Planetary and Space Sciences Research Institute (PSSRI)

Huygens-SSP

Experimenter to Archive Interface Control Document

PY-SSP-OU-PR-100-00

Issue 2 Rev 5

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Change Log

Date	Sections Affected	Changes
25/05/03, First draft	First draft	
30/11/2006, Issue 1.0	All	Input from OW, LH
06/12/2004	0	‘open issues’ removed
06/12/2004	3.1	File naming convention & dir structure: ‘IMPACT’ added,
06/12/2004	1.7	Addresses updated
06/12/2004	1.2	List of contents inserted
06/12/2004	3.2	Time description changed
06/12/2004	All	Typo in FORTRAN removed
25/07/2005	1, 2	Reference list updated
25/07/2005	All	Sensor sequence harmonised
25/07/2005	2	‘Tbc’ removed
26/07/2005	2.3.	APIS description reviewed
26/07/2005	3	Tables 3,4 amended, housekeeping description added

Change log contd.

Date	Sections Affected	Changes
26/07/2005	3.4	Directory structure updated
27/07-01/08/2005	4.2	Labels updated
01/08/2005	4.2	Table removed
01/08/2005	4.3	Section added, objects amended
01/08/2005	Appendix	Obsolete appendix removed
01/08/2005	2.3	Functional table added
31/10/05	3.4.3	‘tbc’ removed
17/11/05	2.2	Table 1 amended
21/11/05	3.4.3	superseded in parts
21/02/05	4	Sample labels & object definitions updated
01/03/05	3.4	Table 4 amended
04/07/06	All	Typos corrected
04/07/06	2 & 3	Review info added
01/10/06		

Acronyms and Abbreviations

ACC-E – Accelerometer / Force Transducer (External) sub-system

ACC-I – Accelerometer (Internal) sub-system

APIS – Acoustic sounder sub-system

APIV – Acoustic velocity sub-system

DDID – ESOC's Data Delivery Interface Document

DEN – Density sub-system

DL – PDS term 'Detached Label'

DN – A/D converters output in 'counts' (PDS term = Digital Number)

DTWG – Descent trajectory working group

EAICD - Experimenter to (Science) Archive Interface Control Document

ESA – European Space Agency

ESOC – European Space Operations Centre

HK – Housekeeping data

NASA – National Aeronautics and Space Administration

PDD – Parachute deployment device

PDS – Planetary Data System

PER – Relative permittivity and conductivity sub-system

PSA – Planetary Science Archive

PSSRI – Planetary and Space Sciences Research Institute

SSP – Surface Science Package

REF – Refractive index sub-system

TBC – to be confirmed

TBD – to be determined

TBW – to be written

THP – Thermal properties sub-system

TIL – 2 axis tilt angle measuring sub-system

List of contents

1 Introduction

1.1 Purpose and Scope

The primary objective of this EAICD document is to provide a detailed explanation of the SSP data ingested into the PSA. It describes data flow, data types and directory structures for data volumes. The secondary objective of this document is to provide a formal interface for communication between SSP PI and the archiving authority. The methods used for interpreting SSP data any further than given in the archive or a detailed description of the SSP experiment is beyond the scope of this document. Please refer to reference section for some further details.

1.2 Contents

This document describes the SSP data as presented to the PDS data archive. It includes information on how the data is processed, formatted, labelled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained.

The design of the data set structure and the data product is given. Examples of these are given in the appendix.

1.3 Intended Readership

The staff of archiving authority (Planetary Data System for NASA, Planetary Science Archive for ESA) design team and any potential user of the SSP final archive.

1.4 Applicable Documents

[AD-1] Planetary Data System Preparation Workbook, February 1, 1995, Version 3.1, JPL, D-7669, Part 1
[AD-2] Planetary Data System Standards Reference, October 30, 2002, Version 3.5, JPL, D-7669, Part 2
[AD-3] PY-SSP-RAL-xxxx, Huygens Surface Science Package, On-board Software Users Guide, Issue 2, August 2004.
[AD-4] HMCS-ICD-DDID, Huygens DDID, Data Delivery Interface Document, Issue 2.1, September 1996.
[AD-5] PY-SSP-UKC-EID-001, SSP-EID-B, Experiment Interface Control Document, 23 February 1995
[AD-6] HUY-RSSD-PL-001, Huygens Data Archive Generation, Validation and Transfer Plan DRAFT, 1September 2004.

1.5 Reference Documents

[RD-1] J.C. Zarnecki, M.R. Leese, J.R.C. Garry, N. Ghafoor and B. Hathi (2002): HUYGENS' SURFACE SCIENCE PACKAGE.. Space Science Reviews, Vol. 104(1), p. 591-609
[RD-2] English, M.A., (1995): The development of instrumentation and modelling for the understanding of Titan. PhD thesis, University of Kent at Canterbury.
[RD-3] Geake, J. E., Mill, C. and Mohammadi, M.S.: 1994, *Meas. Sci. Technol.* **5**, 531.
[RD-4] J. C. Zarnecki and M. Banaszkiewicz, M. Bannister, W. V. Boynton, P. Challenor, B. Clark, P. M. Daniell, J. Delderfield, M. A. English, M. Fulchignoni, J. R. C. Garry, J. E. Geake, S. F. Green, B. Hathi, S. Jaroslawski, M. R. Leese, R. D. Lorenz, J. A. M. McDonnell, N. Merryweather--Clarke, C. S. Mill, R. J. Miller, D. J. Parker, P. Rabbetts, H. Svedhem, R. F. Turner, M. J. Wright (1997): The Huygens Surface Science Package, ESA SP-1177, 177-195.

[RD-5] M. K. Bird, M. Heyl, M. Allison, S.W. Asmar, D.H> Atkinson, P. Edenhofer, D. Plettemeier, R. Wohlmuth, L. Iess & GIL. Tyler (1997) The Huygens Doppler Wind Experiment, ESA SP-1177, 139-162.

[RD-6] R. Lorenz (1994): Exploring the surface of Titan. Dissertation, University of Kent, Canterbury.

[RD-7] A. Wilson (ed.)(1997): Huygens – Science, Payload and Mission. ESA SP-1177.

1.6 Relationships to Other Interfaces

N/A

1.7 Contact Names and Addresses

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2 Overview of Process and Product Generation

Huygens SSP data will be analysed at the PSSRI at the Open University. Descent data are provided by ESOC (see [AD-4]). Further data include those of calibrations, carried out mainly at the Open University, the University of Kent at Canterbury and other Institutions (See [AD-5] for details).
Data types are grouped into Science data and calibration data. All data will be ingested into the PSA in compliance with [AD-6].
The process of data analysis as described in this document includes the extraction of SSP packet data from Huygens telemetry packets provided by ESOC, seperation into the packets from the individual SSP sensors and extraction into human-readable (PDS-compliant) format. Data are processed using custom software written in FORTRAN, PYTHON and IDL.

2.1 Experiment Overview

The SSP experiment consists of nine separate sensors that are designed to measure a wide range of physical properties of Titan's lower atmosphere, surface, and sub-surface. By measuring a number of physical properties of the surface it is expected that the SSP will be able to constrain the inferred composition and structure of the Titan's near-surface environment. Although the SSP is primarily designed to sense properties of the surface, some of its sensors will also make measurements of the atmosphere along the probe's entry path and will complement the data gathered by other experiments on the Huygens probe.

