

MARS GLOBAL SURVEYOR



Mars Orbiter Laser Altimeter

**MOLA AGGREGATED EXPERIMENT DATA RECORD
SOFTWARE INTERFACE SPECIFICATION
(MOLA AEDR SIS)**

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**NASA
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Greenbelt MD 20771**

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Submitted:

Gregory A. Neumann
MOLA Science Team

Date

Concurred:

Maria Zuber
MOLA Deputy Principal Investigator

Date

Approved:

David E. Smith
MOLA Principal Investigator

Date

MARS ORBITER LASER ALTIMETER AGGREGATED EXPERIMENT DATA RECORD SOFTWARE INTERFACE SPECIFICATION (MOLA AEDR SIS)

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1.0 General Description

The MOLA Science Team is required to create, validate, and archive the MOLA standard data products. To define each standard data product, the MOLA Science Team is required to provide a Software Interface Specification (SIS). The SIS shall describe the data product contents and define the record and data format. The Planetary Data System (PDS) Geosciences Node has agreed to archive the MOLA standard data products. The MOLA archive volume shall be described in a separate SIS. The MOLA standard science data products are the Aggregated Experiment Data Record—all MOLA raw data aggregated by calendar day; Precision Experiment Data Record—MOLA science data processed into profiles with precision orbit locations added; Any Experiment Gridded Data Record—MOLA gridded data in 2 different densities. This SIS shall define the Aggregated Experiment Data Record (AEDR) Data Product.

1.1 Purpose

This document describes the format and contents of the AEDR data product. This includes a description of the required SFDU format and the format and contents of the AEDR.

1.2 Scope

This SIS describes the format of the SFDU labels and headers and the AEDR to the bit level. The AEDR file is an aggregation of the MOLA telemetry packets (Experiment Data Records) received from the Space Flight Operations Center (SFOC) at the Jet Propulsion Laboratory (JPL). The Experiment Data Records (EDRs) will be produced continuously during instrument operation. The instrument can operate in either science or maintenance mode; data is collected during each mode and stored in the telemetry packets. There are three types of maintenance (or diagnostic) modes that the instrument can be commanded to perform with varying output stored in the packet. Consequently, there are several record formats possible within the AEDR file. The formats of all record types are described in this SIS.

1.3 Applicable Documents

1. DRSE007 Mars Observer Software Interface Specification MOLA Packet Data Record, September 16, 1991, Jet Propulsion Laboratory
2. SFOC0038-05-12-03 SFOC Software Interface Specification SFDUs Generated/Received by TIS, November 30, 1990, Jet Propulsion Laboratory
3. MOLA-672-PL-89.354 Operations Facility Configuration and Control Plan, Version 3.0, January 15, 1992, NASA GSFC WFF
4. SFOC0088-00-04-02 SFOC User's Guide for Workstation End Users, Volume 2: Accessing Data, Version 15 (Review Copy Only)
5. SFOC0038-00-TBD-01 SFOC-2-CDB-Any-Catalog 2, Draft, February 6, 1990
6. MOLA-972-SP-92.213 MOLA CD-ROM Standard Product Archive Collection Software Interface Specification, Version 1.0, S. Slavney, R. E. Arvidson, Washington University, August 11, 1993

1.4 Functional Description

1.4.1 Data Source, Destination, and Transfer Method

The source of the telemetry packet data is SFOC through a dedicated NASA Communications (NASCOM) link to the MOLA Science Operations Planning Computer (SOPC). The packets will be aggregated by calendar day using the SFOC-provided Browser tool and stored as an AEDR file on the SOPC. Refer to Applicable Document #3 for a description of the SOPC. The Browser tool is described in Applicable Document #4. The AEDR files will be transferred to the MOLA operations file system via FTP (standard UNIX File Transfer Protocol). From the MOLA operations file system, the AEDR file is available for retrieval by the science team via FTP and for input to the processor to create the PEDR Data Product. The AEDR Data Product will be created by prefixing the required SFDU and PDS labeling to the AEDR file. After product verification by the MOLA Science Team, the AEDR data product shall be transferred to the SOPC for subsequent delivery to the Planetary Data System's (PDS) Geosciences Node using FTP. The PDS Geosciences Node will archive the AEDR Data Products to CD-ROM and make the products available to the science community.

1.4.2 Pertinent Relationships with Other Interfaces

Since the AEDR file is an aggregation of the MOLA Experiment Data Records (EDR), any changes to the EDR may directly affect the AEDR file.

The Precision Experiment Data Record (PEDR) Data Product is derived from the AEDR file. Therefore, any changes to the AEDR file may affect the software creating the PEDR Data Product.

1.4.3 Labeling and Identification

The AEDR data product shall be labeled according to the standards of the MGS Project and the PDS. SFDU label and header definitions and descriptions are contained in Applicable Document #2.

The data set id for the MOLA AEDR data product is MO-M-MOLA-2-AEDR-L0-V1.0. This is the data set id that was provided to the PDB and the PDS. This id describes the overall AEDR data product. The version number is incremented should the AEDR Data Product format change.

The file naming convention for each AEDR data product produced is AA#####a.B.

Where:

A represents the MOLA instrument, an altimeter

A is the data product, AEDR, identifier

is the number of the first orbit in the product, with leading zeros (see below)

a is the product edition number

B indicates the file is fixed point, binary.

1.4.4 Orbit Numbering

On March 9, 1999, the MGS spacecraft entered the Mapping Phase of the mission after spending nearly two years in the Orbit Insertion Phase. The MGS Project reset the orbit count to 1 at the beginning of the Mapping Phase, at the descending equator crossing of actual orbit 1683. Since MOLA had already generated many products during Orbit Insertion with product IDs based on the orbit number, there was a potential problem that the product ID would not be unique if MOLA continued to use the Project orbit number. To ensure a unique product ID, MOLA Mapping Phase products are therefore identified by the Project orbit number plus 10000. For example, an AEDR product containing data acquired starting in Mapping Phase orbit 24 is identified as AA10024a.B.

1.4.5 Assumptions and Constraints

1. The AEDR product contains all MOLA telemetry packets.
2. Each AEDR retains the CHDO information contained in the corresponding EDR.
3. The AEDR product will contain one day's worth of data.
4. Each record will contain one packet of MOLA data.
5. SFDU headers and labels will be attached to the AEDR file.
6. The EDR format will be maintained in the AEDR.

2.0 Environment

2.1 Hardware Characteristics and Limitations

Not applicable.

2.2 Interface Medium and Characteristics

For the creation and archival of the AEDR file, several interfaces will be necessary: SFOC-to-SOPC transfer of telemetry packets (EDRs) via NASCOM link. The AEDR file shall be transferred to the MOLA operations file system for further processing to create the PEDR Data Product and for Science Team availability.

The AEDR Data Product shall be distributed to the PDS Geosciences Node for archival. The MOLA CD-ROM Archive Volume SIS, Applicable Document #6 for the CD-ROM structure and data access information.

The interface media for file transfer and distribution are described in detail in Applicable Document #3.

2.3 Input / Output Protocols

Not applicable.

2.4 Failure Protection, Detection, and Recovery Features

2.4.1 Backup Requirements

The AEDR data product will be backed up on magnetic media on the MOLA operations file system at GSFC. The AEDR data product will be archived by the PDS to CD-ROM. The MGS Project Data Base will be available as an additional backup location.

2.4.2 Security and Integrity Measures

Refer to Applicable Document #3 for a description of the MOLA system security and integrity plan.

2.5 End-Of-File (or Medium) Conventions

The AEDR Data Product shall be written as a standard UNIX flat, sequential file. The end of an AEDR Data Product will be detected by the end-of-file marker. In the FORTRAN programming language, the file may be opened with the keywords ACCESS='DIRECT', RECL=1230 (bytes) and end-of-file detected in a READ statement with the ERR= keyword.

2.6 Utility Programs

The following utilities are provided by SFOC and will be used to check the AEDR files for completeness and validity:

1. Browser
2. DECOM
3. DMD

Refer to Applicable Document #4 for the description and the functions of these utilities.

3.0 Data Flow Characteristics

3.1 Operational Characteristics

3.1.1 Generation Method and Frequency

The process to create the AEDR data product is performed as part of MOLA mission operations. The telemetry packets will be aggregated on a UTC calendar day basis. There will be approximately 12 orbits per day with each orbit taking 117 minutes 39 seconds to complete. The mapping mission will last for one Martian year which is 687 Earth days.

3.1.2 Time Span of Product

The AEDR data products will be produced continuously for the life of mission (687 days). Each product will contain approximately 86400 seconds of data.

3.2 Data Volume

The daily volume of telemetry data is about 7.6 Mbytes or approximately 6170 packets per day.

3.3 Flow Rate

Nominally, the AEDR Data Product is created on the SOPC and transferred to the MOLA operations file system once per day for the previous 24 hours of data. Since MOLA operations will be performed during a standard five day work week, on Mondays (or the first day of the work week) the processing will need to include the data collected since the last day of the previous work week.

4.0 Detailed Data Object Definition

4.1 Structure and Organization Overview

The AEDR products will be built to include the required SFDU structure. See Applicable Document #6 for a definition of SFDUs and their structure.

4.2 Data Format and Definition

4.2.1 Format

The AEDR product will have SFDU labels and headers, as required by Mars Global Surveyor. These will be attached to the AEDR file which will contain one orbit of AEDRs.

4.2.2 Externally Declared Structure Templates

Format files describing the record format of the AEDR data product shall be provided to the Planetary Data System. The format files are referenced by the AEDR data product label. The format files are MOLASCI.FMT and MOLAMNT.FMT. These files are provided in Appendix C.2 and Appendix C.3. Additionally, MOLASCI.FMT references the format files MOLASCFR.FMT and MOLASCCT.FMT to further describe the AEDR format. These files are provided in Appendix C.4 and Appendix C.5.

4.2.3 Data Description

The product will be formatted as a Standard Formatted Data Unit (SFDU). This means the AEDR data shall be wrapped in a series of labels (the SFDU Primary Label, the K-Header, and the I-class Label) describing the data and supplying required information to the Project Database. An orbit of AEDRs shall make up the data portion of the file. Figure 1 depicts the overall Product format. The sections below describe each label and the data records in detail. The labels were created using Applicable Document #5 and Applicable Document #6 as guidelines. Label formats are provided in Appendix C.

4.2.3.1 Primary SFDU Label

The Primary SFDU Label, also known as the aggregation label, wraps and therefore, delimits the entire product. The Primary Label is 20 bytes long and shall have the following format for the AEDR Data Product. The start label is

CCSD3ZF00001000000001

where:

- CCSD is the Control Authority ID
- 3 is the SFDU version ID
- Z is the class ID for primary labels
- F is the SFDU delimiter type, delimits product by total EOFs
- 0 is a spare octet
- 0001 is the Data Descriptive Package ID
- 00000001 is the delimiter value field, Total EOF Indicator Count (ASCII)

4.2.3.2 K-Header

The K-header is made up of a label and catalog data objects that are to be stored in the Mars Global Surveyor PDB. The start label has the following form:

NJPL3KS0PDSX\$\$INFO\$\$

where:

NJPL is the Control Authority ID
 3 is the SFDU version ID
 K is the class ID for catalog data object labels
 S is the SFDU delimiter type, start marker
 0 is a spare octet
 PDSX is the Data Descriptive Package ID
 \$\$INFO\$\$ is the delimiter value for this label

After the label, shall be the catalog entries required by the Project. These shall be in the KEY-WORD=VALUE format. The catalog entries (keywords) that are required by the Project are

PDS_VERSION_ID	UPLOAD_ID
RECORD_TYPE	PRODUCT_RELEASE_DATE
FILE_RECORDS	START_TIME
RECORD_BYTES	STOP_TIME
LABEL_RECORDS	SPACECRAFT_CLOCK_START_COUNT
FILE_NAME	SPACECRAFT_CLOCK_STOP_COUNT
DATA_SET_ID	PRODUCT_CREATION_TIME
PRODUCT_ID	MISSION_PHASE_NAME
SPACECRAFT_NAME	ORBIT_NUMBER
INSTRUMENT_ID	PRODUCER_ID
INSTRUMENT_NAME	PRODUCER_FULL_NAME
TARGET_NAME	PRODUCER_INSTITUTION_NAME
SOFTWARE_NAME	DESCRIPTION

Example catalog entries and their values are provided in Appendix C.1.

The catalog entries will be delimited by the K-header end label; it has the following form:

CCSD\$\$MARKER\$\$INFO\$\$

4.2.3.3 I-class Label

The I-class Label precedes the actual data in the SFDU. This label is also known as the data object label or the tertiary header. The I-class label is registered individually with the JPL Control Authority and bears a unique DDPID. The start label has the following format

NJPL3IF00000000000001

where:

NJPL is the Control Authority ID
 3 is the SFDU version ID

- I is the class ID for data labels
- F is the SFDU delimiter type, delimits by total EOFs
- 0 is a spare octet
- 0000 is the Data Descriptive Package ID
- 00000001 is the delimiter value field, Total EOF Indicator Count (ASCII)

4.2.3.4 Data Format

The data is written sequentially. Each record will contain one packet of MOLA telemetry data—either science or maintenance mode and its corresponding CHDO header. The MOLA telemetry data is described in Applicable Document #1. This document also defines the CHDO header format. Byte 11 in each AEDR indicates the mode for the packet: 0 indicates normal science mode; 1, 2, or 3 indicate maintenance (diagnostic) mode. To date, values 4 and above have not been assigned. Table 1 and Table 2 describe the record formats for the Aggregated Experiment Data Record (AEDR) MOLA Science Mode Packet and the Aggregated Experiment Data Record (AEDR) MOLA Maintenance Mode Packet. The tables define the record format to the bit level. The tables define the starting byte for each data element in the record. Refer to the AEDR data dictionaries in Appendix A and Appendix B for detailed descriptions and formats of the data elements in each record.

FIGURES

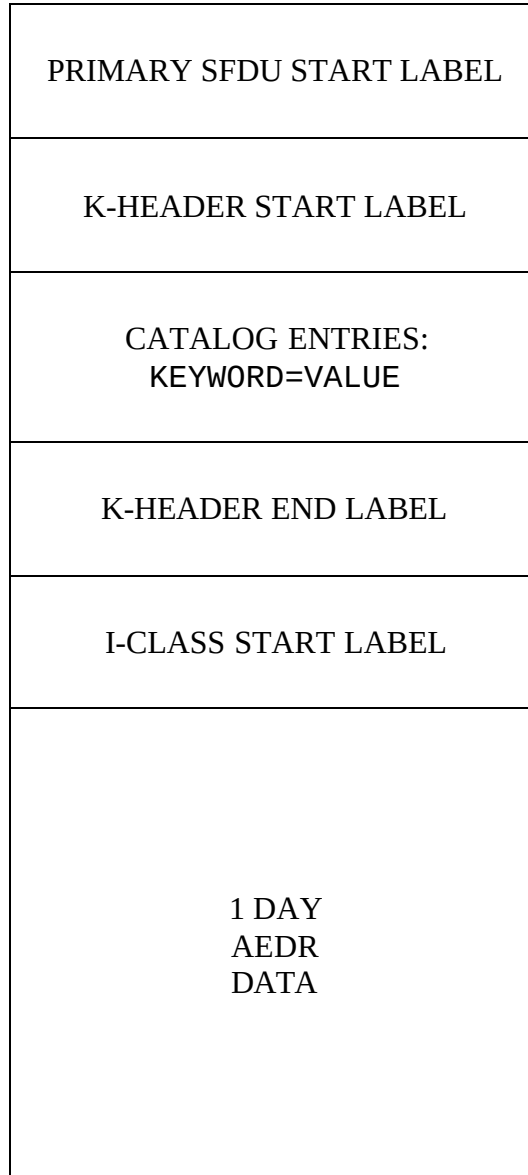


Figure 1: AEDR Data Product Structure and Organization

TABLES

Table 1: AEDR Science Mode Packet Format

Start Byte	Data Elements			Length (bits)	Length (bytes)
0	CHDO header			1200	150
150	Source primary header			48	6
156	Time code words			40	5
161	Packet Type (0 = normal science)	Mux	Chan	8	1
162	Computer Memory temperature	A	2	8	1
163	Computer CPU temperature	A	1	8	1
164	Power Supply temperature	A	4	8	1
165	Computer I/O temperature	A	3	8	1
166	LASER array heat sink temperature	A	6	8	1
167	LASER diode array drive electronics temperature	A	5	8	1
168	Optical Test Source (OTS) LED temperature	A	8	8	1
169	100 MHz Oscillator temperature	A	7	8	1
170	Start Detector temperature	A	10	8	1
171	Outside Detector Box temperature	A	9	8	1
172	LASER Radiator Opposite Output port temperature	A	12	8	1
173	LASER Radiator Output port temperature	A	11	8	1
174	Interface Plate near Hot foot temperature	A	14	8	1
175	Radiation sheet transition temperature	A	13	8	1
176	Electronics Box top near S/C thermistor temperature	A	16	8	1
177	LASER Box near Hot foot temperature	A	15	8	1
178	28 Volt monitor	B	2	8	1
179	Reference Voltage monitor	B	1	8	1
180	+12 Volt voltage monitor	B	4	8	1
181	+24 Volt voltage monitor	B	3	8	1
182	+5 Volt voltage monitor	B	6	8	1
183	-12 Volt voltage monitor	B	5	8	1
184	LASER / thermal current monitor	B	8	8	1
185	-5 Volt voltage monitor	B	7	8	1
186	Power Supply current monitor	B	10	8	1
187	High Voltage current monitor	B	9	8	1
188	-12 Volt current monitor	B	12	8	1
189	+12 Volt current monitor	B	11	8	1
190	-5 Volt current monitor	B	14	8	1
191	+5 Volt current monitor	B	13	8	1
192	Current STATUS register value (SEU counter)			8	1
193	Software Version Number (4.4 bit format)			8	1
194	Flag word (2 KB RAM block test)			16	2
196	Status Flags (EFLAG1(16 bits),EFLAG2(16 bits))			32	4
200	Software validity checksum			16	2
202	Received command count (modulo 8 bits)			8	1
203	Command error count (modulo 8 bits)			8	1

