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Planetary Missions Division

Rosetta - ROLIS

To Planetary Science Archive Interface Control Document

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DLR
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Distribution List

Recipient	Organisation	Recipient

Change Log

Date	Sections Changed	Reasons for Change
15 April 2013	Creation of Issue 1 Revision 0	Delivery of Issue 1.0 to PSA after peer review
08 July 2015	Updated: 2.4.4 In-Flight data products 2.4.8 Ancillary Data Usage 3.2.2.2.2 LOBT 3.2.2.2.4 UTC 4.2 Datasets, Definition and Content Added: 3.2.2.2.5 Spacecraft Clock Count in PDS Labels Deleted: 3.4.3.4.2 Geometric Index File 3.4.3.6 Geometry Directory	Delivery of Issue 1.1 updated for the Comet phase
26 January 2016	Updated: 3.4.3 Directories (CALIB directory addition) 3.4.3.2 Calibration directory	Issue 1.2: addition of Level 3 data description
11 Oct 2016	Updated: 4.3.3.1 4.3.4	Issue 1.2b: addition of Level 5 data description

TBD ITEMS

Section	Description
4.3.4	Level 5 definition

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to (Science) Archive Interface Control Document) is twofold. First it provides users of the ROLIS instrument with detailed description of the product and a description of how it was generated, including data sources and destinations. Secondly, the EAICD describes the interface to the Planetary Science Archive (PSA) of ESA and it is the official interface between each experimenter team and the PSA.

1.2 Archiving Authorities

The *Planetary Data System* Standard is used as archiving standard by:

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

ESA's *Planetary Science Archive* (PSA)
ESA implements an online science archive, the PSA

- to support and ease data ingestion
- to offer additional services to the scientific user community and science operations teams as e.g.:
  - search queries that allow searches across instruments, missions and scientific disciplines
  - several data delivery options as:
    - direct download of data products, linked files and data sets
    - ftp download of data products, linked files and data sets

The PSA aims for online ingestion of logical archive volumes and offers the creation of physical archive volumes on request.

1.3 Contents

This document describes the data flow of the ROLIS instrument on ROSETTA from the s/c until the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labeled 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. Software that may be used to access the product is explained further-on.

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

1.4 Intended Readership

The staff of the archiving authority (Planetary Science Archive, ESA, RSSD, design team) and any potential user of the ROLIS data.

1.5 Applicable Documents

[AD 1] Planetary Data System Preparation Workbook, February 1, 1995, Version 3.1, JPL, D-7669, Part1
[AD 2] Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2
[AD 3] Rosetta Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-

PL-5011

[AD 4] CDMS Command and Data Management System - Subsystem Specification RO-LCD-SP-3101 29/08/2001, Issue 3, Rev. 5

[AD 5] CDMS Command and Data Management System - Operation Manual RO-LCD-SW-3402 12/02/2001, Issue 1, Rev. 2

[AD 6] Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004

[AD 7] Civa/Rolis IME GRM Acceptance Data Package RO-LRS-ADP-3306 Issue 1 / Revision 2; chapter 5 and chapter 8

[AD 8] Civa/Rolis IME FM Acceptance Data Package RO-LRS-ADP-3304 Issue 1 / Revision 5

[AD 9] Definition of the Flexible Image Transport System (FITS), FITS Standard Version 2.1b, IAU FITS Working Group http://fits.gsfc.nasa.gov/iaufwg, December 9, 2005

[AD 10] ROSETTA Archive Conventions RO-EST-TN-3372 Issue 7, Rev. 9, 06 April 2015

[AD 11] DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003

1.6 Relationships to Other Interfaces

ROLIS is in relation with the ÇIVA instrument and the CDMS lander subsystem.
Together with ÇIVA it is part of the PHILAE imaging package. Technically speaking, one common Imaging Main Electronics (IME) controls both the ÇIVA and the ROLIS instruments. The ROLIS-part of the IME is in charge to control and process data of the Descent and Down-looking camera ROLIS-D and is for both instruments ROLIS and ÇIVA in charge of the power, telemetry and telecommand interfacing with the Lander CDMS and PSS sub-systems. That configuration implies an imperative switching-on of the ROLIS-part of IME before any other activation of the ROLIS-D camera or the ÇIVA-part of the IME and the ÇIVA-P, ÇIVA-M/V and ÇIVA-M/I:

1. (ROLIS-part of) IME power-on
2a. ROLIS-D camera on
2b. ÇIVA-part of the IME on
3b1. ÇIVA-P on
3b2. ÇIVA-M/V on
3b3. ÇIVA-M/I on

The step-by-step activation sequences can be the following:
1-2a;
1-2b-3b1 or
1-2b-3b2 or
1-2b-3b3.

The ROLIS-part of IME is interfaced to the CDMS and the PSS by means of the Experiment-I/F-Board.
The ÇIVA heater power lines are directly connected from the TCU / PSS to the ÇIVA-part of the IME not using the Experiment-I/F-Board. Once switched on by the ROLIS part of the IME, this direct "heater-I/F" allows to heat the CIVA-instruments independently whether the power of the ROLIS-part of IME is On or Off.

1.7 Acronyms and Abbreviations

AD Applicable Document
APID Application Process IDentifier.
AU Astronomical Unit
CDMS Command and Data Management System
CIVA Cometary Infrared and Visible Analyser
ÇIVA-CE ÇIVA Central Electronics
CNES Centre National d'Etudes Spatiales
DN Digital Number
DDS Data Delivery System (ESOC server)
DECW Data Error Control Word

DIS **D**escent **I**maging with instrument internal data **S**torage
DIT **D**escent **I**maging with instant data **T**ransmission
DLR Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
DLR-PF DLR-Institut für Planetenforschung (Institute of Space Research)
DPU Data Processing Unit
EAICD Experiment Archive Interface Control Document
EGSE Electrical Ground Support Equipment
ESA European Space Agency
ESOC European Space Operation Center
ESTEC European Space Research and Technology Center
FOV Field of View
GRM Ground Reference Model
HK Housekeeping
IFL Infinity Lens
IFOV Instantaneous Field of View
I/F Interface
IME Rolis&Civa Imaging Main Electronics
IR infra-red
LED Light Emitting Device
MEM Rolis mass Memory board
MJT Modified Julian Time
OBDH On Board Data Handling
OBT On Board Time
NAIF Navigation Ancillary Information Facility
PDS Planetary Data System
PECW Packet Error Control Word
PI Principal Investigator
PID Process Identifier
PSA Planetary Science Archive
PSS PHILAE Power SubSystem
PVV PSA Volume Verifier
RD Reference Document
RF Radio Frequency
RGB red-green-blue
ROLIS ROsetta Lander Imaging System
ROM Read-Only Memory
S/C Spacecraft
SCET Spacecraft Elapsed Time
SFDU Standard Formatted Data Unit
SMO Surface Mode Optics
SONC Science Operations and Navigation Center (CNES-Toulouse)
S/W Software
TBC To Be Confirmed
TBD To Be Defined
TCmd Telecommand
TCU PHILAE Thermal Control Unit
TM Telemetry
WRT With Respect To

1.8 Contact Names and Addresses

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2 Overview of Instrument Design, Data Handling Process and Product Generation

2.1 Scientific Objectives

The ROSETTA LANDER IMAGING SYSTEM - DESCENT AND CLOSEUP IMAGER ROLIS is designed to characterize the landing site on the cometary nucleus of Churyumov-Gerasimenko, and the sampling areas of the other experiments onboard of PHILAE before and after landing.

ROLIS obtains panchromatic images of the landing site during the descent phase, acquiring high resolution images to characterize the morphology of the undisturbed landing site and sampling areas.
The first ROLIS images acquired during the descent phase (DIT - Descent Imaging with instant data Transmission) are immediately processed and transferred via PHILAE's CDMS to the ROSETTA-orbiter.
During the last meters before touchdown a TBC number of images (DIS - Descent Imaging with instrument internal data Storage) with a resolution of typically 2 to 0.2 cm per pixel, and a FOV of 10 to 1 meters, is acquired, and temporarily stored in the ROLIS memory. In order not to lose the buffered ROLIS-images it is mandatory to have the IME switched-on during touch-down.
After a controlled touch-down ROLIS observes the structure of the comet surface in the landing area. ROLIS operates to characterize the surface below the Lander and the sites of sample acquisition (surface and drilled samples) by mono- and stereo imaging. It thus helps interpreting the data acquired by the in-situ analyzers.

The camera optics realizes two fixed-focus modes:

- descent (or infinity -) mode to obtain focused images during the descent phase
- surface mode with a depth-of-focus of approx. 30 (+10/−8) cm focused on the surface below the Lander.