2.2 Measurements Summary

Table 1 (below) summarises the measurements made by the SSP experiment.

sensor	**Measured parameters**	**Derived parameters**
ACC-E	Impact force	Impact force
ACC-I	Acceleration	Acceleration
API-S	Acoustic excitation	Sounding information
API-V	Time delay in milli seconds	Speed of sound and Mean molecular mass
DEN	Strain (of buoyancy float)	Density
PER	Capacitance	Permittivity and conductivity
REF	Light intensities	Refractive index
THP	Resistance	Temperature and thermal conductivity
TIL	2-axis tilt angles	Tilt angles
HK	Temperatures, and other engineering information	Temperatures, and other engineering information

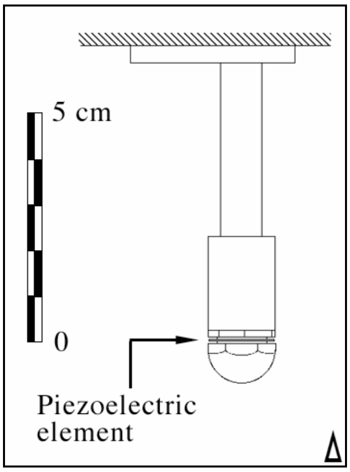
Table 1: SSP experiment – measured and derived parameters summary

The housekeeping sensors (HK) give information about sensor temperatures, times of mode changes, software glitches, packet counts and other relevant data. Details can be found in [AD-3].

2.3 Sensors Overview

The following listing of the SSP sensors consists mainly of excerpts from RD-1 which should be consulted for more detailed information.

2.3.1 Accelerometer External (ACC-E)

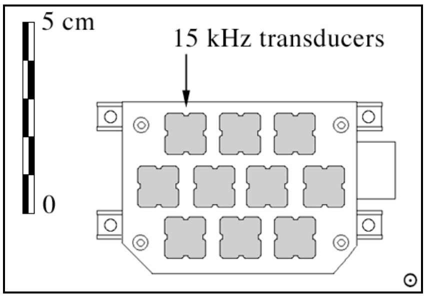


The accelerometer subsystem is designed to characterise the immediate surface of the landing site by recording the dynamic response of two devices mounted in different positions on the probe. One of the sensors, discussed by in [RD-6] is designed to sense the force exerted on a pylon that protrudes from the foredome aperture. The force is sensed by a piezoelectric ceramic element that is mounted between a hemispherical titanium alloy head and the pylon shaft. If Huygens lands on a relatively uniform surface the ACC-E penetrometer will be smoothly driven into the surface material until the probe's fore-dome strikes the surface, bringing it to a halt. During the impact process the ACC-E is sampled at a rate of 10 kHz, giving it an effective depth resolution of 1 mm for a nominal mission impact speed of 5 m s^{-1}.

2.3.2 Accelerometer Internal (ACC-I)

A single commercially available accelerometer forms the second part of the ACC sensor. This device is mounted on a foot of the SSP electronics box, which is fixed to the upper experiment platform. The ACC-I provides information about the vertical non-static accelerations experienced by the entire probe.

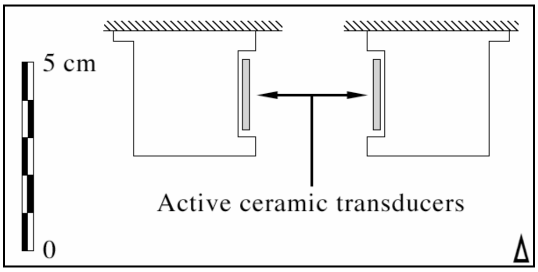
2.3.3 Acoustic Properties Instrument – Sonar (API-S)



Like the ACC subsystem, the API has two separate parts. The first of these is an active sonar system (API-S*onar*) mounted on the front of the Top Hat cavity pointing downwards. This sensor will measure the effective acoustic cross-section of the medium within its field of view at a frequency of around 15kHz. Each echo is sampled at a rate of 1kHz, and during the final section of the probe's descent this sensor may be able to provide information about the topography of the landing site with a vertical precision of around 0.1 m. In the case of a liquid touchdown the API-S may also be able to provide lower bounds to the depth of the liquid in which it has landed.

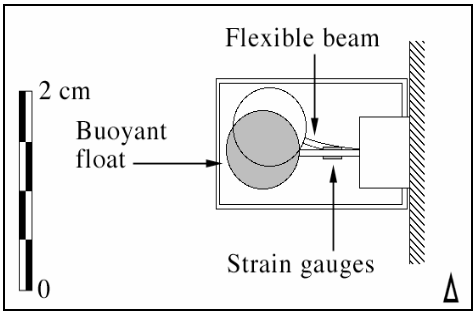
In the final few hundred metres of Huygens' trajectory the API-S will be sufficiently close to the surface for it to detect the back-scattered echo from the surface beneath it. Following the impact of the probe with a liquid body the API-S will act as a depth sounder, using information gathered from the Acoustic Properties Instrument-Velocimeter (API-V) on the speed of sound in the medium. In comparison to its atmospheric operation the API-S operates with an increased efficiency when immersed simply as a result of the medium's higher density and its better acoustic coupling to the API-S. Whilst afloat the API-S should be able to record the depth of the liquid beneath the probe (up to a maximum depth of 1000m).

2.3.4 Acoustic Properties Instrument – Velocimeter (API-V)



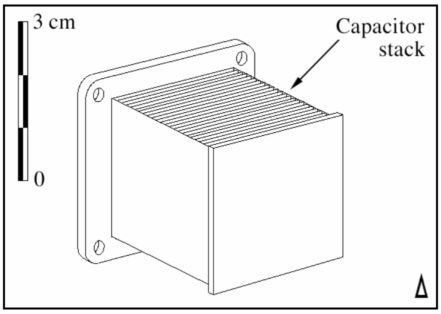
The second portion of the API consists of a pair of piezoelectric transducers mounted at the front surface of the Top Hat on either side of the cavity. These sensors measure the speed of sound by transmitting, and subsequently receiving, a brief 1 MHz acoustic signal. The time interval between transmission and reception is measured with a precision of 250 ns and the separation of 0.125 m gives a speed resolution of 8 cm s^{-1} when operating in gas at Titan's surface. Throughout the descent these sensors will be driven and subsequently sampled once a second, giving a detailed profile of the speed of sound along the probe's trajectory. At least three other sensors in the probe's payload can sense the atmospheric temperature, and thus the speed of sound will yield the ratio of γ (the ratio of specific heats) to *m* (mean molecular mass). The next important contribution made by the API-V is at Titan's surface in the event of the probe landing in a liquid body. The speed of sound is measured to a precision of 8 m s^{-1}, a fidelity that corresponds to a mixing ratio of 1.6 % for a methane / ethane ocean.

2.3.5 Density Sensor (DEN)



Upon landing in a liquid the density of any fluid that makes its way into the cavity of the SSP will be estimated by the DEN sensor. This instrument measures the upthrust applied by a liquid to a small buoyant float which is attached to the SSP by a pair of epoxy beams that are equipped with strain gauges [RD-2].

In addition considerable scope remains for the detection of phenomena that are secondary to the main role of the SSP. For example, immediately following the probe's impact with a liquid the DEN may detect the periodic inflow and outflow of fluid from the SSP cavity. Measurements of the rate at which this bobbing motion decays will place constraints on the viscosity of the impacted liquid, a property that is not directly measured by any sensor.

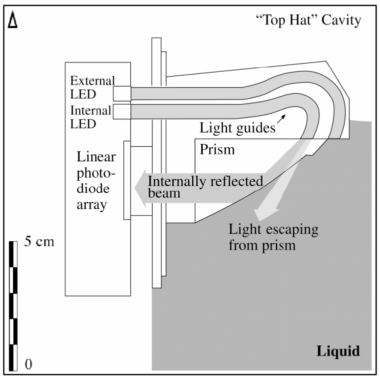


2.3.6 Permittivity Sensor (PER)

In the event of a liquid landing the SSP will also be able to determine a number of electrical properties of the fluid. The PER device consists of 22 stacked parallel plates, the capacitance of which is measured at a number of different frequencies. By briefly pulsing the sensor with DC voltages the conductivity of the surrounding liquid may also be ascertained, placing constraints on the population of dissolved ions (if any) in the medium. The PER also carries a thermometer in the form of a silicon diode, which has a precision of better than 0.5 K.

