CDF DATA FORMAT

SWARM L1B

Prepared by: Maria Jose Brazal

X

Maria Jose Brazal

Approved by: Teresa Iscar

X

Authorized by: Maria Jose Brazal

X

Maria Jose Brazal

Code:	SW-ID-GMV-GS-0006
Internal code:	GMVAD 20370/10 V12/15
Version:	3.11
Date:	29/04/2016

DOCUMENT STATUS SHEET

Version	Date	Pages	Changes
1.0	29/04/2016	34	First issue
1.1	26/03/2010	35	Updated with comments from ESA: • Added Appendix A (product metadata definition) • Section 4.2: Record Header explained in more detail. Changes to its format to CDF_EPOCH. • Section 3.3: Comment indicating the non-conversion of ASCII files. • Section 3.3: Update filename conventions with new product filename specification. • Change in all products specification to CDF_DOUBLE when having scale factors applied. • Change of time formats to CDF_EPOCH in cdf format across MAGNET and ORBATT products.
1.2	08/10/2010	36	Updated version for CDR2: • Section 5.2.3.3: Dimensions of temperatures in MDR_PROP_HK updates • Section 5.2.4.1: Dimensions of MDR_STAT_HK updates • Section 6.3.3.2 and 6.3.4.2: ASM_VFM_IC data updated
1.3	03/12/2010	36	Updated version for CDR2-closeout: • Section 2.1: SW-GMV-CDR2-12 implemented: The last version of AD.3 is 5.6 instead of 5.4 • Section 6.6.1: Added MAGxMAN_1B product. • Section 4.2: Additional comments on CDF_EPOCH creation.
3.0	04/07/2011	36	Updated version for CDR3/OSAT • Section 5.4.2.2 removed pulse period "tp" and Shutter pulse width "tw" fields
3.1	08/09/2011	32	Updated for L2 CAT2 PDR1
3.2	10/10/2011	32	Updated fro PDR-1 close-out. The following RIDs have been implemented:PDR-1_2
3.3	19/10/2011	32	Flags_LP_ne tag name changed to Flags_LP_n to be aligned with L1B product specification v5.9
3.4	28/11/2011	32	Types of var_x_H, var_y_H, var_x_V and var_y_V variables in EFI_PL_1B product chaned fromCDF_INT4 to CDF_DOUBLE
3.5	17/02/2012	32	Version for L2 CAT2 CDR: • VpLTC1043 and VnLTC1043 fields added to ACCx_PR_1B CDF product definition.
3.6	01/04/2014	32	SPR-L2CAT2-63: TIIx_CA_1B updated SPR-L2CAT2-64: LP__OFF_CA and ACC_PR_1B parameter names updated
3.7	28/11/2014	32	SWL1L2DB-22: New parameters in CDF added
3.8	30/03/2015	32	EFI_LP_1A CDF format updated. Section 5.4.1.2 Several sections: L1A and L1B product format reviewed and aligned.
3.9	15/06/2015	32	sweepIndicator field added to EFIx_LP_1A harmonic product. Table 5-20 Tables Table 6-7, Table 6-9, Table 6-11 and Table 6-5 updated with new fields related to dB_Sun correction.
3.10	11/04/2016	33	Changes due to v3.17 L1bOP delivery: - Several parameters of the LP_x_CA_1B product changed from CDF_UINT32 to CDF_INT32. Section 6.4.2

Version	Date	Pages	Changes
3.11	29/04/2016	33	- ASM_VFM_IC MDR in MAGxMAN L1B product aligned with ASM_VFM_IC records in MAG_LR/HR/CA_1B products

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1. INTRODUCTION

1.1. PURPOSE

The purpose of this document is to identify and describe the output data format of the CDF converter tool with respect to the SWARM L1B IPF.

1.2. SCOPE

The definition of interfaces between the Swarm L1b output products and the CDF products produced as a result of the conversion process.

1.3. DEFINITIONS AND ACRONYMS

1.3.1. DEFINITIONS

Concepts and terms used in this document and needing a definition are included in the following table:

Concept / Term	Definition
CDF	The Common Data Format is a self-describing data format for the storage and manipulation of scalar and multidimensional data.

Table 1-1: Definitions

1.3.2. ACRONYMS

Acronyms used in this document are detailed in the following table:

Acronym	Definition
CDF	Common Data Format
NASA	National Aeronautics and Space Administration
MDR	Measurement data record

Table 1-2: Acronyms

2. REFERENCES

2.1. APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form part of this document to the extent specified herein. Applicable documents are those referenced in the Contract or approved by the Approval Authority.

See SW-CS- GMV-GS-2001 Configuration Accounting Status Report v1.20.

2.2. REFERENCE DOCUMENTS

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.X]:

Ref.	Title	Code	Version	Date
[RD.1]	http://cdf.gsfc.nasa.gov/	-	-	-

Table 2-1: Reference documents

3. OVERVIEW

3.1. CDF FORMAT

The Common Data Format (CDF) is a self-describing data format for the storage and manipulation of scalar and multidimensional data in a platform- and discipline-independent fashion.

When one first hears the term **"Common Data Format"** one intuitively thinks of data formats in the traditional (i.e. messy/convoluted storage of data on disk or tape) sense of the word. Although CDF has its own internal self describing format, it consists of more than just a data format. CDF is a scientific data management package (known as the "CDF Library") which allows programmers and application developers to manage and manipulate scalar, vector, and multi-dimensional data arrays.