The descent mode is realized by a rotatable lens (IFL) that is located in front of the surface mode optics (SMO) during the landing phase, and can be removed from the ray path by a 90° turn after touch-down have been finished. An additional task of the IFL is dust protection of the SMO during landing, and, possibly, during drilling actions on the cometary nucleus surface.

In order to adequately illuminate the nucleus surface below the Lander, an illumination device containing a four-color LED array is available, allowing the camera to obtain images in blue, green, red, and infra-red color (Blue [470 nm], Green [530 nm], Red [640 nm], Infra-Red [870 nm]).

A slight rotation movement of PHILAE allows sequentially acquisition of high resolution stereo-images of the cometary surface. In this way it is possible to reconstruct the local 3-dimensional structure of the surface in color and in high resolution to characterize the morphology of the undisturbed landing site and sampling areas.

2.2 Instrument Design

ROLIS consists of two separate units:

- the descent and down-looking camera (ROLIS-D), and
- the on-board processing and data handling electronics – the so-named Imaging Main Electronics (IME).

ROLIS-D is mounted at the balcony of PHILAE. The IME is located in the Central Electronic Box "CEB-Z", within the warm compartment.

The technical characteristics of ROLIS-D are the following:

- Frame-Transfer CCD with 1024 x 1024 pixels with a size 14 µm x 14 µm
  Wide angle optics (FOV=75°) with two fixed focus positions: 1) with IFL for far distances (descent) and 2) without IFL for the near field (close-up imaging after landing) :
  - far distance (1m to ∞m to surface)
  - near distance (310 mm to surface): resolution 0.3 mm/pixel
- Integrated illumination device (LED-Array each with 36 LEDs in the colors RGB and IR) for illuminating the field of view on the comet surface in the shadow and during night.
- The Thermal Design of the camera guarantees an extremely large range of operational temperature between -150°C and +30°C
- Operations on the comet are possible between approximately 3 and 1.8 AU
- The envelope of ROLIS-camera is cc. 90 x 63 x 86 mm^3
- The weight of ROLIS-camera is nearly exact 400 g

ROLIS is sharing the common Imaging Main Electronics (IME) with ÇIVA.
The ROLIS-part of the IME includes the Command and Data Processing Unit on the base of a RTX 2010 processor (ROLIS-DPU board), and a 16 Mbytes mass memory (MEM board), in addition to the camera-I/F to ROLIS-D (on MEM-board) and I/F to CDMS and PSS (Experiment-I/F-board).

2.2.1 ROLIS-DPU Software Functions

The ROLIS-DPU has to fulfill the following software functions:

- Start ROLIS-IME after power-on
- Receive and distribute telecommands (incl. to ÇIVA-CE)
- Start and control the ROLIS-D camera
- Define the ROLIS working mode
- Acquire the ROLIS status
- Acquire ÇIVA temperature inputs for analog multiplexing in the ROLIS-IME
- Send ROLIS and ÇIVA HK within a Health Status report packet
- Receive ROLIS data from the ROLIS-D camera
- Store ROLIS data in the MEM
- Receive ÇIVA data (incl. HK) from the ÇIVA-CE
- Store ÇIVA data in the MEM
- Process ROLIS raw data (data compression)
- Measure the ROLIS temperatures and voltage values of selected power lines
- Transfer ROLIS and ÇIVA data to CDMS

2.2.2 ROLIS camera position

The only mechanical interfaces between the ROLIS-D Camera Head and the Rosetta Lander are the recess inside the Lander (balcony) baseplate, and the three contact areas of the attachment legs ATL A, B, and C with the top (+z_U) surface of the balcony (cf. *figure 1).* The origin of Lander URF and the origin of ROLIS-D URF are also shown in figure 1.
The circular contact areas of the ATLs are centered on the footprint URF coordinates (cf. Table 2-1 for the ROLIS-D position in ROLIS-D coordinates and parallel in Lander coordinates).

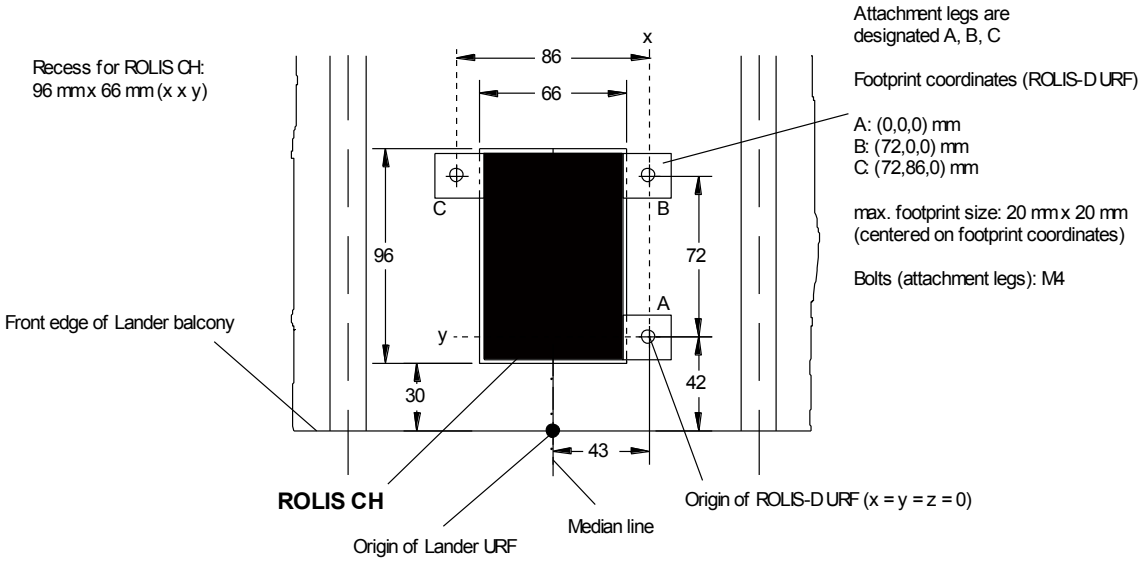

Figure 1 Accommodation of ROLIS-D on the Rosetta Lander balcony (schematics)

	ROLIS-D URF			Lander URF		
ATL	**x_U / mm**	**y_U / mm**	**z_U / mm**	**X_U / mm**	**Y_U / mm**	**Z_U / mm**
A	±0.0	±0.0	±0.0	+42.0	-43.0	±0.0
B	+72.0	±0.0	±0.0	+114.0	-43.0	±0.0
C	+72.0	+86.0	±0.0	+114.0	+43.0	±0.0

Table 2-1 Footprint URF center coordinates for the ATLs of ROLIS-D

The maximum height of ROLIS-D above the Lander balcony is **35.1 mm** incl. the M4 fixation screws mounting the ROLIS-D to the ATLs (cf. Figure 2); no part of ROLIS-D extends below the balcony baseplate (margin ≥ 1.3 mm provided a balcony plate thickness of 51.6 mm).

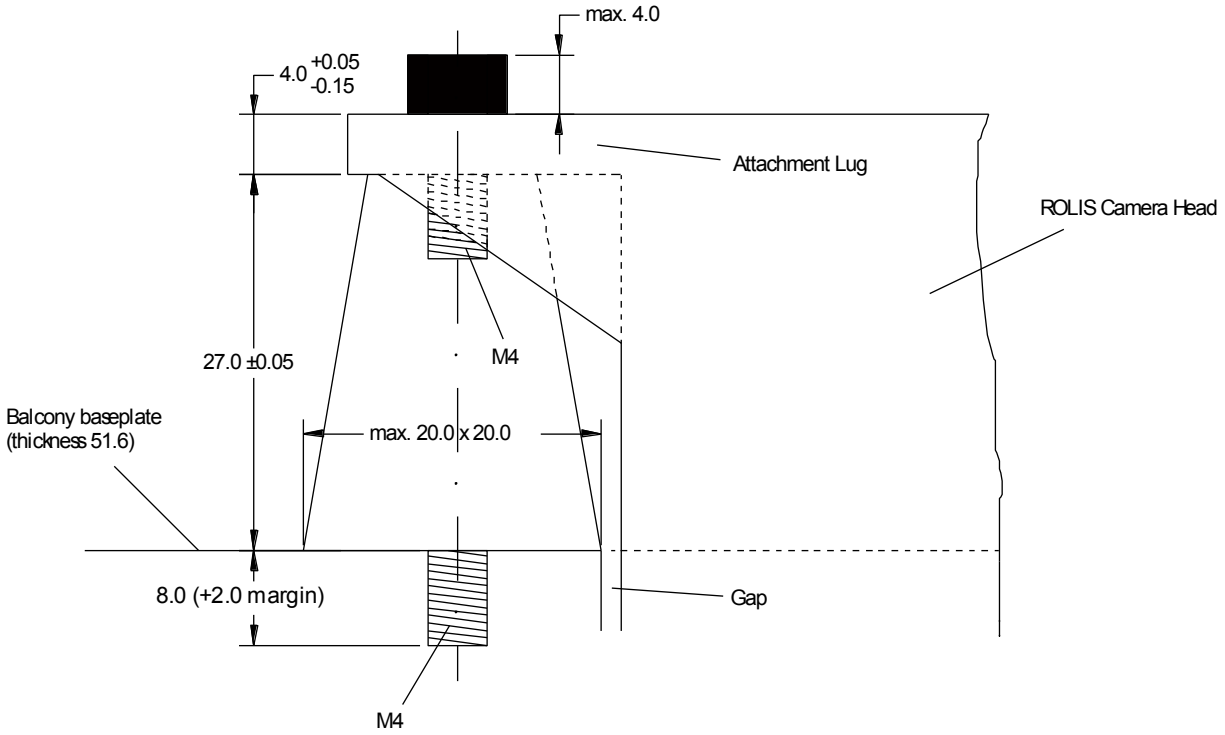

Figure 2 ROLIS-D (CH) attachment leg (ATL) dimensions (schematics)

