed. WISE uses the secondary header to provide timestamp and addressing fields.
Time stamp	The time stamp contains the most significant 40 bits of the 52 bit Vehicle Time Code, providing 10-millisecond resolution. The time stamp identifies when the telemetry packet was assembled by the source FSW application.
Source Packet ID (bits 88 through 95)	The source packet ID field is in the secondary header to allow for expanded addressing, and identifies the originating FSW application.
Routing ID	
Destination Application ID (bits 96 through 103)	The secondary header application ID identifies the destination application within the flight or ground software. WISE FSW will use the value “6” as the destination application ID for ground software. The CTB uses 0xFF and the MUB uses 0xFE.
Destination Packet ID (bits 104 through 111)	The secondary header destination packet ID identifies the destination packet. WISE will use this field to identify the VC on which the packet is sent. The CTB and MUB duplicate the Source Packet ID in this field.
Source Data	Following the secondary header, the source data sub-field contains source application data generated by the application process identified in the primary header.

INTERFACE DESCRIPTION FORM

Interface name: **WISE_C_Kernel**

WISE C Kernel - WISE reconstructed pointing (attitude) derived from the WISE attitude data from telemetry in the SPICE C-kernel format

EXCHANGE DESCRIPTION

Provider:	NAV	*Consumer:*	EOS,WSDC
Server:	WISE Server	*Client:*	EOS,WSDC
Protocol:	FTP	*Connection initiator:*	EOS,WSDC

Schedule:	Daily
Comment:	File naming convention: See NAIF Document No. 370 Version 1.0 (or current version)

INTERFACE DATA DESCRIPTION

This interface is described in the NAIF multi-mission SIS: NAIF Document No. 370 Version 1.0 (or current version), SPICE C-Matrix Kernel

INTERFACE DESCRIPTION FORM

Interface name: WISE_SCLK

Spacecraft Clock in SPICE kernel format- Listing of correlated spacecraft clock and UTC data points in the SPICE kernel format

EXCHANGE DESCRIPTION

Provider:	NAV	*Consumer:*	All
Server:	WISE Server	*Client:*	All
Protocol:	FTP	*Connection initiator:*	All

Schedule:	Generated several times each week
Comment:	File naming convention: See NAIF SIS: NAIF Document No 374 Version 1.0.

INTERFACE DATA DESCRIPTION

This interface is described in the NAIF multi-mission SIS: NAIF Document No. 374 Version 1.0 (or current version), SPICE Spacecraft Clock Coefficients Kernel.

INTERFACE DESCRIPTION FORM

Interface name: **WISE_SP_Kernel**

Ephemeris File - WISE and TDRSS ephemeris files in SPK format

EXCHANGE DESCRIPTION

Provider:	NAV	*Consumer:*	EOS,WSDC
Server:	NAV	*Client:*	EOS,WSDC
Protocol:	FTP	*Connection initiator:*	EOS,WSDC

Schedule:	Several times weekly. Generated whenever a fresh TLE is obtained from NORAD or FDF
Comment:	File naming convention: WIS_SPK_YYYY_DDD_HH_MM_SS.bsp

INTERFACE DATA DESCRIPTION

This interface is described in the NAIF multi-mission SIS: NAIF Document No. 367 Version 1.0 (or current version), SPICE Spacecraft and Planet Ephemeris Kernel