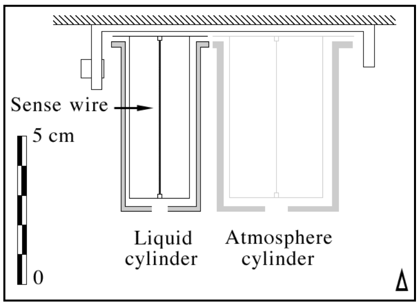
Although any probable Titan atmosphere has a relative permittivity that is almost identical to 1, and therefore cannot be detected by PER, at the tropopause (altitude 40 km) significant quantities of methane/nitrogen may condense temporarily on the PER sensor. If sufficient material collects on the PER some or all of the sensing plates may be bridged and the condensate may thus be detected.

2.3.7 Refractive Index Sensor (REF)



The REF sensor measures the refractive index of a liquid by using a linear critical angle refractometer, the method and design of which is discussed in [RD-3]. This device consists of a section of a cylindrical prism that can be illuminated by collimated sources (light guides fed by light emitting diodes, LEDs, at 635 nm) that are both internal and external to the prism. When the REF is immersed in a medium of given refractive index light striking the interface between the prism and the liquid will experience a critical angle effect, in which case the light is refracted or reflected. For both the internal and external illumination only part of the beam is reflected or refracted onto the detector, the remainder escaping or being reflected from the prism. A 512 element linear photodiode array is attached to one face of the prism and this array is used to measure the resulting transition from light to dark, the position of this transition, or cut-off, being linearly related to the refractive index of the liquid. The sensor covers the refractive index range 1.250 to 1.450 with a discrimination of 0.001. The external light source is provided so that an estimate can be made of the opacity of the ambient liquid, from a comparison of the illumination profile received from the internal and external sources.

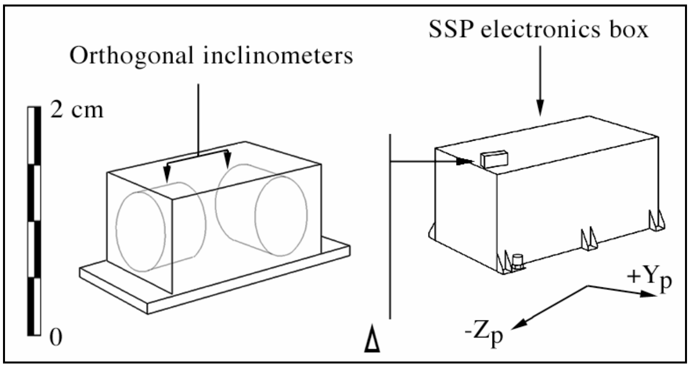
2.3.8 Thermal Properties Sensor (THP)



The main role of the THP is to measure the thermal conductivity and diffusivity of the ambient medium in the SSP cavity. Along with the Acoustic Properties Instrument (API), the THP is designed to sense properties of both liquid and gaseous media, using two separate sets of redundant hot wire sensors enclosed in cylindrical shields. By applying a known current for a fixed duration to the THP's sense wires in each of the four cylindrical canisters the wires are made to act as regulated heat sources. This method is covered in detail by Healy et al. (1976). In the close confines of the wires' shields the transient heat pulse thus generated is lost by conduction to the medium surrounding the wires at a rate that is determined by the thermal properties of the material. Measurements of the wires' resistance as a function of time before and after the heating pulse reveal the initial temperature of the medium and its thermal properties. Two diameters of platinum wire are used in the THP, the thinner wires (10 µm diameter) are sized for the relatively low thermal conductivity of the atmosphere, and the thicker 25 µm diameter wires are only driven when the Huygens probe has reached the surface.

A THP measurement is made every minute throughout the atmospheric phase of the descent and will therefore provide a relatively fine record of the thermal properties of the atmosphere along Huygens' trajectory.

2.3.9 Tiltmeter (TIL)



One of the important analyses to be carried out after arrival at Titan is the reconstruction of the probe's motion, i.e. its trajectory, attitude, swing and spin, as it falls through the atmosphere and then subsequently during any post-impact dynamics. Throughout Huygens' descent particular aspects of the probe's motion will be measured with varying precision by three separate experiments, Doppler Wind Experiment [RD-5], Huygens Atmospheric Structure Instrument (HASI), and SSP. Of these, TIL is the only device that provides unambiguous information about the Huygens probe's attitude with respect to the local vertical rather than its acceleration. Two inclinometers are arranged to form an orthogonal x-y pair inside the sensor housing which is attached to the SSP electronics box. During the probe's descent the TIL is sampled at a rate of 1 Hz.

2.4 Definition of SSP Operating Modes

The SSP operating modes are defined as follows:

M0: Checkout / Diagnostic mode – not used during the real descent

M1: upper atmosphere mode

M2: mid atmosphere mode

M3: lower atmosphere mode

M4: proximity mode

M5: surface mode

M6: extended surface mode

M7: Checkout / Diagnostic mode – not used during the real descent

A functional breakdown of SSP's sensors is given in Table 1.

<table>
<tr><td rowspan="2">SENSOR</td><td colspan="3">Atmospheric Modes</td><td colspan="3">Surface Modes</td></tr>
<tr><td>SSP Mode 1 Upper Atmosphere</td><td>SSP Mode 2 Mid Atmosphere</td><td>SSP Mode 3 Lower Atmosphere</td><td>SSP Mode 4 Proximity Mode</td><td>SSP Mode 5 Post Impact</td><td>SSP Mode 6 Extended Surface Mission</td></tr>
<tr><td>ACC-I</td><td>Sampled at 1Hz</td><td>Sampled at 1Hz</td><td>Sampled at 1Hz</td><td>Monitor ACC-I Impact Buffer</td><td>Readout ACC-I Impact Buffer</td><td>Sampled at 1Hz</td></tr>
<tr><td>ACC-E</td><td></td><td></td><td></td><td>Monitor ACC-E Impact Buffer</td><td>Readout ACC-E Impact Buffer</td><td></td></tr>
<tr><td>REF</td><td colspan="3">Internal, external modes and dark scan every 3 minutes</td><td>Single set of scans</td><td colspan="2">Internal, external modes and dark scan every 3 minutes</td></tr>
<tr><td>THP</td><td></td><td colspan="3">Sampling in atmospheric mode</td><td colspan="2">Sampling in surface mode</td></tr>
<tr><td>API-V</td><td></td><td colspan="5">Sampled at 1Hz (in alternate directions)</td></tr>
<tr><td>API-S</td><td></td><td colspan="2">Sample in Atmospheric Mode</td><td>Proximity Mode</td><td colspan="2">Sample in Surface Mode</td></tr>
<tr><td>DEN</td><td colspan="6">Sampled at 1Hz throughout Modes 1 to 6</td></tr>
<tr><td>TIL</td><td colspan="3">2 axes at 1Hz sampling rate</td><td colspan="3">2 axes at 2Hz sampling rate</td></tr>
<tr><td>PER</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 1 Functional breakdown of SSP sensors

3 Archive Format and Content

3.1 Format and Conventions

3.1.1 Deliveries and Archive Volume Format

The individual logical archive volumes delivered always contain

- the data from ALL sensors
- the raw data, calibrated data and the calibration data and software

The logical archive volumes will contain one data set per volume. 2 logical archive volumes were identified:

- Descent data
- Selected laboratory data

The descent dataset contains all data necessary for an analysis the SSP measurements. Laboratory data will be added on a best effort basis, provided they are considered helpful in the analysis.
The **SSP sensor housekeeping data** and the **SSP status data** will always be archived similar to other sensor data within the appropriate data sets.

