

SFOC Software Interface Specification (SIS) Module		Name: <u>SFOC-5-SYS-*DU-NJPL</u> Revision Date: <u>05-31-89</u> Revision A	
MODULE TITLE: NJPL SFDU Global Definitions			
PURPOSE: This document describes the Standard Formatted Data Unit records. These records are used to transfer data between SFOC sub-systems and also to users external to SFOC.			
DATA FLOW:			
<u>From</u>	<u>To</u>	<u>Data Object</u>	<u>Physical Medium</u>
SFOC	SFOC & external	SFDU	Tape/Disk/LAN
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LIST OF TBD ITEMS

<u>Page</u>	<u>Section</u>	<u>Item</u>
4-15	4.2.2.2	Spacecraft Command Data specifics

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CONTENTS

1	GENERAL DESCRIPTION	1-1
1.1	PURPOSE OF DOCUMENT	1-1
1.2	SCOPE	1-1
1.3	APPLICABLE DOCUMENTS	1-1
1.4	FUNCTIONAL DESCRIPTION	1-2
1.4.1	Data Source, Destination, and Transfer Method	1-2
1.4.2	Pertinent Relationships with Other Interfaces	1-2
1.4.3	Labeling and Identification	1-2
1.4.4	Assumptions and Constraints	1-2
2	ENVIRONMENT	2-1
2.1	HARDWARE CHARACTERISTICS AND LIMITATIONS	2-1
2.2	INTERFACE MEDIUM AND CHARACTERISTICS	2-1
2.3	INPUT / OUTPUT PROTOCOLS	2-1
2.3.1	Device Addressing	2-1
2.3.2	Operating System Protocols	2-1
2.3.3	Deformatting	2-1
2.3.4	Calling Sequence	2-1
2.4	FAILURE PROTECTION, DETECTION, AND RECOVERY FEATURES	2-1
2.4.1	Backup Requirements	2-1
2.4.2	Security/Integrity Measures	2-1
2.5	END-OF-FILE (OR MEDIUM) CONVENTIONS	2-1
2.6	UTILITY PROGRAMS	2-1
3	DATA FLOW CHARACTERISTICS	3-1
4	DETAILED DATA OBJECT DEFINITION	4-1
4.1	STRUCTURE AND ORGANIZATION OVERVIEW	4-1
4.2	DATA FORMAT AND DEFINITION	4-3
4.2.1	Format of Logical Records	4-3
4.2.1.1	<u>Primary label</u> (NJPL _____)	4-3
4.2.1.2	<u>Compressed Header Data Object (CHDO)</u> <u>Structure</u>	4-4
4.2.1.3	<u>Composition of a SFOC Standard CHDO-</u> <u>structured SFDU</u>	4-6
4.2.1.4	Formal SFDU Product Structures	4-7
4.2.2	Data Definition for Logical SFDUs	4-11
4.2.2.1	<u>SFOC Data Type Identification</u>	4-11
4.2.2.2	<u>Use of Major/Minor/Format Type</u>	4-12
4.2.2.3	<u>Component Lists for Logical SFDUs</u>	4-16
4.2.2.4	<u>Identifiers for Originator/Last Modifier</u>	4-20
4.2.3	Format of Physical Records	4-21
4.2.3.1	<u>SFOC-generated Physical SFDU</u>	4-22
4.2.3.2	<u>Components of Physical Records Received and</u> <u>Produced by SFOC</u>	4-24

SECTION 1

GENERAL DESCRIPTION

This SIS module is the controlling document for SFDU formatting conventions in SFOC. It also controls the assignment of certain key fields used for the identification of records and their components.

This document describes the general structure of all SFOC Standard Formatted Data Unit (SFDU) records. These records can be exchanged between applications, combined into physical records (e.g. on tapes), into files (e.g. on disks), etc. The methods used by SFOC for combining (blocking) them are described here. Methods of exchange and complete file and tape formats are described elsewhere. This SIS module: 1) describes the general structure of the SFOC SFDU record, and 2) provides a directory for other SFOC SIS modules which describe the specific variants of the SFOC SFDU records.

This document is the only source that provides a complete list and description of SFDUs that are processed or produced by SFOC; the list includes the specification of SFDU components and their identifiers. SFOC Identifiers controlled by this document are:

- primary SFDU label identifiers
- mission identifiers
- codes for major type, minor type, and format
- compressed header data object (CHDO) type identifiers

1.1 PURPOSE OF DOCUMENT

This document describes the SFOC Standard Formatted Data UNIT (SFDU) records. These records are used to transfer data between SFOC subsystems and to users external to the SFOC system.

1.2 SCOPE

This SIS module describes the composition of records from individual parts rather than the content of each part or interfaces between applications or agencies. SFOC SFDUs can be exchanged using any method acceptable to applications using them; the methods of exchange are not addressed here.

The control of identifiers described in the section above is meant to be accomplished in cooperation with the JPL Control Authority, which has the responsibility for controlling registered SFDU labels, CHDO types, and mission identifiers.

1.3 APPLICABLE DOCUMENTS

- 1) JJPL0006-01-00 JPL Standard Formatted Data Unit Usage and Description, Issue 5, March 7, 1988.

1.4 FUNCTIONAL DESCRIPTION

1.4.1 Data Source, Destination, and Transfer Method

This module describes the structure of records rather than a flow of data between applications or agencies. SFOC SFDUs can be exchanged using any method acceptable to applications using them; the methods of exchange are not addressed here.

1.4.2 Pertinent Relationships with Other Interfaces

Not applicable

1.4.3 Labeling and Identification

All data structure and content described here and in all SFOC SFDU SIS modules is in terms of a Global Data Representation (GDR), which is compatible with the CCSDS method of describing data. GDR signifies:

All byte offsets are assumed to be relative to the beginning of a structure or substructure. The first byte of a structure is called offset 0 (normally shown as the left byte of two), the second byte is at offset 1 (normally shown as the right byte of two), etc.

All words (two bytes) have their more-significant byte at the lower-number byte offset and less-significant byte at the higher-number byte offset. Words always occupy an even offset and succeeding odd offset in a structure or substructure.

All long words (four bytes) have their most-significant byte at the lowest-number byte offset of four through their least-significant byte at the highest-number byte offset. Long words always occupy a 0-modulo-4 offset through 3-modulo-4 offset in a structure or substructure.