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Star t Byte	Data Elements	Length (bits)	Length (bytes)
204	Transmitter threshold setting (XMITDA)	8	1
205	Range Tracking Status (frame #7654321) (1=tracking, 0=acquisition, MSB=OTS)	8	1
206	Range gate tracker array (73.728 km starting at HSTART)	384	48
254	HSTART value for HISTOGRAM dump	16	2
256	Valid commands received count (modulo 16 bits)	16	2
258	Memory dump segment (16 Kbytes/16 bytes = 1024 packets ~= 4 hours)	128	16
274	Command echo	128	16
290	Packet validity checksum	16	2
292	Frame 1 / Shot 1 Range to surface (TIU counts)	16	2
294	1st channel received pulse energy (counts)	8	1
295	1st channel received Channel number / Pulse width	8	1
296	Shot 2	32	4
300	Shot 3	32	4
304	Shot 4	32	4
308	Shot 5	32	4
312	Shot 6	32	4
316	Shot 7	32	4
320	Shot 8	32	4
324	Shot 9	32	4
328	Shot 10	32	4
332	Shot 11	32	4
336	Shot 12	32	4
340	Shot 13	32	4
344	Shot 14	32	4
348	Shot 15	32	4
352	Shot 16	32	4
356	Shot 17	32	4
360	Shot 18	32	4
364	Shot 19	32	4
368	Shot 20	32	4
372	Shot 2 LASER transmitter power	8	1
373	Shot 1 LASER transmitter power	8	1
374	Shot 4 LASER transmitter power	8	1
375	Shot 3 LASER transmitter power	8	1
376	Shot 6 LASER transmitter power	8	1
377	Shot 5 LASER transmitter power	8	1
378	Shot 8 LASER transmitter power	8	1
379	Shot 7 LASER transmitter power	8	1
380	Shot 10 LASER transmitter power	8	1
381	Shot 9 LASER transmitter power	8	1
382	Shot 12 LASER transmitter power	8	1
383	Shot 11 LASER transmitter power	8	1
384	Shot 14 LASER transmitter power	8	1
385	Shot 13 LASER transmitter power	8	1

MOLA AEDR Software Interface Specification

Star t Byte	Data Elements	Length (bits)	Length (bytes)
386	Shot 16 LASER transmitter power	8	1
387	Shot 15 LASER transmitter power	8	1
388	Shot 18 LASER transmitter power	8	1
389	Shot 17 LASER transmitter power	8	1
390	Shot 20 LASER transmitter power	8	1
391	Shot 19 LASER transmitter power	8	1
392	Shot 3 Encoder start and stop bits	4	0.5
392.5	Shot 4 Encoder start and stop bits	4	0.5
393	Shot 1 Encoder start and stop bits	4	0.5
393.5	Shot 2 Encoder start and stop bits	4	0.5
394	Shot 7 Encoder start and stop bits	4	0.5
394.5	Shot 8 Encoder start and stop bits	4	0.5
395	Shot 5 Encoder start and stop bits	4	0.5
395.5	Shot 6 Encoder start and stop bits	4	0.5
396	Shot 11 Encoder start and stop bits	4	0.5
396.5	Shot 12 Encoder start and stop bits	4	0.5
397	Shot 9 Encoder start and stop bits	4	0.5
397.5	Shot 10 Encoder start and stop bits	4	0.5
398	Shot 15 Encoder start and stop bits	4	0.5
398.5	Shot 16 Encoder start and stop bits	4	0.5
399	Shot 13 Encoder start and stop bits	4	0.5
399.5	Shot 14 Encoder start and stop bits	4	0.5
400	Shot 19 Encoder start and stop bits	4	0.5
400.5	Shot 20 Encoder start and stop bits	4	0.5
401	Shot 17 Encoder start and stop bits	4	0.5
401.5	Shot 18 Encoder start and stop bits	4	0.5
402	TIU upper range bits	4	0.5
402.5	Receiver channel mask status (ALTMOD)	4	0.5
403	Algorithm status (HIT_CNT)	8	1
404	Channel 1 1st half-frame threshold setting	8	1
405	Channel 2 1st half-frame threshold setting	8	1
406	Channel 3 1st half-frame threshold setting	8	1
407	Channel 4 1st half-frame threshold setting	8	1
408	Channel 1 2nd half-frame threshold setting	8	1
409	Channel 2 2nd half-frame threshold setting	8	1
410	Channel 3 2nd half-frame threshold setting	8	1
411	Channel 4 2nd half-frame threshold setting	8	1
412	Range delay	16	2
414	Range width	16	2
416	Algorithm status (MIN_HITS)	8	1
417	Software status (frame counter in upper 4 bits, trigger channel in lower 4 bits)	8	1
418	Channel 1 1st half-frame background count (PLog base 2 5.3 bit format)	8	1
419	Channel 2 1st half-frame background count	8	1
420	Channel 3 1st half-frame background count	8	1
421	Channel 4 1st half-frame background count	8	1

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Star t Byte	Data Elements	Length (bits)	Length (bytes)
422	Channel 1 2nd half-frame background count	8	1
423	Channel 2 2nd half-frame background count	8	1
424	Channel 3 2nd half-frame background count	8	1
425	Channel 4 2nd half-frame background count	8	1
426	Frame 2	1072	134
560	Frame 3	1072	134
694	Frame 4	1072	134
828	Frame 5	1072	134
962	Frame 6	1072	134
1096	Frame 7	1072	134
1230	TOTALS	9840	1230

Table 2: AEDR Maintenance Mode Packet Format

Start Byte	Data Elements	Length (bits)	Length (bytes)
0	CHDO	1200	150
150	Source primary header	48	6
156	Time code words	40	5
161	Packet type (1 = status packet, 2 = memory dump, 3 = noise count)	8	1
162	Comp. Memory Temperature	8	1
163	Comp. CPU temp.	8	1
164	Power Supply temp.	8	1
165	Comp. I/O temp.	8	1
166	LASER array sink heat temp.	8	1
167	LASER diode array drive temp.	8	1
168	Optical Test Source (OTS) LED temp.	8	1
169	100 MHz Osc. temp.	8	1
170	Start Detector temp.	8	1
171	Outside Detector box temp.	8	1
172	LASER Radiator Opposite Output port temp.	8	1
173	LASER Radiator Output port temp.	8	1
174	I/F Plate near Òhot footÓ temp.	8	1
175	Radiation sheet transition temp.	8	1
176	Electronics Box top near S/C thermistor temp.	8	1
177	LASER Box near Òhot footÓ temp.	8	1
178	28V Monitor	8	1
179	Reference Voltage monitor	8	1
180	+12V mon.	8	1
181	24V mon.	8	1
182	+5V mon.	8	1
183	-12V mon.	8	1
184	LASER/thermal current mon.	8	1
185	-5V mon.	8	1
186	PS current mon.	8	1
187	HV current mon.	8	1
188	-12V current mon.	8	1
189	+12V current mon.	8	1
190	-5V current mon.	8	1
191	+5V current mon.	8	1
192	STATUS register value (SEU counter)	8	1
193	Software Version 4.4 bit format	8	1
194	Flag word (2 KB RAM block test)	16	2
196	Command count (Parameter Updates)	16	2
198	Command count (Memory Loads)	16	2
200	Command count (Memory Dumps)	16	2
202	Command errors	16	2
204	Status flags	16	2
206	Sub-command errors	16	2
208	Commands received	16	2

MOLA AEDR Software Interface Specification

Start Byte	Data Elements	Length (bits)	Length (bytes)
210	Command echo	1232	154
364	Memory Dump Start Address	16	2
366	Memory Dump Length	16	2
368	Memory Dump Segment	6880	860
1228	Packet Checksum	16	2
1230	Total	9840	1230

Appendix A AEDR File Science Mode Data Dictionary

Version 6.0, 9/26/96

ENTRY_NAME	= "Aggregated Experiment Data Record File"
COMMENTS	= "The first archived MOLA data product. The experiment data records grouped by orbit. The Level 0 data product consisting of all 14-second science and maintenance mode telemetry data packets or EDRs collected in chronological order for a specific Mars orbit to form the raw packet data file."
ALIAS	= "AEDR File; MOLA Aggregated Packet Data File"
AUTHOR	= "Abshire, Blair, Hancock, Hayne, and Northam"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 08/27/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= "N/A"
FIELD_FORMAT	= "One logical record per physical record (unblocked)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "N/A"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "AEDR + AEDR + ... + AEDR"
DATA_TYPE	= "sequential access file"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "N/A"
UNITS	= "N/A"

ENTRY_NAME	= "Aggregated Experiment Data Record"
COMMENTS	= "The first archived MOLA data product logical record. The experiment data record. The Level 0 data product logical record; a 14-second science or maintenance mode telemetry data packet or EDR. Packet Error Control is optional; it is not used for MOLA"
ALIAS	= "AEDR; MOLA Raw Packet; Maintenance Mode EDR; Science Mode EDR"
AUTHOR	= "Abshire, Blair, Hancock, Hayne, and Northam"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 08/27/90
DATE_MODIFIED	= 12/02/92
FIELD_NAME	= "N/A"
FIELD_FORMAT	= "N/A"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "N/A"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CHDO+P_SHDR+TIMCD+SOURCE_DATA+Packet Error Control"
DATA_TYPE	= "logical record"
ACCURACY	= "N/A"

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PRECISION          = "N/A"
DATA_RATE          = "once per 14-seconds"
UNITS              = "N/A"

ENTRY_NAME         = "Packet CHDO"
COMMENTS           = "The compressed header data object applied to the
    packet by the Telemetry Input System (TIS); 150 bytes"
ALIAS              = "N/A"
AUTHOR             = "Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = 12/02/92
DATE_MODIFIED      = 12/02/92
FIELD_NAME         = CHDO
FIELD_FORMAT       = "150 bytes"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "1200-bit, unsigned"
RANGE              = "N/A"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = CHDO
DATA_TYPE          = "INTEGER"
ACCURACY           = "N/A"
PRECISION          = "N/A"
DATA_RATE          = "once per 14-seconds"
UNITS              = "N/A"

ENTRY_NAME         = "Packet source header"
COMMENTS           = "The primary source information header applied by
    the Payload Data System (PDS) to the MOLA telemetry packet at the time
    of creation of the packet prior to transfer frame creation."
ALIAS              = "telemetry packet header, primary header"
AUTHOR             = "Garvin, Hancock, Northam, and Jester"
ENTRY_TYPE         = "GROUP"
DATE_CREATED       = 03/17/90
DATE_MODIFIED      = 08/20/91
FIELD_NAME         = P_SHDR
FIELD_FORMAT       = "3I*2"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "48-bit, unsigned"
RANGE              = "N/A"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = " PKT_ID + SEQ_CTRL + PKT_LEN"
DATA_TYPE          = "INTEGER"
ACCURACY           = "N/A"
PRECISION          = "N/A"
DATA_RATE          = "once per 14-seconds"
UNITS              = "N/A"

ENTRY_NAME         = "Packet ID"
COMMENTS           = "Identifies the format and originating source of

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    the packet."
    ALIAS                = "N/A"
    AUTHOR               = "Jester"
    ENTRY_TYPE           = "GROUP"
    DATE_CREATED         = 12/07/90
    DATE_MODIFIED        = 08/20/91
    FIELD_NAME           = PKT_ID
    FIELD_FORMAT         = "I*2"
    ALLOW_BLANKS         = "N/A"
    BINARY_VALUES        = "16-bit, unsigned"
    RANGE                = 0:65535
    DISCRETE_VALUES      = "N/A"
    COMPOSITION          = " VERS_NUM + SPARE + FLAG + APPL_ID"
    DATA_TYPE           = "INTEGER"
    ACCURACY             = "N/A"
    PRECISION            = "N/A"
    DATA_RATE           = "once per 14-seconds"
    UNITS                = "N/A"

ENTRY_NAME              = "Version number"
    COMMENTS            = "These bits identify Version 1 as the Source
    Packet structure. These bits shall be set to '000'."
    ALIAS                = "N/A"
    AUTHOR               = "Jester"
    ENTRY_TYPE           = "ELEMENT"
    DATE_CREATED         = 12/07/90
    DATE_MODIFIED        = 09/24/91
    FIELD_NAME           = VERS_NUM
    FIELD_FORMAT         = "3 bits (0-2)"
    ALLOW_BLANKS         = "N/A"
    BINARY_VALUES        = "UNSIGNED"
    RANGE                = 0:7
    DISCRETE_VALUES      = {0}
    COMPOSITION          = VERS_NUM
    DATA_TYPE           = "INTEGER"
    ACCURACY             = "N/A"
    PRECISION            = "N/A"
    DATA_RATE           = "once per 14 seconds"
    UNITS                = "N/A"

ENTRY_NAME              = "Spare"
    COMMENTS            = "Reserved spare. This bit shall be set to '0'."
    ALIAS                = "N/A"
    AUTHOR               = "Jester"
    ENTRY_TYPE           = "ELEMENT"
    DATE_CREATED         = 12/07/90
    DATE_MODIFIED        = 09/24/91
    FIELD_NAME           = SPARE
    FIELD_FORMAT         = "1 bit (3)"

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ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= 0:0
DISCRETE_VALUES	= {0}
COMPOSITION	= SPARE
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Flag"
COMMENTS	= "This flag signals the presence or absence of a Secondary Header data structure within the Source Packet. This bit shall be set to '0' since no Secondary Header formatting standards currently exist for Mars Global Surveyor."
ALIAS	= "Secondary header flag"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/07/90
DATE_MODIFIED	= 09/24/91
FIELD_NAME	= FLAG
FIELD_FORMAT	= "1 bit (4)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= 0:0
DISCRETE_VALUES	= {0}
COMPOSITION	= FLAG
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Application ID"
COMMENTS	= "This field uniquely identifies the individual application process within the spacecraft that created the Source Packet data."
ALIAS	= "Application Process ID"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 12/07/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= APPL_ID
FIELD_FORMAT	= "11 bits (5 - 15)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "N/A"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"

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COMPOSITION	= "ERR_STAT + INSTR_ID"
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Error status bits (PDS)"
COMMENTS	= "000 is the bit pattern for valid data, 011 for fill packet data generated when a MOLA packet is incomplete."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= ERR_STAT
FIELD_FORMAT	= "3 bits (5-7)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= 0:7
DISCRETE_VALUES	= N/A
COMPOSITION	= ERR_STAT
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Instrument ID"
COMMENTS	= "00100011 is the bit pattern for MOLA"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= INSTR_ID
FIELD_FORMAT	= "8 bits (8-15)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= "N/A"
DISCRETE_VALUES	= {00100011 (35)}
COMPOSITION	= INSTR_ID
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Sequence control"

COMMENTS	= "N/A"
ALIAS	= "Packet sequence control"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 12/06/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= SEQ_CTRL
FIELD_FORMAT	= I*2
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16-bit, unsigned"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "SEG_FLAG + SEQ_CNT"
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14-seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Segmentation Flag"
COMMENTS	= "For Mars Global Surveyor segmentation shall not occur. These bits shall be set to '11'."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/07/90
DATE_MODIFIED	= 09/24/91
FIELD_NAME	= SEG_FLAG
FIELD_FORMAT	= "2 bits (0-1)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= "N/A"
DISCRETE_VALUES	= {11 (3)}
COMPOSITION	= SEG_FLAG
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once per 14 seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Sequence count"
COMMENTS	= "This field contains a straight sequential count (modulo 16384) of each packet generated by the MOLA application process on the spacecraft. The purpose of the field is to order this packet with respect to other packets from the same application process. The last four bits are the counter into the OTS array in the Parameter Table."
ALIAS	= "Source sequence count"
AUTHOR	= "Jester"

ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/07/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= SEQ_CNT
FIELD_FORMAT	= "14 bits (2-15)"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= 0:16383
DISCRETE_VALUES	= "N/A"
COMPOSITION	= SEQ_CNT
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Packet length"
COMMENTS	= "This field contains a sequential 16-bit binary count 'C' of the length (in octets) of the data area structure that is enclosed between the first bit of the Secondary Header and the last bit of the packet (i.e., the last bit of the Source Data field). C = ((no. of octets) - 1)"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/06/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= PKT_LEN
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16-bit, unsigned, fixed-point"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= PKT_LEN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per 14-seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "MOLA System time code"
COMMENTS	= "The MOLA system time is created from the 2 time words input from the PDS time broadcast command. The MOLA time is updated 7/8 of a second after reception of the time broadcast command and 6/8 of a second after interpreting the time broadcast command with S/C + 1 second to arrive at the correct time. B[0] is S/C time in seconds * 224; B[1] is S/C time in seconds * 216; B[2] is S/C time in seconds * 28; B[3] is S/C time in seconds"
ALIAS	= "N/A"

AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= TIME
FIELD_FORMAT	= I*4
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "32 bit, unsigned"
RANGE	= 0:4,294,967,295
DISCRETE_VALUES	= "N/A"
COMPOSITION	= TIME
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "Fine Time"
COMMENTS	= "The hi-resolution timer reading taken during interrupt handling routine triggered by the trailing edge of the first 10 Hz interrupt encountered during this packet."
ALIAS	= "N/A"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= MSECS
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "MSECS"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "Source data"
COMMENTS	= "The source data field contains the measurement information generated by the primary application process operating within each source. The size of the field shall be an integral number of octets. For MOLA the measurement information is generated by the Laser Altimeter and the field size is 1080 bytes (8640 bits). The field size includes the source primary header (48 bits) and the time code words (40 bits). Both Maintenance Mode and Science Mode packets are included in composition."
ALIAS	= "Telemetry packet data, science mode data"

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AUTHOR           = "Jester"
ENTRY_TYPE       = "GROUP"
DATE_CREATED     = 12/11/90
DATE_MODIFIED    = 08/20/91
FIELD_NAME       = SOURCE_DATA
FIELD_FORMAT     = N/A /* Formatted as described in the following
    entries. */
ALLOW_BLANKS    = "N/A"
BINARY_VALUES    = "UNSIGNED"
RANGE           = "N/A"
DISCRETE_VALUES  = "N/A"
COMPOSITION      = " 'PKT_TYPE + ENG_HSK_DAT + SEU_CNT + SW_VNUM +
    FL_RAMTEST + SCI_DAT' or 'PKT_TYPE + ENG_HSK_DAT + SEU_CNT + SW_VNUM +
    FL_RAMTEST + MM_DAT'"
DATA_TYPE        = "N/A"
ACCURACY         = "N/A"
PRECISION        = "N/A"
DATA_RATE        = "once / 14 seconds"
UNITS            = "N/A"

ENTRY_NAME       = "Packet type"
COMMENTS         = "Packet type identifier byte. Distinguishes
    Science Mode packets from Maintenance Mode packets. Science Mode = 0.
    Maintenance Mode = [1 = Status packet, 2 = memory dump, 3 = noise
    count]. Values 4 - 255 are reserved for future modes. Modes 0, 1, 2 are
    hard coded in the flight software. Mode 3 is the result of a code
    patch. The packet type value should be patched when a code patch occurs
    that affects that mode's packet content."
ALIAS            = "N/A"
AUTHOR           = "Blair, Jester"
ENTRY_TYPE       = "ELEMENT"
DATE_CREATED     = 12/11/90
DATE_MODIFIED    = 06/11/92
FIELD_NAME       = PKT_TYPE
FIELD_FORMAT     = "I*1"
ALLOW_BLANKS    = "N/A"
BINARY_VALUES    = "unsigned, 8 bit"
RANGE           = 0:255
DISCRETE_VALUES  = {0, 1, 2, ..., 255}
COMPOSITION      = PKT_TYPE
DATA_TYPE        = "INTEGER"
ACCURACY         = "N/A"
PRECISION        = "N/A"
DATA_RATE        = "once / 14 seconds"
UNITS            = "N/A"

ENTRY_NAME       = "Engineering/Housekeeping data"
COMMENTS         = "Analog monitor values; occur once per packet.
    Used for instrument health and welfare assessment."

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ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 03/06/91
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= ENG_HSK_DAT
FIELD_FORMAT	= N/A /* Formatted as follows */
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CM_TMP + CPU_TMP + PS_TMP + IO_TMP + AHS_TMP + DADE_TMP + LED_TMP + OSC_TMP + SD_TEMP + DB_TMP + LOPP__TMP + LOUT_TMP + IF_TMP + RST_TMP + EB_TMP + LB_TMP + P28V_MN + RV_MN + P12V_MN + P24V_MN + P5V_MN + N12V_MN + LTC_MN + N5V_MN + PSC_MN + HV_MON + N12VC_MN + P12VC_MN + N5VC_MN + P5VC_MN"
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"
ENTRY_NAME	= "Computer memory temperature"
COMMENTS	= "Mux A, Ch #2"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= CM_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= CM_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Computer CPU temperature"
COMMENTS	= "Mux A, Ch #1"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91

FIELD_NAME	= CPU_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= CPU_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Power Supply temperature"
COMMENTS	= "Mux A, Ch #4"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= PS_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= PS_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Computer I/O temperature"
COMMENTS	= "Mux A, Ch #3"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= IO_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= IO_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"

PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER array heat sink temperature"
COMMENTS	= "Mux A, Ch #6"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LARY_TEMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= AHS_TEMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER diode array drive electronics temperature"
COMMENTS	= "Mux A, Ch #5"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= DADE_TEMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LDRV_TEMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Optical Test Source (OTS) LED temperature"
COMMENTS	= Mux A, Ch #8
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"

DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LED_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LED_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "100 MHz Oscillator temperature"
COMMENTS	= Mux A, Ch #7
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= OSC_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= OSC_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Start detector temperature"
COMMENTS	= "Mux A, Ch #10"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= SD_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= SD_TMP

DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Outside Detector Box temperature"
COMMENTS	= Mux A, Ch #9
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= DH_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= DB_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER Radiator opposite output port temperature"
COMMENTS	= Mux A, Ch #11
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LOPP_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LOPP_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER Radiator output port temperature"
COMMENTS	= "Mux A, Ch #11"
ALIAS	= "N/A"

AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LOUT_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LOUT_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Interface Plate near Öhot footÖ temperature"
COMMENTS	= "Mux A, Ch #14"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= IF_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= IF_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Radiation sheet transition temperature"
COMMENTS	= "Mux A, Ch #13"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= HP_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255

DISCRETE_VALUES	= "N/A"
COMPOSITION	= RST_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Electronics Box top near S/C thermistor
temperature"	
COMMENTS	= "Mux A, Ch #16"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= EB_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= EB_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER Box near Öhot footÖ temperature"
COMMENTS	= "Mux A, Ch #15"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LB_TMP
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LB_TMP
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "28 Volt monitor"
COMMENTS	= "Mux B, Ch #2"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P28V_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P28V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Reference Voltage monitor"
COMMENTS	= "Mux B, Ch #1"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= RV_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= RV_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "+12 Volt voltage monitor"
COMMENTS	= "Mux B, Ch #4"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P12V_MN
FIELD_FORMAT	= "I*1"

ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P12V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "24 Volt voltage monitor"
COMMENTS	= "Mux B, Ch #3"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P24V_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P24V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "+5 Volt voltage monitor"
COMMENTS	= "Mux B, Ch #6"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P5V_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P5V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"

UNITS	= "COUNTS"
ENTRY_NAME	= "-12 Volt voltage monitor"
COMMENTS	= "Mux B, Ch #5"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= N12V_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= N12V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "LASER / thermal current monitor"
COMMENTS	= "Mux B, Ch #8"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LTC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= LTC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "-5 Volt voltage monitor"
COMMENTS	= "Mux B, Ch #7"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91

FIELD_NAME	= N5V_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= N5V_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Power Supply current monitor"
COMMENTS	= "Mux B, #10"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= PSC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= PSC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "High Voltage current monitor"
COMMENTS	= "Mux B, Ch #9"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= HV_MON
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= HV_MON
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"

PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "-12 Volt current monitor"
COMMENTS	= "Mux B, Ch #12"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= N12VC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= N12VC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "+12 Volt current monitor"
COMMENTS	= "Mux B, Ch #11"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P12VC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P12VC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "-5 Volt current monitor"
COMMENTS	= "Mux B, Ch #14"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"

DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= N5VC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= N5VC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "+5 Volt current monitor"
COMMENTS	= "Mux B, Ch #13"
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/10/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= P5VC_MN
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= P5VC_MN
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"
ENTRY_NAME	= "Current STATUS register value (SEU counter)"
COMMENTS	= "Value read from STATUS register at end of packet collection cycle. Read STATUS register and store lower 8 bits. MSnibble = SEU counter value"
ALIAS	= "STATUS register at end of packet collection cycle"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= SEU_CTR
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"

RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= SEU_CTR
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "Software Version Number (4.4 bit format)"
COMMENTS	= "4.4 bit format version number. Version number is hard coded in software and is stored in packet at the end of the packet collection cycle. Any software patches should include an update to this value. Current flight version is 7.6 therefore, 76h is hard coded in the Pack_it() routine of the Science Mode. Maintenance Mode version is 6.2 therefore 62h is coded."
ALIAS	= "N/A"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= SW_VER
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= SW_VER
DATA_TYPE	= "INTEGER"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Flag word (2 KB RAM block test)"
COMMENTS	= "RAM block test flag word. Memory test results. Bit representation of the results of the RAM write/read/verify block test performed after a CPU reset (HOT or COLD start). MSB (#15) represents the memory block from 7800h to 7FFFh; LSB (#0) from 0000h to 7FFh. 1 = error detected, 0 = block O.K. {jbb - A 0 represents a validated block, while a 0 (1?) means that the program encountered an invalid compare on at least one byte in that block area. B[0] is bits 15 - 8 of RAM test flag; B[1] is bits 7 - 0 of RAM test flag"
ALIAS	= "RAM block test flag word"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= RAMTEST

```

FIELD_FORMAT      = "I*2"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "16 bit, unsigned"
RANGE             = "0:65535"
DISCRETE_VALUES   = "N/A"
COMPOSITION       = "RAMTEST"
DATA_TYPE         = "INTEGER"
ACCURACY          = "UNK"
PRECISION         = "N/A"
DATA_RATE         = "once / 14 seconds"
UNITS             = "N/A"

```

```

NOTE              = "At this point the format and data elements in the two
                    modes differ."

```

```

ENTRY_NAME        = "Science Mode Data"
COMMENTS          = "The description of the Science Mode Data (SCI_DAT) is
                    included here. See the AEDR Maintenance Mode Data Dictionary for a
                    description of the Maintenance Mode telemetry data packets (MM_DAT)."
ALIAS             = "N/A"
AUTHOR            = "Jester"
ENTRY_TYPE        = "ELEMENT"
DATE_CREATED      = "09/28/91"
DATE_MODIFIED     = "09/28/91"
FIELD_NAME        = "SCI_DAT"
FIELD_FORMAT      = "N/A"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "N/A"
RANGE             = "N/A"
DISCRETE_VALUES   = "N/A"
COMPOSITION       = "ST_FLAGS + SW_VAL + RECCMD_CNT + CMDERR_CNT +
                    XMIT_TH + RT_STAT + R_GATE + HSTART_VAL + VALCMD_CNT + MEM_DUMP +
                    CMD_ECHO + PKT_VAL + FRM_SHOT_DATA"
DATA_TYPE         = "INTEGER"
ACCURACY          = "N/A"
PRECISION         = "N/A"
DATA_RATE         = "once / 14 seconds"
UNITS             = "N/A"

```

```

ENTRY_NAME        = "Status Flags (SFLAG1(16 bits),SFLAG2(16 bits))"
COMMENTS          = "Values of SFLAG1 and SFLAG2 stored at packet
                    completion. Each flag represents four 4 bit words. B[0] = byte 0; B[1]
                    = byte 1; B[2] = byte 2; B[3] = byte 3. SFLAG1 = (B[0] * 256) + B[1];
                    SFLAG2 = (B[2] * 256) + B[3]. The meanings of the individual bit
                    settings is in Appendix A of the Flight Software's User's Guide"
ALIAS             = "32 software status bits"
AUTHOR            = "Blair, Jester"
ENTRY_TYPE        = "ELEMENT"
DATE_CREATED      = "12/11/90"

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DATE_MODIFIED	= 06/11/92
FIELD_NAME	= "ST_FLG_1, ST_FLG_2"
FIELD_FORMAT	= "eight 4 bit values"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "32 bit, unsigned"
RANGE	= 0:4,294,967,295
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "ST_FLG_1, ST_FLG_2"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Software validity checksum"
COMMENTS	= "Checksum (end-around-carry, word adds) calculated using start address and length from Parameter Table. One word calculated using (CHKLEN/2)# of word end-around-carry additions start at word # (CHKSTART/2). Note : CHKLEN and CHKSTART exist in the parameter table and are BYTE length and BYTE address or offset. B[0] is MSByte and B[1] is LSByte of software validity checksum."
ALIAS	= "N/A"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= SW_CKSM
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bits, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= SW_CKSM
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Received command count (modulo 8 bits)"
COMMENTS	= "Number of commands received in the DMA buffer, i.e., number separated by CMD_START bits set, never cleared, init = 0. Number of CMD_START bits set in the commands received buffer. Only look at the number of commands received during that RTI interval. Count performed during RTI 4ms 'quiet time'. Counter starts at 0 from a HOT/COLD start, counts up and rolls over from 0FFh to 00h."
ALIAS	= "Number of commands received"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"

DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= REC_CMD
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= 8 bits, unsigned
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= REC_CMD
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "Command error count (modulo 8 bits)"
COMMENTS	= "Number of invalid MOLA specific commands received, never cleared, init = 0. Command errors counter works the same way as Received command count (see above), except, this counts the # of command errors, defined as TBD."
ALIAS	= "Number of command errors encountered"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= CMD_ERR
FIELD_FORMAT	= "I*1"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= CMD_ERR
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME	= "Transmitter threshold setting (XMITDA)"
COMMENTS	= "Value of XMITDA from Parameter table, stored at packet completion. LSB is equivalent to 1 mv. This byte reports the value of XMITDA from PARAM_TABLE. It is stored in the packet at the end of the packet collection cycle."
ALIAS	= "Transmitter start detector threshold setting"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= XMTR_TS

```

FIELD_FORMAT      = "I*1"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "8 bit, unsigned"
RANGE             = 0:255
DISCRETE_VALUES   = "N/A"
COMPOSITION       = XMTR_TS
DATA_TYPE         = "INTEGER"
ACCURACY          = "UNK"
PRECISION         = "UNK"
DATA_RATE         = "once / 14 seconds"
UNITS             = millivolts

ENTRY_NAME        = "Range Tracking Status"
COMMENTS          = "MSB = OTS_FIRE value, bits 7654321, 1 = TRACKING,
0 = ACQ. MSB (#7) is the LSB of OTS_FIRE from PARAM_TABLE, stored at
the end of the packet collection cycle. It is the value used to determine
the firing status of the OTS for the first shot of the packet cycle. Bits
6-0 represent frames 7-1 tracking status. 0 means that the software was
in acquisition mode for that frame, while 1 represents tracking mode."
ALIAS             = "Ranging status byte and OTS fire flag value"
AUTHOR           = "Blair, Jester"
ENTRY_TYPE        = "ELEMENT"
DATE_CREATED      = 12/11/90
DATE_MODIFIED     = 06/11/92
FIELD_NAME        = R_TRK_ST
FIELD_FORMAT      = "I*1"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "8 bit, unsigned"
RANGE             = 0:255
DISCRETE_VALUES   = "N/A"
COMPOSITION       = R_TRK_ST
DATA_TYPE         = "INTEGER"
ACCURACY          = "UNK"
PRECISION         = "N/A"
DATA_RATE         = "once / 14 seconds"
UNITS             = "N/A"

ENTRY_NAME        = "Range gate tracker array (73.728 km)"
COMMENTS          = "73.728 km, 48 HISTOGRAM bins starting at HSTART.
48 sequential bins of the ranging histogram, stored after the sixth
shot is collected, but before the ranging algorithm is executed on that
frame's data. HSTART, from PARAM_TABLE, with the LSB cleared is the
number of the first bin stored. Bins are represented as bytes, but they
are stored as words. Therefore, the bytes are swapped. HSTART
correction : HSTART = HSTART + 0xFFFE. The following denotes the range
of each bin for each data byte (B[x]). C = 1.536km.
B[ 0] : (HSTART + 1) * C; B[ 1] : (HSTART + 0) * C;
B[ 2] : (HSTART + 3) * C; B[ 3] : (HSTART + 2) * C;
B[ 4] : (HSTART + 5) * C; B[ 5] : (HSTART + 4) * C;

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B[ 6] : (HSTART + 7) * C; B[ 7] : (HSTART + 6) * C;
B[ 8] : (HSTART + 9) * C; B[ 9] : (HSTART + 8) * C;
B[10] : (HSTART + 11) * C; B[11] : (HSTART + 10) * C;
B[12] : (HSTART + 13) * C; B[13] : (HSTART + 12) * C;
B[14] : (HSTART + 15) * C; B[15] : (HSTART + 14) * C;
B[16] : (HSTART + 17) * C; B[17] : (HSTART + 16) * C;
B[18] : (HSTART + 19) * C; B[19] : (HSTART + 18) * C;
B[20] : (HSTART + 21) * C; B[21] : (HSTART + 20) * C;
B[22] : (HSTART + 23) * C; B[23] : (HSTART + 22) * C;
B[24] : (HSTART + 25) * C; B[25] : (HSTART + 24) * C;
B[26] : (HSTART + 27) * C; B[27] : (HSTART + 26) * C;
B[28] : (HSTART + 29) * C; B[29] : (HSTART + 28) * C;
B[30] : (HSTART + 31) * C; B[31] : (HSTART + 30) * C;
B[32] : (HSTART + 33) * C; B[33] : (HSTART + 32) * C;
B[34] : (HSTART + 35) * C; B[35] : (HSTART + 34) * C;
B[36] : (HSTART + 37) * C; B[37] : (HSTART + 36) * C;
B[38] : (HSTART + 39) * C; B[39] : (HSTART + 38) * C;
B[40] : (HSTART + 41) * C; B[41] : (HSTART + 40) * C;
B[42] : (HSTART + 43) * C; B[43] : (HSTART + 42) * C;
B[44] : (HSTART + 45) * C; B[45] : (HSTART + 44) * C;
B[46] : (HSTART + 47) * C; B[47] : (HSTART + 46) * C"

```