3.1.2 Data Set ID Formation

The following data sets are foreseen:

- HP-SSA-SSP-3-DESCENT-V1.0

3.1.3 Data Directory Naming Convention

For all data sets the following directory naming scheme will be used:

/DATA/{type}/{dpl}/{sensor}/filename, with

- type = {DESCENT}
- dpl = {RAW, CALIBRATED}, with dpl standing for data processing level
- sensor = {ACCI, ACCE, APIS, APIV, DEN, HK, IMPACT, PER, REF, THP, TIL, STATUS}

The calibration data will be archived in the **CALIB** directory below the root directory, as

- /CALIB/SSP_CAL.ASC

3.1.4 File naming Convention

The following file naming scheme will be used for all data sets:

SSP_{sensor}_{mode}_{id}_{data processing level}_{spec}, with

- sensor = {ACCI, ACCE, APIS, APIV, DEN, HK, IMPACT, PER, REF, THP, TIL, STATUS}
- mode = {0, 1, 2, 3, 4, 5, 6, 7, 8, 123, 1236, 123456}, these modes represent the SSP mode as defined in [AD-3]
- id= {0,1,2}, data type identifier as defined in [AD-3]
- data processing level = {R, C}, for raw and calibrated data respectively
- spec = {ATMOS, PROX, SURF, EXTD, IMPACT, METHAN, ETHAN, ….}, the specs give additional information on the mission phase or the laboratory conditions.

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

PDS Standard version 3.5 is used for the design of the SSP archive.

3.2.2 Time Standards

The timing information used in all SSP data is derived from the Huygens Probe clock. This clock starts at zero (T_0 as defined by the Probe's firing of the PDD) and has resolution of 2 milliseconds. The format used to represent SSP time is a REAL number consisting of seconds (integer part) and milliseconds (fractional part of the number) . Examples of the time format are given by the parameters: SC_CLOCK_START_COUNT and SC_CLOCK_STOP_COUNT.

3.2.3 Reference Systems

TBD by the DTWG

3.2.4 Other Applicable Standards

No other applicable standards are used.

3.3 Data Validation

Science validation will be performed during data analysis. Descent data can be compared to laboratory tests. Dataset completeness will be verified manually at each revision of the dataset and reviewed before release to the public.

Compliance of SSP datasets with PDS standards on structural as well as label level will be verified prior to ingestion using the PVV tool delivered by ESTEC (TBC).

3.4 Content

3.4.1 Volume Set

The SSP team will aim to deliver three logical archive volumes. The **volumes names** and **volume ids** are the following (tbc):

Volume Name	**Volume ID**	**Data Set ID**
HUYGENS PROBE DESCENT SSP DATA RECORD	UK_ESA_PSA_HP_1001 (tbc), as provided by PSA	HP-SSA-SSP-3/4-DESCENT-V1.0
HUYGENS PROBE FLIGHT CHECK OUTS SSP DATA RECORD	UK_ESA_PSA_HP_1002 (tbc), as provided by PSA	HP-CRU-SSP-3/4-FLIGHT-CHECK-OUTS-V1.0

Table 2: Proposed SSP Data (or 'logical archive volumes') for PDS archive

3.4.2 Data Set

Table 3 gives the definition of the **data set name** and **data set id**:

Data Set ID	**Data Set Name**
HP-SSA-SSP-3/4-DESCENT-V1.0	HUYGENS SSP DESCENT RAW AND CALIBRATED DATA V1.0

Table 3: SSP Data sets description

Table 4 describes the data types used for the raw data, data processing level 3 in the PDS standard. The raw data will contain the DN of the A/D converters from the individual sensors and for some of these DN, the data sets will contain the corresponding voltages in addition. DL is used to identify Detached Label. The IMPACT packets will be handled separately. For details of table sizes refer to the template labels in the next section.

Sensor	**HP-SSA-SSP-3/4-DESCENT**		**HP-CRU-SSP-3/4-FLIGHT-CHECK-OUTS**	**HP-CAL-SSP-3-LABORATORY**
ACC-E	DL + table(column,time series) DL + table(column,time series)	5 (impact) 1,2,3 (stimulus)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
ACC-I	DL+ table	5	Same as	N/A

	DL + table 1,2,3,5,6	'HP-SSA-SSP-3/4-DESCENT'	
API-S	DL + table (mode 2,3) DL + table (mode 4,5) DL + table (mode 6)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
API-V	DL + table (n x 3) (all modes)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
DEN	DL + table (all modes)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
HK	DL + table	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
IMPACT	DL + table	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
PER	Dl + table (all modes)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
REF	DL+ table (all modes)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
STATUS	DL + table (TBD)	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
THP	DL + table	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A
TIL	DL + table	Same as 'HP-SSA-SSP-3/4-DESCENT'	N/A

Table 4: SSP data types and presentation to the PDS archive – data processing level 3

3.4.3 Directories

Directories are defined in Table 5

Top-Level Directory Structure for a SSP data volume

ROOT	AAREADME.TXT		*description of volume contents*
	ERRATA.TXT		*overview of anomalies and errors*
	VOLDESC.CAT		*description of the contents of the logical volume*
	CATALOG	CATINFO.TXT	*text description of the directory contents*
		MISSION.CAT	*PDS catalog object for Mission*
		INST.CAT	*brief description of the SSP Sensors*
		INSTHOST.CAT	*brief description of the Instrument Host*
		DATASET.CAT	*brief description of the reduced data*
		PERSON.CAT	*description of key persons involved in SSP*
		TARGET.CAT	*brief description of the targets of the mission*
		REFERENCE.CAT	*References used in catalogue files*
		SOFT.CAT	*Obsolete*
	CALIB	SSP_CAL.*	*Calibration file*
	DOCUMENT	DOCINFO.TXT	*description of the content of the Document Directory*
		SSP_EAICD.PDF	*contains the SSP EAICD*
		SSP_SUM.PDF	*Software user manual for SSP = [AD-3]*
		Others	*[RD-4], PHD_GHAFOOR, PHD_LORENZ, ….*

<table>
<tr><td rowspan="4"></td><td rowspan="3">INDEX</td><td colspan="2">INDEX.LBL</td><td colspan="3">detached PDS label to describe INDEX.TAB</td></tr>
<tr><td colspan="2">INDEX.TAB</td><td colspan="3">PDS table, listing all data files included in the volume</td></tr>
<tr><td colspan="2">INDXINFO.TXT</td><td colspan="3">N/A</td></tr>
<tr><td>DATA
(each data file is described in the accompanying detached PDS label)</td><td>{type}</td><td>RAW</td><td>{sensor}</td><td>{file}</td><td>Data file</td></tr>
<tr><td colspan="7">Where
• type = { DESCENT}
dpl = {RAW, CALIBRATED},
sensor = {ACC, ACCE, APIS,APIV, DEN, HK, IMPACT, PER, REF, STATUS, THP, TIL}</td></tr>
</table>

Table 5: Overview of the SSP data volume structure

Root Directory

CALIB Directory

The calibration data will be archived in the **CALIB** directory below the root directory, as

- /CALIB/SSP_CAL.ASC

  for the sensors ACC, ACCE, APIS, APIV, DEN, HK, IMPACT, PER, REF, STATUS, THP, TIL

Data from the HP-CRU-SSP-3/4-FLIGHT-CHECK-OUTS data set will be provided and added to the delivery of the descent data sets on a best effort basis. The calibration information will not be updated in this data set. A note will be put in the catalog files to explicitely warn future users of this fact and point them to the calibration information that will be delivered with the descent data set that might have been updated and improved.