Bits in a byte are labeled 0 through 7, where the 0th bit is the most-significant or sign bit (left-most bit) and the 7th bit is the least-significant bit (right-most bit). Bits in words and long words are labeled 0 through 15 and 0 through 31 correspondingly.

All data items in a structure are described in terms of the following three primitive item types:

- 1) unsigned n-bit data: values 0 .. $+2^{**n} - 1$.
- 2) signed n-bit data: values $-2^{**(n-1)}$.. $+2^{**(n-1)} - 1$, 2s complement notation.
- 3) 1-bit or boolean data: 1=true, 0=false.

1.4.4 Assumptions and Constraints

Not applicable

SECTION 2
ENVIRONMENT

2.1 HARDWARE CHARACTERISTICS AND LIMITATIONS

Not applicable

2.2 INTERFACE MEDIUM AND CHARACTERISTICS

Not applicable

2.3 INPUT / OUTPUT PROTOCOLS

2.3.1 Device Addressing

Not applicable

2.3.2 Operating System Protocols

Not applicable

2.3.3 Deformatting

All data structure and content described here and in all SFOC SFDU SIS modules is in terms of a Global Data Representation (GDR), which is compatible with the CCSDS method of describing data.

2.3.4 Calling Sequence

Not applicable

2.4 FAILURE PROTECTION, DETECTION, AND RECOVERY FEATURES

2.4.1 Backup Requirements

Not applicable

2.4.2 Security/Integrity Measures

Not applicable

2.5 END-OF-FILE (OR MEDIUM) CONVENTIONS

Not applicable.

2.6 UTILITY PROGRAMS

Not applicable.

SECTION 3

DATA FLOW CHARACTERISTICS

This chapter is inapplicable to this SIS module.

SECTION 4

DETAILED DATA OBJECT DEFINITION

4.1 STRUCTURE AND ORGANIZATION OVERVIEW

This document describes how SFOC SFDUs are composed from individual components and lists those components for SFDUs received or produced by SFOC. It addresses the structure of individual "logical" SFDUs as well as the blocking of logical SFDUs into "physical" ones. Sections 4.1 through 4.2.2 discuss logical SFDUs. Section 4.2.3 discusses physical SFDUs.

A logical SFDU consists of a primary label conforming to the CCSDS SFDU standard, plus additional information. In regards to the CCSDS standard, the additional information is considered to represent the "data" portion of the SFDU. Most SFOC-generated SFDUs, and some SFDUs generated by other systems, contain a primary label that is followed by type-length-value objects (TLVOs) that are modeled after the CCSDS standard but have a compressed header. These TLVOs are called Compressed Header Data Objects (CHDOs).

The CHDOs that follow the primary label in SFOC-generated SFDUs are called the subheader aggregation CHDO, the primary sub-header, secondary sub-header, tertiary sub-header, quaternary sub-header, and data CHDO. The terms "primary", "secondary", etc. merely refer to the position of the sub-header CHDO in the record. It is possible that a given sub-header CHDO appears as the third CHDO in one SFDU and as the fourth CHDO in a different SFDU. The format of a CHDO is described below.

Non-SFOC-generated SFDUs also consist of a primary label and additional information, but the additional information may not always be CHDO-structured. They may contain some, but not all, CHDO elements, or the SFDUs may be constructed of CHDOs in a way that conflicts with SFOC rules. SFOC also generates some SFDUs that are not CHDO-structured. Accordingly, the following SFDU categories are distinguished:

- SFOC standard CHDO-structured SFDUs
- non-standard CHDO-structured SFDUs
- non-CHDO-structured SFDUs

As a general rule which applies to all SFDUs, each SFDU that has a unique structure must also be uniquely identified by its primary label.

For SFOC-standard CHDO-structured SFDUs the following rules apply and are mandatory for all records that are produced by SFOC or passed between SFOC subsystems:

The subheader aggregation CHDO is mandatory. Its "value(s)" are the aggregated subheaders. Its length identifies the combined length of all subheaders and thus provides easy access to the data CHDO.

4.2 DATA FORMAT AND DEFINITION

4.2.1 Format of Logical Records

4.2.1.1 Primary label (NJPL_____)

This label accompanies all SFDU records generated by SFOC.

0	control_authority_id	
2		
4	version_id	class_id
6	spare	
8		
10	ddp_id	
12		
14		
16	block_length	
18		
20		