The irony of the term "FORMAT" is that the actual data format which CDF utilizes is completely transparent to the user and accessible through a consistent set of interface (known as the "CDF Interface") routines. Therefore, programmers are not burdened with performing low level I/O's to physically format and un-format the data file. This is all done for them automatically.

3.2. CDF VERSION

The CDF version used to generate the CDF products described in the document is CDF 3.30. At the time of writing these pages this is the latest version of CDF released by NASA.

3.3. FILENAME CONVENTIONS

The names used for the CDF files have been obtained using a combination of the operational product filename and the MDR names of the individual MDR types that compose that specific product. Thus for a product containing three different MDR types, three different files will be created (each one with the name of its associated MDR type). The header part of the operational products is copied without modification to same location as the CDF product.
The output of the processor will be a zip file with the name equal to: Original_File_Name.CDF.zip. This zip file shall contain (in a flat way, without a directory):

- <Original_File_Name>.HDR (HDR file copied from the original EEF file with the original name)
- <Original_File_Name>_<MDR_Name_1>.cdf
- <Original_File_Name>_<MDR_Name_2>.cdf
- …
- <Original_File_Name>_<MDR_Name_X>.cdf

The mappings for each product are provided below in the L1a and L1b sections respectively.
Please note that ASCII product files (L1a and L1b) have not been converted to CDF as many standard utilities already exist that deal with these product files (RINEX, SP3 readers…).

4. COMMON FIELDS

4.1. CDF METADATA

CDF files can contain metadata in the files. These data is used to characterize the CDF product in order to help trace the origin of the file, creation, etc.

For a thorough list of metadata please check Appendix A.

4.2. TIMESTAMP INFORMATION

All records in the CDF structures for Swarm share a common, first fields, the timestamp of the record. The field has not been included in the description of the records as it is the same for all.

Field Name	Type	Dimension
Timestamp	CDF_EPOCH	-
SyncStatus	CDF_UINT2	-

Table 4-1: CDF product header

The CDF_EPOCH data type is used to store time values referenced from a particular epoch. For CDF that epoch values for CDF_EPOCH is 01-Jan-0000 00:00:00.000.
It is worth mentioning that originally the CDF_EPOCH timestamp is created with a library function that only has a 1 millisecond precision. But, as stated by the library documentation, the generated CDF_EPOC time can store values up to 10 microseconds, this microsecond value is added after creation to account for the lost precision.
The SyncStatus variable is a quality indicator used to check the time synchronization of the products. It is also the same for all records, so it is only listed here.

4.3. SCALE FACTORS

Many converted product have scale factors in the operational product files that need to be applied in order to convert the values from the operational product format to physical magnitudes. These scale factors are provided in L1a Product Specification and L1b product specification.

The CDF converter takes these scaling factors into account in order to provide the CDF products in scientific format.

5. L1A DATA FORMAT

Next the correspondence between the different filetypes and the generated CDF files is shown for L1a products. Following that information details on the contents of each CDF file is also presented.

In the tables below:

- **Field name**: Indicates the name of the variable as used in the operational products.
- **Type**: Indicates the CDF type used to encode the variable. U for unsigned.
- **Dimension:** refers to the number of values a variable have of each kind if it is an array or '-' if it is a regular single variable.

5.1. L1A PRODUCT TYPES

The applicable L1a file types that have a CDF counterpart are:

ORBATT
STRxSCI_1A
GPSxNOM_1A
HK_xAOCS1A
HK_xBUS_1A
MAGNET
ASMxSCI_1A
VFMxSCI_1A
PLASMA
EFIx_LP_1A
EFIx_TII1A
ACCELE
ACCxSCI_1A

Table 5-1: L1a product Types

5.2. ORBATT

The CDF files generated for ORBATT L1a file types are:

STRxSCI_1A
MDR_STR_SCI.cdf
MDR_STR_INS.cdf
MDR_STR_PRC.cdf
GPSxNOM_1A
MDR_GPS_LEO.cdf
MDR_GPS_GPS.cdf
MDR_GPS_TCOR.cdf
MDR_GPS_TEMP.cdf
MDR_GPS_CARR.cdf
MDR_GPS_CODE.cdf
MDR_GPS_CNO.cdf

HK_xAOCS1A
MDR_MAG_HK.cdf
MDR_THRU_HK.cdf
MDR_PROP_HK.cdf
HK_xBUS_1A
MDR_STAT_HK.cdf
MDR_CURR_HK.cdf

Table 5-2: ORBATT L1a output files

For each of these files, the complete format description is provided:

5.2.1. STRXSCI_1A

5.2.1.1. MDR_STR_SCI.cdf

Field Name	Type	Dimension
Att1_q	CDF_DOUBLE	4
Att1_Seq	CDF_UINT1	-
Att1_Cor	CDF_UINT1	-
Att1_HR	CDF_UINT1	-
Att1_BBO	CDF_UINT1	-
Att1_t_ref	CDF_UINT1	-
Att1_Valid	CDF_UINT1	-
Att1_Res	CDF_ DOUBLE	-
Att1_Stars	CDF_UINT1	-
Att1_Locks	CDF_UINT1	-
Att2_q	CDF_ DOUBLE	4
Att2_Seq	CDF_UINT1	-
Att2_Cor	CDF_UINT1	-
Att2_HR	CDF_UINT1	-
Att2_BBO	CDF_UINT1	-
Att2_t_ref	CDF_UINT1	-
Att2_Valid	CDF_UINT1	-
Att2_Res	CDF_ DOUBLE	-
Att2_Stars	CDF_UINT1	-
Att2_Locks	CDF_UINT1	-
Att3_q	CDF_ DOUBLE	4
Att3_Seq	CDF_UINT1	-
Att3_Cor	CDF_UINT1	-
Att3_HR	CDF_UINT1	-
Att3_BBO	CDF_UINT1	-
Att3_t_ref	CDF_UINT1	-
Att3_Valid	CDF_UINT1	-
Att3_Res	CDF_ DOUBLE	-

Att3_Stars	CDF_UINT1	-
Att3_Locks	CDF_UINT1	-

Table 5-3: MDR_STR_SCI L1a fields

5.2.1.2. MDR_STR_INS.cdf

Field Name	Type	Dimension
q_CRF_ICRF	CDF_ DOUBLE	4
q_CRF_ICRF_error	CDF_ DOUBLE	-

Table 5-4 MDR_STR_INS L1a fields

5.2.1.3. MDR_STR_PRC.cdf

Field Name	Type	Dimension
q_ITRF_ICRF	CDF_ DOUBLE	4
q_CRF_ICRF	CDF_ DOUBLE	4
q_CRF_ICRF_error	CDF_ DOUBLE	-
Flags_q	CDF_UINT1	-

Table 5-5: MDR_STR_PRC L1a fields

5.2.2. GPSXNOM_1A

5.2.2.1. MDR_GPS_LEO.cdf

Field Name	Type	Dimension
tGPST_day	CDF_INT4	-
tGPST_milisec	CDF_UINT4	-
tGPST_nanosec	CDF_DOUBLE	-
tIMT_day	CDF_INT4	-
tIMT_milisec	CDF_UINT4	-
tIMT_nanosec	CDF_DOUBLE	-
Temp	CDF_DOUBLE	-
P_SWARM	CDF_DOUBLE	3
V_SWARM	CDF_DOUBLE	3
roll	CDF_INT4	-
pitch	CDF_INT4	-
yaw	CDF_INT4	-
GDOP	CDF_INT2	-
PVT_QI	CDF_UINT2	-
MNS_method	CDF_UINT1	-

Table 5-6: MDR_GPS_LEO L1a fields

5.2.2.2. MDR_GPS_GPS.cdf

Field Name	Type	Dimension
tGPST_day	CDF_INT4	-
tGPST_milisec	CDF_UINT4	-
tGPST_nanosec	CDF_UINT4	-

tIMT_day	CDF_INT4	-
tIMT_milisec	CDF_UINT4	-
tIMT_nanosec	CDF_UINT4	-
SV_ID	CDF_UINT4	-
Secondary structures (n = N_GPS)		
t_GPS	CDF_DOUBLE	-
P_GPS	CDF_INT4	3
V_GPS	CDF_INT4	3
phi_GPS	CDF_DOUBLE	-
theta_GPS	CDF_DOUBLE	-
L1	CDF_DOUBLE	-
L2	CDF_DOUBLE	-
PR_CA	CDF_DOUBLE	-
PR_P1	CDF_DOUBLE	-
PR_P2	CDF_DOUBLE	-
A_L1	CDF_INT2	-
A_L2	CDF_INT2	-
CNo_L1	CDF_INT2	-
CNo_L2	CDF_INT2	-

Table 5-7: MDR_GPS_GPS L1a fields

5.2.3. HK_XAOCS1A

5.2.3.1. MDR_MAG_HK.cdf

Field Name	Type	Dimension
Imea_MTQ	CDF_DOUBLE	6
t_mtq	CDF_DOUBLE	-

Table 5-8: MDR_MAG_HK L1a fields

5.2.3.2. MDR_THRU_HK.cdf

Field Name	Type	Dimension
dt	CDF_DOUBLE	12
Valid	CDF_UINT2	12
TCj	CDF_DOUBLE	-

Table 5-9: MDR_THRU_HK L1a fields

5.2.3.3. MDR_PROP_HK.cdf

Field Name	Type	Dimension
P_A	CDF_ DOUBLE	-
P_B	CDF_ DOUBLE	-
T_A	CDF_ DOUBLE	5
T_B	CDF_ DOUBLE	5

Table 5-10: MDR_PROP_HK L1a fields

5.2.4. HK_XBUS_1A

5.2.4.1. MDR_STAT_HK.cdf

Field Name	Type	Dimension
States_Name	CDF_CHAR	85
States_Value	CDF_UINT1	85
Heat_Name	CDF_ CHAR	54
Heat_Value	CDF_UINT1	54
Thru_Name	CDF_CHAR	24
Thru_Value	CDF_UINT1	24
Manoeuvre	CDF_UINT1	-

Table 5-11: MDR_STAT_HK L1a fields

5.2.4.2. MDR_CURR_HK.cdf

Field Name	Type	Dimension
SP_names	CDF_CHAR	8
I_SP	CDF_ DOUBLE	8
Other_names	CDF_CHAR	41
I_other	CDF_ DOUBLE	41
Bat_names	CDF_CHAR	3
I_bat	CDF_ DOUBLE	3