2.2.3 ROLIS imaging modes

ROLIS operates in different imaging modes, defined in Table 2-1:

	Mode Name	**Mode Description**
DIT	**D**escent **I**maging with instant data **T**ransmission	In the first descent phase ROLIS takes single images, process (compress) the data and immediately transfer the processed data to the CDMS
DIS	**D**escent **I**maging with instrument internal data **S**torage	In this second descent mode ROLIS continuously performs imaging until landing. The landing act is signalled and finish the DIS mode by the first one of the following events: 1) Hard-wired touch-down signal; 2) CDMS broadcast message: 3) ROLIS command 5857 Images are stored in a ring-buffer which contains up to 7 descent images.
CUC	**C**lose-**U**p **C**olor imaging	ROLIS takes images on the cometary surface in the near distance. A CUC image set consists nominally of 4 images + 1 dark image according to the 4 illumination sources of ROLIS-D
CUS	**C**lose-**U**p **S**tereo imaging	ROLIS takes a CUC image set in a particular lander position and after slight rotation an additional image on this new position. On Earth it is possible to generate a stereo color image on the base of images taken on different positions of ROLIS.
FFI	Full Frame Image	In this imaging mode ROLIS generates a full frame image including the dark reference pixels.

Table 2-1: ROLIS imaging modes

2.3 Data Handling Process

SONC is responsible for data preparation and the ROLIS PI is responsible for the distribution to CoI's. The relevant contact information is provided in section 1.8.
The SONC is responsible for PDS ROLIS data sets generation and delivery to the PSA.

The CIVA/ROLIS telemetry data is provided by the ESA DDS (Data Distribution Server). Following the operations plan the SONC pulls out archived packets (SC and HK) by direct request to the DDS via FTP and stores them into SONC database.
As soon they are received, the SC raw packets are passed through the DLR data processing software (integrated in SONC) for decommutation, and decompression (raw images). The raw images are converted to JPG and PNG formats and stored into SONC database.
In the same way, the HK raw packets are passed through the SONC data processing software for decommutation and calibration.

So, the following data are immediately available through W3-SONC server (http://soncv2-rosetta.cnes.fr) and the authorized[1] users can get them for a selected time interval :
- Science (SC) and Housekeeping (HK) raw packets as binary files with .rolbin extension.
- Raw images in FITS format as files with .FIT extension.
- Calibrated HK data as ASCII files with .csv extension (directly readable).
Moreover, the W3-SONC provides interactive plots of ROLIS which can be downloaded as images formats such as JPG, PNG.

SONC also handles Auxiliary data (Attitude and Orbit files) pushed by the ESA DDS server.

The Rolis PI generates calibrated and final ROLIS data described in §2.4 only for the Descent and On-comet phase.

Three periods must be distinguished in the ROLIS data handling process:

1. pre-flight tests and the ground-based tests during the ROSETTA mission with reference models
2. in-flight activities after the launch including the Commissioning and Cruise phases. Data produced during this period are not scientifically relevant.
3. scientific mission (starting with the descent phase). Only in this period scientific valuable data are produced.

SONC handles the data produced by ROLIS experiment (all flight data as well as Ground data), as well as auxiliary data.

2.4 Overview of Data Products

The ROLIS team uses or will use 4 different ROLIS data products:

(1) ROLIS telemetry data

The ROLIS EGSE S/W is able to process selected ROLIS ROLBIN-data which could contain non-separated science data and HK. The EGSE S/W can analyze these raw TM-packets by hex-dump and ASCII-interpretation. The hex-dump is helpful for the image data packets while the ASCII-interpretation is convenient especially for the status- and text-packets. Furthermore the EGSE-S/W can recognize and decode the HK-packets. The output is HK in physical values.

[1] The authorization is controlled by the PI. At his request, SONC delivers a login/password to the authorized user.

The ROLIS EGSE S/W accepts the following data types:
*.rolbin (SC- and/or HK-data generated by ROLIS)
*.dat (ROLIS generated SC- data of CDMS-simulator for example)
*.hk (ROLIS generated HK-data of CDMS-simulator for example).

This stage of ROLIS data processing should be performed in SONC and in DLR-PF in parallel.

(2) ROLIS raw images

The ROLIS Quick-look as a part of the EGSE S/W is able to process ROLIS science data and recover the ROLIS raw images. The accepted input data are:
*.rolbin (ROLIS generated SC- (and HK-) data)
*.dat (ROLIS generated SC- data by CDMS-simulator for example).
Two different data processing routines are applicable depending on the input data containing compressed or un-compressed image data.
The outputs of these Quick-look routines are uni - or pan-chromatic, un-calibrated, single images in the following formats:
*.afl (special image file format for AstPhot32-S/W written by S. Mottola)
*.fits (standard image file format which includes header information)
*.rim (image file which contains only image pixel information)
An important task of the ROLIS Quick-look routines is to find for each single image the accompanying Imaging Status Block (ISB). The ISB content is used for the header of *.fits-files.

A special visualization problem is with so-named “full-frame images” (cf. FIS-mode in section 2.2.2). This kind of images includes also the dark reference pixels beside the 1024 x 1024 image pixels of the CCD-detector. Therefore one has to treat those generally un-compressed “full-frame images” explicitly as “raw-images” and (manually) insert an additional input information about the real physical CCD-row length, the number of columns to visualize and the number of pre-image-pixels.

This stage of ROLIS data processing should be performed in SONC and in DLR-PF in parallel.

(3) ROLIS calibrated images

The calibration of the ROLIS raw images consists of a temperature-depending correction of the dark current and the responsivity of each image pixel. The following sequence has to be applied:
1. Decode the ROLIS-D temperature during image exposure
2. Correct the dark-current-offsets of all image pixels using the FM-calibration data set for the relevant ROLIS-D temperature
3. Correct the responsivity of all image pixels using the FM-calibration data set for the relevant ROLIS-D temperature

The result is a pixel-corrected ROLIS image. It corresponds to CODMAC level 3 data.

This stage of ROLIS data processing should be performed in DLR-PF exclusively.

(4) ROLIS final images

Finally the ROLIS-data processing shall result in following types of ROLIS images:
- RGB and IGB false color images in (TBD) format (cf. CUC-mode in section 2.2.2)
- monochromatic or color stereo image pairs
- false color image pairs.

The inputs for this stage are the **ROLIS calibrated images**.

This stage of ROLIS data processing should be performed in DLR-PF exclusively. ROLIS final images correspond to CODMAC level 5 data.

2.4.1 Pre-Flight Data Products

Selected ground data are made available to PSA. These could be the **ROLIS raw images** of the Lander-TV-Test or the functional Separation-Descent-Landing Test of the Lander at ESTEC.

2.4.2 Sub-System Tests

Additional data from the instrument characterization tests are made available to PSA.

2.4.3 Instrument Calibrations

ROLIS calibrated images are produced in DLR-PF exclusively. For this reason the ROLIS-team do not provide the calibration files to SONC but only the calibrated images in order to generate the relevant datasets. The file ROLIS_CALIBRATION_DESC.TXT (located in the DOCUMENT directory) provides information about this calibration.

2.4.4 In-Flight Data Products

The ROLIS data consist of individual two-dimensional images.

The descent images show the comet surface at different distances (and following in different resolutions) in VIS-NIR spectral range. The DIT images (transferred to the orbiter already during the descent phase) show the whole comet or a larger part of the cometary surface. The DIS images show the landing area at different distances and resolutions. The final product of the descent images is **ROLIS calibrated images.**

The close-up images show an area of the comet surface under the Lander with an expected resolution 0.33 mm/pixel. The typical CUC- and CUS-images consists of a set of images at different wavelength (RGB and NIR). By means of a little rotation of the Lander the bore hole cought be exposed before and after boring. Little rotations would allow generate stereo- images (CUS) also.