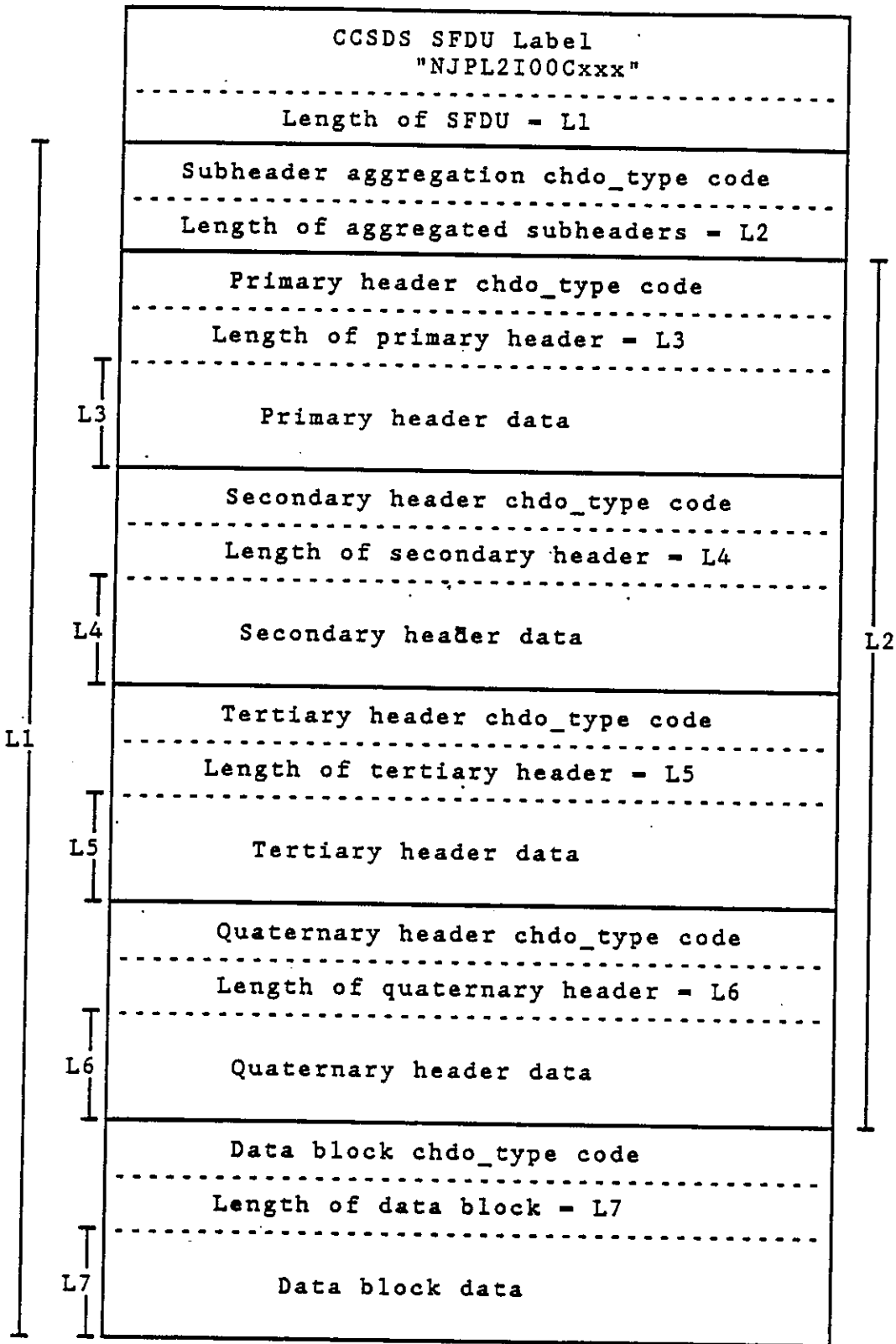
Byte
offset

- 0-3 control_authority_id - this will always have a Value = NJPL, Restricted ASCII (RA), for SFOC-internal SFDUs. It may also have a value = CCSD for certain other SFDU structures (see Section 4.2.1.4). Note: Restricted ASCII consists of uppercase characters A-Z and digits 0-9.
- 4 version_id - Version ID for length field. Value = 2 (RA) indicates that the length field will be a 64-bit unsigned integer field, while value = 1 indicates an ASCII representation of length. For most SFOC-internal SFDUs, the value = 2 option will be employed.
- 5 class_id - Identifies the label class. Value is one restricted ASCII character (capital letter or digit). See reference [1] for definitions.
- 6-7 Spares, each set to ASCII "zero".

Note: The chdo_value field must be an even number of bytes in length, making all CHDOs an even byte-length, and thus keeping all SFDUs an even byte-length. Data which is naturally packaged in records of odd byte-length must be padded with an extra byte to make the length of the chdo_value field even. Any additional headers necessary to retain knowledge of the unpadded length is part of the data definition, not another CHDO header.

Continues-->>>

4.2.1.2 Composition of a SFOC Standard CHDO-structured SFDU

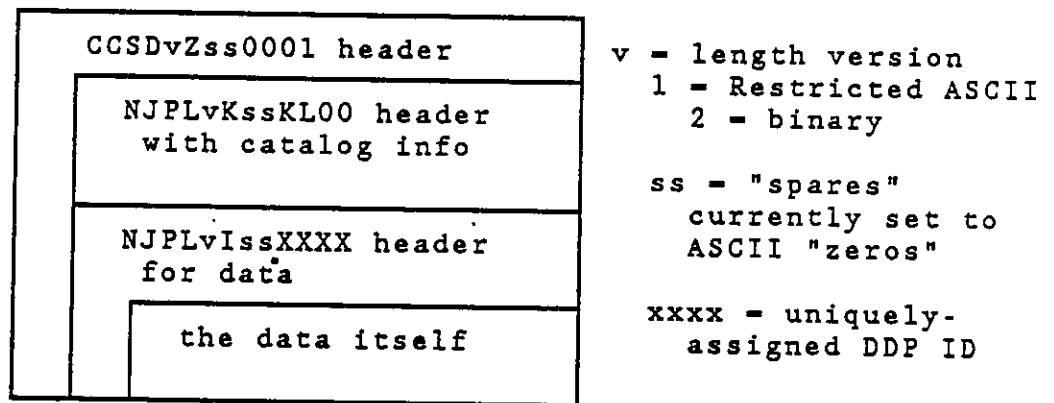


4.2.1.3 Formal SFDO Product Structures

In order to comply with Applicable Document #1, SFDOs intended for transfer out of SFOC or SFDOs coming into SFOC (with the exception of DSN telemetry and monitor data) must have a formal label structure not dependent on CHDO headers for structure identification. The Magellan project will have two basic types of SFDO structures, as described below. The first structure is data that has been aggregated by length and the second is data that has been aggregated by marker. See applicable document #1 for examples and a detailed discussion of each structure.

4.2.1.3.1 Aggregation By Length

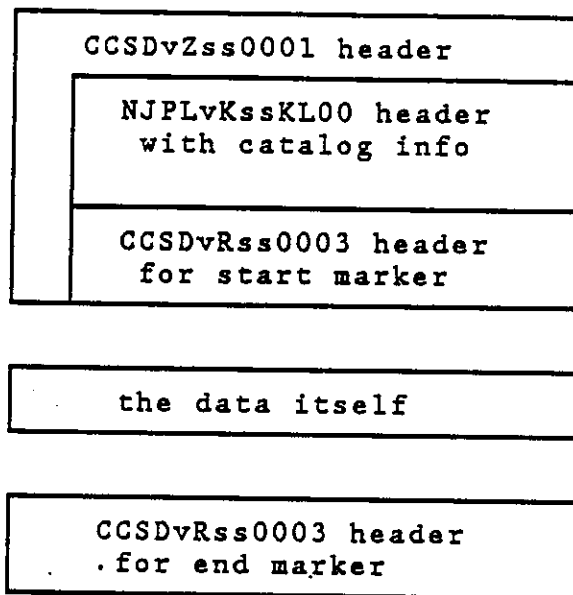
This is the least-common method of data aggregation employed by Magellan products, as indicated in Section 4.2.2.3.4. A basic block diagram of the structure is given below and a detailed example is given on page 4-9.