```

ALIAS           = "N/A"
AUTHOR          = "Jester"
ENTRY_TYPE     = "ELEMENT"
DATE_CREATED    = "12/11/90"
DATE_MODIFIED   = "08/20/91"
FIELD_NAME      = "R_BIN_HG"
FIELD_FORMAT    = "48 1 byte bins"
ALLOW_BLANKS    = "N/A"
BINARY_VALUES   = "384 bits, unsigned"
RANGE          = "0:255"
DISCRETE_VALUES = "N/A"
COMPOSITION     = "R_BIN_HG"
DATA_TYPE       = "INTEGER"
ACCURACY        = "UNK"
PRECISION       = "N/A"
DATA_RATE       = "once / 14 seconds"
UNITS           = "COUNTS"

```

```

ENTRY_NAME      = "HSTART value for HISTOGRAM dump"
COMMENTS        = "Value of HSTART from Parameter table, stored at
                  packet completion. Stored at the end of the packet collection cycle.
                  HSTART is used to store the Histogram dump bins on the previous frame
                  (2 seconds earlier). HSTART is right shifted one bit and used as a word
                  pointer, therefore, its LSB is cleared. B[0] = MSByte of HSTART; B[1] =
                  LSByte of HSTART"
ALIAS           = "N/A"
AUTHOR          = "Blair, Jester"
ENTRY_TYPE     = "ELEMENT"

```


DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= HSTART
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bits, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "HSTART"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME = "Valid commands received count (modulo 16 bits)"

COMMENTS = "Number of Time broadcast and Parameter update and channel on/off commands executed, never cleared, init. = 0. This is a 16 bit counter that starts at 0 after a CPU reset and rolls over from 0FFFFh to 0. Valid MOLA specific commands are defined as Channel ON/OFF commands and Parameter Update command (irregardless of parameter offset validity - invalid offsets are flagged and counted as Subcommand errors). All other MOLA specific commands are either flagged as errors or cause a mode change or CPU reset. B[0] = MSByte and B[1] = LSByte of valid cmd counter"

ALIAS	= "# valid MOLA specific commands"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= VAL_CMD
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= VAL_CMD
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "COUNTS"

ENTRY_NAME = "Memory dump segment"

COMMENTS = "16 bytes read from memory space starting at ((SEQUENCE & 0x3FFh)*16), dumps 0 - 3FFFh then starts again at 0. Using the lower 11 bits of the SEQUENCE count, stored in this packet, multiplied by 16 as the starting byte address, 8 words are read from RAM and stored in the packet. The following denotes the memory address

```

    at each data byte (B[x]). C = ((SEQUENCE & 0x3FFF) *16).
B[ 0] : C+ 1; B[ 1] : C+ 0; B[ 2] : C+ 3; B[ 3] : C+ 2;
B[ 4] : C+ 5; B[ 5] : C+ 4; B[ 6] : C+ 7; B[ 7] : C+ 6;
B[ 8] : C+ 9; B[ 9] : C+ 8; B[10] : C+11; B[11] : C+10;
B[12] : C+13; B[13] : C+12; B[14] : C+15; B[15] : C+14"
ALIAS                = "Ram dump portion"
AUTHOR               = "Blair, Jester"
ENTRY_TYPE           = "ELEMENT"
DATE_CREATED         = 12/11/90
DATE_MODIFIED        = 08/20/91
FIELD_NAME           = MEM_DUMP
FIELD_FORMAT         = "16 1 byte values"
ALLOW_BLANKS         = "N/A"
BINARY_VALUES        = "128 bits, unsigned"
RANGE                = 0:255
DISCRETE_VALUES       = "N/A"
COMPOSITION          = "MEM_DUMP"
DATA_TYPE            = "INTEGER"
ACCURACY             = "UNK"
PRECISION            = "N/A"
DATA_RATE            = "once / 14 seconds"
UNITS                = "N/A"

ENTRY_NAME           = "Command echo"
COMMENTS             = "First 8 command words received during current
    packet, only complete commands are stored, MOLA specific commands only.
    The software attempts to echo all valid commands. If the command will
    fit in the room remaining in the buffer, then it is stored and that
    much room is removed from that which remains in the echo buffer. If a
    command will not fit, then a buffer overflow is flagged, but subsequent
    commands that will fit are still stored in the buffer. B[0]: MSB of
    command word (CW) #1;B[1]: LSB of CW#1;B[2]: MSB of CW#2;B[3]: LSB of
    CW#2;B[4]: MSB of CW#3;B[5]: LSB of CW#3; B[6]: MSB of CW#4;B[7]: LSB
    of CW#4;B[8]: MSB of CW#5;B[9]: LSB of CW#5;B[10]: MSB of CW#6;B[11]:
    LSB of CW#6;B[12]: MSB of CW#7; B[13]: LSB of CW#7;B[14]: MSB of
    CW#8;B[15]: LSB of CW#8. NOTE: The command echo buffer is filled with
    zeros at the start of each packet."
ALIAS                = "Echo valid commands"
AUTHOR               = "Blair, Jester"
ENTRY_TYPE           = "ELEMENT"
DATE_CREATED         = 12/11/90
DATE_MODIFIED        = 08/20/91
FIELD_NAME           = CMD_ECHO
FIELD_FORMAT         = "8 I*2 words"
ALLOW_BLANKS         = "N/A"
BINARY_VALUES        = "128 bits, unsigned"
RANGE                = 0:65535
DISCRETE_VALUES       = "N/A"
COMPOSITION          = CMD_ECHO

```

DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Packet validity checksum"
COMMENTS	= "Simple 16 bit addition of entire packet contents upon completion. This location is zeroed for addition. This word is zeroed, then words 0-539 are added without carry to a variable that is initially zero. The resulting lower 16 bits are stored in this location. To verify, read, store, and clear this location. Then, word add without carry these 540 words and compare the lower 16 bits with the stored value."
ALIAS	= "N/A"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/11/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= PKT_CKSM
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65536
DISCRETE_VALUES	= "N/A"
COMPOSITION	= PKT_CKSM
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / 14 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Frame /Shot data"
COMMENTS	= "For each of 7 frames, the good laser data out of 20 laser shots per frame."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 08/20/91
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= FRM_SHOT_DATA
FIELD_FORMAT	= "N/A" /* Formatted as described below */
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "UNSIGNED"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "RANGING_CNT + CH_1_RE + CH_2_RE + LZ_XMT + MF_ID + TIU_URB + RC_MSK + AS_HCT + CH_1_TS + CH_2_TS + CH_3_TS + CH_4_TS + R_DELAY + R_WIDTH + AS_MHT + SWSTAT + CH_1_BC + CH_2_BC + CH_3_BC +

```

    CH_4_BC"
DATA_TYPE          = "INTEGER"
ACCURACY           = "N/A"
PRECISION          = "N/A"
DATA_RATE          = "once per two seconds"
UNITS              = "COUNTS"

ENTRY_NAME         = "Range to surface"
COMMENTS           = "The possible 20 valid frame laser shots surface
    ranging measurements in Timing Interval Unit (TIU) counts. The least
    significant 16 bits of TIU (LSTIU), stored for every shot. B[0] = Bits
    15 - 8 of TIU reading; B[1] = Bits 7 - 0 of TIU reading"
ALIAS              = "Lower 16 bits of TIU"
AUTHOR             = "Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "08/20/91"
FIELD_NAME         = "RANGING_CNT"
FIELD_FORMAT       = "20 I*2 words"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "16 bit, unsigned"
RANGE              = "0:65535"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "RANGING_CNT"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "10 shots per second"
UNITS              = "COUNTS"

ENTRY_NAME         = "1st channel received pulse energy"
COMMENTS           = "The level of return, reflected energy as received
    by the first channel and matched filter to trigger. This is a set of
    values for all possible 20 shots within the frame. Lowest numbered
    non-zero energy reading for each shot."
ALIAS              = "Return energy in first triggered channel, First
    channel to receive energy"
AUTHOR             = "Blair, Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "08/20/91"
FIELD_NAME         = "CH_1_RE"
FIELD_FORMAT       = "20 1 byte values"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "8 bit, unsigned"
RANGE              = "0:255"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "CH_1_RE"
DATA_TYPE          = "INTEGER"

```

ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "10 per second"
UNITS	= "COUNTS"

ENTRY_NAME	= "Channel Number / Pulse Width of Return Energy"
COMMENTS	= "The channel triggered by the return energy; bits 7,6 = channel number - 1. The pulse width of the returned shot; Bit 5 - 0."
ALIAS	= "Trigger channel"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 4/1/97
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= CHAN_PW
FIELD_FORMAT	= "20 1 byte values"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned, fixed point"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CHAN_PW"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "10 per second"
UNITS	= "COUNTS"

ENTRY_NAME	= "LASER transmitter power"
COMMENTS	= "Transmitted laser pulse energy level. This is a set of values for all 20 shots within the frame. Energy reading for LASER transmit power for each shot."
ALIAS	= "Laser transmit power, laser shot power level, Laser shot transmit power"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/12/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= LZ_XMT
FIELD_FORMAT	= "20 1 byte values"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8 bit, unsigned, fixed point"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "LZ_XMT"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "10 per second"
UNITS	= "Pulse height"

```

ENTRY_NAME          = "Encoder Bits"
COMMENTS            = "The start and stop encoder bits for each shot.
    Applied to range to surface counts to get a more precise range value. A
    set of 20 half-byte values, one for each laser shot. Each byte contains
    values for an odd and an even numbered shot. Per byte = Bit 7 - 6 -
    encoder stop bits for odd shots; Bit 5 - 4 - encoder start bits for odd
    shots; Bit 3 - 2 - encoder stop bits for even shots; Bit 1 - 0 - encoder
    start bits for even shots. Odd numbered SHOTs order - 3,1, 7, 5,11, 9,
    15, 13, 19, 17; Even numbered SHOTs order - 4, 2, 8, 6, 12, 10, 16, 14,
    20, 18"
ALIAS                = "Interpolator bits"
AUTHOR              = "Blair, Jester"
ENTRY_TYPE          = "ELEMENT"
DATE_CREATED        = 4/1/97
DATE_MODIFIED       = 4/1/97
FIELD_NAME          = ENC_BITS
FIELD_FORMAT        = "20 0.5 byte values"
ALLOW_BLANKS        = "N/A"
BINARY_VALUES       = "4-bit, unsigned, fixed-point"
RANGE               = 0:15
DISCRETE_VALUES     = "N/A"
COMPOSITION         = "ENC_BITS"
DATA_TYPE           = "INTEGER"
ACCURACY            = "N/A"
PRECISION           = "N/A"
DATA_RATE           = "10 per second"
UNITS               = "N/A"

ENTRY_NAME          = "TIU upper range bits"
COMMENTS            = "The upper 3 or 3 highest ordered bits of the MOLA
    time interval unit (TIU). Only the largest MSTIU value read in current
    frame is saved. Only bits 6, 5, 4 are used. With Receiver channel mask
    status (bits 3-0) below forms one byte. Will be either the values 3 or
    4."
ALIAS                = "Most significant portion of the range to surface
    measurement"
AUTHOR              = "Jester"
ENTRY_TYPE          = "ELEMENT"
DATE_CREATED        = 12/12/90
DATE_MODIFIED       = 09/24/91
FIELD_NAME          = TIU_URB
FIELD_FORMAT        = "7 0.5 byte values"
ALLOW_BLANKS        = "N/A"
BINARY_VALUES       = "4-bit, unsigned"
RANGE               = 0:7
DISCRETE_VALUES     = {3,4}
COMPOSITION         = "TIU_URB"
DATA_TYPE           = "INTEGER"
ACCURACY            = "UNK"

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PRECISION          = "UNK"
DATA_RATE          = "once per 2 seconds; 7 per packet"
UNITS              = "COUNTS"
ENTRY_NAME         = "Receiver channel mask status"
COMMENTS           = "The altimeter channel mask settings from the flight
                      parameter table at the time of acquisition and storage of the TIU upper
                      range bits. The mask indicates if the channel filter is active or is
                      masked out to prevent triggering the TIU. Least significant 4 bits of
                      ALTSET from Parameter table; stored at same time as largest MSTIU. The
                      value sent to ALTMOD in Altimeter Electronics. With TIU upper range bits
                      above forms one byte. Bit 3 = Channel 1; Bit 2 = Channel 2; Bit 1 =
                      Channel 3; Bit 0 = Channel 4. 1 = channel on, 0 = channel off"
ALIAS              = "ALTMOD; parameter table channels enabled,
                      Receiver channel mask status bits"
AUTHOR             = "Blair, Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "08/20/91"
FIELD_NAME         = "RC_MSK"
FIELD_FORMAT       = "7 0.5 bytes per packet"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "4-bit, unsigned"
RANGE              = "0:15"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "RC_MSK"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "once per 2 seconds"
UNITS              = "N/A"

ENTRY_NAME         = "Algorithm status (HIT_COUNT)"
COMMENTS           = "Current value from the active data frame showing
                      the number of hits counted in the possible 20 shot hits in the single
                      frame or the number of hits summed over the possible 100 shots when in
                      the 5 frame mode. This is an indicator of the performance of the
                      tracking algorithm. If in the acquisition mode, this field will contain
                      the number of shot hits from a possible 80 shots within the 4 frame
                      acquisition window. HIT_CNT from previous frame."
ALIAS              = "Tracking algorithm hit count status"
AUTHOR             = "Blair, Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "09/24/91"
FIELD_NAME         = "AS_HCT"
FIELD_FORMAT       = "7 1 byte values"
ALLOW_BLANKS      = "N/A"
BINARY_VALUES     = "8-bit, unsigned"
RANGE              = "0:20 or :80(tracking) or :80(acquisition)"

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```

DISCRETE_VALUES      = {0, 20, 80}
COMPOSITION          = "AS_HCT"
DATA_TYPE            = "INTEGER"
ACCURACY              = "UNK"
PRECISION             = "UNK"
DATA_RATE            = "once per 2 seconds"
UNITS                 = "COUNTS"

ENTRY_NAME           = "Channel half-frame threshold settings"
COMMENTS              = "The active channel threshold settings in the
    current frame. The settings of the 4 channel thresholds are sampled for
    the first 10 shots in the frame, and again for the final 10 frame
    shots. Value of CH(1,2,3,4) TH during a half-frame of current frame."
ALIAS                 = "Receiver threshold settings"
AUTHOR                = "Blair, Jester"
ENTRY_TYPE            = "ELEMENT"
DATE_CREATED          = 12/12/90
DATE_MODIFIED         = 08/20/91
FIELD_NAME            = "CH_1_TS,CH_2_TS,CH_3_TS,CH_4_TS"
FIELD_FORMAT          = "8 1 byte values per frame (56 per packet)"
ALLOW_BLANKS          = "N/A"
BINARY_VALUES         = "8-bit, fixed point, unsigned"
RANGE                 = 0:255
DISCRETE_VALUES        = "N/A"
COMPOSITION           = "CH_1_TS,CH_2_TS,CH_3_TS,CH_4_TS"
DATA_TYPE             = "INTEGER"
ACCURACY               = "UNK"
PRECISION              = "UNK"
DATA_RATE             = "Once per second (for each channel)"
UNITS                  = "UNK"

ENTRY_NAME           = "Range delay"
COMMENTS              = "Current frame range gate delay value (DELAY) as
    set from the previous data frame. B[0] : Bits 3 - 0 are bits 11 - 8 and
    B[1] : LSByte (bits 0-7) of the 12 bit Range Delay setting for this frame."
ALIAS                 = "range gate delay"
AUTHOR                = "Blair, Jester"
ENTRY_TYPE            = "ELEMENT"
DATE_CREATED          = 12/12/90
DATE_MODIFIED         = 08/20/91
FIELD_NAME            = "R_DELAY"
FIELD_FORMAT          = "I*2"
ALLOW_BLANKS          = "N/A"
BINARY_VALUES         = "16-bit, unsigned, fixed point"
RANGE                 = 0:65535
DISCRETE_VALUES        = "N/A"
COMPOSITION           = "R_DELAY"
DATA_TYPE             = "INTEGER"
ACCURACY               = "UNK"

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PRECISION          = "UNK"
DATA_RATE          = "once per 2 seconds"
UNITS              = "COUNTS"

ENTRY_NAME         = "Range width"
COMMENTS           = "Current frame range gate window or width; set at
    end of the previous data frame. B[0] : Bits 3 - 0 are bits 11 - 8 and
    B[1] : LSByte of the 12 bit Range Gate Window setting for this frame."
ALIAS              = "range gate width"
AUTHOR             = "Blair, Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "08/20/91"
FIELD_NAME         = "R_WIDTH"
FIELD_FORMAT       = "I*2"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "16-bit, unsigned, fixed-point"
RANGE              = "0:(2^12 - 1)"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "R_WIDTH"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "once per 2 seconds"
UNITS              = "COUNTS"