The in-flight data correspond to all the on board data. They can be produced during following mission phases:

MISSION_PHASE_ NAME	**Abbrevi ation**	**Start Date** (dd/mm/yyyy)	**End Date** (dd/mm/yyyy)	**ROLIS data** (1)			
				Level1	**Level2**	**Level3**	**Level5**
Commissioning (part 1)	CVP1	05/03/2004	06/06/2004	**X**	**6 images**		
Cruise 1	CR1	07/06/2004	05/09/2004				
Commissioning (part 2)	CVP2	06/09/2004	16/10/2004	**X**	**2 images**		
Earth Swing-by 1 (including PC#0)	EAR1	17/10/2004	04/04/2005	**X**	**1 stripe**		
Cruise 2 (including PC#1,2)	CR2	05/04/2005	28/07/2006	**X**	**2 stripes**		
Mars Swing-by	MARS	29/07/2006	28/05/2007	**X**	**20 images**		

(including PC#3,4,5)					**6 stripes**		
Cruise 3	CR3	29/05/2007	12/09/2007				
Earth Swing-by 2 (including PC#6,7)	EAR2	13/09/2007	27/01/2008	**X**	**13 images 2 stripes**		
Cruise 4-1 (including PC#8)	CR4A	28/01/2008	03/08/2008	**X**	**10 images 2 stripes**		
Steins Flyby	AST1	04/08/2008	05/10/2008				
Cruise 4-2 (including PC#9)	CR4B	06/10/2008	13/09/2009	**X**	**5 images 1 stripe**		
Earth Swing-by 3 (including PC#10)	EAR3	14/09/2009	13/12/2009				
Cruise 5 (including PC#12)	CR5	14/12/2009	06/06/2010	**X**	**21 images 2 stripes**		
Lutetia Flyby	AST2	07/06/2010	10/09/2010				
RV Manoeuver 1 (including PC#13)	RVM1	11/09/2010	13/07/2011	**X**	**18 images 2 stripes**		
Cruise 6	CR6	14/07/2011	22/01/2014				
Post Hibernation Commissionning	PHC	09/04/2014	24/04/2014	**X**	**13 images 2 stripes**		
Pre-delivery calibration Science	PDCS	25/04/2014	11/11/2014				

(1) The last column indicates if ROLIS data are available, the first one if data can come from Payload Checkout). Calibrated data are generated by Rolis-PI

After the release of the Lander, we distinguish four phases, characterized by:

- The Start and Stop dates need to be expressed in seconds
- The Lander has its own Auxiliary data

Separation/Descent /Landing	SDL	2014/11/12 08:35:02	2014/11/12 15:34:04	**X**
Rebounds	RBD	2014/11/12 15:34:05	2014/11/12 17:30:20	
First Science Sequence	FSS	2014/11/12 17:30:21	2014/11/15 01:00:00	**X**
Long Term Science	LTS			

Table 2-2 Mission phases

2.4.5 Software

The ROLIS-EGSE-software can control the ROLIS experiment in a stand-alone configuration with a CDMS-Simulator. In the EGSE-S/W a Quick-Look tool is included, which allows a quick data analysis (science data, HK, raw images with different input formats -> cf. section 2.4).
It is important that the EGSE-S/W is able to read also *.rolbin –files where the SC- and the HK-data are still together.
By means of the integrated image visualization tool AstPhot32 the ROLIS-images can be analyzed on the level of **ROLIS raw images.**
The EGSE-S/W contains a help-menu.
The current version is cdms.exe with RolisQL1-30_10jun04 and AstPhot32-3_28oct05.

The EGSE-S/W is already delivered to SONC. Up-dates are delivered to PSA accordingly.
Note: as the Level 2 data are archived, the EGSE software usage shouldn't be needed.

2.4.6 Documentation

The documentation directory contains the following documents:

- CIVAROLIS_IME_FM_ADP.PDF [AD 8]
- ROLIS EAICD (this document)
- ROLIS_CALIBRATION_DESC.TXT, description of ROLIS images calibration
- TIMELINE_ph.TXT, timeline Ascii file for phase ph
- TIMELINE_ph_DESC.TXT, description of the timeline file for phase ph
- TIMELINE_ph,PNG, timeline Image file for phase ph

2.4.7 Derived and other Data Products

A few derived products, built at DLR, are delivered for archiving

- **ROLIS calibrated images** of the comet surface
- **ROLIS calibrated images** of the landing area
- **RGB and IGB false color** close-up images in Microsoft bmp format of the terrain below the lander.
- **monochromatic or color stereo** close-up image pairs of the terrain below the lander.

2.4.8 Ancillary Data Usage

The Lander Auxiliary Data on the comet (Position/Orientation/Illumination at any time + Comet models + Ancillary Data from the instruments) will be available in an ANCDR (Ancillary Data Record) whose definition is in progress, pending the Lander auxiliary data reconstruction.

ROLIS uses the following ancillary data:

- the information of the angular position of the Philae main compartment for the 3D reconstruction.
- Coordinates of landing site in a Comet fixed frame
- Height of the compartment relative to the surface
- Sun angle (e.g. azimuth, elevation)

3 Archive Format and Content

3.1 Format and Conventions

Data processing level number used in ROLIS naming scheme conforms to CODMAC norm :

1: Raw Data Telemetry data with data embedded.
2: Edited Data Corrected for telemetry errors and split or decommutated into a data set for a given instrument. Sometimes called Experimental Data Record. Data are also tagged with time and location of acquisition. Corresponds to NASA Level 0 data.
3: Calibrated Data Edited data that are still in units produced by instrument, but that have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so

edited data can be reconstructed. NASA Level 1A.
5: Derived Data Derived results, as maps, reports, graphics, etc. NASA Levels 2 through 5.

3.1.1 Deliveries and Archive Volume Format

A data set is delivered for each **simple mission phase.** Each data set contains **only one level data processing**.

The list of simple mission phases is given in

Post Hibernation Commissionning	PHC	09/04/2014	24/04/2014	**X**	**13 images 2 stripes**		
Pre-delivery calibration Science	PDCS	25/04/2014	11/11/2014				

(1) The last column indicates if ROLIS data are available, the first one if data can come from Payload Checkout). Calibrated data are generated by Rolis-PI

After the release of the Lander, we distinguish four phases, characterized by:

- The Start and Stop dates need to be expressed in seconds
- The Lander has its own Auxiliary data

Separation/Descent /Landing	SDL	2014/11/12 08:35:02	2014/11/12 15:34:04	**X**
Rebounds	RBD	2014/11/12 15:34:05	2014/11/12 17:30:20	
First Science Sequence	FSS	2014/11/12 17:30:21	2014/11/15 01:00:00	**X**
Long Term Science	LTS			

Table 2-2
.

A data set is level-stamped as below :

- Level 1 when it contains :
  - SC and HK raw data (packets) contained in .rolbin file (CODMAC level 1).

- Level 2 when it contains :
  - Raw ROLIS Images in FITS format in .FIT files (CODMAC level 2)

- Level 3 when it contains :
  - Calibrated Images (CODMAC level 3)

- Level 5 when it contains :
  - Final images (CODMAC level 5)

In addition a data set contains :

- Software (see chapter 2.4.5)
- Documents (see chapter 2.4.6

A new version of a dataset is provided when :
- calibration information refining
- new data processing

- higher levels production.

3.1.2 Data Set ID Formation

The following naming formation scheme is used for the data sets :

DATA_SET_ID = <INSTRUMENT_HOST_ID>-<target id>-<INSTRUMENT_ID>-<data processing level number>-<mission phase abbreviation>-<version>

DATA_SET_NAME = <INSTRUMENT_HOST_NAME> <target name> <INSTRUMENT_ID> <data processing level number> <mission phase abbreviation> <version>

See [AD 10] § 2.1.1 and 2.1.2

Examples of DATA_SET_ID and DATA_SET_NAME for ROLIS level 3 data obtained from the Comet phase:

DATA_SET_ID = "RL-C-ROLIS-3-COM-V1.0"

DATA_SET_NAME= "ROSETTA-LANDER 67P ROLIS 3 COM V1.0"

3.1.3 Data Directory Naming Convention

See § 3.4.3

3.1.4 File naming Convention

The following file naming scheme is used :

{exp}_{datatype}_{begin of observation}_{ime-model}{rolisd-model}{sw-version}_{nn}.{ext}

- **exp** (3 character) = ROL
- **datatype** (3 character) = XYZ
  - X = **G** for Ground, **F** for Flight
  - Y = **S** for Science Data, **H** for Housekeeping Data, **B** for files with both data mixed together
  - Z = CODMAC level : **1** for raw packets, **2** for raw images, **3** for calibrated data (SC or HK), **5** for derived data, **P** for Plots
- **begin of observation** (12 characters) = time of test or working session yymmddhhmnss:
  - yy = year
  - mm = month
  - dd = day
  - hh = hour
  - mn = minute
  - ss = second
- **ime-model** (decimal number, 1 character) = used model of IME
  - 1 for EGSE at IAS in Orsay
  - 2 for PFM at DLR-PF in Berlin
  - 3 for FM on ROSETTA
  - 4 for FS at IAS in Orsay