The class identifier "Z" in the label "CCSDvZss0001" is used for an unclassified aggregation. It must be used if records of different classes are aggregated. If only records of e.g. class "I" were aggregated, the class identifier "I" would also be used in the type field of the SFDO containing the aggregation.

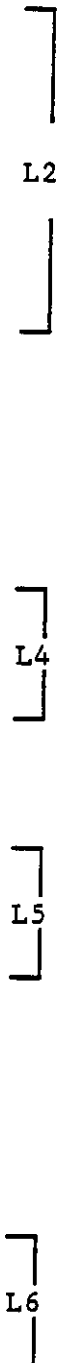
4.2.1.3.2 Aggregation By Marker

Most Magellan products employ this approach. The basic block diagram is shown below, with a detailed example on page 4-10.



L1	T	CCSD1Z000001	
	L	length L1	
Value	T	NJPL1K00KL00	
	L	length L2	
	V	DATA_OBJECT_TYPE=KEY_TIMES	
	a	DATA_SET_NAME=yyyyyyyyy.zzz	
	l	MISSION_ID=4	
	u	SPACECRAFT_NAME=MAGELLAN	
	e	PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff	
		SEF_CREATION_TIME=YYYY-MM-DDThh:mm:ss.fff	
		UPLOAD_ID=YZZZR	
		ORBIT_START_NUMBER=mmmm	
		ORBIT_STOP_NUMBER=nnnn	
	T	CCSD1I000001	
	L	length L3	
	T	NJPL1I000600	
L	length L4		
V	Orbit Data Set #1		
a			
l	NJPL1I000600		
u	length L5		
e	Orbit Data Set #2		
	o		
	o		
	o		
T	NJPL1I000600		
L	length L6		
V	Orbit Data Set #n		
a			
l			
u			
e			

Note:
 The "value" fields in "KL00" SFDOs are of variable length.
 "Keyword=value" entries are separated by <CR>, <LF>, <space>, <tab>, or a combination of these characters. "T" and "L" entries occupy fields of fixed length and do not require delimiters.



Key Spacecraft Event Times File Structure
 (EXAMPLE OF AGGREGATION BY LENGTH)

T	CCSD1Z000001		
L	length L1		
V a l l u e	T	NJPL1K00KLO0	L2
	L	length L2	
	V	DATA_OBJECT_TYPE-PROCESSED_BANDWIDTH	L1
	a	DATA_SET_NAME-YYYYYYYY.ZZZ	
	l	MISSION_ID-4	
	l	SPACECRAFT_NAME-MAGELLAN	
u	SPACECRAFT_NUMBER-18		
e	PROCESS_TIME-YYYY-MM-DDThh:mm:ss.fff		
	UPLOAD_ID-(ZXXXXR[,ZXXXXR])		
	ORBIT_NUMBER-(NNNN[,NNNN])		
T	CCSD1R000003		
L	length L3		
V	DELIMITER-SMARKER		L3
a	PRODUCT_NAME-PROCESSING_BANDWIDTH		
l	TYPE-NJPL1I000124		
u	PROTOCOL-NONE		
e			

Processing Bandwidth Data

T	CCSD1R000003		
L	length L4		
V	DELIMITER-EMARKER		L4
a	PRODUCT_NAME-PROCESSING_BANDWIDTH		
l			

Radar Processing Bandwidth File Structure
(EXAMPLE OF AGGREGATION BY MARKER)

4.2.2 Data Definition for Logical SFDUs

4.2.2.1 SFOC Data Type Identification

SFOC-generated SFDU records are identified by major/minor/format data type for each mission. These fields uniquely identify the format and data content of an SFDU. Although this could be done with a single field, three fields are used to permit some mechanism of categorization (and thus easier recognition) of related data types. These fields are located in the record identification CHDO which is always located in the primary sub-header position. Their meaning is described below.

4.2.2.1.1 Major Data Type

The following major data type values are defined:

major	Description
0	Unknown data. This data type should not be used by applications creating SFDUs
1	Raw mission telemetry
2	Spacecraft engineering telemetry frame or packet
3	Low-rate science telemetry frame/packet
4	High-rate science telemetry frame/packet
5	Playback telemetry transfer frame/packet
6	Ground station monitor data
7	TDM transport frame or packet transfer frame
8	Other (not type 2, 3, 4, or 5) telemetry frame or packet
9	Science instrument telemetry record
10	Other (not type 2) engineering telemetry record
11	Channelized data
12	Out-of-sync data
13	Summary and accountability data
14	Telemetry processing parameters
15	Operator interface log (of commands, events, status, etc.)
16	Special processing events (link start-up, etc.)
17	Ancillary product data (MDR, EDR, CDR, SEDR, etc.)
18	Spacecraft command data
19	System configuration and routing control information
20	System configuration and routing status information
21 \	
.	
. \	
. /	Reserved. Further assignments will be made if and when the need arises.
.	
125 /	
126	SFOC debug aid/diagnostic data
127	Filler record
128 \	
.	
. \	
. /	available for mission-specific use
.	
255 /	

4.2.2.1.2 Minor Data Type

Minor Data Type is used to further distinguish between data types within a major category. The interpretation of the minor data type field is unique for each major data type, although some parallel usage across multiple major types is possible.

For some major data types, standard values for the minor type field are assigned. For others, specific values must be assigned according to mission-unique requirements. Values in the range "0" through "127" are used for standard values that are mission-independent. Values that are mission-unique are assigned from the range "128" through "255".

Section 4.2.2.2 of this document contains a list of major/minor/format field combinations used in SFOC. It shows assigned standard values and provides some guidelines for the non-standard use of the minor type and format fields. Section 4.2.2.3 identifies all SFDUs currently defined for SFOC.

4.2.2.1.3 Format

The Format field is used to further distinguish between records of a given major and minor type.

The conventions for the assignment of values are the same as those detailed above for the minor data type field.

4.2.2.1.4 Mission Identifier

The Mission Identifier identifies the mission for which this record contains data. The values of the four fields: "major", "minor", "format", and "mission id" determine what additional subheaders, if any, are present. Currently defined values for "mission id" are:

- 0 - Voyager
- 1 - Galileo
- 2 - Ampte
- 3 - Ulysses
- 4 - Magellan
- 5 - Mars Observer
- 255 - Data not related to a specific mission

4.2.2.2 Use of Major/Minor/Format Type

The following list represents the standard template upon which the assignment of values for the Major Data Type, Minor Data Type, and Format fields in the primary header CHDO are based.