Table 5-12: MDR_CURR_HK L1a fields

5.3. MAGNET

The CDF files generated for MAGNET L1a file types are:

ASMxSCI_1A
MDR_ASM_SCI.cdf
MDR_ASM_INS.cdf
VFMxSCI_1A
MDR_VFM_SCI.cdf
MDR_VFM_INS.cdf

Table 5-13: MAGNET L1a output files

5.3.1. ASMXSCI_1A

5.3.1.1. MDR_ASM_SCI.cdf

Field Name	Type	Dimension
E	CDF_DOUBLE	-
N	CDF_UINT4	-
T_sensor	CDF_DOUBLE	-
Mode	CDF_UINT1	-

Table 5-14: MDR_ASM_SCI L1a fields

5.3.1.2. MDR_ASM_INS.cdf

Field Name	Type	Dimension
F	CDF_DOUBLE	-
F_err	CDF_DOUBLE	-

Table 5-15: MDR_ASM_ INS L1a fields

5.3.2. VFMXSCI_1A

5.3.2.1. MDR_VFM_SCI.cdf

Field Name	Type	Dimension
EU_X	CDF_DOUBLE	50
EU_Y	CDF_DOUBLE	50
EU_Z	CDF_DOUBLE	50
Tx	CDF_DOUBLE	-
Src_Tx	CDF_UINT1	-
DPU_id	CDF_UINT1	-

Table 5-16: MDR_ASM_ INS L1a fields

5.3.2.2. MDR_VFM_INS.cdf

Field Name	Type	Dimension
VFM_X	CDF_DOUBLE	50
VFM_Y	CDF_DOUBLE	50
VFM_Z	CDF_DOUBLE	50

Table 5-17: MDR_VFM_ INS L1a fields

5.4. PLASMA

The CDF files generated for PLASMA L1a file types are:

EFIx_LP_1A
MDR_LP_SM.cdf
MDR_LP_HM.cdf
EFIx_TII1A
MDR_TII_SCI.cdf
MDR_TII_HK.cdf

Table 5-18: PLASMA L1a output files

5.4.1. EFIX_LP_1A

5.4.1.1. MDR_LP_SM.cdf

Field Name	Type	Dimension
Isw1	CDF_DOUBLE	-
Isw2	CDF_DOUBLE	-

Vbias1	CDF_DOUBLE	-
Vbias2	CDF_DOUBLE	-
dt	CDF_INT2	-
dU	CDF_INT2	-
Uo	CDF_DOUBLE	-
Ninv	CDF_INT2	-
N	CDF_UINT1	-
Iface	CDF_DOUBLE	16
Vface	CDF_DOUBLE	-
P1_Gain	CDF_DOUBLE	-
P2_Gain	CDF_DOUBLE	-
Fp_Gain	CDF_DOUBLE	-
deltaTime	CDF_DOUBLE	-

Table 5-19: MDR_LP_SM L1a fields

5.4.1.2. MDR_LP_HM.cdf

Field Name	Type	Dimension
I1_ion	CDF_DOUBLE	-
I1_lin	CDF_DOUBLE	-
I1_ret	CDF_DOUBLE	-
D1_ion	CDF_DOUBLE	-
C1_ion	CDF_DOUBLE	-
D1_lin	CDF_DOUBLE	-
C1_lin	CDF_DOUBLE	-
D1_ret	CDF_DOUBLE	-
C1_ret	CDF_DOUBLE	-
I2_ion	CDF_DOUBLE	-
I2_lin	CDF_DOUBLE	-
I2_ret	CDF_DOUBLE	-
D2_ion	CDF_DOUBLE	-
C2_ion	CDF_DOUBLE	-
D2_lin	CDF_DOUBLE	-
C2_lin	CDF_DOUBLE	-
D2_ret	CDF_DOUBLE	-
C2_ret	CDF_DOUBLE	-
V1_ret	CDF_DOUBLE	-
V2_ret	CDF_DOUBLE	-
V1_ion	CDF_DOUBLE	-
V2_ion	CDF_DOUBLE	-
V1_lin	CDF_DOUBLE	-
V2_lin	CDF_DOUBLE	-
overflow_p2_ret_e	CDF_UINT2	-

overflow_p1_ret_e	CDF_UINT2	-
overflow_p2_lin_e	CDF_UINT2	-
overflow_p1_lin_e	CDF_UINT2	-
Iface	CDF_DOUBLE	16
Vface	CDF_DOUBLE	-
P1_Gain	CDF_DOUBLE	-
P2_Gain	CDF_DOUBLE	-
Fp_Gain	CDF_DOUBLE	-
deltaTime	CDF_DOUBLE	-
ZMbias1	CDF_DOUBLE	-
ZMbias2	CDF_DOUBLE	-
sweepIndicator	CDF_UINT1	-

Table 5-20: MDR_LP_HM L1a fields

5.4.2. EFIX_TII1A

5.4.2.1. MDR_TII_SCI.cdf

Field Name	Type	Dimension
x_1st_16Hz_H	CDF_UINT2	8
y_1st_16Hz_H	CDF_UINT2	8
y_2nd_16Hz_H	CDF_UINT2	-
y_1st_2Hz_H	CDF_UINT2	8
y_2Hz_H	CDF_UINT2	-
N_i_H	CDF_UINT2	64
x_1st_16Hz_V	CDF_UINT2	8
y_1st_16Hz_V	CDF_UINT2	8
y_2nd_16Hz_V	CDF_UINT2	-
y_1st_2Hz_V	CDF_UINT2	8
y_2Hz_V	CDF_UINT2	-
N_i_V	CDF_UINT2	64