ENTRY_NAME         = "Algorithm status (MIN_HITS)"
COMMENTS           = "The minimum shot hit count value required for a
    matched filter channel to trigger; MIN_HITS value set in algorithm from
    the previous data frame."
ALIAS              = "minimum hit count"
AUTHOR             = "Blair, Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = "12/12/90"
DATE_MODIFIED      = "09/24/91"
FIELD_NAME         = "AS_MHT"
FIELD_FORMAT       = "I*1"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "8-bit, signed, fixed-point"
RANGE              = "{-32768:32767}"
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "AS_MHT"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "once per 2 seconds"
UNITS              = "COUNTS"

ENTRY_NAME         = "Software status (frame counter, trigger channel)"

```

COMMENTS = "Two of values reflecting the operation of the flight software tracking algorithm. The frame counter value and the first channel triggering at or above the minimum hit count are set from the previous data frame tracking algorithm operation. Frame counter (Frame_ctr) value from previous frame's tracking algorithm is in MS 4 bits; MIN_HITS trigger channel from previous frame is in LS 4 bits."

ALIAS = "N/A"
 AUTHOR = "Blair, Jester"
 ENTRY_TYPE = "GROUP"
 DATE_CREATED = 12/12/90
 DATE_MODIFIED = 09/24/91
 FIELD_NAME = SWSTAT
 FIELD_FORMAT = "I*1"
 ALLOW_BLANKS = "N/A"
 BINARY_VALUES = "8-bit, unsigned", fixed-point
 RANGE = 0:255
 DISCRETE_VALUES = "N/A"
 COMPOSITION = "FRM_CTR + SS_MHT"
 DATA_TYPE = "INTEGER"
 ACCURACY = "UNK"
 PRECISION = "UNK"
 DATA_RATE = "once per 2 seconds"
 UNITS = "N/A"

ENTRY_NAME = "Frame counter"
 COMMENTS = "The frame counter value is set from the previous data frame tracking algorithm operation. Frame counter (Frame_ctr) value from previous frame's tracking algorithm is in MS 4 bits (7 - 4) of Software status. Bits 7 - 4 are bits 3 - 0 of frame counter."

ALIAS = "N/A"
 AUTHOR = "Jester"
 ENTRY_TYPE = "ELEMENT"
 DATE_CREATED = 03/06/91
 DATE_MODIFIED = 09/24/91
 FIELD_NAME = FRM_CTR
 FIELD_FORMAT = "0.5 byte"
 ALLOW_BLANKS = "N/A"
 BINARY_VALUES = "4-bit, unsigned, fixed-point"
 RANGE = 0:15
 DISCRETE_VALUES = {1,2,3,4,5,6,7}
 COMPOSITION = "FRM_CTR"
 DATA_TYPE = "INTEGER"
 ACCURACY = "UNK"
 PRECISION = "UNK"
 DATA_RATE = "once per 2 seconds"
 UNITS = "COUNTS"

ENTRY_NAME = "Trigger channel"
 COMMENTS = "The first channel triggering at or above the

minimum hit count is set from the previous data frame tracking algorithm operation. MIN_HITS trigger channel from previous frame is in LS 4 bits (0 - 3) of Software status. Bit 0 = Channel 1; Bit 1 = Channel 2; Bit 2 = Channel 3; Bit 3 = Channel 4"

ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 03/0691
DATE_MODIFIED	= 09/24/91
FIELD_NAME	= SS_MHT
FIELD_FORMAT	= "0.5 byte"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "4-bit, unsigned, fixed-point"
RANGE	= 0:15
DISCRETE_VALUES	= {1,2,3,4}
COMPOSITION	= "SS_MHT"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per 2 seconds"
UNITS	= "N/A"

ENTRY_NAME	= "Channel background count"
COMMENTS	= "The background energy or noise count levels in channels 1, 2, 3, and 4 respectively by half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the end of a half-frame of current frame, 5.3 bit format. Plog base 2 of background count summed over 1st 10 shots / 2nd 10 shots of frame."
ALIAS	= "channel background noise levels, channel background power"
AUTHOR	= "Blair, Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/12/90
DATE_MODIFIED	= 08/20/91
FIELD_NAME	= CH_1_BC,CH_2_BC,CH_3_BC,CH_4_BC
FIELD_FORMAT	= "8 1 byte values"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "8-bit, unsigned, fixed-point"
RANGE	= 0:255
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CH_1_BC,CH_2_BC,CH_3_BC,CH_4_BC"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once per second (for each channel)"
UNITS	= "COUNTS"

REFERENCE	= "MOLA Data Packet Description"
REF_AUTHOR	= "James N. Caldwell"

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REF_DATE = "09/28/90"
REF_VERSION = "PRELIMINARY"

REFERENCE = "Experiment Data Record (EDR) MOLA Science
Telemetry Packet Spreadsheet"

REF_AUTHOR = "E. Thomas Northam"
REF_DATE = 01/16/91
REF_VERSION = 6.37

REFERENCE = "MOLA Packet Data Dictionary"

REF_AUTHOR = "J. Bryan Blair"
REF_DATE = 03/04/91
REF_VERSION = "UNK"

REFERENCE = "Mars Observer Spacecraft Data Standards"

REF_AUTHOR = "Kerry D. Erikson"
REF_DATE = 07/01/88
REF_VERSION = "Revision A"

REFERENCE = "MOLA Flight Software User's Guide"

REF_AUTHOR = "J. Bryan Blair"
REF_DATE = 04/10/91
REF_VERSION = "2.4"

Appendix B The AEDR Maintenance Mode Data Dictionary

Version 3.1, 06/11/92

Note: See Appendix A, the AEDR Science Mode Data Dictionary for the description of Maintenance Mode Data Elements that occur prior to those listed here. The definition of the data elements in all packet types is the same until this point.

ENTRY_NAME	= "Maintenance Mode Data"
COMMENTS	= "Describes the contents and format of the maintenance mode data. For maintenance mode status packets (packet type = 1), the contents of the record will be filler data starting at byte 214 to the end of the record. For maintenance mode memory dumps (packet type = 2), the entire record will be filled with valid data. For maintenance mode noise count data (packet type = 3), the entire record will be filled with valid data."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP"
DATE_CREATED	= 09/28/91
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= MM_DAT
FIELD_FORMAT	= "N/A"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "N/A"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "PARMUP_CC + MEMLOADS_CC + MEMDUMPS_CC + CMD_ERR + STAT_FLAG + SCMD_ERR + CMD_REC + CMD_ECHO + MSTART_ADD + MEMDUMP_LEN + MEMDUMP_SEG + P_CHECK"
DATA_TYPE	= "N/A"
ACCURACY	= "N/A"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "N/A"
ENTRY_NAME	= "Command count (parameter updates)"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= PARMUP_CC
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= PARMUP_CC

DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "counts"
ENTRY_NAME	= "Command count (memory loads)"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12 /17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= MEMLOADS_CC
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= MEMLOADS_CC
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "counts"
ENTRY_NAME	= "Command count (memory dumps)"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= MEMDUMPS_CC
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= MEMDUMPS_CC
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "count"
ENTRY_NAME	= "Command errors"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"

AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= CMD_ERR
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CMD_ERR"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "counts"
ENTRY_NAME	= "Status flags"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "GROUP?"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= STAT_FLAG
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "STAT_FLAG"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "UNK"
ENTRY_NAME	= "Sub-command errors"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= SCMD_ERR
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535

DISCRETE_VALUES	= "N/A"
COMPOSITION	= "SCMD_ERR"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "counts"
ENTRY_NAME	= "Commands received"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/18/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= CMD_REC
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CMD_REC"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "N/A"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "counts"
ENTRY_NAME	= "Command echo"
COMMENTS	= "Valid data for packet types 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= CMD_ECHO
FIELD_FORMAT	= "I*154"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "1232 bit, unsigned"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "CMD_ECHO"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "UNK"
ENTRY_NAME	= "Memory dump start address"


```

COMMENTS          = "Valid data for packet type 2. Filler data for packet
                    type 1. Noise count data for packet type 3."
ALIAS              = "N/A"
AUTHOR             = "Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = 12/17/90
DATE_MODIFIED      = 06/11/92
FIELD_NAME         = MSTART_ADD
FIELD_FORMAT       = "I*2"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "16 bit, unsigned"
RANGE              = 0:65535
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "MSTART_ADD"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "once / maintenance mode packet (14 secs.)"
UNITS              = "UNK"

ENTRY_NAME         = "Memory dump length"
COMMENTS          = "Valid data for packet type 2. Filler data for packet
                    type 1. Noise count data for packet type 3."
ALIAS              = "N/A"
AUTHOR             = "Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = 12/17/90
DATE_MODIFIED      = 06/11/92
FIELD_NAME         = MEMDUMP_LEN
FIELD_FORMAT       = "I*2"
ALLOW_BLANKS       = "N/A"
BINARY_VALUES      = "16 bit, unsigned"
RANGE              = 0:65535
DISCRETE_VALUES    = "N/A"
COMPOSITION        = "MEMDUMP_LEN"
DATA_TYPE          = "INTEGER"
ACCURACY           = "UNK"
PRECISION          = "UNK"
DATA_RATE          = "once / maintenance mode packet (14 secs.)"
UNITS              = "counts"

ENTRY_NAME         = "Memory dump segment"
COMMENTS          = "Valid data for packet type 2. Filler data for packet
                    type 1. Noise count data for packet type 3."
ALIAS              = "N/A"
AUTHOR             = "Jester"
ENTRY_TYPE         = "ELEMENT"
DATE_CREATED       = 12/17/90
DATE_MODIFIED      = 06/11/92

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FIELD_NAME	= MEMDUMP_SEG
FIELD_FORMAT	= "I*860"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "6880 bits, unsigned"
RANGE	= "N/A"
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "MEMDUMP_SEG"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "UNK"
ENTRY_NAME	= "Packet checksum"
COMMENTS	= "Valid data for packet type 1, 2, and 3."
ALIAS	= "N/A"
AUTHOR	= "Jester"
ENTRY_TYPE	= "ELEMENT"
DATE_CREATED	= 12/17/90
DATE_MODIFIED	= 06/11/92
FIELD_NAME	= P_CHECK
FIELD_FORMAT	= "I*2"
ALLOW_BLANKS	= "N/A"
BINARY_VALUES	= "16 bit, unsigned"
RANGE	= 0:65535
DISCRETE_VALUES	= "N/A"
COMPOSITION	= "P_CHECK"
DATA_TYPE	= "INTEGER"
ACCURACY	= "UNK"
PRECISION	= "UNK"
DATA_RATE	= "once / maintenance mode packet (14 secs.)"
UNITS	= "UNK"
REFERENCE	= "MOLA Data Packet Description"
REF_AUTHOR	= "James N. Caldwell"
REF_DATE	= "09/28/90"
REF_VERSION	= "PRELIMINARY"
REFERENCE	= "Experiment Data Record (EDR) MOLA Science Telemetry Packet Spreadsheet"
REF_AUTHOR	= "E. Thomas Northam"
REF_DATE	= 01/16/91
REF_VERSION	= "6.37"
REFERENCE	= "MOLA Packet Data Dictionary"
REF_AUTHOR	= "J. Bryan Blair"
REF_DATE	= 03/04/91
REF_VERSION	= "UNK"

MOLA AEDR Software Interface Specification

REFERENCE	= "Mars Observer Spacecraft Data Standards"
REF_AUTHOR	= "Kerry D. Erikson"
REF_DATE	= 07/01/88
REF_VERSION	= "Revision A"

Appendix C

C.1 MOLA AEDR Data Product SFDU Labels and Catalog Header

```

CCSD3ZF00001000000001NJPL3KS0PDSX$$INFO$$
PDS_VERSION_ID      = PDS3
RECORD_TYPE         = FIXED_LENGTH
FILE_RECORDS        = UNK
RECORD_BYTES        = 1230
LABEL_RECORDS       = 4
FILE_NAME           = "AA00003F.B"
^MOLA_SCIENCE_MODE_TABLE = 5
^MOLA_MAINTENANCE_MODE_TABLE = 5
DATA_SET_ID         = 'MGS-M-MOLA-1-AEDR-L0-V1.0'
PRODUCT_ID          = 'MOLA-AA00003F.B'
SPACECRAFT_NAME     = 'MARS_GLOBAL_SURVEYOR'
INSTRUMENT_ID       = 'MOLA'
INSTRUMENT_NAME     = 'MARS_ORBITER_LASER_ALTIMETER'
TARGET_NAME         = 'MARS'
SOFTWARE_NAME       = 'BROWSER 17.1'
UPLOAD_ID           = '7.6'
PRODUCT_RELEASE_DATE = 1997-258
START_TIME          = 1997-212T19:10:00.000
STOP_TIME           = 1997-212T19:45:00.000
SPACECRAFT_CLOCK_START_COUNT = 443588190.140
SPACECRAFT_CLOCK_STOP_COUNT = 443595246.140
PRODUCT_CREATION_TIME = 1997-258T22:45:00.000
NATIVE_START_TIME   = -187606958.86449
NATIVE_STOP_TIME    = -187599902.86499
MISSION_PHASE_NAME  = 'ORBIT INSERTION'
ORBIT_NUMBER        = 00003
PRODUCER_ID         = 'MGS_MOLA_TEAM'
PRODUCER_FULL_NAME  = 'DAVID E. SMITH'
PRODUCER_INSTITUTION_NAME = 'GODDARD SPACE FLIGHT CENTER'
DESCRIPTION          = "This data product contains the aggregation of
  MOLA telemetry packets by orbit. All Experiment Data Record packets
  retrieved from the PDB are collected in this data product. The AEDR
  data product is put together with the Project-provided software tool
  Browser."

OBJECT              = MOLA_SCIENCE_MODE_TABLE
INTERCHANGE_FORMAT  = BINARY
ROWS               = 'UNK'
COLUMNS           = 801
ROW_BYTES          = 1080
^STRUCTURE         = "MOLASCI.FMT"
DESCRIPTION        = "This table is one of two that describe the
  arrangement of information on the Mars Orbiter Laser Altimeter (MOLA)

```

Aggregated Engineering Data Record (AEDR). These Experiment Data Records (EDRs) are produced during the science and maintenance modes of instrument operation. Consequently, there are two record formats possible within the AEDR file. The MOLA_SCIENCE_MODE_TABLE describes the format of the data taken in the Science mode. The MOLA_MAINTENANCE_MODE_TABLE describes the format of the data taken in the Maintenance mode. The data are written sequentially. Each record will contain one packet of MOLA telemetry data. Each record contains an indicator of its packet type (e.g. science, maintenance, memory dump) in byte 11 of the file. It is by interpreting this indicator that the user will know which table to apply to the data. For fuller description of the values associated with this indicator, please see the column labeled PACKET_TYPE, associated with this table. The number of columns indicated above in the table definitions refers to the number of column objects described in this label. The number of actual columns in the entire data record, when each set of descriptors is multiplied by each of the seven frames, is 790."

END_OBJECT = MOLA_SCIENCE_MODE_TABLE

OBJECT = MOLA_MAINTENANCE_MODE_TABLE

INTERCHANGE_FORMAT = BINARY

ROWS = 'UNK'

COLUMNS = 52

ROW_BYTES = 1080

^STRUCTURE = "MOLAMNT.FMT"

DESCRIPTION = "This table is one of two that describe the arrangement of information on the Mars Orbiter Laser Altimeter (MOLA) Aggregated Engineering Data Record (AEDR). These Experiment Data Records (EDRs) are produced during the science and maintenance modes of instrument operation. Consequently, there are two record formats possible within the AEDR file. The MOLA_SCIENCE_MODE_TABLE describes the format of the data taken in the Science mode. The MOLA_MAINTENANCE_MODE_TABLE describes the format of the data taken in the Maintenance mode. The data are written sequentially. Each record will contain one packet of MOLA telemetry data. Each record contains an indicator of its packet type (e.g. science, maintenance, memory dump) in byte 11 of the file. It is by interpreting this indicator that the user will know which table to apply to the data. For fuller description of the values associated with this indicator, please see the column labeled PACKET_TYPE, associated with this table."