For each field the list specifies one of the following:

A standard binary identifier in the range 0 to 127, along with a definition of its meaning.

An indication of the intended field content. Identifiers in the range 128 to 255 are assigned separately for each mission.

An indication that identifiers in the range 128 to 255, as well as the definition of their meaning, are completely mission-dependent.

The definitions for the three fields are shown indented in the form:

```
major data type n
  minor data type 1
    format 1
    format 2
    format 3
  minor data type 2
  minor data type 3
    format a
    format b
major data type m
  minor data type x
    format y
```

When several minor data type descriptions appear in successive lines, the format description following the last line applies to all minor data types; i.e. "format a" and "format b" in the example above apply to both "minor data type 2" and "minor data type 3" of "major data type n".

- 1 - raw telemetry SFDUs and GCF/NASCOM blocks
 - 0 - raw telemetry SFDU - DSN alignment attempted
 - 1 - raw telemetry SFDU - DSN alignment not attempted
 - 0 - DSN-formatted
 - 1 - GIF-formatted
 - 2 - 1200-bit GCF block
 - 3 - 4800-bit GCF block
 - 4 - 4800-bit NASCOM block
 - 0 - block content unknown
 - 1 - block containing raw telemetry bits
 - 2 - block containing DSN-formatted raw telemetry SFDUs
 - 3 - block containing DSN-formatted monitor 5-12 SFDUs
 - 4 - block containing monitor 5-9 data
- 2 - engineering telemetry frame or packet
- 3 - low rate science telemetry frame or packet
- 4 - high rate science telemetry frame or packet
- 5 - playback telemetry frame or packet
 - for TDM: frame length/data rate
 - specific frame format/content
 - for packets: packet ID
 - mission-specific
- 6 - ground station monitor data
 - 0 - DSN monitor 5-12 data
 - 1 - DSN monitor 5-9 data
 - 0 - DSN-formatted
 - 1 - GIF-formatted
 - 2 - data extracted/derived from GCF monitor data
 - 3 - NASCOM status block
 - 4 - data extracted/derived from NASCOM status block
 - format mission-specific

- 7 - TDM transport frame or packet transfer frame
 - for TDM: frame length/data rate
 - specific frame format/content
 - for packet transfer frames: virtual channel ID
 - format mission-specific
- 8 - other telemetry frame or packet data
 - for TDM: frame length/data rate
 - specific frame format/content
 - for packets: packet ID
 - mission-specific
- 9 - science instrument telemetry record (TDM telemetry)
 - instrument/experiment ID
 - mission-specific
- 10 - other engineering telemetry record
 - mission-specific
 - mission-specific
- 11 - channelized data
 - 0 - channelized engineering frame data
 - format mission-specific
 - 1 - DMD channel data record
 - 0 - n/a
 - 2 - channelized ground station monitor data
 - 0 - monitor 5-12
 - 1 - monitor 5-9.
 - 3 - channelized QQC data
 - 4 - channelized memory readout data
 - format mission-specific
 - other minor types mission-specific
 - format mission-specific
- 12 - out-of-sync data
 - 0 - raw out-of-sync SFDU
 - format identifies record length
 - 1 - playback out-of-sync data
 - format identifies length/data rate
- 13 - SFOC summary and accountability data
 - 0 - telemetry QQC data
 - 1 - file status summary
 - 2 - system/subsystem configuration summary
 - 3 - directory information
 - 4 - data catalogue
 - 5 - processing summary
 - format identifies format/content
- 14 - telemetry processing parameters
 - 0 - decommutation map - source text
 - 1 - translated decommutation map
 - 2 - decom map version control information
 - format identifies map type
 - 3 - time conversion information - source text
 - 4 - binary time conversion information
 - format identifies specific content
 - 5 - channel parameters - source text
 - 6 - binary channel parameters

- 7 - channel parameter version control information
 - format identifies specific parameter types
- 8 - channel conversion/derivation information - source
- 9 - channel conversion/derivation information - binary
 - format identifies specific content
- 15 - operator interface log (directives and events)
 - 0 - directive and response log
 - 1 - event log
 - 2 - combined log
 - 0 - system-wide
 - otherwise: subsystem ID
- 16 - special processing events (not covered by anomaly recs)
 - 0 - system/subsystem configuration changes
 - 0 - start-up
 - 1 - shut-down
 - 1 - communication link change
 - 0 - start-up
 - 1 - shut-down
 - 2 - pausing
 - 3 - resuming
 - 2 - spooler file status information
 - 0 - start spooling
 - 1 - stop spooling
 - 2 - end of data reached, no new data being added
 - 3 - no data found with specified filters
 - 4 - despooling overrun by spooling
- 17 - ancillary product data
 - 0 - navigation data
 - 1 - tracking data
 - 2 - radiometric data
 - format further identifies data
- 18 - spacecraft command data
 - TBD
- 19 - system configuration and routing control information
- 20 - system configuration and routing status information
 - minor type application-specific
 - format application-specific
- 21 - volume/data set control information for magnetic tapes
 - 0 - volume header/trailer information
 - 1 - data set header/trailer information
 - 2 - file header/trailer information
 - 0 - begin/header
 - 1 - end/trailer
 - 2 - continuation
 - 3 - SFDU aggregation control information
 - 0 - n/a
- 126 - SFOC debug aid, diagnostic, and test data
 - same as for major types 19/20 above
 - subsystem-specific record type
- 127 - filler record
 - 0 - n/a
 - 0 - n/a

4.2.2.3 Component Lists for Logical SFDUs4.2.2.3.1 CHDO Type Identifiers

The following list identifies all CHDO types known to SFOC.