CATALOG Directory

This directory contains catalog files.

INDEX directory

This directory contains index files and labels.

Browse Directory and Browse Files

Not envisaged.

Geometry Directory

N/A

SOFTWARE Directory

N/A

GAZETTER Directory

N/A.

Label Directory

N/A

DOCUMENTS Directory

Will contain the documents necessary for analysing SSP data.
This directory will contain at least the following documents:

- On-board Software User Guide [AD-3]
- EID-B [AD-5]
- SP-1177, SSP [RD-4]
- Publication in scientific journals

The format of the documentation may vary and may be very old. Reformatting is done on a best effort basis. The conversion to ASCII format will also be done on a best effort basis. Documents that cause a format problem will be provided as they are (i.e. in pdf, TIFF or Word .doc format) in the extras directory. Important images and diagrams will be converted to PNG or JPG format.

EXTRAS Directory

Digital images of test equipment, sensors etc will be put on this directory. Types and sizes is TBD.

DATA Directory

see section 3.1.3

Pre-Flight Data

The following pre-flight data are available:

Pre-Flight Data	**Status**	**Expected Data Volume**
Laboratory data	Selected data will be archived	TBD
Campaign data	Not available	n/a
EMC data	Included in laboratory data	n/a

In-Flight Data

In-Flight Data	**Status**	**Expected Data Volume**
In-flight check-outs	will be archived	14 * ~50Mbytes
Descent trajectory	Will be archived	< 1MByte

3.4.4 Derived and other Data Products

N/A

4 Detailed Interface Specifications

Data will be received by PSSRI as described in [AD-4]. Datasets will be ingested into the PSA using the interfaces described in [AD-6]. Dataset integrity will be verified using the tools provided by ESOC (TBC).

4.1 Data Product Design

Descent data products will be tables of 2 to 1129 colums, depending on the type of SSP sensor, with detached labels. Calibration data will be delivered in tables or as PDF documents.

4.2 Sample Labels

Sample labels in this document are subject to revision once processing software has been completed.

4.2.1 ACCE - Data Label 1

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 72
FILE_RECORDS                    = 512

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_ACCE_057_1_R_IMPACT.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_ACCE_057_1_R_IMPACT.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_ACCE_057_1_R_IMPACT.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T11:38:10.4600
STOP_TIME                       = 2005-01-14T11:38:10.5111
SPACECRAFT_CLOCK_START_COUNT    =  8869.7600
SPACECRAFT_CLOCK_STOP_COUNT     =  8869.8111
NATIVE_START_TIME               =  8869.7600
NATIVE_STOP_TIME                =  8869.8111
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.2 ACCE - Data Label 2

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 2132
FILE_RECORDS                    = 3
```

```
/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                = "SSP_ACCE_123_2_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_ACCE_123_2_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_ACCE_123_2_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:11:22.7100
STOP_TIME                       = 2005-01-14T10:35:20.7060
SPACECRAFT_CLOCK_START_COUNT    =    62.0100
SPACECRAFT_CLOCK_STOP_COUNT     =  5100.0060
NATIVE_START_TIME               =    62.0100
NATIVE_STOP_TIME                =  5100.0060
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.3 ACCI - Data Label 1

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 72
FILE_RECORDS                    = 512

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                = "SSP_ACCI_057_1_R_IMPACT.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_ACCI_057_1_R_IMPACT.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_ACCI_057_1_R_IMPACT.LBL"
PRODUCT_CREATION_TIME           = 2005-02-07T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR  /* EDR for RAW, RDR for calibrated data,
tbc */
START_TIME                      = 2005-01-14T11:38:10.4700
STOP_TIME                       = 2005-01-14T11:38:11.4920
SPACECRAFT_CLOCK_START_COUNT    =  8869.7700
SPACECRAFT_CLOCK_STOP_COUNT     =  8870.7920
NATIVE_START_TIME               =  8869.7700
NATIVE_STOP_TIME                =  8870.7920
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.4 ACCI - Data Label 2

```
PDS_VERSION_ID                 = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 1452
FILE_RECORDS                   = 1

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_ACCI_1_2_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_ACCI_1_2_R_ATMOS.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_ACCI_1_2_R_ATMOS.LBL"
PRODUCT_CREATION_TIME          = 2004-10-07T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
PRODUCT_TYPE                   = EDR
 START_TIME                     = 2005-01-14T09:11:16.0000
 STOP_TIME                      = 2005-01-14T09:11:16.0000
 SPACECRAFT_CLOCK_START_COUNT   =    55.3000
 SPACECRAFT_CLOCK_STOP_COUNT    =    55.3000
 NATIVE_START_TIME              =    55.3000
 NATIVE_STOP_TIME               =    55.3000
PRODUCER_ID                    = "HP_SSP_OU"
PRODUCER_FULL_NAME             = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME      = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                    = "TITAN"
ACCI - Data Label 3
PDS_VERSION_ID                 = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 102
FILE_RECORDS                   = 10998

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_ACCI_1236_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_ACCI_1236_0_R_ATMOS.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_ACCI_1236_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME          = 2005-02-07T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
PRODUCT_TYPE                   = EDR  /* EDR for RAW, RDR for calibrated data,
tbc */
START_TIME                     = 2005-01-14T09:11:22.0440
STOP_TIME                      = 2005-01-14T12:47:28.5880
SPACECRAFT_CLOCK_START_COUNT   =    61.3440
SPACECRAFT_CLOCK_STOP_COUNT    = 13027.8880
NATIVE_START_TIME              =    61.3440
NATIVE_STOP_TIME               = 13027.8880
```

```
PRODUCER_ID                    = "HP_SSP_OU"
PRODUCER_FULL_NAME             = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME      = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                    = "TITAN"
```

4.2.5 APIS - Data Label 1

```
PDS_VERSION_ID                 = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 572
FILE_RECORDS                   = 4615

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_APIS_23_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_APIS_23_0_R_ATMOS.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_APIS_23_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME          = 2005-02-01T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
PRODUCT_TYPE                   = EDR
START_TIME                     = 2005-01-14T09:20:20.7860
STOP_TIME                      = 2005-01-14T11:10:19.5860
SPACECRAFT_CLOCK_START_COUNT   =   600.0860
SPACECRAFT_CLOCK_STOP_COUNT    =  7198.8860
NATIVE_START_TIME              =   600.0860
NATIVE_STOP_TIME               =  7198.8860
PRODUCER_ID                    = "HP_SSP_OU"
PRODUCER_FULL_NAME             = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME      = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                    = "TITAN"
```

4.2.6 APIS - Data Label 2

```
PDS_VERSION_ID                 = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 2772
FILE_RECORDS                   = 654

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_APIS_4_0_R_PROX.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_APIS_4_0_R_PROX.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_APIS_4_0_R_PROX.LBL"
PRODUCT_CREATION_TIME          = 2005-10-07T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
```

```
PRODUCT_TYPE                      = EDR  /* EDR for RAW, RDR for calibrated data,
tbc */
START_TIME                        = 2005-01-14T11:10:20.8040
STOP_TIME                         = 2005-01-14T11:40:44.2180
SPACECRAFT_CLOCK_START_COUNT      =  7200.1040
SPACECRAFT_CLOCK_STOP_COUNT       =  9023.5180
NATIVE_START_TIME                 =  7200.1040
NATIVE_STOP_TIME                  =  9023.5180
PRODUCER_ID                       = "HP_SSP_OU"
PRODUCER_FULL_NAME                = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME         = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                       = "TITAN"
```