END_OBJECT = MOLA_MAINTENANCE_MODE_TABLE

END

CCSD\$\$MARKER\$\$INFO\$\$NJPL3IF00000000000001

C.2 Contents of the MOLASCI.FMT File

```

OBJECT          = COLUMN
NAME            = PACKET_CHDO
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 1
BYTES           = 150
MINIMUM         = "N/A"
MAXIMUM         = "N/A"
DESCRIPTION      = "Packet_chdo is the compressed header data object
                    attached to the MOLA telemetry packet by TIS."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = PACKET_ID
DATA_TYPE       = MSB_BIT_STRING
START_BYTE      = 151
BYTES           = 2
DESCRIPTION      = "Packet_id constitutes one of three parts in the
                    primary source information header applied by the Payload Data System
                    (PDS) to the MOLA telemetry packet at the time of creation of the packet
                    prior to transfer frame creation."

OBJECT          = BIT_COLUMN
NAME            = VERSION_NUMBER
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 1
BITS            = 3
MINIMUM         = 0
MAXIMUM         = 0
DESCRIPTION      = "These bits identify Version 1 as the Source Packet
                    structure. These bits shall be set to '000'."
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = SPARE
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 4
BITS            = 1
MINIMUM         = 0
MAXIMUM         = 0
DESCRIPTION      = "Reserved spare. This bit shall be set to '0'"
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = FLAG
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 5

```

```

BITS                = 1
MINIMUM             = 0
MAXIMUM             = 0
DESCRIPTION         = "This flag signals the presence or absence of a
                        Secondary Header data structure within the Source Packet. This bit shall
                        be set to '0' since no Secondary Header formatting standards currently
                        exist for Mars Global Surveyor."
END_OBJECT          = BIT_COLUMN

OBJECT              = BIT_COLUMN
NAME                = ERROR_STATUS
BIT_DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BIT           = 6
BITS                = 3
MINIMUM             = 0
MAXIMUM             = 7
DESCRIPTION         = "This field identifies in part the individual
                        application process within the spacecraft that created the Source Packet
                        data."
END_OBJECT          = BIT_COLUMN

OBJECT              = BIT_COLUMN
NAME                = INSTRUMENT_ID
BIT_DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BIT           = 9
BITS                = 8
MINIMUM             = 35
MAXIMUM             = 35
DESCRIPTION         = "This field identifies in part the individual
                        application process within the spacecraft that created the Source Packet
                        data. 00100011 is the bit pattern for MOLA."
END_OBJECT          = BIT_COLUMN
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = SEQUENCE_CONTROL
DATA_TYPE           = MSB_BIT_STRING
START_BYTE          = 153
BYTES               = 2
DESCRIPTION         = "Sequence_control constitutes one of three parts in the
                        primary source information header applied by the Payload Data System
                        (PDS) to the MOLA telemetry packet at the time of creation of the packet
                        prior to transfer frame creation."

OBJECT              = BIT_COLUMN
NAME                = SEGMENTATION_FLAG
BIT_DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BIT           = 1
BITS                = 2

```

```

MINIMUM          = 3
MAXIMUM          = 3
DESCRIPTION      = "For Mars Global Surveyor segmentation shall not occur.
    These bits shall be set to '11'."
END_OBJECT       = BIT_COLUMN

OBJECT           = BIT_COLUMN
NAME             = SEQUENCE_COUNT
BIT_DATA_TYPE    = MSB_UNSIGNED_INTEGER
START_BIT        = 3
BITS             = 14
MINIMUM          = 0
MAXIMUM          = 16383
DESCRIPTION      = "This field contains a straight sequential count
    (modulo 16384) of each packet generated by the MOLA application process
    on the spacecraft. The purpose of the field is to order this packet with
    respect to other packets from the same application process. The OTS
    counter is contained in the lower 4 bits."
END_OBJECT       = BIT_COLUMN
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = PACKET_LENGTH
DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BYTE       = 155
BYTES            = 2
MINIMUM          = 0
MAXIMUM          = 65535
DESCRIPTION      = "Packet_length constitutes one of three parts in the
    primary source information header applied by the Payload Data System
    (PDS) to the MOLA telemetry packet at the time of creation of the packet
    prior to transfer frame creation. This field contains a sequential 16-bit
    binary count 'C' of the length (in octets) of the data area structure
    that is enclosed between the first bit of the Secondary Header and the
    last bit of the packet (i.e., the last bit of the Source Data field). C =
    ((no. of octets) - 1)."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = COARSE_TIME
DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BYTE       = 157
BYTES            = 4
MINIMUM          = 0
MAXIMUM          = 4294967295
DESCRIPTION      = "The MOLA system time is created from the 2 time words
    input from the PDS time broadcast command. The MOLA time is updated 7/8
    of a second after reception of the time broadcast command and 6/8 of a
    second after interpreting the time broadcast with S/C + 1 second to

```



```

        arrive at the correct time. B[0] is S/C time in seconds * 2**24; B[1] is
        S/C time in seconds * 2**16; B[2] is S/C time in seconds * 2**8; B[3] is
        S/C time in seconds."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = FINE_TIME
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 161
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Fine_time is the high-resolution timer reading taken
                        during interrupt handling routine triggered by the trailing edge of the
                        first 10 Hz interrupt encountered during this packet."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PACKET_TYPE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 162
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Packet type identifier byte. Distinguishes Science
                        Mode packets from Maintenance Mode packets. Science Mode = 0; Maintenance
                        Mode = [1 = Status packet, 2 = memory dump, 3 = noise count data]. Values
                        4 - 255 are reserved for future modes. Modes 0, 1, 2 are hard coded in
                        the flight software. Mode 3 is patched in when the noise count patch is
                        uploaded to the spacecraft. The packet type value should be patched when
                        a code patch occurs that affects that mode's packet content."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = COMPUTER_MEMORY_TEMPERATURE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 163
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux A, Ch #2"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = COMPUTER_CPU_TEMPERATURE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 164
BYTES               = 1
MINIMUM             = 0

```

MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #1"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= POWER_SUPPLY_TEMPERATURE
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 165
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #4"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= 'COMPUTER_I/O_TEMPERATURE'
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 166
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #3"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LASER_ARRAY_HEAT_SINK_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 167
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #6"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= DIODE_ARRAY_DRIVE_ELECS_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 168
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #5"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= OPTICAL_TEST_SOURCE_LED_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 169
BYTES	= 1

MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #8"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= HUNDRED_MHZ_OSCILLATOR_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 170
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #7"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= START_DETECTOR_TEMPERATURE
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 171
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #10"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= OUTSIDE_DETECTOR_BOX_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 172
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #9"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LASR_RADIATR_OPP_OPT_PORT_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 173
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #11"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LSR_RADIATOR_OUTPUT_PORT_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 174

```

BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #11"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = INTERFACE_PLATE_HOT_FOOT_TEMP
DATA_TYPE      = UNSIGNED_INTEGER
START_BYTE     = 175
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #14"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = RADIATION_SHEET_TRNSITION_TEMP
DATA_TYPE      = UNSIGNED_INTEGER
START_BYTE     = 176
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #13"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = ELECTRONICS_BOX_TOP_SC_THRMSTR
DATA_TYPE      = UNSIGNED_INTEGER
START_BYTE     = 177
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #16"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = LASER_BOX_HOT_FOOT_TEMP
DATA_TYPE      = UNSIGNED_INTEGER
START_BYTE     = 178
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #15"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = PLUS_28_VOLT_VOLTAGE_MONITOR
DATA_TYPE      = UNSIGNED_INTEGER

```

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```

START_BYTE      = 179
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #2"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = REFERENCE_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 180
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux B, Ch #1"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_12_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 181
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux B, Ch #4"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_24_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 182
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux B, Ch #3"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_5_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 183
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux B, Ch #6"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = MINUS_12_VOLT_VOLTAGE_MONITOR

```

```

DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 184
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #5"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = LASER_THERMAL_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 185
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #8"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = MINUS_5_VOLT_VOLTAGE_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 186
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #7"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = POWER_SUPPLY_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 187
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #10"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = HIGH_VOLTAGE_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 188
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #9"
END_OBJECT         = COLUMN

OBJECT             = COLUMN

```

```

NAME                = MINUS_12_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 189
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux B, Ch #12"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PLUS_12_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 190
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux B, Ch #11"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = MINUS_5_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 191
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux B, Ch #14"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PLUS_5_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 192
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux B, Ch #13"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = CURRENT_STATUS_REGISTER_VALUE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 193
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Value read from STATUS register at end of packet
                        collection cycle. Read STATUS register and store lower 8 bits. MSnibble =
                        SEU counter value"

```

```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = SOFTWARE_VERSION_NUMBER
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 194
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "4.4 bit format version number. Version number is hard
                        coded in software and is stored in packet at the end of the packet
                        collection cycle. Any software patches should include an update to this
                        value. Current flight version is 5.3 therefore, 53h is hard coded in the
                        Pack_it() routine of the Science Mode. Maintenance Mode version is 6.2
                        therefore 62h is coded."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = FLAG_WORD
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 195
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "RAM block test flag word. Memory test results. Bit
                        representation of the results of the RAM write/read/verify block test
                        performed after a CPU reset (HOT or COLD start). MSB (#15) represents the
                        memory block from 7800h to 7FFFh; LSB (#0) from 0000h to 7FFh. 1 = error
                        detected, 0 = block O.K. 0 represents a validated block, while a 1 means
                        that the program encountered an invalid compare on at least one byte in
                        that block area. B[0] is bits 15 - 8 of RAM test flag; B[1] is bits 7 - 0
                        of RAM test flag"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = STATUS_FLAGS
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 197
BYTES               = 4
ITEMS               = 2
ITEM_BYTES          = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "Values of SFLAG1 and SFLAG2 stored at packet
                        completion. Each flag represents four 4 bit words. B[0] = byte 0; B[1] =
                        byte 1; B[2] = byte 2; B[3] = byte 3. SFLAG1 = (B[0] * 256) + B[1];
                        SFLAG2 = (B[2] * 256) + B[3]. The meanings of the individual bit settings
                        are in Appendix A of the MOLA Flight Software Users' Guide."
END_OBJECT          = COLUMN

```



```

OBJECT          = COLUMN
NAME            = SOFTWARE_VALIDITY_CHECKSUM
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 201
BYTES           = 2
MINIMUM         = 0
MAXIMUM         = 65535
DESCRIPTION      = "Checksum (end-around-carry, word adds) calculated
                    using start address and length from Parameter Table. One word calculated
                    using (CHKLEN/2)# of word end-around-carry additions start at word #
                    (CHKSTART/2). Note : CHKLEN and CHKSTART exist in the parameter table and
                    are BYTE length and BYTE address or offset. B[0] is MSByte and B[1] is
                    LSByte of software validity checksum."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = RECEIVED_COMMAND_COUNT
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 203
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION      = "Number of commands received in the DMA buffer, i.e.,
                    number separated by CMD_START bits set, never cleared, init = 0. Number
                    of CMD_START bits set in the commands received buffer. Only look at the
                    number of commands received during that RTI interval. Count performed
                    during RTI 4ms 'quiet time'. Counter starts at 0 from a HOT/COLD start,
                    counts up and rolls over from 0FFh to 00h."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = COMMAND_ERROR_COUNT
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 204
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION      = "Number of invalid MOLA specific commands received,
                    never cleared, init = 0. Command errors counter works the same way as
                    Received command count (see above), except, this counts the # of command
                    errors, defined as TBD."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = TRANSMITTER_THRESHOLD_SETTING
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 205
BYTES           = 1

```

```

MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "Value of XMITDA from Parameter table, stored at packet
                    completion. LSB is equivalent to 1 mv. This byte reports the value of
                    XMITDA from PARAM_TABLE. It is stored in the packet at the end of the
                    packet collection cycle."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = RANGE_TRACKING_STATUS
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 206
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "MSB = OTS_FIRE value, bits 7654321, 1 = TRACKING, 0 =
                    ACQ. MSB (#7) is the LSB of OTS_FIRE from PARAM_TABLE, stored at the end
                    of the packet collection cycle. It is the value used to determine the
                    firing status of the OTS for the first shot of the packet cycle. Bits 6-0
                    represent frames 7-1 tracking status. 0 means that the software was in
                    acquisition mode for that frame, while 1 represents tracking mode."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = RANGE_GATE_TRACKER_ARRAY
DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BYTE       = 207
BYTES            = 48
ITEMS            = 24
ITEM_BYTES       = 2
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "73.728 km, 48 HISTOGRAM bins starting at HSTART. 48
                    sequential bins of the ranging histogram, stored after the sixth shot is
                    collected, but before the ranging algorithm is executed on that frame's
                    data. HSTART, from PARAM_TABLE, with the LSB cleared is the number of the
                    first bin stored. Bins are represented as bytes, but they are stored as
                    words. Therefore, the bytes are swapped. HSTART correction : HSTART =
                    HSTART + 0xFFFE. The following denotes the range of each bin for each
                    data byte (B[x]). C = 1.536km.
                    B[0] : (HSTART + 1) * C; B[1] : (HSTART + 0) * C;
                    B[2] : (HSTART + 3) * C; B[3] : (HSTART + 2) * C;
                    B[4] : (HSTART + 5) * C; B[5] : (HSTART + 4) * C;
                    B[6] : (HSTART + 7) * C; B[7] : (HSTART + 6) * C;
                    B[8] : (HSTART + 9) * C; B[9] : (HSTART + 8) * C;
                    B[10] : (HSTART + 11) * C; B[11] : (HSTART + 10) * C;
                    B[12] : (HSTART + 13) * C; B[13] : (HSTART + 12) * C;
                    B[14] : (HSTART + 15) * C; B[15] : (HSTART + 14) * C;
                    B[16] : (HSTART + 17) * C; B[17] : (HSTART + 16) * C;

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```

B[18] : (HSTART + 19) * C; B[19] : (HSTART + 18) * C;
B[20] : (HSTART + 21) * C; B[21] : (HSTART + 20) * C;
B[22] : (HSTART + 23) * C; B[23] : (HSTART + 22) * C;
B[24] : (HSTART + 25) * C; B[25] : (HSTART + 24) * C;
B[26] : (HSTART + 27) * C; B[27] : (HSTART + 26) * C;
B[28] : (HSTART + 29) * C; B[29] : (HSTART + 28) * C;
B[30] : (HSTART + 31) * C; B[31] : (HSTART + 30) * C;
B[32] : (HSTART + 33) * C; B[33] : (HSTART + 32) * C;
B[34] : (HSTART + 35) * C; B[35] : (HSTART + 34) * C;
B[36] : (HSTART + 37) * C; B[37] : (HSTART + 36) * C;
B[38] : (HSTART + 39) * C; B[39] : (HSTART + 38) * C;
B[40] : (HSTART + 41) * C; B[41] : (HSTART + 40) * C;
B[42] : (HSTART + 43) * C; B[43] : (HSTART + 42) * C;
B[44] : (HSTART + 45) * C; B[45] : (HSTART + 44) * C;
B[46] : (HSTART + 47) * C; B[47] : (HSTART + 46) * C"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = HSTART_VALUE_HISTOGRAM_DUMP
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 255
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "Value of HSTART from Parameter table, stored at packet
                        completion. Stored at the end of the packet collection cycle. HSTART is
                        used to store the Histogram dump bins on the previous frame (2 seconds
                        earlier). HSTART is right shifted one bit and used as a word pointer,
                        therefore, its LSB is cleared. B[0] = MSByte of HSTART; B[1] = LSByte of
                        HSTART"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = VALID_COMMANDS_RECEIVED_COUNT
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 257
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "Number of Time broadcast and Parameter update and
                        channel on/off commands executed, never cleared, init. = 0. This is a 16
                        bit counter that starts at 0 after a CPU reset and rolls over from 0FFFFh
                        to 0. Valid MOLA specific commands are defined as Channel ON/OFF commands
                        and Parameter Update command (irregardless of parameter offset validity -
                        invalid offsets are flagged and counted as Subcommand errors). All other
                        MOLA specific commands are either flagged as errors or cause a mode
                        change or CPU reset. B[0] = MSByte and B[1] = LSByte of valid cmd
                        counter"
END_OBJECT          = COLUMN

```

```

OBJECT                = COLUMN
NAME                  = MEMORY_DUMP_SEGMENT
DATA_TYPE             = MSB_UNSIGNED_INTEGER
START_BYTE           = 259
BYTES                 = 16
ITEMS                 = 8
ITEM_BYTES            = 2
MINIMUM               = 0
MAXIMUM               = 65535
DESCRIPTION           = "16 bytes read from memory space starting at ((SEQUENCE
    & 0x3FFh)*16), dumps 0 - 3FFFh then starts again at 0. Using the lower 11
    bits of the SEQUENCE count, stored in this packet, multiplied by 16 as
    the starting byte address, 8 words are read from RAM and stored in the
    packet. The following denotes the memory address at each data byte
    (B[x]). C = ((SEQUENCE & 0x3FFF) *16).
    B[ 0] : C + 1; B[ 1] : C + 0; B[ 2] : C + 3; B[ 3] : C + 2;
    B[ 4] : C + 5; B[ 5] : C + 4; B[ 6] : C + 7; B[ 7] : C + 6;
    B[ 8] : C + 9; B[ 9] : C + 8; B[10] : C + 11; B[11] : C + 10;
    B[12] : C + 13; B[13] : C + 12; B[14] : C + 15; B[15] : C + 14"
END_OBJECT            = COLUMN

OBJECT                = COLUMN
NAME                  = COMMAND_ECHO
DATA_TYPE             = MSB_UNSIGNED_INTEGER
START_BYTE           = 275
BYTES                 = 16
ITEMS                 = 8
ITEM_BYTES            = 2
MINIMUM               = 0
MAXIMUM               = 65535
DESCRIPTION           = "First 8 command words received during current packet,
    only complete commands are stored, MOLA specific commands only. The
    software attempts to echo all valid commands. If the command will fit in
    the room remaining in the buffer, then it is stored and that much room is
    removed from that which remains in the echo buffer. If a command will not
    fit, then a buffer overflow is flagged, but subsequent commands that will
    fit are still stored in the buffer.
    B[ 0] : MSB of command word (CW) #1;
    B[ 1] : LSB of CW#1; B[ 2] : MSB of CW#2; B[ 3] : LSB of CW#2;
    B[ 4] : MSB of CW#3; B[ 5] : LSB of CW#3; B[ 6] : MSB of CW#4;
    B[ 7] : LSB of CW#4; B[ 8] : MSB of CW#5; B[ 9] : LSB of CW#5;
    B[10] : MSB of CW#6; B[11] : LSB of CW#6; B[12] : MSB of CW#7;
    B[13] : LSB of CW#7; B[14] : MSB of CW#8; B[15] : LSB of CW#8.
    NOTE: The command echo buffer is filled with zeros at the start of each
    packet."
END_OBJECT            = COLUMN

OBJECT                = COLUMN

```

```

NAME                = PACKET_VALIDITY_CHECKSUM
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 291
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "Simple 16 bit addition of entire packet contents upon
                        completion. This location is zeroed for addition. This word is zeroed,
                        then words 0-539 are added without carry to a variable that is initially
                        zero. The resulting lower 16 bits are stored in this location. To verify,
                        read, store, and clear this location. Then, word add without carry these
                        540 words and compare the lower 16 bits with the stored value."
END_OBJECT          = COLUMN

OBJECT              = CONTAINER
NAME                = FRAME_STRUCTURE
^STRUCTURE          = "MOLASCFR.FMT"
START_BYTE          = 293
BYTES               = 134
REPETITIONS         = 7
DESCRIPTION          = "The MOLA data described on a per frame basis; there
                        are 7 frames in a packet; 20 laser shots per frame."
END_OBJECT          = CONTAINER

```

C.3 Contents of the MOLAMNT.FMT File

```

OBJECT          = COLUMN
NAME            = PACKET_CHDO
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE     = 1
BYTES          = 150
MINIMUM        = "N/A"
MAXIMUM        = "N/A"
DESCRIPTION     = "Packet_chdo is the compressed header data object
                  attached to the MOLA telemetry packet by TIS."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = PACKET_ID
DATA_TYPE       = LSB_BIT_STRING
START_BYTE     = 151
BYTES          = 2
DESCRIPTION     = "Packet_id constitutes one of three parts in the
                  primary source information header applied by the Payload Data System
                  (PDS) to the MOLA telemetry packet at the time of creation of the packet
                  prior to transfer frame creation."