type	meaning
00	null (placeholder) CHDO
01	subheader aggregation CHDO
02	SFOC standard primary (sub)header - identifies record type
03	DSN telemetry secondary header
06	DSN count and checksum CHDO for physical SFDUs (see section 4.2.3)
10	header for data segments <u>not</u> consisting of a CHDO aggregation or ASCII characters
12	DSN monitor secondary header
13	GIF telemetry secondary header
14	MGN ancillary data secondary header
15	TIS telemetry secondary header
18	GIF raw log telemetry secondary header
19	MGN TIS telemetry tertiary header
20	TIS out-of-sync telemetry quaternary header
21	MGN TIS engineering telemetry quaternary header
22	MGN TIS DED/STARCAL quaternary header
23	MGN TIS normal MRO/AACS quaternary header
24	MGN TIS SAB quaternary header - begin of frame
25	MGN TIS SAB quaternary header - continuation of frame
26	MGN TIS altimeter quaternary header
27	TIS quaternary header for channelized data
28	header for data segments containing aggregated channel data
30	MGN TIS quaternary header for Radar Composite Data (RCD)
121	GIF monitor secondary header
122	TIS QQC secondary header
123	header for data segment consisting of ASCII characters

4.2.2.3.2 Composition of SFOC Standard CHDO-structured Logical SFDUs

The following is the list of CHDO components of SFDUs which follow the SFOC standard. This list is ordered by "major", "minor", "format", and "mission_id". It includes only SFDUs for existing non-SFOC missions and the Magellan mission. It will be expanded when the need arises. These SFDUs have in common:

- the first CHDO (subheader aggregation CHDO - type 01)
- the second CHDO (record ID CHDO or "primary subheader" - type 02)

For DSN-provided telemetry SFDUs the complete label is:

"NJPL2Z000001"

SFOC-produced CHDO-structured SFDUs have a label of the general format:

"NJPL2I00Cnnn"

The first character of the ddp_id field ("C") identifies the record as standard CHDO-structured. The next 3 characters ("nnn") uniquely describe the structure of the remainder of the record.

NOTE: Those SFDUs that are described as GIF formatted are processed by GIF and include transformations of the SFDU header. Those records that are marked by an * are considered GIF raw and consist of raw data blocks enclosed within an SFDU.

ddp id	mjr type	mnr type	fmt type	msn id	hdr sec	CHDOs ter	data qua	Description	
0001	01	00	00	04	03	--	--	10	DSN Formatted SFDU, align attempted
C101	01	00	01	04	13	--	--	10	GIF Formatted SFDU, align attempted
0001	01	01	00	04	03	--	--	10	DSN Formatted SFDU, no align attempt
C101	01	01	01	04	13	--	--	10	GIF Formatted SFDU, no align attempt
C102	01	02	01	00	18	--	--	10	GCF 1200 bit raw block, VGR
C102	01	02	01	01	18	--	--	10	GCF 1200 bit raw block, GLL
C102	01	02	01	03	18	--	--	10	GCF 1200 bit raw block, ULS
C103	01	02	04	00	18	--	--	10	GCF 1200 w/Monitor 5-9, VGR
C103	01	02	04	01	18	--	--	10	GCF 1200 w/Monitor 5-9, GLL
C103	01	02	04	03	18	--	--	10	GCF 1200 w/Monitor 5-9, ULS
C104	01	03	01	00	18	--	--	10	GCF 4800 bit raw block, VGR
C104	01	03	01	01	18	--	--	10	GCF 4800 bit raw block, GLL
C104	01	03	01	03	18	--	--	10	GCF 4800 bit raw block, ULS
C104	01	03	01	04	18	--	--	10	GCF 4800 bit raw block, MGN*
C105	01	03	02	04	18	--	--	10	GCF 4800 w/embedded TLM SFDU*
C105	01	03	03	04	18	--	--	10	GCF 4800 w/embedded MON SFDU*
C106	01	04	01	01	18	--	--	10	NASCOM 4800 bit raw block, GLL
C106	01	04	01	03	18	--	--	10	NASCOM 4800 bit raw block, ULS
C106	01	04	01	04	18	--	--	10	NASCOM 4800 bit raw block, MGN*
C108	02	128	00	04	15	19	21	10	SED frame, MGN
C109	02	129	00	04	15	19	21	10	RED frame, MGN
C110	04	130	00	04	15	19	30	10	RCD frame, MGN
C111	04	131	00	04	15	19	24	10	SAB header record, MGN
C112	04	132	00	04	15	19	24	10	SAB frame, MGN
C114	04	134	00	04	15	19	26	10	Altimeter data, MGN
C115	06	00	01	04	121	--	--	10	GIF Formatted Monitor 5-12, MGN
C116	06	01	00	00	12	--	--	10	DSN Formatted Monitor 5-9, VGR
C116	06	01	00	01	12	--	--	10	DSN Formatted Monitor 5-9, GLL
C116	06	01	00	03	12	--	--	10	DSN Formatted Monitor 5-9, ULS
C117	10	135	00	04	15	19	23	10	Normal MRO, MGN
C118	10	136	00	04	15	19	22	10	DED, MGN
C119	10	137	00	04	15	19	23	10	AACS, MGN
C120	10	138	00	04	15	19	22	10	STARCAL, MGN
C121	11	00	128	04	15	19	27	28	Channelized SED, MGN
C121	11	00	131	04	15	19	27	28	Channelized SAB Header, MGN
C122	11	01	00	04	--	--	--	10	DMD channel data record, MGN

ddp id	mjr type	mnr type	fmt	msn id	hdr sec	CHDOs ter	data qua	chdo	Description
C123	11	02	00	04	121	00	27	28	Channelized monitor 5-12, MGN
C124	11	03	00	04	122	00	27	28	Channelized QQC, MGN
C121	11	04	136	04	15	19	27	28	Channelized DED, MGN
C121	11	04	138	04	15	19	27	28	Channelized STARCAL, MGN
C125	11	128	00	04	--	--	--	28	ETF query response (CDB to DMD), MGN
C126	12	00	128	04	15	19	20	10	Out-of-sync - SED size, MGN
C126	12	00	129	04	15	19	20	10	Out-of-sync - RED size, MGN
C126	12	00	130	04	15	19	20	10	Out-of-sync - RCD size, MGN
C126	12	01	130	04	15	19	20	10	Out-of-sync - SAB (RCD size), MGN
C127	13	00	00	04	122	--	--	10	TIS QQC record, MGN
C128	19	0	129	255	--	--	--	10	SFOC G/W routing table
C128	19	1	129	255	--	--	--	10	SFOC G/W routing table reply
C128	19	0	130	255	--	--	--	10	SFOC G/W routing table chg req
C129	19	0	131	255	--	--	--	--	SFOC G/W ack of chg req
C129	19	0	128	255	--	--	--	--	SFOC G/W query for routing tbl
C130	19	0	132	255	--	--	--	10	SFOC G/W test record
O130	06	0	0	4	121			10	DSN Raw Monitor 5-12
C131	20	0	128	255	--	--	--	10	SFOC G/W monitor periodic perf.
C132	20	0	129	255	--	--	--	10	SFOC G/W mon - req. for add. data
C133	20	0	130	255	--	--	--	10	SFOC G/W mon - response to req.
C134	20	0	131	255	--	--	--	10	SFOC G/W mon - configuration data
C135	02	129	01	04	15	19	21	10	Out-of-orbit RED, MGN
C136	02	129	02	04	15	19	21	10	Duplicate RED, MGN
C137	04	130	01	04	15	19	30	10	Out-of-orbit RCD, MGN
C138	04	130	02	04	15	19	30	10	Duplicate RCD, MGN