- 5 for GRM at DLR in Cologne

- **rolisd-model** (decimal number, 1 character) = used model of ROLIS-D
  - 2 for PFM at DLR-PF in Berlin
  - 3 for FM on ROSETTA
  - 4 for FS at DLR-PF in Berlin
  - 5 for GRM at DLR in Cologne

- **sw-version** (hexadecimal number,1 character)
  - 0 not used
  - 1 for ROLIS S/W-versions before flight-versions
  - 2 for Rolis-FM/2010 08.05.2001 16:26
  - 3 for Rolis-FM/2010 19.12.2001 13:20
  - 4 for Rolis-FM/2010 22.08.2002 14:04
  - 5 for Rolis-FM/2010 07.05.2002 14:02 –Flight software from launch till Nov 2006
  - 6 for Rolis-FM/2010 18.05.2006 16.02 – Current (since Dec 2006) flight software
  - 7, 8, 9, A, B, C, D, E reserved for further versions
  - F version unknown

- **nn** (decimal number,2 characters) = image number
  - 0 for the 1st image in the data obtained at this time
  - 1 for the 2nd image in the data obtained at this time

  etc.

  This numbering corresponds with the ROLIS-EGSE

- **ext** = extension of file. For ROLIS the files can be:
  - .DAT raw telemetry packets
  - .FIT raw image data de-compressed in FITS format.
  - .FIT calibrated images in FITS format

For .FIT files, begin of observation is UT time of the Rolis image. For .ROL files, begin of observation is UT time of the Rolis session (two Rolis sessions are separated by a gap greater than 300 seconds).

Example:
Cruise PC#1 data: ROL_FS2_051004033813_335_00.FIT

These data were obtained on 2005/10/04 starting at 03:38:13 and contain the 1st raw ROLIS-D image at this time generated by FM-IME and FM-RolisD with the S/W-Version "Rolis-FM/2010 07.05.2002 14:02**"** .

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

The archive structure given in this document complies with PDS standard version 3.6.

3.2.2 Time Standards

3.2.2.1 Generalities

This paragraph gives a summary of the different existing formats in the Rosetta Ground segment, from their generation by the instruments to their availability at SONC :

- The Lander CDMS requires the scientific instruments to transmit the data by bursts of 8 or 64 bytes (4 or 32 16-bit words)

- When sufficient data are received, the CDMS builds packets containing 256 bytes of instrument data. The CDMS adds 18 bytes header (unit PID, sequence count, OOBT : Orbiter OBT, data type) and a 2 bytes checksum (DECW) and creates packets with a fixed length of 276 bytes[2]. For transmission between Lander and Orbiter, a 4 bytes synchro header and a 2 bytes trailing checksum (PECW) are added, increasing the packet size to 282 bytes. The extra bytes are removed by the ESS.

  To comply with ESA requirements, the time registered in the CDMS packets is the **OOBT**. It is reconstituted from the LOBT, as shown in Figure 3 :

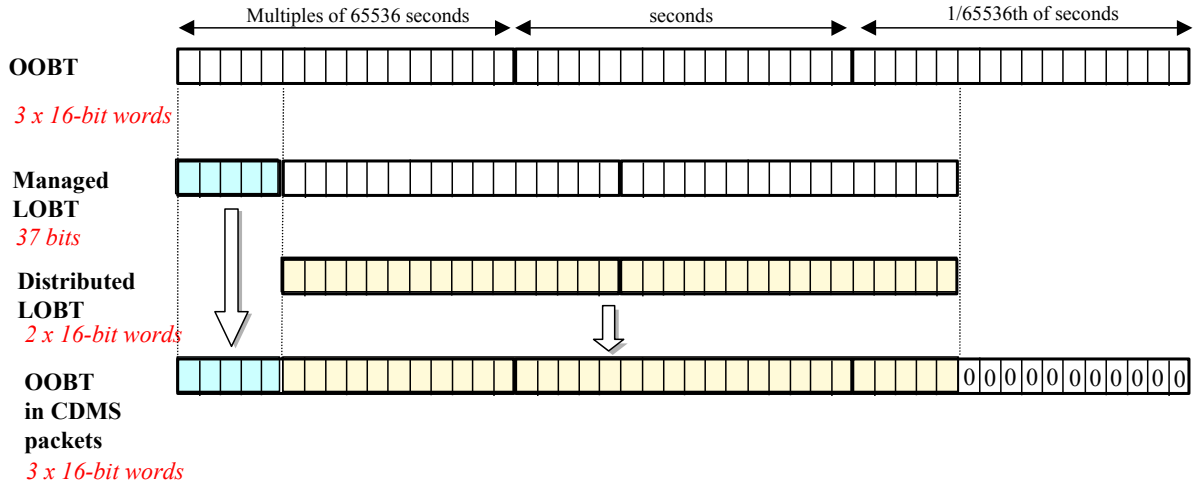

Figure 3 Reconstruction of the on board time in CDMS packets

- The ESS groups together several packets and passes them to the Orbiter OBDH, which transmits them according to the Space/Ground interface. This part is transparent for the Lander ground segment.

- The data are delivered by the Rosetta Data Distribution System (DDS) to the SONC in SFDU format. A SFDU file is basically a collection of 276-byte packets interspersed with auxiliary information records. An 18 bytes SFDU header is added to the CDMS 276-byte packets. This header contains information added at the ground station (time correlated OBT, ground station id, virtual channel id, service channel, type of data, time quality)

- SONC processes the SFDU files to retrieve the 276-byte packets. This format is available in the SONC database.

[2] The Lander CDMS header and the headers of the telemetry source packets from the Orbiter instruments are quite similar. There is a difference in the data field header. The byte containing PUS version, checksum flag and spare fields is set to zero in the CDMS header. Besides the last byte of the OOBT is set to zero in th e CDMS header. The CDMS header has an additional word (2 bytes) after the data field header named "FORMAT ID". This word is mainly used for HK data and it contains the HK scanning period and the SID (structure identification).

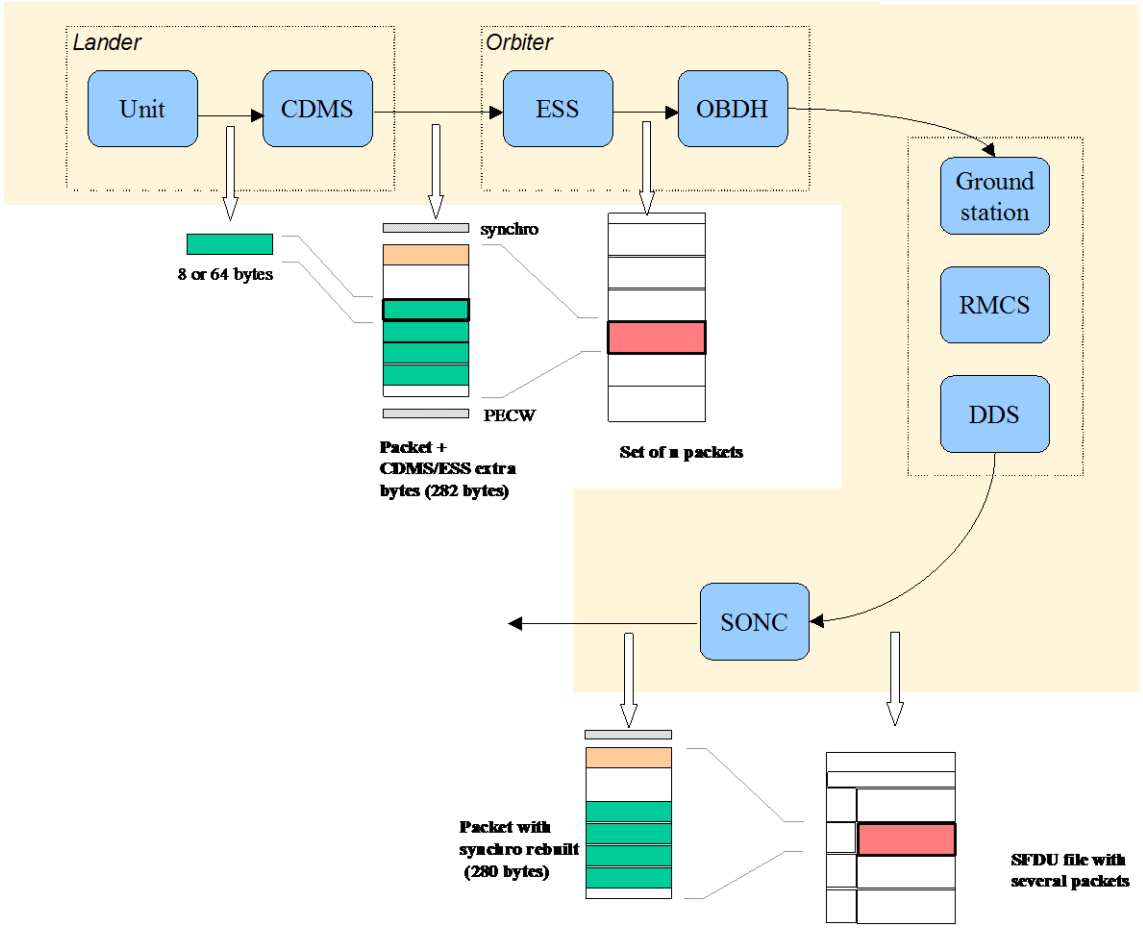

Figure 4 On board data flow

- Afterwards, SONC processes science raw packets in order to recompose the science measurement (e.g. an image, a spectrum, ...).