OBJECT          = BIT_COLUMN
NAME            = VERSION_NUMBER
BIT_DATA_TYPE   = UNSIGNED_INTEGER
START_BIT      = 1
BITS           = 3
MINIMUM        = 0
MAXIMUM        = 7
DESCRIPTION     = "These bits identify Version 1 as the Source Packet
                  structure. These bits shall be set to '000'."
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = SPARE
BIT_DATA_TYPE   = UNSIGNED_INTEGER
START_BIT      = 4
BITS           = 1
MINIMUM        = 0
MAXIMUM        = 0
DESCRIPTION     = "Reserved spare. This bit shall be set to '0'"
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = FLAG
BIT_DATA_TYPE   = UNSIGNED_INTEGER
START_BIT      = 5

```

```

BITS                = 1
MINIMUM             = 0
MAXIMUM             = 0
DESCRIPTION         = "This flag signals the presence or absence of a
                        Secondary Header data structure within the Source Packet. This bit shall
                        be set to '0' since no Secondary Header formatting standards currently
                        exist for Mars Global Surveyor."
END_OBJECT          = BIT_COLUMN

OBJECT              = BIT_COLUMN
NAME                = ERROR_STATUS
BIT_DATA_TYPE       = UNSIGNED_INTEGER
START_BIT           = 6
BITS                = 3
MINIMUM             = 0
MAXIMUM             = 7
DESCRIPTION         = "This field identifies in part the individual
                        application process within the spacecraft that created the Source Packet
                        data."
END_OBJECT          = BIT_COLUMN

OBJECT              = BIT_COLUMN
NAME                = INSTRUMENT_ID
BIT_DATA_TYPE       = UNSIGNED_INTEGER
START_BIT           = 9
BITS                = 8
MINIMUM             = 35
MAXIMUM             = 35
DESCRIPTION         = "This field identifies in part the individual
                        application process within the spacecraft that created the Source Packet
                        data. 00100011 is the bit pattern for MOLA."
END_OBJECT          = BIT_COLUMN
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = SEQUENCE_CONTROL
DATA_TYPE           = LSB_BIT_STRING
START_BYTE          = 153
BYTES               = 2
DESCRIPTION         = "Sequence_control constitutes one of three parts in the
                        primary source information header applied by the Payload Data System
                        (PDS) to the MOLA telemetry packet at the time of creation of the packet
                        prior to transfer frame creation."

OBJECT              = BIT_COLUMN
NAME                = SEGMENTATION_FLAG
BIT_DATA_TYPE       = UNSIGNED_INTEGER
START_BIT           = 1
BITS                = 2

```

```

MINIMUM          = 3
MAXIMUM          = 3
DESCRIPTION      = "For Mars Global Surveyor segmentation shall not occur.
    These bits shall be set to '11'."
END_OBJECT       = BIT_COLUMN

OBJECT           = BIT_COLUMN
NAME            = SEQUENCE_COUNT
BIT_DATA_TYPE   = UNSIGNED_INTEGER
START_BIT       = 3
BITS            = 14
MINIMUM         = 0
MAXIMUM         = 16383
DESCRIPTION     = "This field contains a straight sequential count
    (modulo 16384) of each packet generated by the MOLA application process
    on the spacecraft. The purpose of the field is to order this packet with
    respect to other packets from the same application process. -- The OTS
    counter -- ."
END_OBJECT       = BIT_COLUMN
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME            = PACKET_LENGTH
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 155
BYTES           = 2
MINIMUM         = 0
MAXIMUM         = 65535
DESCRIPTION     = "Packet_length constitutes one of three parts in the
    primary source information header applied by the Payload Data System
    (PDS) to the MOLA telemetry packet at the time of creation of the packet
    prior to transfer frame creation. This field contains a sequential 16-bit
    binary count 'C' of the length (in octets) of the data area structure
    that is enclosed between the first bit of the Secondary Header and the
    last bit of the packet (i.e., the last bit of the Source Data field). C =
    ((no. of octets) - 1)."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME            = COARSE_TIME
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 157
BYTES           = 4
MINIMUM         = 0
MAXIMUM         = 4294967295
DESCRIPTION     = "The MOLA system time is created from the 2 time words
    input from the PDS time broadcast command. The MOLA time is updated 7/8
    of a second after reception of the time broadcast command and 6/8 of a
    second after interpreting the time broadcast with S/C + 1 second to

```



```

        arrive at the correct time. B[0] is S/C time in seconds * 2**24; B[1] is
        S/C time in seconds * 2**16; B[2] is S/C time in seconds * 2**8; B[3] is
        S/C time in seconds."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = FINE_TIME
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 161
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Fine_time is the high-resolution timer reading taken
        during interrupt handling routine triggered by the trailing edge of the
        first 10 Hz interrupt encountered during this packet."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PACKET_TYPE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 162
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Packet type identifier byte. Distinguishes Science
        Mode packets from Maintenance Mode packets. Science Mode 0 Maintenance
        Mode = [1 = Status packet, 2 = memory dump, 3 = noise count]. Values 4 -
        255 are reserved for future modes. Modes 0, 1, 2 are hard coded in the
        flight software. Packet type 3 is patched in when the noise count code
        patch is uploaded. The packet type value should be patched when a code
        patch occurs that affects that mode's packet content."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = COMPUTER_MEMORY_TEMPERATURE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 163
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Mux A, Ch #2"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = COMPUTER_CPU_TEMPERATURE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 164
BYTES               = 1
MINIMUM             = 0

```

MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #1"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= POWER_SUPPLY_TEMPERATURE
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 165
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #4"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= 'COMPUTER_I/O_TEMPERATURE'
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 166
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #3"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LASER_DIODE_ARRAY_TEMPERATURE
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 167
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #6"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LASER_DIODE_DRIVE_ELECS_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 168
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #5"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= OPTICAL_TEST_SOURCE_LED_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 169
BYTES	= 1

MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #8"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= HUNDRED_MHZ_OSCILLATOR_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 170
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #7"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= START_DETECTOR_TEMPERATURE
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 171
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #10"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= OUTSIDE_DETECTOR_HOUSING_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 172
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #9"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LASR_RADIATR_OPP_OPT_PORT_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 173
BYTES	= 1
MINIMUM	= 0
MAXIMUM	= 255
DESCRIPTION	= "Mux A, Ch #11"
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= LSR_RADIATOR_OUTPUT_PORT_TEMP
DATA_TYPE	= UNSIGNED_INTEGER
START_BYTE	= 174

```

BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION    = "Mux A, Ch #11"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = INTERFACE_PLATE_HOT_FOOT_TEMP
DATA_TYPE     = UNSIGNED_INTEGER
START_BYTE    = 175
BYTES         = 1
MINIMUM       = 0
MAXIMUM       = 255
DESCRIPTION   = "Mux A, Ch #14"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME          = HONEYCOMB_PANEL_TEMPERATURE
DATA_TYPE     = UNSIGNED_INTEGER
START_BYTE    = 176
BYTES         = 1
MINIMUM       = 0
MAXIMUM       = 255
DESCRIPTION   = "Mux A, Ch #13"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME          = ELECTRONICS_BOX_TOP_SC_THRMSTR
DATA_TYPE     = UNSIGNED_INTEGER
START_BYTE    = 177
BYTES         = 1
MINIMUM       = 0
MAXIMUM       = 255
DESCRIPTION   = "Mux A, Ch #16"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME          = LASER_CASE_HOT_FOOT_TEMP
DATA_TYPE     = UNSIGNED_INTEGER
START_BYTE    = 178
BYTES         = 1
MINIMUM       = 0
MAXIMUM       = 255
DESCRIPTION   = "Mux A, Ch #15"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME          = PLUS_28_VOLT_VOLTAGE_MONITOR
DATA_TYPE     = UNSIGNED_INTEGER

```

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```

START_BYTE      = 179
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #2"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = REFERENCE_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 180
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #1"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_12_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 181
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #4"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_24_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 182
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #3"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = PLUS_5_VOLT_VOLTAGE_MONITOR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 183
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Mux B, Ch #6"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = MINUS_12_VOLT_VOLTAGE_MONITOR

```

```

DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 184
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #5"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = LASER_THERMAL_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 185
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #8"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = MINUS_5_VOLT_VOLTAGE_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 186
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #7"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = POWER_SUPPLY_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 187
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #10"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = HIGH_VOLTAGE_CURRENT_MONITOR
DATA_TYPE          = UNSIGNED_INTEGER
START_BYTE         = 188
BYTES              = 1
MINIMUM            = 0
MAXIMUM            = 255
DESCRIPTION        = "Mux B, Ch #9"
END_OBJECT         = COLUMN

OBJECT             = COLUMN

```

```

NAME                = MINUS_12_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 189
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION         = "Mux B, Ch #12"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PLUS_12_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 190
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION         = "Mux B, Ch #11"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = MINUS_5_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 191
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION         = "Mux B, Ch #14"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PLUS_5_VOLT_CURRENT_MONITOR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 192
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION         = "Mux B, Ch #13"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = CURRENT_STATUS_REGISTER_VALUE
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 193
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION         = "Value read from STATUS register at end of packet
collection cycle. Read STATUS register and store lower 8 bits. MSnibble =
SEU counter value"

```

```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = SOFTWARE_VERSION_NUMBER
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 194
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "4.4 bit format version number. Version number is hard
                        coded in software and is stored in packet at the end of the packet
                        collection cycle. Any software patches should include an update to this
                        value. Current flight version is 5.3 therefore, 53h is hard coded in the
                        Pack_it() routine of the Science Mode. Maintenance Mode version is 6.2
                        therefore 62h is coded."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = FLAG_WORD
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 195
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "RAM block test flag word. Memory test results. Bit
                        representation of the results of the RAM write/read/verify block test
                        performed after a CPU reset (HOT or COLD start). MSB (#15) represents the
                        memory block from 7800h to 7FFFh; LSB (#0) from 0000h to 7FFh. 1 = error
                        detected, 0 = block O.K. 0 represents a validated block, while a 1 means
                        that the program encountered an invalid compare on at least one byte in
                        that block area. B[0] is bits 15 - 8 of RAM test flag; B[1] is bits 7 - 0
                        of RAM test flag"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = PARAMETER_UPDATE_CMD_COUNT
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 197
BYTES               = 2
MINIMUM             = 0
MAXIMUM             = 65535
DESCRIPTION          = "Valid data for packet types 1, 2, and 3."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = MEMORY_LOADS_CMD_COUNT
DATA_TYPE           = MSB_UNSIGNED_INTEGER
START_BYTE          = 199
BYTES               = 2

```


MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= MEMORY_DUMPS_CMD_COUNT
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 201
BYTES	= 2
MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= COMMAND_ERRORS
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 203
BYTES	= 2
MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= STATUS_FLAGS
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 205
BYTES	= 2
MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= SUB_COMMAND_ERRORS
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 207
BYTES	= 2
MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= COMMANDS_RECEIVED
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 209

```

BYTES                = 2
MINIMUM              = 0
MAXIMUM              = 65535
DESCRIPTION          = "Valid data for packet types 1, 2, and 3."
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = COMMAND_ECHO
DATA_TYPE            = MSB_UNSIGNED_INTEGER
START_BYTE           = 211
BYTES                = 154
ITEMS                = 77
ITEM_BYTES           = 2
MINIMUM              = 0
MAXIMUM              = 65535
DESCRIPTION          = "Valid data for packet types 1, 2, and 3."
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = MEMORY_DUMP_START_ADDRESS
DATA_TYPE            = MSB_UNSIGNED_INTEGER
START_BYTE           = 365
BYTES                = 2
MINIMUM              = 0
MAXIMUM              = 65535
DESCRIPTION          = "Valid data for packet type 2; noise count data starts
    here when packet type is 3."
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = MEMORY_DUMP_LENGTH
DATA_TYPE            = MSB_UNSIGNED_INTEGER
START_BYTE           = 367
BYTES                = 2
MINIMUM              = 0
MAXIMUM              = 65535
DESCRIPTION          = "Valid data for packet type 2."
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = MEMORY_DUMP_SEGMENT
DATA_TYPE            = MSB_UNSIGNED_INTEGER
START_BYTE           = 369
BYTES                = 860
ITEMS                = 430
ITEM_BYTES           = 2
MINIMUM              = 0
MAXIMUM              = 65535
DESCRIPTION          = "Valid data for packet type 2."

```

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END_OBJECT	= COLUMN
OBJECT	= COLUMN
NAME	= PACKET_CHECKSUM
DATA_TYPE	= MSB_UNSIGNED_INTEGER
START_BYTE	= 1129
BYTES	= 2
MINIMUM	= 0
MAXIMUM	= 65535
DESCRIPTION	= "Valid data for packet types 1, 2, and 3."
END_OBJECT	= COLUMN

C.4 Contents of the MOLASCFR.FMT File

```

OBJECT          = CONTAINER
NAME            = COUNTS
START_BYTE      = 1
BYTES           = 4
REPETITIONS     = 20
^STRUCTURE      = "MOLASCCT.FMT"
DESCRIPTION     = "This container has three sub-elements (range to
                  surface counts, 1st channel received pulse energy, and channel
                  number/pulse width). The three sub-elements repeat for each of 20 shots."
END_OBJECT      = CONTAINER

```

```

OBJECT          = COLUMN
NAME            = SHOT_2_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 81
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 2."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_1_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 82
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 1."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_4_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 83
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 4."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN

```

```

NAME                = SHOT_3_LASER_TRANSMITTER_POWR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 84
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Transmitted laser pulse energy level. Energy reading
                        for LASER transmit power for shot 3."
END_OBJECT           = COLUMN

OBJECT              = COLUMN
NAME                = SHOT_6_LASER_TRANSMITTER_POWR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 85
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Transmitted laser pulse energy level. Energy reading
                        for LASER transmit power for shot 6."
END_OBJECT           = COLUMN

OBJECT              = COLUMN
NAME                = SHOT_5_LASER_TRANSMITTER_POWR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 86
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Transmitted laser pulse energy level. Energy reading
                        for LASER transmit power for shot 5."
END_OBJECT           = COLUMN

OBJECT              = COLUMN
NAME                = SHOT_8_LASER_TRANSMITTER_POWR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 87
BYTES               = 1
MINIMUM             = 0
MAXIMUM             = 255
DESCRIPTION          = "Transmitted laser pulse energy level. Energy reading
                        for LASER transmit power for shot 8."
END_OBJECT           = COLUMN

OBJECT              = COLUMN
NAME                = SHOT_7_LASER_TRANSMITTER_POWR
DATA_TYPE           = UNSIGNED_INTEGER
START_BYTE          = 88
BYTES               = 1
MINIMUM             = 0

```

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```

MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 7."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_10_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 89
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 10."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_9_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 90
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 9."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_12_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 91
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 12."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_11_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 92
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 11."
END_OBJECT       = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_14_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 93
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 14."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_13_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 94
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 13."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_16_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 95
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 16."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_15_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 96
BYTES          = 1
MINIMUM        = 0
MAXIMUM        = 255
DESCRIPTION     = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 15."
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
NAME            = SHOT_18_LASER_TRANSMITTER_POWR
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE     = 97
BYTES          = 1

```

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```

MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 18."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_17_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 98
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 17."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_20_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 99
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 20."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SHOT_19_LASER_TRANSMITTER_POWR
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 100
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "Transmitted laser pulse energy level. Energy reading
                  for LASER transmit power for shot 19."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = ENCODER_BITS_1
DATA_TYPE        = MSB_BIT_STRING
START_BYTE       = 101
BYTES            = 2
DESCRIPTION      = "This first container includes encoder start and stop
                  bit values from Shots 1-4"

OBJECT           = BIT_COLUMN
NAME             = SHOT_2_ENC