4.2.2.3.3 Composition of Non-Standard CHDO-structured Logical SFDUs

The following SFDUs are generated by systems other than SF0C. The records are CHDO-structured, but do not follow the SF0C standard. The columns for major type, minor type, format, and mission ID apply only when a record identification CHDO (type 02) is present.

mjr typ	mnr typ	fmt typ	msn ID	primary label	CHDOs				Description
					1st	2nd	3rd	4th	
06	00	01	04	NJPL2I000115	02	12	10	--	GIF Formatted Mon 5-12, MGN

4.2.2.3.4 Composition of Formal (Non-CHDO-structured) Logical SFDUs

The following records do not contain CHDOs. The type of data and other needed information can be located by parsing the structure as discussed in applicable document #1. As described in Section 4.2.1.4, the structure in each case will be an aggregation by length or an aggregation by marker. Since a catalog/keyword header with descriptive information will be provided for each, the table below will not be needed. It is added to this document in order to give a clearer picture of the different types of SF0C SFDU structures. Note that each structure, whether aggregated by length or marker, has a unique JPL Control Authority assigned-ID which can be used to reference more detailed documentation. The ID is a DDP_ID in an I label (for aggregation by length) or an entry in a "CCSDvRss0003" or "NJPLvRssKL00" header (for aggregation by marker of unlabelled data objects).

The following is a list of unlabelled data objects that are aggregated by marker. The start marker supplies the CCSDS TLVO TYPE field for the aggregated objects.

TYPE	Description
NJPL1I000124	MGN Radar processing bandwidth
NJPL1I000126	MGN Average Orbital Elements
NJPL1I000127	MGN Mapping quaternion polynomial coefficients
NJPL1I000128	MGN SCLK/SCET coefficients
NJPL1I000136	NAIF spice kernel data
NJPL1I000141	MGN Orbit header record
NJPL1I000142	MGN Data Quality summary records
NJPL1I000150	Spacecraft ephemeris data
NJPL1I000152	NAIF General Ephemeris Format (GEF) data
NJPL1I000160	Combined decom and decal data
NJPL1I000170	Engineering decom map - display format from DMDL
NJPL1I000171	Eng. decal 1 - channel parameters - dBase III display format
NJPL1I000172	Eng. decal 2 - conv. factors for status channels - dB dsp fmt
NJPL1I000173	Eng. decal 3 - EU conv. - calibration changes - dB dsp fmt
NJPL1I000174	ENG. decal 4 - EU conv. - interpolation table - dB dsp fmt

The following are other labeled data objects that are not CHDO-structured. An "x" in column "Aggr." indicates that these objects usually occur in aggregations by marker and are accompanied by a catalog/keyword label ("NJPL1K00KL00") that contains further data identification.

TYPE	Aggr.	Description
NJPL1I00A001	x	Section of decom map - any type - DMDL syntax
NJPL1I000400		MGN TPS directory file
NJPL1I000600		Key spacecraft event times file data
NJPL2I000151		SFOC count and sequence record

The following are the TYPE values for miscellaneous TLVOs used for SFDU aggregations, file and volume markers, catalog information, etc. These objects usually appear in conjunction with "I" class SFDUs. Where indicated by "v", the version_id field may assume the values "1" or "2". Note: For some of these records, TYPE values were assigned as SFDU standards were evolving. They may therefore not always conform to the current CCSDS and JPL standards.

TYPE	Description
CCSDvR000003	Aggregation start/end marker
CCSDvZ000001	Unclassified SFDU aggregation
NJPL1K00KL02	Non-standard catalog/keyword label (used in Spacecraft Event Times file)
NJPL2A00KL01	DSN ODR tape volume trailer
NJPL2V00KL01	DSN ODR tape volume header
NJPLvK00KL00	SFOC Catalog/keyword label (standard "keyword-value" format)

4.2.2.4 Identifiers for Originator/Last Modifier

Secondary SFDU headers, as currently implemented for SFOC and Magellan, contain fields for "Originator ID" and "Last Modifier ID". The table below lists possible values for those fields. Note that a change to "Last Modifier ID" would be called for when data structures are re-aggregated, even if the data is not modified.

- 48 - DSN - Deep Space Network
- 66 - FEP - Front End Processor (AMPTE/DACS)
- 100 - CMD - Command Subsystem
- 101 - DMD - Data Monitor and Display
- 102 - CDA - Central Data Access
- 103 - DPS - Data Products Subsystem
- 104 - DTS - Data Transport Subsystem
- 105 - DTV - Digital Television Subsystem
- 106 - EAS - Engineering Analysis
- 107 - EUA - External User Access
- 108 - GIF - GCF Interface
- 109 - MAS - Mission planning and Analysis
- 110 - IPS - Image Processing Subsystem
- 111 - NAV - Multi-mission Navigation subsystem
- 112 - SAS - Science Analysis Subsystem
- 113 - SEQ - Sequence generation subsystem
- 114 - SIM - Simulation subsystem
- 115 - SMC - SFOC Monitor and Control
- 116 - TCA - Telecommunications Analysis

- 117 - TIS - Telemetry Input Subsystem
- 118 - TWS - Test Workstation
- 119 - WSE - Workstation Environment
- 120 - MHR - Magellan High-Rate processor

4.2.3 Format of Physical Records

This section specifically addresses record aggregation that becomes necessary for data transport purposes, i.e. it describes the structure of physical records. For information about aggregation in general refer to Applicable Document #1.