Table 5-21: MDR_TII_SCI L1a fields

5.4.2.2. MDR_TII_HK.cdf

Field Name	Type	Dimension
U_FP	CDF_DOUBLE	-
T_CCD	CDF_DOUBLE	2
U_grid	CDF_DOUBLE	2
U_MCP	CDF_DOUBLE	2
U_phos	CDF_DOUBLE	2

Table 5-22: MDR_TII_HK L1a fields

5.5. ACCELE

The CDF files generated for ACCELE L1a file types are:

ACCxSCI_1A
MDR_ACC_INS.cdf
MDR_ACC_SCI.cdf

Table 5-23: ACCELE L1a output files

5.5.1. ACCXSCI_1A

5.5.1.1. MDR_ACC_INS.cdf

Field Name	Type	Dimension
a_lin_Inst	CDF_ DOUBLE	3
a_ang_Inst	CDF_ DOUBLE	3
p_lin_Inst	CDF_ DOUBLE	3
p_ang_Inst	CDF_ DOUBLE	3
U_pol_Inst	CDF_DOUBLE	-

Table 5-24: MDR_ACC_INS L1a fields

5.5.1.2. MDR_ACC_SCI.cdf

Field Name	Type	Dimension
a_lin	CDF_DOUBLE	3
a_ang	CDF_DOUBLE	3
p_lin	CDF_ DOUBLE	3
p_ang	CDF_ DOUBLE	3
T	CDF_ DOUBLE	6
U_pol	CDF_ DOUBLE	-
Mode	CDF_UINT1	-
DRDY	CDF_UINT1	-
DRDY_HK	CDF_UINT1	-
ALSwitch	CDF_UINT1	-

Table 5-25: MDR_ACC_SCI L1a fields

6. L1B DATA FORMAT

Next the correspondence between the different filetypes and the generated CDF files is shown for L1b products. Following that information details on the contents of each CDF file is also presented.

In the tables below:

- **Field name**: Indicates the name of the variable as used in the operational products.
- **Type**: Indicates the CDF type used to encode the variable. U for unsigned.
- **Dimension:** refers to the number of values a variable have of each kind if it is an array or '-' if it is a regular single variable.

6.1. L1B PRODUCT TYPES

The applicable L1a file types that have a CDF counterpart are:

ORBATT
STRxATT_1B
MAGNET
VFMx_AUX_1B
ASMx_AUX_1B
MAGx_HR_1B
MAGx_LR_1B
MAGx_CA_1B
PLASMA
TIIx_CA_1B
LP_x_CA_1B
EFIx_PL_1B
ACC
ACCx_PR_1B
MAGCMP
MAGxMAN_1B

Table 6-1: L1b product Types

6.2. ORBATT

The CDF files generated for ORBATT L1b file types are:

STRxATT_1B
MDR_SAT_AT.cdf

Table 6-2: ORBATT L1b output files

6.2.1. STRXATT_1B

6.2.1.1.1. MDR_SAT_AT.cdf

Field Name	Type	Dimension
q	CDF_ DOUBLE	4
Flags_q	CDF_UINT1	-
Maneuver_Id	CDF_UINT1	-

Table 6-3: MDR_SAT_AT L1b fields

6.3. MAGNET

The CDF files generated for MAGNET L1b file types are:

VFMx_AUX_1B
MDR_VFMAUX.cdf
ASMx_AUX_1B
MDR_ASMAUX.cdf
MAGx_HR_1B
MDR_MAG_HR.cdf
ASM_VFM_IC.cdf
MAGx_LR_1B
MDR_MAG_LR.cdf
ASM_VFM_IC.cdf
MAGx_CA_1B
MDR_MAG_CA.cdf
ASM_VFM_IC.cdf

Table 6-4: MAGNET L1b output files

6.3.1. VFMX_AUX_1B

6.3.1.1. MDR_VFMAUX.cdf

Field Name	Type	Dimension
dB_Sun	CDF_DOUBLE	3
dB_AOCS	CDF_DOUBLE	3
dB_Thrust	CDF_DOUBLE	3
dB_Battery	CDF_DOUBLE	3
dB_SP	CDF_DOUBLE	3
dB_Bus	CDF_DOUBLE	3
dB_STR	CDF_DOUBLE	3
dB_Static	CDF_DOUBLE	3
dB_Ind	CDF_DOUBLE	3
dB_State	CDF_DOUBLE	3

Table 6-5: MDR_VFMAUX L1b fields

6.3.2. ASMX_AUX_1B

6.3.2.1. MDR_ASMAUX.cdf

Field Name	Type	Dimension
dB_AOCS	CDF_DOUBLE	3
dB_Thrust	CDF_DOUBLE	3
dB_Battery	CDF_DOUBLE	3

dB_SP	CDF_DOUBLE	3
dB_Bus	CDF_DOUBLE	3
dB_VFM	CDF_DOUBLE	3
dB_Static	CDF_DOUBLE	3
dB_Ind	CDF_DOUBLE	3
dB_State	CDF_DOUBLE	3