```



```

BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 1
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 2. Bits 1 and 2 are
                      encoder start bits; bits 3 and 4 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_1_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 5
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 1. Bits 5 and 6 are
                      encoder start bits; bits 7 and 8 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_4_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 9
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 4. Bits 9 and 10 are
                      encoder start bits; bits 11 and 12 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_3_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 13
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 3. Bits 13 and 14 are
                      encoder start bits; bits 15 and 16 are encoder stop bits."
END_OBJECT         = BIT_COLUMN
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = ENCODER_BITS_2

```

```

DATA_TYPE          = MSB_BIT_STRING
START_BYTE         = 103
BYTES              = 2
DESCRIPTION        = "This second container includes encoder start and stop
                      bit values from Shots 5-8"

OBJECT             = BIT_COLUMN
NAME               = SHOT_6_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 1
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 6. Bits 1 and 2 are
                      encoder start bits; bits 3 and 4 are encoder stop bits"
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_5_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 5
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 5. Bits 5 and 6 are
                      encoder start bits; bits 7 and 8 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_8_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 9
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 8. Bits 9 and 10 are
                      encoder start bits; bits 11 and 12 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_7_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 13
BITS               = 4
MINIMUM            = 0
MAXIMUM            = 15

```

```

DESCRIPTION          = "The encoder stop and start bits of the first channel
                        to receive laser returned pulse energy for shot 7. Bits 13 and 14 are
                        encoder start bits; bits 15 and 16 are encoder stop bits."
END_OBJECT           = BIT_COLUMN
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = ENCODER_BITS_3
DATA_TYPE            = MSB_BIT_STRING
START_BYTE           = 105
BYTES                = 2
DESCRIPTION          = "This third container includes encoder start and stop
                        bit values from Shots 9-12"

OBJECT               = BIT_COLUMN
NAME                 = SHOT_10_ENC
BIT_DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BIT            = 1
BITS                 = 4
MINIMUM              = 0
MAXIMUM              = 15
DESCRIPTION          = "The encoder stop and start bits of the first channel
                        to receive laser returned pulse energy for shot 10. Bits 1 and 2 are
                        encoder start bits; bits 3 and 4 are encoder stop bits"
END_OBJECT           = BIT_COLUMN

OBJECT               = BIT_COLUMN
NAME                 = SHOT_9_ENC
BIT_DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BIT            = 5
BITS                 = 4
MINIMUM              = 0
MAXIMUM              = 15
DESCRIPTION          = "The encoder stop and start bits of the first channel
                        to receive laser returned pulse energy for shot 9. Bits 5 and 6 are
                        encoder start bits; bits 7 and 8 are encoder stop bits."
END_OBJECT           = BIT_COLUMN

OBJECT               = BIT_COLUMN
NAME                 = SHOT_12_ENC
BIT_DATA_TYPE        = MSB_UNSIGNED_INTEGER
START_BIT            = 9
BITS                 = 4
MINIMUM              = 0
MAXIMUM              = 15
DESCRIPTION          = "The encoder stop and start bits of the first channel
                        to receive laser returned pulse energy for shot 12. Bits 9 and 10 are
                        encoder start bits; bits 11 and 12 are encoder stop bits."
END_OBJECT           = BIT_COLUMN

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```

OBJECT          = BIT_COLUMN
NAME            = SHOT_11_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 13
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION     = "The encoder stop and start bits of the first channel
                  to receive laser returned pulse energy for shot 11. Bits 13 and 14 are
                  encoder start bits; bits 15 and 16 are encoder stop bits."
END_OBJECT      = BIT_COLUMN
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = ENCODER_BITS_4
DATA_TYPE       = MSB_BIT_STRING
START_BYTE      = 107
BYTES           = 2
DESCRIPTION     = "This fourth container includes start and stop bit
                  values from Shots 13 -16."

OBJECT          = BIT_COLUMN
NAME            = SHOT_14_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 1
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION     = "The encoder stop and start bits of the first channel
                  to receive laser returned pulse energy for shot 14. Bits 1 and 2 are
                  encoder start bits; bits 3 and 4 are encoder stop bits"
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = SHOT_13_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 5
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION     = "The encoder stop and start bits of the first channel
                  to receive laser returned pulse energy for shot 13. Bits 5 and 6 are
                  encoder start bits; bits 7 and 8 are encoder stop bits."
END_OBJECT      = BIT_COLUMN

OBJECT          = BIT_COLUMN
NAME            = SHOT_16_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER

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```

START_BIT          = 9
BITS               = 4
MINIMUM           = 0
MAXIMUM           = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 16. Bits 9 and 10 are
                      encoder start bits; bits 11 and 12 are encoder stop bits."
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_15_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 13
BITS               = 4
MINIMUM           = 0
MAXIMUM           = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 15. Bits 13 and 14 are
                      encoder start bits; bits 15 and 16 are encoder stop bits."
END_OBJECT         = BIT_COLUMN
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME               = ENCODER_BITS_5
DATA_TYPE          = MSB_BIT_STRING
START_BYTE         = 109
BYTES              = 2
DESCRIPTION        = "This fifth container includes start and stop bit
                      values from Shots 17-20."

OBJECT             = BIT_COLUMN
NAME               = SHOT_18_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 1
BITS               = 4
MINIMUM           = 0
MAXIMUM           = 15
DESCRIPTION        = "The encoder stop and start bits of the first channel
                      to receive laser returned pulse energy for shot 18. Bits 1 and 2 are
                      encoder start bits; bits 3 and 4 are encoder stop bits"
END_OBJECT         = BIT_COLUMN

OBJECT             = BIT_COLUMN
NAME               = SHOT_17_ENC
BIT_DATA_TYPE      = MSB_UNSIGNED_INTEGER
START_BIT          = 5
BITS               = 4
MINIMUM           = 0
MAXIMUM           = 15

```

```

DESCRIPTION      = "The encoder stop and start bits of the first channel
                    to receive laser returned pulse energy for shot 17. Bits 5 and 6 are
                    encoder start bits; bits 7 and 8 are encoder stop bits."
END_OBJECT       = BIT_COLUMN

OBJECT           = BIT_COLUMN
NAME            = SHOT_20_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 9
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION      = "The encoder stop and start bits of the first channel
                    to receive laser returned pulse energy for shot 20. Bits 9 and 10 are
                    encoder start bits; bits 11 and 12 are encoder stop bits."
END_OBJECT       = BIT_COLUMN

OBJECT           = BIT_COLUMN
NAME            = SHOT_19_ENC
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 13
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION      = "The encoder stop and start bits of the first channel
                    to receive laser returned pulse energy for shot 19. Bits 13 and 14 are
                    encoder start bits; bits 15 and 16 are encoder stop bits."
END_OBJECT       = BIT_COLUMN
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME            = TIU_MASK_VALUES
DATA_TYPE       = MSB_BIT_STRING
START_BYTE      = 111
BYTES           = 1
DESCRIPTION      = "One byte to hold the TIU upper range bits and the
                    receiver channel mask status."

OBJECT           = BIT_COLUMN
NAME            = TIU_UPPER_RANGE_BITS
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 1
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 7
DESCRIPTION      = "The upper 3 or 3 highest ordered bits of the MOLA time
                    interval unit (TIU). Only the largest MSTIU value read in current frame
                    is saved. Only bits 6, 5, 4 are used."
END_OBJECT       = BIT_COLUMN

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```

OBJECT          = BIT_COLUMN
NAME            = RECEIVER_CHANNEL_MASK_STATUS
BIT_DATA_TYPE   = MSB_UNSIGNED_INTEGER
START_BIT       = 5
BITS            = 4
MINIMUM         = 0
MAXIMUM         = 15
DESCRIPTION     = "The altimeter channel mask settings from the flight
                    parameter table at the time of acquisition and storage of the TIU upper
                    range bits. The mask indicates if the channel filter is active or is
                    masked out to prevent triggering the TIU. Bit 3 = Channel 1; Bit 2 =
                    Channel 2; Bit 1 = Channel 3; Bit 0 = Channel 4. 1 = channel on, 0 =
                    channel off"
END_OBJECT      = BIT_COLUMN
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = ALGORITHM_STATUS_HIT_CNT
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 112
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 80
DESCRIPTION     = "Current value from the active data frame showing the
                    number of hits counted in the possible 20 shot hits in the single frame
                    or the number of hits summed over the possible 100 shots when in the 5
                    frame mode. This is an indicator of the performance of the tracking
                    algorithm. If in the acquisition mode, this field will contain the number
                    of shot hits from a possible 80 shots within the 4 frame acquisition
                    window. HIT_CNT from previous frame."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_1_1ST_HALF_FRM_THRSHLD_SET
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 113
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "The active channel threshold settings in the current
                    frame. The setting of the Channel 1 threshold sampled for the first 10
                    shots in the frame"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_2_1ST_HALF_FRM_THRSHLD_SET
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 114

```

```

BYTES                = 1
MINIMUM              = 0
MAXIMUM              = 255
DESCRIPTION          = "The active channel threshold settings in the current
                        frame. The setting of the Channel 2 threshold sampled for the first 10
                        shots in the frame"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = CH_3_1ST_HALF_FRM_THRSHLD_SET
DATA_TYPE            = UNSIGNED_INTEGER
START_BYTE           = 115
BYTES                = 1
MINIMUM              = 0
MAXIMUM              = 255
DESCRIPTION          = "The active channel threshold settings in the current
                        frame. The setting of the Channel 3 threshold sampled for the first 10
                        shots in the frame"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = CH_4_1ST_HALF_FRM_THRSHLD_SET
DATA_TYPE            = UNSIGNED_INTEGER
START_BYTE           = 116
BYTES                = 1
MINIMUM              = 0
MAXIMUM              = 255
DESCRIPTION          = "The active channel threshold settings in the current
                        frame. The setting of the Channel 4 threshold sampled for the first 10
                        shots in the frame"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = CH_1_2ND_HALF_FRM_THRSHLD_SET
DATA_TYPE            = UNSIGNED_INTEGER
START_BYTE           = 117
BYTES                = 1
MINIMUM              = 0
MAXIMUM              = 255
DESCRIPTION          = "The active channel threshold settings in the current
                        frame. The setting of the Channel 1 threshold sampled for the last 10
                        shots in the frame"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
NAME                 = CH_2_2ND_HALF_FRM_THRSHLD_SET
DATA_TYPE            = UNSIGNED_INTEGER
START_BYTE           = 118
BYTES                = 1

```



```

MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION      = "The active channel threshold settings in the current
                    frame. The setting of the Channel 2 threshold sampled for the last 10
                    shots in the frame"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_3_2ND_HALF_FRM_THRSHLD_SET
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 119
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION      = "The active channel threshold settings in the current
                    frame. The setting of the Channel 3 threshold sampled for the last 10
                    shots in the frame"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_4_2ND_HALF_FRM_THRSHLD_SET
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 120
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION      = "The active channel threshold settings in the current
                    frame. The setting of the Channel 4 threshold sampled for the last 10
                    shots in the frame"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = RANGE_DELAY
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 121
BYTES           = 2
MINIMUM         = 0
MAXIMUM         = 65535
DESCRIPTION      = "Current frame range gate delay value (DELAY) as set
                    from the previous data frame. B[0] : Bits 3 - 0 are bits 11 - 8 and B[1]
                    : LSByte (bits 0-7) of the 12 bit Range Delay setting for this frame."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = RANGE_WIDTH
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 123
BYTES           = 2
MINIMUM         = 0

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```

MAXIMUM          = 4096
DESCRIPTION      = "Current frame range gate window or width; set at end
                    of the previous data frame. B[0] : Bits 3 - 0 are bits 11 - 8 and B[1] :
                    LSByte of the 12 bit Range Gate Window setting for this frame."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = ALGORITHM_STATUS_MIN_HITS
DATA_TYPE        = MSB_INTEGER
START_BYTE       = 125
BYTES            = 1
MINIMUM          = -32768
MAXIMUM          = 32767
DESCRIPTION      = "The minimum shot hit count value required for a
                    matched filter channel to trigger; MIN_HITS value set in algorithm from
                    the previous data frame."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = SOFTWARE_STATUS
DATA_TYPE        = MSB_BIT_STRING
START_BYTE       = 126
BYTES            = 1
DESCRIPTION      = "Two of values reflecting the operation of the flight
                    software tracking algorithm. The frame counter value and the first
                    channel triggering at or above the minimum hit count are set from the
                    previous data frame tracking algorithm operation. Frame counter
                    (Frame_ctr) value from previous frame's tracking algorithm is in MS 4
                    bits; MIN_HITS trigger channel from previous frame is in LS 4 bits."

OBJECT           = BIT_COLUMN
NAME             = FRAME_COUNTER
BIT_DATA_TYPE    = MSB_UNSIGNED_INTEGER
START_BIT        = 1
BITS             = 4
DESCRIPTION      = "The frame counter value is set from the previous data
                    frame tracking algorithm operation. Frame counter (Frame_ctr) value from
                    previous frame's tracking algorithm is in MS 4 bits (7 - 4) of Software
                    status. Bits 7 - 4 are bits 3 - 0 of frame counter."
END_OBJECT       = BIT_COLUMN

OBJECT           = BIT_COLUMN
NAME             = TRIGGER_CHANNEL
BIT_DATA_TYPE    = MSB_UNSIGNED_INTEGER
START_BIT        = 5
BITS             = 4
DESCRIPTION      = "The first channel triggering at or above the minimum
                    hit count is set from the previous data frame tracking algorithm
                    operation. MIN_HITS trigger channel from previous frame is in LS 4 bits

```

(0 - 3) of Software status. Bit 0 = Channel 1; Bit 1 = Channel 2; Bit 2 = Channel 3; Bit 3 = Channel 4"

```

END_OBJECT      = BIT_COLUMN
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_1_1ST_HALF_FRAME_BKGRND_CN
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 127
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "The background energy or noise count levels for
                  channel 1 first half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                  end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                  background count summed over 1st 10 shots of frame for channel 1."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_2_1ST_HALF_FRAME_BKGRND_CN
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 128
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "The background energy or noise count levels for
                  channel 2 first half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                  end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                  background count summed over 1st 10 shots of frame for channel 2."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_3_1ST_HALF_FRAME_BKGRND_CN
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 129
BYTES           = 1
MINIMUM         = 0
MAXIMUM         = 255
DESCRIPTION     = "The background energy or noise count levels for
                  channel 3 first half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                  end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                  background count summed over 1st 10 shots of frame for channel 3."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CH_4_1ST_HALF_FRAME_BKGRND_CN
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 130
BYTES           = 1

```

```

MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "The background energy or noise count levels for
                    channel 4 first half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                    end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                    background count summed over 1st 10 shots of frame for channel 4."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_1_2ND_HALF_FRAME_BKGRND_CN
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 131
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "The background energy or noise count levels for
                    channel 1 second half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                    end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                    background count summed over last 10 shots of frame for channel 1."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_2_2ND_HALF_FRAME_BKGRND_CN
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 132
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "The background energy or noise count levels for
                    channel 2 second half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                    end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                    background count summed over last 10 shots of frame for channel 2."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_3_2ND_HALF_FRAME_BKGRND_CN
DATA_TYPE        = UNSIGNED_INTEGER
START_BYTE       = 133
BYTES            = 1
MINIMUM          = 0
MAXIMUM          = 255
DESCRIPTION       = "The background energy or noise count levels for
                    channel 3 second half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
                    end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
                    background count summed over last 10 shots of frame for channel 3."
END_OBJECT       = COLUMN

OBJECT           = COLUMN
NAME             = CH_4_2ND_HALF_FRAME_BKGRND_CN

```

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DATA_TYPE = UNSIGNED_INTEGER
START_BYTE = 134
BYTES = 1
MINIMUM = 0
MAXIMUM = 255
DESCRIPTION = "The background energy or noise count levels for
channel 4 second half-frame. Pseudo log value of NOISE(1, 2, 3, 4) at the
end of a half-frame of current frame, 5.3 bit format. Plog base 2 of
background count summed over last 10 shots of frame for channel 4."
END_OBJECT = COLUMN

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```

OBJECT          = COLUMN
NAME            = RANGE_TO_SURFACE_TIU_CNTS
DATA_TYPE       = MSB_UNSIGNED_INTEGER
START_BYTE      = 1
BYTES           = 2
DESCRIPTION      = "The laser shot surface ranging measurement in Timing
                    Interval Unit (TIU) counts. The least significant 16 bits of TIU (LSTIU),
                    stored for every shot. B[0] = Bits 15-8 of TIU reading; B[1] = Bits 7-0
                    of TIU reading."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = FIRST_CH_RCVD_PULSE_ENRGY
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 3
BYTES           = 1
DESCRIPTION      = "The level of return, reflected energy as received by
                    the first channel and matched filter to trigger. Lowest numbered non-zero
                    energy reading for each shot."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = CHANNEL_NUMBER_PULSE_WIDTH
DATA_TYPE       = UNSIGNED_INTEGER
START_BYTE      = 4
BYTES           = 1
DESCRIPTION      = "The number of the first channel to trigger and the
                    pulse width of the returned energy. Bits 8-7 : channel number - 1; bits
                    6-1: pulse width"
END_OBJECT      = COLUMN

```