Often, the blocking of logical records into physical ones is done by the operating system or transport software package and remains transparent to the application software. However, there are some instances when the application must block/de-block the data.

SFOC uses the "aggregation by length" method, as it is defined in Applicable Document #1. This method provides for the concatenation of logical SFDUs which then form the "value" portion of a new TLVO, to which "type" and "length" information is added.

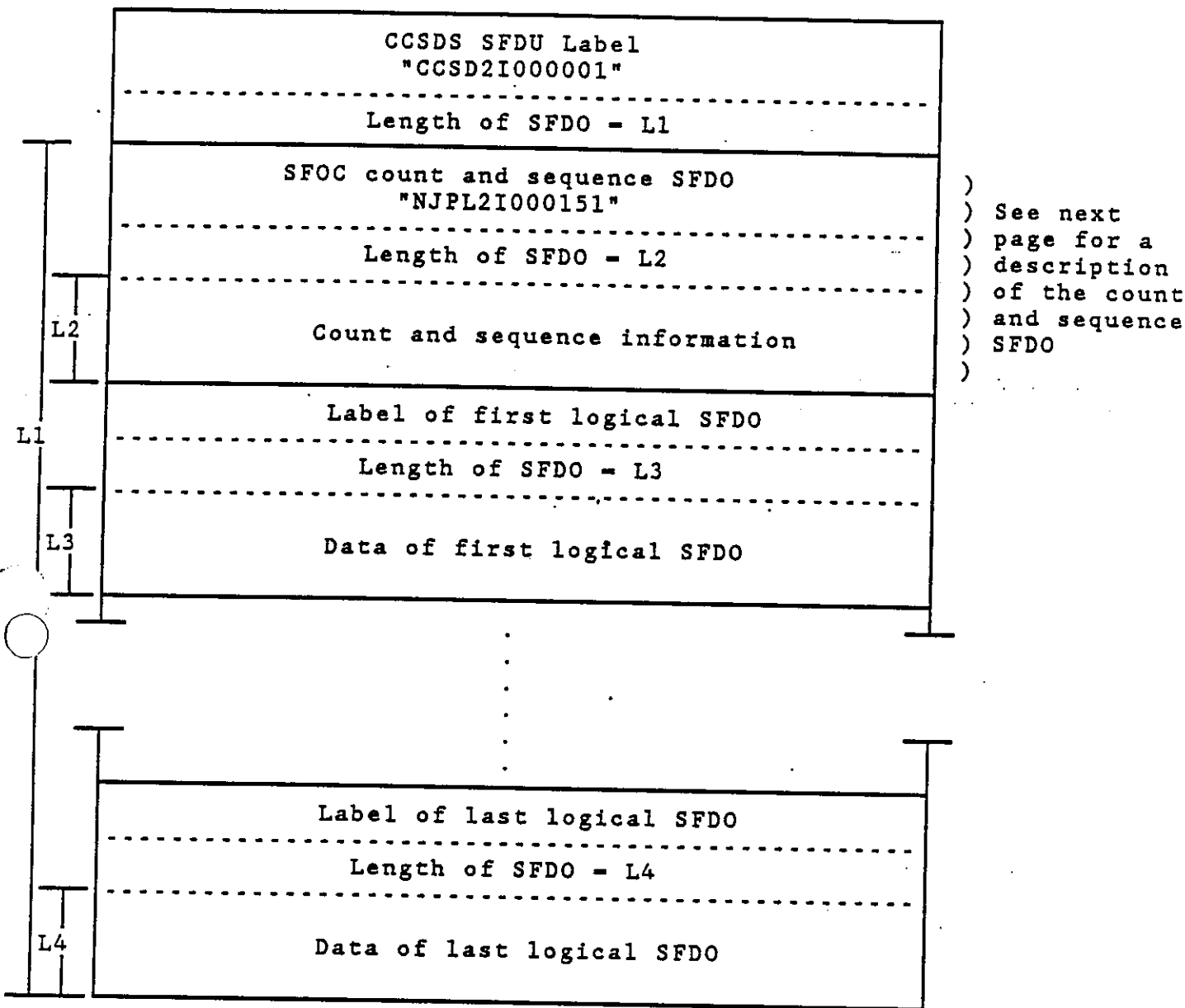
As an additional convention, SFOC requires a "count and sequence" SFDU as the first logical record within the physical SFDU. This format is used regardless of the categories of logical SFDUs (SFOC standard CHDO-structured, non-standard CHDO-structured, non-CHDO-structured) that follow in the physical SFDU.

Section 4.2.3.1 describes the SFOC-generated physical SFDU.

Section 4.2.3.2 lists physical SFDU components, including those for physical records received by SFOC.

4.2.3.1 SFOC-generated Physical SFDU

SFOC-generated physical SFDU are structured as follows:



Maximum physical record size is 65,536 bytes. The maximum value for L1 thus is 65,524.

records that follow this record within the physical SFDU.

4.2.3.2 Components of Physical Records Received and Produced by SFOC

The following list identifies all SFDU-formatted physical records encountered in SFOC. For each physical record, the logical records contained in it are identified by primary SFDU label and a description of SFDU content.

Note that, depending on the medium across which physical SFDUs are transferred, additional control records, such as volume and file-begin and -end markers, may be defined. These records may not always follow SFDU standards. Those that do not are not identified here.

The format used for the lists below is:

CCSDS label record content

1. standard SFOC physical SFDU:

CCSD2I000001	
NJPL2I000151	standard SFOC count and sequence SFDU
1st logical SFDU	any type of logical SFDU
last logical SFDU	any type of logical SFDU

2. DSN physical SFDU on MGN ODR tape:

NJPL2Z000001	chdo_type 06 - count and checksum
1st logical SFDU	DSN logical SFDU
last logical SFDU	DSN logical SFDU

3. DSN MGN ODR tape header:

CCSD2Z000001	
NJPL2V00KL01	DSN volume header
NJPL2K00KL00	DSN file header/trailer

4. DSN MGN ODR tape trailer:

CCSD2Z000001	
NJPL2A00KL01	DSN volume trailer
NJPL2K00KL00	DSN file header/trailer