4.2.7 APIS - Data Label 3

```
PDS_VERSION_ID                    = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                       = FIXED_LENGTH
RECORD_BYTES                      = 12782
FILE_RECORDS                      = 92

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_APIS_6_0_R_EXTD.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                         = "SSP_APIS_6_0_R_EXTD.LBL"
DATA_SET_ID                       = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                     = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                        = "SSP_APIS_6_0_R_EXTD.LBL"
PRODUCT_CREATION_TIME             = 2005-10-07T00:00:00
MISSION_NAME                      = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME              = "HUYGENS PROBE"
INSTRUMENT_HOST_ID                = HP
MISSION_PHASE_NAME                = "DESCENT"
PRODUCT_TYPE                      = EDR
START_TIME                        = 2005-01-14T11:41:21.1360
STOP_TIME                         = 2005-01-14T12:46:26.9380
SPACECRAFT_CLOCK_START_COUNT      =  9060.4360
SPACECRAFT_CLOCK_STOP_COUNT       = 12966.2380
NATIVE_START_TIME                 =  9060.4360
NATIVE_STOP_TIME                  = 12966.2380
PRODUCER_ID                       = "HP_SSP_OU"
PRODUCER_FULL_NAME                = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME         = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                       = "TITAN"
```

4.2.8 APIV - Data Label

```
PDS_VERSION_ID                    = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                       = FIXED_LENGTH
RECORD_BYTES                      = 82
FILE_RECORDS                      = 12132

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_APIV_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                         = "SSP_APIV_123456_0_R_ATMOS.LBL"
DATA_SET_ID                       = "HP-SSA-SSP-3/4-DESCENT-V1.0"
```

```
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "HP-SSP-DEN-M123456-R.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:20:20.7060
STOP_TIME                       = 2005-01-14T12:47:09.2600
SPACECRAFT_CLOCK_START_COUNT    =   600.0060
SPACECRAFT_CLOCK_STOP_COUNT     = 13008.5600
NATIVE_START_TIME               =   600.0060
NATIVE_STOP_TIME                = 13008.5600
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.9 DEN Data Label

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 72
FILE_RECORDS                    = 12640

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_DEN_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_DEN_123456_0_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_DEN_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:11:21.4840
STOP_TIME                       = 2005-01-14T12:46:33.0760
SPACECRAFT_CLOCK_START_COUNT    =    60.7840
SPACECRAFT_CLOCK_STOP_COUNT     = 12972.3760
NATIVE_START_TIME               =    60.7840
NATIVE_STOP_TIME                = 12972.3760
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.10 HK - Data Label

```
DS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 1092
FILE_RECORDS                    = 638

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
```

```
^TABLE                = "SSP_HK_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_HK_123456_0_R_ATMOS.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_HK_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME          = 2005-02-01T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
PRODUCT_TYPE                   = EDR
START_TIME                     = 2005-01-14T09:11:21.1060
STOP_TIME                      = 2005-01-14T12:47:46.9940
SPACECRAFT_CLOCK_START_COUNT   =    60.4060
SPACECRAFT_CLOCK_STOP_COUNT    = 13046.2940
NATIVE_START_TIME              =    60.4060
NATIVE_STOP_TIME               = 13046.2940
PRODUCER_ID                    = "HP_SSP_OU"
PRODUCER_FULL_NAME             = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME      = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                    = "TITAN"
```

4.2.11 IMPACT Data Label

```
PDS_VERSION_ID                 = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 812
FILE_RECORDS                   = 8

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                = "SSP_IMPACT_5_0_R_SURF.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                      = "SSP_IMPACT_5_0_R_SURF.LBL"
DATA_SET_ID                    = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                  = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                     = "SSP_IMPACT_5_0_R_SURF.LBL"
PRODUCT_CREATION_TIME          = 2005-02-01T00:00:00
MISSION_NAME                   = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME           = "HUYGENS PROBE"
INSTRUMENT_HOST_ID             = HP
MISSION_PHASE_NAME             = "DESCENT"
PRODUCT_TYPE                   = EDR
START_TIME                     = 2005-01-14T11:38:10.4700
STOP_TIME                      = 2005-01-14T11:38:10.4700
SPACECRAFT_CLOCK_START_COUNT   =  8869.7700
SPACECRAFT_CLOCK_STOP_COUNT    =  8869.7700
NATIVE_START_TIME              =  8869.7700
NATIVE_STOP_TIME               =  8869.7700
PRODUCER_ID                    = "HP_SSP_OU"
PRODUCER_FULL_NAME             = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME      = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                    = "TITAN"
```

4.2.12 PER Data Label

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 122
FILE_RECORDS                    = 1332

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_PER_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_PER_123456_0_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_PER_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:11:31.1380
STOP_TIME                       = 2005-01-14T12:47:43.7180
SPACECRAFT_CLOCK_START_COUNT    =    70.4380
SPACECRAFT_CLOCK_STOP_COUNT     = 13043.0180
NATIVE_START_TIME               =    70.4380
NATIVE_STOP_TIME                = 13043.0180
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.13 REF Data Label

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 10282
FILE_RECORDS                    = 182

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                 = "SSP_REF_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_REF_123456_0_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_REF_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-02-01T00:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:20:21.6980
STOP_TIME                       = 2005-01-14T12:45:46.7800
SPACECRAFT_CLOCK_START_COUNT    =   600.9980
SPACECRAFT_CLOCK_STOP_COUNT     = 12926.0800
NATIVE_START_TIME               =   600.9980
```

```
NATIVE_STOP_TIME                = 12926.0800
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.14 THP – Data Label

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 142
FILE_RECORDS                    = 13260

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                = "SSP_THP_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_THP_123456_0_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_THP_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-11-18T14:14:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:11:22.4740
STOP_TIME                       = 2005-01-14T12:47:16.8150
SPACECRAFT_CLOCK_START_COUNT    =    61.7740
SPACECRAFT_CLOCK_STOP_COUNT     = 13016.1150
NATIVE_START_TIME               =    61.7740
NATIVE_STOP_TIME                = 13016.1150
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

4.2.15 TIL Data Label

```
PDS_VERSION_ID                  = PDS3

/* FILE CHARACTERISTICS DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 122
FILE_RECORDS                    = 16668

/* DATA OBJECT POINTER IDENTIFICATION ELEMENTS */
^TABLE                = "SSP_TIL_123456_0_R_ATMOS.TAB"


/* INSTRUMENT AND DETECTOR DESCRIPTIVE DATA ELEMENTS */
FILE_NAME                       = "SSP_TIL_123456_0_R_ATMOS.LBL"
DATA_SET_ID                     = "HP-SSA-SSP-3/4-DESCENT-V1.0"
DATA_SET_NAME                   = "HUYGENS DESCENT RAW AND CALIBRATED DATA"
PRODUCT_ID                      = "SSP_TIL_123456_0_R_ATMOS.LBL"
PRODUCT_CREATION_TIME           = 2005-11-23T14:00:00
MISSION_NAME                    = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME            = "HUYGENS PROBE"
INSTRUMENT_HOST_ID              = HP
MISSION_PHASE_NAME              = "DESCENT"
```