Table 6-6: MDR_ASMAUX L1b fields

6.3.3. MAGX_HR_1B

6.3.3.1. MDR_MAG_HR.cdf

Field Name	Type	Dimension
Latitude	CDF_DOUBLE	-
Longitude	CDF_DOUBLE	-
Radius	CDF_DOUBLE	-
B_VFM	CDF_DOUBLE	3
B_NEC	CDF_DOUBLE	3
dB_Sun	CDF_DOUBLE	3
dB_AOCS	CDF_DOUBLE	3
dB_other	CDF_DOUBLE	3
B_error	CDF_DOUBLE	3
q_NEC_CRF	CDF_DOUBLE	4
Att_error	CDF_DOUBLE	-
Flags_B	CDF_UINT1	-
Flags_q	CDF_UINT1	-
Flags_Platform	CDF_UINT2	-

Table 6-7: MDR_MAG_HR L1b fields

6.3.3.2. ASM_VFM_IC.cdf

Field Name	Type	Dimension
Timestamp_end	CDF_EPOCH	-
Primary_EU	CDF_INT4	-
Bias	CDF_DOUBLE	3
Scale	CDF_DOUBLE	3
Non_orth	CDF_DOUBLE	3
Samples	CDF_UINT4	-
Rms	CDF_DOUBLE	-
Cov_row1	CDF_DOUBLE	-
Cov_row2	CDF_DOUBLE	2
Cov_row3	CDF_DOUBLE	3
Cov_row4	CDF_DOUBLE	4

Cov_row5	CDF_DOUBLE	5
Cov_row6	CDF_DOUBLE	6
Cov_row7	CDF_DOUBLE	7
Cov_row8	CDF_DOUBLE	8
Cov_row9	CDF_DOUBLE	9
W_scale	CDF_DOUBLE	9

Table 6-8: ASM_VFM_IC L1b fields

6.3.4. MAGX_LR_1B

6.3.4.1. MDR_MAG_LR.cdf

Field Name	Type	Dimension
Latitude	CDF_DOUBLE	-
Longitude	CDF_DOUBLE	-
Radius	CDF_DOUBLE	-
F	CDF_DOUBLE	-
dF_AOCS	CDF_DOUBLE	-
dF_other	CDF_DOUBLE	-
F_error	CDF_DOUBLE	-
B_VFM	CDF_DOUBLE	3
B_NEC	CDF_DOUBLE	3
dB_Sun	CDF_DOUBLE	3
dB_AOCS	CDF_DOUBLE	3
dB_other	CDF_DOUBLE	3
B_error	CDF_DOUBLE	3
q_NEC_CRF	CDF_DOUBLE	4
Att_error	CDF_DOUBLE	-
Flags_F	CDF_UINT1	-
Flags_B	CDF_UINT1	-
Flags_q	CDF_UINT1	-
Flags_Platform	CDF_UINT2	-
ASM_Freq_Dev	CDF_DOUBLE	-

Table 6-9: MDR_MAG_LR L1b fields

6.3.4.2. ASM_VFM_IC.cdf

Field Name	Type	Dimension
Timestamp_end	CDF_EPOCH	-
Primary_EU	CDF_INT4	-
Bias	CDF_DOUBLE	3
Scale	CDF_DOUBLE	3
Non_orth	CDF_DOUBLE	3

Samples	CDF_UINT4	-
Rms	CDF_DOUBLE	-
Cov_row1	CDF_DOUBLE	-
Cov_row2	CDF_DOUBLE	2
Cov_row3	CDF_DOUBLE	3
Cov_row4	CDF_DOUBLE	4
Cov_row5	CDF_DOUBLE	5
Cov_row6	CDF_DOUBLE	6
Cov_row7	CDF_DOUBLE	7
Cov_row8	CDF_DOUBLE	8
Cov_row9	CDF_DOUBLE	9
W_scale	CDF_DOUBLE	9

Table 6-10: ASM_VFM_IC L1b fields

6.3.5. MAGX_CA_1B

6.3.5.1. MDR_MAG_CA.cdf

Field Name	Type	Dimension
Latitude	CDF_DOUBLE	-
Longitude	CDF_DOUBLE	-
Radius	CDF_DOUBLE	-
F	CDF_DOUBLE	-
dF_AOCS	CDF_DOUBLE	-
dF_other	CDF_DOUBLE	-
F_error	CDF_DOUBLE	-
F_VFM	CDF_DOUBLE	-
B	CDF_DOUBLE	3
dB_Sun	CDF_DOUBLE	3
dB_AOCS	CDF_DOUBLE	3
dB_other	CDF_DOUBLE	3
B_pre	CDF_DOUBLE	3
EU_VFM	CDF_DOUBLE	3
T_CDC	CDF_DOUBLE	-
T_CSC	CDF_DOUBLE	-
T_EU	CDF_DOUBLE	-
dt_VFM	CDF_DOUBLE	-
alpha	CDF_DOUBLE	-
beta	CDF_DOUBLE	-