Figure 4 gives an overview of this data flow.

Only the following principles are applied :

- the packet wrapping is removed, and science frames that had to be split into several raw data packets are rebuilt. Basic error detection controls are applied, to recover from possible problems in the transmission chain.

- the Lander On-Board time (LOBT) (synchronised with OOBT) extracted from the packet, and corresponding UTC time coming from the SFDU header, are added.

- in few cases, bit fields are expanded : flags that were stored as bits in the telemetry (to save bandwidth) are stored as integer values instead ; the aim is to ease further processing.

- UTC time is calculated from the On-Board time taking into account the On-Board clock drift as following : UTC (seconds since 01/01/1970) = LOBT(seconds) * Gradient + Offset (these coefficients are extracted from TCP packets delivered by DDS).
LOBT is either the LOBT extracted from CDMS header or the Experiment internal clock when it exists (CIVA, COSAC, PTOLEMY, ROMAP, ROLIS, SESAME). In the last case, it must be taken into account that

the Internal clock (32 bits) resets all 4 years, 4 months, 3 days (first reset : 03/04/2007 10 :42 :07).

UTC time-stamped Science and HK data are available in the SONC database and used to generate PDS format.

3.2.2.2 ROLIS data products time standards

The time standards used in the ROLIS data products are :
- the ROLIS on-board time,
- the Lander on-board time,
- the DDS header time correlated,
- the UTC.

3.2.2.2.1 The ROLIS On-Board Time

It is the internal RolisDPU-time (in milliseconds) after booting the ROLIS on-board S/W. It is reset after switch-off of the ROLIS/CIVA-experiment. The ROLIS On-Board Time is saved in the HK (HK#17/18). The time interval between two HK-time-values is 2 minutes 12 seconds. This time is used for internal ROLIS processes only. The time line for the data handling is the LOBT.

3.2.2.2.2 The Lander On-Board Time (LOBT)

The instruments on board the spacecraft (Orbiter) generate telemetry source packets with an OOBT (orbiter on board time) time stamp in the header.
The OOBT written into the packet header specifies the time, when CDMS can complete a packet.

In terms of HK packets this is the time of the last HK word. Using the HK scanning rate, which is given in word #9 of the packet, one can calculate the OBT of every individual word in this packet. Note that this is only valid if packets with SID (word #9) 1 or 2 are generated. Packets with SID 4 and 5 are "snapshots", which means you can apply the packet OOBT for every word in this packet. SID 3 packets have to be analysed case by case.

In terms of SC packets this is the reception of the last 32 word block by CDMS, which also completes the SC packet. How often 32 word blocks are created (and sent) by the unit, and corresponding to this the delta time between each block, might be different for each unit. So, re-calculation of OOBT for SC words depends on this unit feature.

The Orbiter On-Board Time (OOBT) is a linear binary counter having a resolution of 1/65536 sec stored in 3 16-bit words.

The Lander On-Board Time (LOBT) is a linear binary counter having a resolution of 1/32 sec, kept in 37 bits. Only the 32 least significant bits are distributed to the instruments, in two 16-bit words. The 5 most significant bits are supposed constant during most of the mission; they are available through a specific service.
The LOBT is derived from the Orbiter On-Board Time (OOBT): the 11 least significant bits of the OOBT are discarded to obtain the LOBT, hence the reduced resolution.

Note that the LOBT (32 bits, 32 Hz) cycles every 4 years, 4 months, 3 days. The first reset occurred on 03/04/2007 10 :42 :07.

A re-synchronization between OOBT and LOBT is performed regularly (see [AD 4]).
The Lander is synchronized prior to Separation and during every RF link after landing. So, during descent and the First Science Sequence this should not be a problem, since LOBT is kept synchronized as long as the Lander is powered.

Technical details about synchronisation of Lander On-board Time can be found in § 2.3.2.6 [AD 4].

For a description of time handling in the Rosetta project see [AD 6].
For a description of Lander on board time handling see [AD 4] :
§ 2.3.2.6 Synchronisation and Adjustment of Lander On-board Time
§ 2.3.2.6.1 Absolute vs. relative time references
§ 2.3.2.6.2 On-board Time Failure Modes and Recovery Procedures
and [AD 5], § 6. About Lander On-board Time.

3.2.2.2.3 The DDS header time correlated

The OOBT is converted to UTC (Coordinated Universal Time) by means of time correlation and included in the additional DDS packet header when the packets are distributed via the DDS server.
The **DDS header time correlated** (SCET field in the DDS header) is the UTC of the start of measurement derived from the OOBT by time correlation.

Its format is the Sun Modified Julian Time (MJT) i.e. two 32 bit integers. The first (MSB) contains the number of seconds since 00:00:00 on 1st January 1970 and the second (LSB) integer the number of micro-seconds from seconds in the first field.

Time correlation is described in [AD 11], Appendix 18 § 18.1.2.1.

3.2.2.2.4 The UTC (Universal Time Coordinated)

The **UTC** used as time stamp for SC and HK ROLIS data products (from level 2 to level 5) is calculated from the experiment on-board time taking into account the drift and reset clock.

UTC is calculated from LOBT using the Time Correlation parameters as following:
UTC (seconds since 01/01/1970) = LOBT(seconds) * Gradient + Offset
Warning : when LOBT (32 bits, 32 Hz) returns to zero, the offset value = FFFFFFFF+1 must be added.

3.2.2.2.5 Spacecraft Clock Count in PDS Labels

The PDS keywords SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT refer to LOBT.
The LOBT is represented in the following format:
SPACECRAFT_CLOCK_START/STOP_COUNT = "<reset number>/<unit seconds>.<fractional seconds>"
The unit seconds and the fractional seconds are separated by the full stop character. **Note that this is not a decimal point.** The fractional seconds are expressed as multiples of $2^{-5} = 0.03125$. seconds and count from 0 to $2^5 - 1 = 31$. E.g. in SPACECRAFT_CLOCK_START_COUNT = "3/356281394.21" the 21 fractional seconds correspond to $21 \times 2^{-5} = 0.65625$ decimal seconds.
The reset number is an integer starting at 1, i.e. "1/" means LOBT = 0 at 2003-01-01T00:00:00 UTC.

3.2.3 Reference Systems

ROLIS uses the Lander Coordinate System (see INSTHOST.CAT for details).

3.3 Data Validation

The ROLIS data products are delivered to PSA by SONC. All the levels SC and HK data produced by SONC are validated by ROLIS PI. These data are also distributed via the W3-SONC server and used by all the experiment team. The higher level products are produced by the lab.

3.3.1 Data Quality ID

The quality of ROLIS data products is defined by the DATA_QUALITY_ID keyword globally.