```
PRODUCT_TYPE                    = EDR
START_TIME                      = 2005-01-14T09:11:25.4700
STOP_TIME                       = 2005-01-14T12:47:39.7260
SPACECRAFT_CLOCK_START_COUNT    =    64.7700
SPACECRAFT_CLOCK_STOP_COUNT     = 13039.0260
NATIVE_START_TIME               =    64.7700
NATIVE_STOP_TIME                = 13039.0260
PRODUCER_ID                     = "HP_SSP_OU"
PRODUCER_FULL_NAME              = "AXEL HAGERMANN"
PRODUCER_INSTITUTION_NAME       = "OPEN UNIVERSITY, PSSRI"
TARGET_NAME                     = "TITAN"
```

The following table gives the definition of the data_quality_flag: (TBC)

DATA QUALITY FLAG	RAW DATA	CALIBRATED DATA
1	Good	N/A
2	Poor	N/A

4.3 Data Product design

All data products will be stored in tables that comprise both voltages and A/D counts in separate columns within the same table. Each row of data contains a time stamp (in seconds after T0), other relevant information like instrument mode and dataset ID (as outlined in [AD-3]) and the measurements. As the data products are very similar in structure we refrain from a complete list for all sensors and modes and only give a few examples. All data will be ordered as contained in the data packets and set out in [AD-3], except for the conversion into voltages which will be added in extra columns. Deviations will be identified in the labels. The following list of product designs is not extensive. A complete list of all object definition is unnecessary as all products are similar. In the following, we detail the Data products of ACCE, ACCI and REF

4.3.1 Data Product Design Example - ACCE Sensor

4.3.1.1 Data Object Definition ACCE_MODE057_TABLE

The ACCE data packets consist of one time-tagged time series of 512 values that represent the ACCE impact event. The data is represented as time (s), ACCE measurements (raw ADC counts), ACCE (V). The third column ACCE(V) is directly reduced from the digital numbers (raw ADC counts) by: Voltage = DN / 256.0 * (VOLTAGE_MAX – VOLTAGE-MIN), with VOLTAGE_MAX =+5V and VOLTAGE_MIN=0 V .

```
/* DATA OBJECT DEFINITION */
/* DATA OBJECT DEFINITIION FOR THE ACCE_MODE057_Table */
OBJECT                              = TABLE
 NAME                         = ACCE_MODE057_Table
 INTERCHANGE_FORMAT  = ASCII
 ROWS                               = 512
 COLUMNS                         = 6
 ROW_BYTES                    = 72
 DESCRIPTION                  = "ACC-E table"

 OBJECT                          = COLUMN
     COLUMN_NUMBER     = 1
     NAME                          = ACCE_SAMPLE_TIME
     DATA_TYPE                = ASCII_REAL
     START_BYTE              = 1
     BYTES                   = 20
     DESCRIPTION             = "Nominal sample time"
     UNIT                    = SECONDS
 END_OBJECT                 = COLUMN

 OBJECT                          = COLUMN
     COLUMN_NUMBER    = 2
     NAME                          = ACCE_MODE
     DATA_TYPE                = ASCII_INTEGER
     START_BYTE              = 21
     BYTES                         = 10
     DESCRIPTION              = "SSP Mode"
 END_OBJECT                 = COLUMN

 OBJECT                          = COLUMN
     COLUMN_NUMBER    = 3
     NAME                          = ACCE_ID
     DATA_TYPE                = ASCII_INTEGER
     START_BYTE              = 31
     BYTES                         = 10
     DESCRIPTION              = "ACC-E ID"
 END_OBJECT                 = COLUMN
```

```
OBJECT                          = COLUMN
     COLUMN_NUMBER     = 4
     NAME                           = ACCE_SEQUENCE
     DATA_TYPE                 =  ASCII_INTEGER
     START_BYTE               = 41
     BYTES                        = 10
     DESCRIPTION               = "Sequence no of current sample"
 END_OBJECT                    = COLUMN
 OBJECT                          = COLUMN
     COLUMN_NUMBER     = 5
     NAME                           = ACCE_VAL
     DATA_TYPE                 =  ASCII_INTEGER
     START_BYTE               = 51
     BYTES                        = 10
     DESCRIPTION               = "8 bit value"
 END_OBJECT                    = COLUMN

  OBJECT                          = COLUMN
     COLUMN_NUMBER     = 6
     NAME                           = ACCE_VOLT
     DATA_TYPE                 =  ASCII_REAL
     START_BYTE               = 61
     BYTES                                                  = 10
     DESCRIPTION               = "Acc-E voltage"
     UNIT                         = VOLTS
 END_OBJECT                    = COLUMN
END_OBJECT                    = TABLE
END
```

4.3.1.2 Data Object Definition ACCE_MODE123_TABLE

The ACCE_MODE123_DN_SERIES is used for the data acquired during instrument modes 1, 2 and 3. There are 3 time series in total that will be archived in one file. The length of each time series is 110 values.

```
/* DATA OBJECT DEFINITION */
/* DATA OBJECT DEFINITIION FOR THE ACCE_MODE123_ID2_Table */
OBJECT                              = TABLE
 NAME                            = ACCE_MODE123_ID2
 INTERCHANGE_FORMAT  = ASCII
 ROWS                               = 3
 COLUMNS                        = 212
 ROW_BYTES                   = 2132
 DESCRIPTION                 = "ACC-I compressed impact signature"

 OBJECT                          = COLUMN
     COLUMN_NUMBER     = 1
     NAME                         = ACCE_SAMPLE_TIME
     DATA_TYPE               =  ASCII_REAL
     START_BYTE             = 1
     BYTES                        = 20
     UNIT                        = SECONDS
     DESCRIPTION             = "Nominal sample time"
 END_OBJECT                  = COLUMN

 OBJECT                          = COLUMN
     COLUMN_NUMBER    = 2
     NAME                         = ACCE_MODE
     DATA_TYPE               =  ASCII_INTEGER
     START_BYTE             = 21
     BYTES                        = 10
     DESCRIPTION             = "SSP Mode"
 END_OBJECT                  = COLUMN
```

```
OBJECT                          = COLUMN
     COLUMN_NUMBER     = 3
     NAME                            = ACCE_ID
     DATA_TYPE                  =  ASCII_INTEGER
     START_BYTE                = 31
     BYTES                          = 10
     DESCRIPTION                = "ACCE datastream packet ID"
 END_OBJECT                     = COLUMN
 OBJECT                           = COLUMN
     COLUMN_NUMBER     = 4
     NAME                            = ACCE_MAX_SIG
     DATA_TYPE                  =  ASCII_INTEGER
     START_BYTE                = 41
     BYTES                          = 10
     DESCRIPTION                = "8 bit maximum value"
 END_OBJECT                     = COLUMN

  OBJECT                          = COLUMN
     COLUMN_NUMBER     = 5
     NAME                            = ACCE_MAX_POS
     DATA_TYPE                  =  ASCII_INTEGER
     START_BYTE                = 51
     BYTES                          = 10
     DESCRIPTION                = "offset of peak from start of signature"
 END_OBJECT                     = COLUMN

  OBJECT                          = COLUMN
     COLUMN_NUMBER     = 6
     NAME                            = ACCE_PRE_MAX_POS
     DATA_TYPE                  =  ASCII_INTEGER
     START_BYTE                = 61
     BYTES                          = 10
     DESCRIPTION                = "offset of leading 1/2 max point from start"
 END_OBJECT                     = COLUMN
...ETC...
```

4.3.1.3 Data Object Definition ACCE Calibrated Data

N/A

4.3.2 Data Object Definition Example – ACCI sensor

The ACCI data packets consist of one time-tagged time series of 512 values that represent the ACCI impact event. The data is represented as time (s) and ACCI measurements as raw ADC counts and voltages.

4.3.2.1 Data object definition ACCI_MODE057_TABLE