Table 6-11: MDR_MAG_CA L1b fields

6.3.5.2. ASM_VFM_IC.cdf

Field Name	Type	Dimension

Timestamp_end	CDF_EPOCH	-
Primary_EU	CDF_INT4	-
Bias	CDF_DOUBLE	3
Scale	CDF_DOUBLE	3
Non_orth	CDF_DOUBLE	3
Samples	CDF_UINT4	-
Rms	CDF_DOUBLE	-
Cov_row1	CDF_DOUBLE	-
Cov_row2	CDF_DOUBLE	2
Cov_row3	CDF_DOUBLE	3
Cov_row4	CDF_DOUBLE	4
Cov_row5	CDF_DOUBLE	5
Cov_row6	CDF_DOUBLE	6
Cov_row7	CDF_DOUBLE	7
Cov_row8	CDF_DOUBLE	8
Cov_row9	CDF_DOUBLE	9
W_scale	CDF_DOUBLE	9

Table 6-12: ASM_VFM_IC L1b fields

6.4. PLASMA

The CDF files generated for PLASMA L1b file types are:

EFIx_PL_1B
MDR_EFI_PL.cdf
LP_x_CA_1B
LP_OFF_CA.cdf
TIIx_CA_1B
TII_FIT_CA.cdf

Table 6-13: PLASMA L1b output files

6.4.1. EFIX_PL_1B

6.4.1.1. MDR_EFI_PL.cdf

Field Name	Type	Dimension
Latitude	CDF_DOUBLE	-
Longitude	CDF_DOUBLE	-
Radius	CDF_DOUBLE	-
v_SC	CDF_DOUBLE	3
v_ion	CDF_DOUBLE	3
v_ion_error	CDF_DOUBLE	3
E	CDF_DOUBLE	3
E_error	CDF_DOUBLE	3
dt_LP	CDF_DOUBLE	-

n	CDF_DOUBLE	-
n_error	CDF_DOUBLE	-
T_ion	CDF_DOUBLE	-
T_ion_error	CDF_DOUBLE	-
T_elec	CDF_DOUBLE	-
T_elec_error	CDF_DOUBLE	-
U_SC	CDF_DOUBLE	-
U_SC_error	CDF_DOUBLE	-
v_ion_H	CDF_DOUBLE	2
v_ion_H_error	CDF_DOUBLE	2
v_ion_V	CDF_DOUBLE	2
v_ion_V_error	CDF_DOUBLE	2
rms_fit_H	CDF_DOUBLE	-
rms_fit_V	CDF_DOUBLE	-
var_x_H	CDF_DOUBLE	-
var_y_H	CDF_DOUBLE	-
var_x_V	CDF_DOUBLE	-
var_y_V	CDF_DOUBLE	-
dv_mtq_H	CDF_DOUBLE	-
dv_mtq_V	CDF_DOUBLE	-
SAA	CDF_UINT1	-
Flags_LP	CDF_UINT1	-
Flags_LP_n	CDF_UINT1	-
Flags_LP_T_elec	CDF_UINT1	-
Flags_LP_U_SC	CDF_UINT1	-
Flags_TII	CDF_UINT1	-
Flags_Platform	CDF_UINT2	-
Maneuver_Id	CDF_UINT2	-

Table 6-14: MDR_EFI_PL L1b fields

6.4.2. LP_X_CA_1B

6.4.2.1. LP_OFF_CA.cdf

Field Name	Type	Dimension
Probe1_I_Bias_Offset	CDF_DOUBLE	-
Probe1_I_Slope_Offset	CDF_DOUBLE	-
Probe1_I_Fit_Error	CDF_DOUBLE	-
Probe1_U_Bias_Offset	CDF_DOUBLE	-
Probe1_U_Slope_Offset	CDF_DOUBLE	-
Probe1_U_Fit_Error	CDF_DOUBLE	-
Probe2_I_Bias_Offset	CDF_DOUBLE	-

Probe2_I_Slope_Offset	CDF_DOUBLE	-
Probe2_I_Fit_Error	CDF_DOUBLE	-
Probe2_U_Bias_Offset	CDF_DOUBLE	-
Probe2_U_Slope_Offset	CDF_DOUBLE	-
Probe2_U_Fit_Error	CDF_DOUBLE	-
FP_I_Bias_Offset	CDF_DOUBLE	-
FP_I_Slope_Offset	CDF_DOUBLE	-
FP_I_Fit_Error	CDF_DOUBLE	-
FP_U_Bias_Offset	CDF_DOUBLE	-
FP_U_Slope_Offset	CDF_DOUBLE	-
FP_U_Fit_Error	CDF_DOUBLE	-
FP_I_offset	CDF_INT2	32
FP_U_offset	CDF_INT2	32
P1_I_offset	CDF_INT2	32
P1_U_offset	CDF_INT2	32
P1_ref_ADC2	CDF_INT2	32
P1_ground	CDF_INT2	32
P2_I_offset	CDF_INT2	32
P2_U_offset	CDF_INT2	32
P2_ref_ADC2	CDF_INT2	32
P2_ground	CDF_INT2	32
P1_Slope	CDF_DOUBLE	-
P1_Bias	CDF_DOUBLE	-
P1_Error	CDF_DOUBLE	-
P2_Slope	CDF_DOUBLE	-
P2_Bias	CDF_DOUBLE	-
P2_Error	CDF_DOUBLE	-