The values of the DATA_QUALITY_ID for CODMAC level 1 data are :
-1 Not yet qualified
0 No missing or corrupted packets
1 Corrupted packets
2 Missing packets
3 Corrupted and missing packets

The values of the DATA_QUALITY_ID for CODMAC level 2 data are :
-1 Not yet qualified
0 Image very well exposed
1 Image moderate over- or underexposed
2 Image extremely over- or underexposed
3 Image out of focus
4 Image with artefacts

The values of the DATA_QUALITY_ID for CODMAC level 3 data are :
-1 Not yet qualified
0 Very good quality of correction/calibration
1 Good quality of correction/calibration
2 Acceptable quality of correction/calibration
3 Bad quality of correction/calibration
4 Calibration failed

The values of the DATA_QUALITY_ID for CODMAC level 5 data are :
-1 Not yet qualified
0 Stereo- or colour composite good quality
1 Stereo- or colour composite moderate quality
2 Stereo- or colour composite bad quality

3.4 Content

3.4.1 Volume Set

One volume corresponds to one data set. The possible values of VOLUME keywords can be found in [AD 10]. The volume keyword values for the Mars mission phase are given in the following exemple.

```
VOLUME_NAME                    = "ROLIS RAW DATA FOR THE
```

```
                                MARS SWING BY PHASE"
VOLUME_SERIES_NAME          = "ROSETTA SCIENCE ARCHIVE"
VOLUME_SET_ID               = "DE_DLR_PF_RLROL_10XX"
VOLUME_SET_NAME             = "ROSETTA ROLIS DATA"
VOLUME_ID                   = "RLROL1_1020"
VOLUME_VERSION_ID           = "VERSION 1"
VOLUME_FORMAT               = "ISO-9660"
MEDIUM_TYPE                 = "ONLINE"
VOLUMES                     =  23
PUBLICATION_DATE            = 2010-01-15
DESCRIPTION                 = "This volume contains  ROLIS
                               level 2 data products and
                               supporting documentation from the
                               Mars swing by phase of Rosetta
                               mission"
```

3.4.2 Data Set

The ROLIS data are archived in as many data sets as simple mission phase and level data processing. The values of the elements of the DATA_SET_ID and DATA_SET_NAME are given in the following table:

Name element	**Data Set ID**	**Data Set Name**
INSTRUMENT_HOST_ID / INSTRUMENT_HOST_NAME	RL (Rosetta Lander)	ROSETTA-LANDER
Target id / target name	See [AD 10]	in [AD 10]
INSTRUMENT_NAME	ROSETTA LANDER IMAGING SYSTEM - DESCENT AND CLOSEUP IMAGER	
INSTRUMENT_ID	ROLIS	
Data processing level number	* Level 1 contains raw telemetry packets science and housekeeping * Level 2 is delivered directly after the end of the proprietary period and contains level 1 SC and HK, level 2 SC and level 3 HK. * Level 3 is delivered after the stabilization of the calibration and contains level 3 SC. * Level 5 is delivered even later and contains the reduced or derived data products.	
mission phase abbreviation	See [AD 10]	
description	N/A	No description.
version	The first version of a data set is V1.0	

3.4.3 Directories

The ROLIS archive has the following directory structure :

```
                        |-AAREADME.TXT
                        |-CATALOG-
                        |
|-root directory------  |-DATA- (contains Level 1 data files, HK and SC mixed)
                        |
                        |-DOCUMENT-
                        |-EXTRAS-
                        |-INDEX-
                        |-VOLDESC.CAT

                        |-AAREADME.TXT
                        |-BROWSE-
                        |-CATALOG-
                        |
|-root directory------  |-DATA- (contains Level 2 (3,5) HK, SC, data files)
                        |
                        |-CALIB-
                        |-DOCUMENT-
                        |-INDEX-
                        |-VOLDESC.CAT
```

3.4.3.1 Root Directory

Files in the Root Directory include an overview of the archive, a description of the volume for the PDS Catalog, and a list of errata or comments about the archive. The following files are contained in the Root Directory.

File Name	File Contents
AAREADME.TXT	Volume content and format information
VOLDESC.CAT	A description of the contents of this volume in a PDS format readable by both humans and computers

3.4.3.2 Calibration Directory

ROLIS calibrated images are produced in DLR-PF exclusively.
Calibration information can be found in the file ROLIS_CALIBRATION_DESC.TXT located in the DOCUMENT directory (Level 3 data sets).

3.4.3.3 Catalog Directory

The files in the Catalog Directory provide a top-level understanding of the mission, spacecraft, instruments, and data sets. The files in this directory are coordinated with the PSA team, who is responsible for loading them into the PDS catalog. The following files are found in the Catalog Directory.

File Name	File Contents
CATINFO.TXT	A description of the contents of this directory
DATASET.CAT	Data set information for the PDS catalog
INSTHOST.CAT	Instrument host (spacecraft-lander) information for the PDS catalog
INST.CAT	Instrument information for the PDS catalog
MISSION.CAT	Mission information for the PDS catalog
PERSON.CAT	PDS personnel catalog information about the instrument team responsible for generating the data products. There is one file for each instrument team providing data to this data set.
REF.CAT	Full citations for references mentioned in any and all of the catalog files, or in any associated label files.
SOFTWARE.CAT	Information about the software included in the EXTRAS directory

3.4.3.4 Index Directory

Files in the Index Directory are provided to help the user locate products on this archive volume and on previously released volumes in the archive. The following files are contained in the Index Directory.

3.4.3.4.1 Dataset Index File

File Name	File Contents
BROWSE_INDEX.LBL	PDS label for the BROWSE index file BROWSE_INDEX.TAB
BROWSE_INDEX.TAB	Index of the BROWSE directory
INDXINFO.TXT	A description of the contents of this directory
INDEX.LBL	A PDS detached label that describes INDEX.TAB
INDEX.TAB	A table listing all data products on this volume

3.4.3.5 Browse Directory and Browse Files

The browse directory contains plots (JPG, PNG files) that are one to one mapping of the corresponding raw images (.raw) in the DATA directory.
For filenaming convention see 3.1.4
The browse directory contains also the file BROWINFO.TXT which describes the contents of the browse directory.

3.4.3.6 Software Directory

The EGSE software is used to read raw telemetry data (CDMS rolbin files). As it does not comply with PDS strong requirements on software for long term archiving, it is instead located in the EXTRAS directory. All

information regarding the usage and requirements for the software are provided in documentation located in ROLIS_EGSE directory. The SOFTWARE.CAT file in the CATALOG directory includes additional information pointing to the software and outlining its basic usage and requirements.

3.4.3.7 Document Directory

The Document Directory contains documentation to help the user understand and use the archive data. The following files are contained in the Document Directory.

File Name	File Contents
DOCINFO.TXT	A description of the contents of this directory
EAICD_ROLIS.PDF	The ROLIS Experiment Archive Interface Control Document (this document) in MS Word .format.
EAICD_ROLIS.LBL	PDS label for file EAICD_ROLIS.PDF
CIVAROLIS_IME_ADP.PDF	Civa/Rolis IME Flight Model Acceptance Data Package
CIVAROLIS_IME_ADP.LBL	PDS label for Civa/Rolis IME Flight Model Acceptance Data Package
ROLIS_CALIBRATION_DESC.ASC	Description of calibration of ROLIS images
ROLIS_CALIBRATION_DESC.LBL	PDS label for ROLIS_CALIBRATION_DESC.ASC
TIMELINE_ph.TXT	Timeline ASCII file with the PDS label attached for phase ph
TIMELINE_ph_DESC.TXT	Description of the timeline file for phase ph
TIMELINE_ph.PNG	Timeline Image file for phase ph
TIMELINE_ph.LBL	PDS label for image TIMELINE_ph.PNG

3.4.3.8 Extras Directory

The Extras directory contains EGSE software to read and visualize raw telemetry data (CDMS rolbin files, CODMAC level 1). The contents of the EXTRAS directory are shown below :

```
                                |-ASTPH32.EXE
|-EXTRAS----------|-ROLIS_EGSE---|-README.TXT
                  |              |-ROLIS_QUICKLOOK_140_INITIAL.ZIP
                  |
                  |-EXTRINFO.TXT
```

The Egse Directory contains the following files :

File Name	Contents
ASTPH32.EXE	Software (PC MS Windows executable) for images visualisation into specific ROLIS format.
README.TXT	Quick-Look browser & decoding software Help

ROLIS_QUICKLOOK_140_INITIAL.ZIP	EGSE software for extracting data from the raw data product files (rolbin), calibration and visualisation.
EXTRTINFO.TXT	A description of the contents of the Extras Directory

3.4.3.9 Data Directory

The structure and naming scheme of the data directory are described in chapters 3.1.3 and 3.4.3.