```
/* DATA OBJECT DEFINITION */
/* DATA OBJECT DEFINITIION FOR THE ACCI_MODE057_Table */
OBJECT                               = TABLE
 NAME                          = ACCI_MODE057_Table
 INTERCHANGE_FORMAT  = ASCII
 ROWS                                = 512
 COLUMNS                          = 6
 ROW_BYTES                    = 72
 DESCRIPTION                  = "ACC-I table"
```

```
 OBJECT                          = COLUMN
     COLUMN_NUMBER     = 1
     NAME                          = ACCI_SAMPLE_TIME
     DATA_TYPE                = ASCII_REAL
     START_BYTE              = 1
     BYTES                         = 20
     DESCRIPTION             = "Nominal sample time"
 END_OBJECT                  = COLUMN

 OBJECT                          = COLUMN
     COLUMN_NUMBER    = 2
     NAME                          = ACCI_MODE
     DATA_TYPE                = ASCII_INTEGER
     START_BYTE              = 21
     BYTES                         = 10
     DESCRIPTION              = "SSP Mode"
 END_OBJECT                  = COLUMN

 OBJECT                          = COLUMN
     COLUMN_NUMBER    = 3
     NAME                          = ACCI_ID
     DATA_TYPE                = ASCII_INTEGER
     START_BYTE              = 31
     BYTES                         = 10
     DESCRIPTION              = "ACC-I ID"
 END_OBJECT                  = COLUMN

OBJECT                          = COLUMN
     COLUMN_NUMBER     = 4
     NAME                            = ACCI_SEQUENCE
     DATA_TYPE                  = ASCII_INTEGER
     START_BYTE                = 41
     BYTES                         = 10
     DESCRIPTION               = "Sequence no of current sample"
 END_OBJECT                    = COLUMN
 OBJECT                          = COLUMN
     COLUMN_NUMBER     = 5
     NAME                            = ACCI_VAL
     DATA_TYPE                  = ASCII_INTEGER
     START_BYTE                = 51
     BYTES                         = 10
     DESCRIPTION               = "12 bit value"
 END_OBJECT                    = COLUMN

  OBJECT                          = COLUMN
     COLUMN_NUMBER     = 6
     NAME                            = ACCI_VOLT
     DATA_TYPE                  = ASCII_REAL
     START_BYTE                = 61
     BYTES                         = 10
     DESCRIPTION               = "Acci voltage"
 END_OBJECT                    = COLUMN
END_OBJECT                     = TABLE
END
```

4.3.2.2 Data Object Definition of ACCI_MODE1236_TABLE

The ACCI sensor is sampled continuously at 500Hz through the mission. One set of values in these data packets consist of Mean, Variance, and Maximum values taken over 200 ACCI samples . The data is represented by 7 columns as: TIME (s), ACCI_MEAN (raw ADC counts), ACCI_MEAN (V), ACCI_VAR (raw ADC counts), ACCI_VAR (V), ACCI_MAX (raw ADC counts), ACCI_MAX (V).
The voltages ACCI (V) values are reduced from the digital numbers (raw ADC counts) by:
Voltage = DN / 4096 * (VOLTAGE_MAX – VOLTAGE-MIN), with VOLTAGE_MAX = +5V and

VOLTAGE_MIN= -5 V.

4.3.2.3 Data Object Definition of ACCI Calibrated Data

N/A

4.3.3 Data Product Design - APIS Sensor

4.3.3.1 Data Object definition of APIS-MODE23_TABLE

The APIS sensor operates from mode2 to the end of mission. The acoustic return signal is formed by 1000 samples measured at 1 millisecond interval. In modes 2 and 3, the data is reduced by selecting a window from the1000 sample acoustic return signal 40^{th} sample to 560^{th} sample and sending an average of 20 samples as 1 value (called bin). Therefore one return signal is represented by 26 such bins.
The data is represented by 4 columns as: time (s), bin number, APIS (raw ADC counts), APIS (V).
The third column ACCI(V) is directly reduced from the digital numbers (raw ADC counts) by:

4.3.3.2 Data Product Design of APIS-MODE4_TABLE

The APIS sensor operates from mode2 to the end of mission. The acoustic return signal is formed by 1000 samples measured at 1 millisecond interval. In mode 4, the data is reduced by transmitting the 60 samples around the peak as uncompressed, and further 140 samples are averaged by 4 with remaining samples averaged by 20. Therefore one return signal is represented by 136 such bins.
The data is represented by 5 columns as: time (s), bin number, APIS (raw ADC counts), APIS (V), APIS_PEAK_POS.

4.3.3.3 Data Object definition of APIS-MODE6_TABLE

The APIS sensor operates from mode2 to the end of mission. The acoustic return signal is formed by 1000 samples measured at 1 millisecond interval, in surface mode (6), the sensor output is taken from 10 pulses separated by 1 second listening interval. In mode 6, the data is reduced by transmitting 10x50 bins (where each bin contains average value of 20 samples) = 500 bins and also the highest return signal is transmitted as mode4 (i.e. compression centred on the peak).
The data is represented by 5 columns as: time (s), bin number, APIS (raw ADC counts), APIS (V), APIS_PEAK_POS.

4.3.3.4 Data Object definition of APIS Calibrated Data

N/A

4.3.4 Data Product design, DEN, HK, PER, THP, TIL

Data products of DEN, PER, REF and THP do not differ greatly from those presented the previous sections. Data objects will be separated into modes as implemented in the flight software of the individual sensors (cf. [AD-4]). All data will be of the type OBJECT=TABLE, INTERCHANGE_FORMAT=ASCII.

4.3.5 Data Product Design - REF Sensor

Ref sensor information contains the complete photodiode array read-out in A/D counts and voltages at every timestep. This results in a 1027 column table.

4.3.5.1 Data Object definition of APIS-MODE23_TABLE

```
/* DATA OBJECT DEFINITION */
/* DATA OBJECT DEFINITIION FOR THE REF_MODE123456_Table */
OBJECT                              = TABLE
 NAME                         = REF_MODE123456_Table
```

```
 INTERCHANGE_FORMAT  = ASCII
 ROWS                             = 182
 COLUMNS                       = 1027
 ROW_BYTES                  = 10282
 DESCRIPTION                = "REF table"

 OBJECT                        = COLUMN
     COLUMN_NUMBER     = 1
     NAME                        = REF_SAMPLE_TIME
     DATA_TYPE              =  ASCII_REAL
     START_BYTE            = 1
     BYTES                       = 20
     DESCRIPTION          = "Nominal sample time "
 END_OBJECT              = COLUMN

 OBJECT                        = COLUMN
     COLUMN_NUMBER    = 2
     NAME                        = SSP_MODE
     DATA_TYPE              =  ASCII_INTEGER
     START_BYTE            = 21
     BYTES                       = 10
     DESCRIPTION            = "SSP Mode"
 END_OBJECT              = COLUMN

OBJECT                          = COLUMN
     COLUMN_NUMBER     = 3
     NAME                          = REF_ILLUMINATION
     DATA_TYPE                =  ASCII_INTEGER
     START_BYTE              = 31
     BYTES                       = 10
     DESCRIPTION              = "REF illumination mode"
 END_OBJECT                = COLUMN

OBJECT              = COLUMN
  COLUMN_NUMBER     =     4
  NAME              = REF_SAMPLE
  DATA_TYPE         = ASCII_INTEGER
  START_BYTE        =    41
  BYTES             =    10
  DESCRIPTION       = "REF value"
END_OBJECT          = COLUMN
[…]
```

5 Appendix: Available Software to read PDS files

N/A

6 Appendix: Auxiliary Data Usage

TBD

7 Appendix: Example of Directory Listing of Data Set

Please refer to section 3.4.