Table 6-15: LP_OFF_CA L1b fields

6.4.3. TIIX_CA_1B

6.4.3.1. TII_FIT_CA.cdf

Field Name	Type	Dimension
x0	CDF_DOUBLE	2
y0	CDF_ DOUBLE	2
phi0	CDF_ DOUBLE	2
r0	CDF_ DOUBLE	2
rms	CDF_ DOUBLE	2
Samples	CDF_UINT4	2
Success	CDF_UINT2	2
r1	CDF_ DOUBLE	2
r1_r1	CDF_ DOUBLE	2

r1_y2	CDF_ DOUBLE	2
U_SC	CDF_DOUBLE	2
dVgf	CDF_DOUBLE	2
Qram	CDF_UINT4	2
r1_samples	CDF_UINT4	2

Table 6-16: TII_FIT_CA L1b fields

6.5. ACCELE

The CDF files generated for ACCELE L1b file types are:

ACCx_PR_1B
MDR_ACC_PR.cdf

Table 6-17: ACCELE L1b output files

6.5.1. ACCX_PR_1B

6.5.1.1. MDR_ACC_PR.cdf

Field Name	Type	Dimension
a	CDF_DOUBLE	3
a_ang	CDF_DOUBLE	3
p	CDF_DOUBLE	3
p_ang	CDF_DOUBLE	3
Temp	CDF_DOUBLE	6
VpLTC1043	CDF_DOUBLE	1
VnLTC1043	CDF_DOUBLE	1
U_pol	CDF_DOUBLE	-
a_centr	CDF_DOUBLE	3
a_GG	CDF_DOUBLE	3
a_Sun	CDF_DOUBLE	3
a_uplift	CDF_DOUBLE	3
e_Sun	CDF_DOUBLE	3
m_SC	CDF_DOUBLE	-
r_CoG	CDF_DOUBLE	3
A_head	CDF_DOUBLE	3
A_rigth	CDF_DOUBLE	3
A_left	CDF_DOUBLE	3
A_down	CDF_DOUBLE	3
K_Earth	CDF_DOUBLE	3
P_Gas	CDF_DOUBLE	2
T_Gas	CDF_DOUBLE	2
Thru_Acc_On	CDF_DOUBLE	-
Flags_ACC	CDF_UINT2	-
Flags_Platform	CDF_UINT2	-

Maneuver_Id	CDF_UINT1	-

Table 6-18: MDR_ACC_PR L1b fields

6.6. MAGCMP

The CDF files generated for MAGCMP L1b file types are:

MAGxMAN_1B
VFM_MAN_RP.cdf
ASM_VFM_IC.cdf

Table 6-19: MAGCMP L1b output files

6.6.1. MAGXMAN_1B

6.6.1.1. VFM_MAN_RP.cdf

Field Name	Type	Dimension
delta_t	CDF_DOUBLE	-
delta_bias	CDF_DOUBLE	3
delta_scale	CDF_DOUBLE	3
delta_non_orth	CDF_DOUBLE	3
Threshold1_bias	CDF_DOUBLE	-
Threshold1_scale	CDF_DOUBLE	-
Threshold1_non_orth	CDF_DOUBLE	-
Threshold2_bias	CDF_DOUBLE	-
Threshold2_scale	CDF_DOUBLE	-
Threshold2_non_orth	CDF_DOUBLE	-
Messages	CDF_INT4	-
Secondary structures (n = Messages)		
Message_ID	CDF_INT4	-

Table 6-20: VFM_MAN_RP L1b fields

**Message_ID is a Secondary structure. There are as many Message_ID fields as indicated by the Messages field.*

6.6.1.1. ASM_VFM_IC.cdf

Field Name	Type	Dimension
Timestamp_end	CDF_EPOCH	-
Primary_EU	CDF_INT4	-
Bias	CDF_DOUBLE	3
Scale	CDF_DOUBLE	3
Non_orth	CDF_DOUBLE	3
Samples	CDF_UINT4	-
Rms	CDF_DOUBLE	-
Cov_row1	CDF_DOUBLE	-
Cov_row2	CDF_DOUBLE	2
Cov_row3	CDF_DOUBLE	3

Cov_row4	CDF_DOUBLE	4
Cov_row5	CDF_DOUBLE	5
Cov_row6	CDF_DOUBLE	6
Cov_row7	CDF_DOUBLE	7
Cov_row8	CDF_DOUBLE	8
Cov_row9	CDF_DOUBLE	9
W_scale	CDF_DOUBLE	9

Table 6-21: ASM_VFM_IC L1b fields

7. APPENDIX A

7.1. GLOBAL METADATA

CDF files metadata are described below. These attributes are global to the whole file and only appear once in the product.

7.1.1. TITLE

It displays the name of the CDF product file. This is the file name as it appears in the file-system.

7.1.2. ORIGINAL_PRODUCT_NAME

It shows the name of the original product file before converting to CDF. It has the naming format of the operational L1a/L1b products.

7.1.3. CREATOR

Agent used to make the conversion (including version number). This will let the user know which tool version has been used to trace back a change in the conversion process.

7.2. VARIABLE METADATA

CDF files metadata are described below. These attributes are global to the whole file and only appear once in the product.

7.2.1. DESCRIPTION

The description of the current variable as it appears in the corresponding documentation in the operational products.

7.2.2. UNITS

The units used for the current variable as it appears in the corresponding documentation in the operational products. In case a unit has not been specified, '-' is put in its place.

END OF DOCUMENT