4 Detailed Interface Specifications

4.1 Structure and Organization Overview

The ROLIS data are archived in a data set on the basis of the data processing level and of mission phase relative to the production of the data. The DATA directory contains :

- rolbin files (raw telemetry packets, file extension ROL)
- raw (uncalibrated) images (file extension FIT) in FITS format
- calibrated images (file extension FIT)

4.2 Data Sets, Definition and Content

Data Set ID	**Data Set Name**
RL-CAL-ROLIS-1-GRND-V1.0	ROSETTA-LANDER CAL ROLIS 1 GRND V1.0
RL-CAL- ROLIS -1-CVP-V1.0	ROSETTA-LANDER CAL ROLIS 1 CVP V1.0
RL-CAL- ROLIS -1-CR2-V1.0	ROSETTA-LANDER CAL ROLIS 1 CR2 V1.0
RL-CAL- ROLIS -1-CR4A-V1.0	ROSETTA-LANDER CAL ROLIS 1 CR4A V1.0
RL-CAL- ROLIS -1-CR4B-V1.0	ROSETTA-LANDER CAL ROLIS 1 CR4B V1.0
RL-CAL- ROLIS -1-CR5-V1.0	ROSETTA-LANDER CAL ROLIS 1 CR5 V1.0
RL-E-ROLIS-1-EAR1-V1.0	ROSETTA-LANDER EARTH ROLIS 1 EAR1 V1.0
RL-E-ROLIS-1-EAR2-V1.0	ROSETTA-LANDER EARTH ROLIS 1 EAR2 V1.0
RL-M-ROLIS-1-MARS-V1.0	ROSETTA-LANDER MARS ROLIS 1 MARS V1.0
RL-CAL-ROLIS-1-RVM1-V1.0	ROSETTA-LANDER CAL ROLIS 1 RVM1 V1.0
RL-CAL-ROLIS-1-PHC-V1.0	ROSETTA-LANDER 67P ROLIS 1 PHC V1.0
RL-CAL-ROLIS-1-PDCS-V1.0	ROSETTA-LANDER 67P ROLIS 1 PDCS V1.0
RL-C-ROLIS-1-SDL-V1.0	ROSETTA-LANDER 67P ROLIS 1 SDL V1.0
RL-C-ROLIS-1-FSS-V1.0	ROSETTA-LANDER 67P ROLIS 1 FSS V1.0
RL-CAL- ROLIS -2-CVP-V1.0	ROSETTA-LANDER CAL ROLIS 2 CVP V1.0
RL-CAL- ROLIS –2-CR2-V1.0	ROSETTA-LANDER CAL ROLIS 2 CR2 V1.0
RL-CAL- ROLIS –2-CR4A-V1.0	ROSETTA-LANDER CAL ROLIS 2 CR4A V1.0
RL-CAL- ROLIS –2-CR4B-V1.0	ROSETTA-LANDER CAL ROLIS 2 CR4B V1.0
RL-CAL- ROLIS –2-CR5-V1.0	ROSETTA-LANDER CAL ROLIS 2 CR5 V1.0
RL-E-ROLIS-2-EAR1-V1.0	ROSETTA-LANDER EARTH ROLIS 2 EAR1 V1.0
RL-E-ROLIS-2-EAR2-V1.0	ROSETTA-LANDER EARTH ROLIS 2 EAR2 V1.0
RL-M-ROLIS-2-MARS-V1.0	ROSETTA-LANDER MARS ROLIS 2 MARS V1.0
RL-CAL-ROLIS-2-RVM1-V1.0	ROSETTA-LANDER CAL ROLIS 2 RVM1 V1.0
RL-CAL-ROLIS-2-PHC-V1.0	ROSETTA-LANDER 67P ROLIS 2 PHC V1.0
RL-CAL-ROLIS-2-PDCS-V1.0	ROSETTA-LANDER 67P ROLIS 2 PDCS V1.0
RL-C-ROLIS-2-SDL-V1.0	ROSETTA-LANDER 67P ROLIS 2 SDL V1.0
RL-C-ROLIS-2-FSS-V1.0	ROSETTA-LANDER 67P ROLIS 2 FSS V1.0
RL-CAL-ROLIS-3-PHC-V1.0	ROSETTA-LANDER 67P ROLIS 3 PHC V1.0

RL-CAL-ROLIS-3-PDCS-V1.0	ROSETTA-LANDER 67P ROLIS 3 PDCS V1.0
RL-C-ROLIS-3-SDL-V1.0	ROSETTA-LANDER 67P ROLIS 3 SDL V1.0
RL-C-ROLIS-3-FSS-V1.0	ROSETTA-LANDER 67P ROLIS 3 FSS V1.0
RL-CAL-ROLIS-5-PHC-V1.0	ROSETTA-LANDER 67P ROLIS 5 PHC V1.0
RL-CAL-ROLIS-5-PDCS-V1.0	ROSETTA-LANDER 67P ROLIS 5 PDCS V1.0
RL-C-ROLIS-5-SDL-V1.0	ROSETTA-LANDER 67P ROLIS 5 SDL V1.0
RL-C-ROLIS-5-FSS-V1.0	ROSETTA-LANDER 67P ROLIS 5 FSS V1.0

The contents of the ROLIS data sets is as follows:

RL-CAL-ROLIS-x-CVP-Vx.x contains data from commisioning (2004)
RL-CAL-ROLIS-x-CRx-Vx.x contains data from cruise phases 1 to 6 (2004-2014)
RL-C-ROLIS-x-COM-Vx.x contains data from comet phase (2014-2015).

4.3 Data Product Design

The following types of data products are defined for ROLIS:

- rolbin files (raw telemetry packets, file extension ROL) : CODMAC level 1
- raw (uncalibrated) images (file extension FIT) : CODMAC level 2 in FITS format
- calibrated images (file extension FIT) : CODMAC level 3
- final images (file extension FIT): CODMAC level 5

All ROLIS data products have PDS detached labels.

4.3.1 Raw data product Design (level 1)

Level 1 contains telemetry packets delivered by the Rosetta Lander with detached PDS labels.

4.3.1.1 File Characteristics Data Elements

The raw files (level 1) are described by PDS minimal detached labels. The file characteristic data elements are RECORD_TYPE, PRODUCT_TYPE and FILE_NAME. The PRODUCT_TYPE is UDR. The RECORD_TYPE for raw data is UNDEFINED, i.e. the structure of records is not described in the PDS labels since these data are intended to be processed with the EGSE software available in the EXTRAS directory. The file contains telemetry packets which are described in [AD 7].

4.3.1.2 Instrument and Detector Descriptive Data Elements

INSTRUMENT_ID = ROLIS
INSTRUMENT_NAME = "ROSETTA LANDER IMAGING SYSTEM - DESCENT AND CLOSEUP IMAGER"
INSTRUMENT_TYPE = "IMAGING CAMERA"
INSTRUMENT_MODE_ID = possible values are : "RING BUFFER", "SINGLE IMAGE" or "FULL-FRAME IMAGE" and comes from the keyword "FLAGS" of the FITS header.
If FLAGS = "EXPOSED,DIS" then INSTRUMENT_MODE_ID = "RING BUFFER"
If FLAGS = "EXPOSED,WAVELET,TRANSMITTED" then INSTRUMENT_MODE_ID = "SINGLE IMAGE"
If FLAGS = "FULL" then INSTRUMENT_MODE_ID = "FULL-FRAME IMAGE"

INSTRUMENT_MODE_DESC = possible values are "DESCENT IMAGING RING-BUFFER-MODE" or "SINGLE IMAGE MODE" or "FULL-FRAME IMAGE STRIPE"

INST_CMPRS_NAME = "WAVELET" or "NONE"

4.3.1.3 Description of Instrument

The description of the instrument is done in [AD 8] and as a brief overview in the INST.CAT catalog file.

4.3.2 Raw Image Product Design (level 2)

4.3.2.1 File Characteristics Data Elements

PDS data product labels contain data element information that describes important attributes of the physical structure of a data product file. The ROLIS levels 2 and 3 data have the same PDS structure. The PDS file characteristic data elements for ROLIS science level 2 and 3 data are:

```
RECORD_TYPE
RECORD_BYTES
FILE_RECORDS
LABEL_RECORDS
```

The `RECORD_TYPE` data element identifies the record characteristics of the data product file. Physical records are always fixed-length. The `RECORD_BYTES` data element identifies the number of bytes in each physical record in the data product file. Records length is always equal to the size of a FITS logical record i.e. 2880 bytes (see [AD 9] for details). The `FILE_RECORDS` data element identifies the number of physical records in the file. The `LABEL_RECORDS` data element identifies the number of physical records that make up the PDS product label.

4.3.2.2 Data Object Pointers Identification Data Elements

The ROLIS level 2 data products are FITS images. Each data product contains a pointer to a HEADER object (FITS header) and a pointer to an IMAGE object (the raw image).
Instrument and Detector Descriptive Data Elements

4.3.2.3 Data Object Definition

The level 2 ROLIS data products are FITS images of size 1024x1024 or 1066xN (where N is max 1064) with a resolution of 16 bits/pixel. The data objects are HEADER and IMAGE. The PDS label of the image also contains information from the ROLIS Image Status Block (ISB).

4.3.2.3.1 Image FITS header object

```
OBJECT                      = IMAGE_HEADER
   BYTES                      = 2880
   HEADER_TYPE                = FITS
   INTERCHANGE_FORMAT         = BINARY
   RECORDS                    = 1
   DESCRIPTION                = "FITS format defined in NASA/Science Office
                                 Standards Technology 100-1.0"
END_OBJECT                  = IMAGE_HEADER
```

The FITS header content:

```
SIMPLE  =                    T / file conforms to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    2 / number of data axes
NAXIS1  =                 1024 / length of data axis 1
```

```
NAXIS2  =                 1024 / length of data axis 1
ORIGIN  = 'DLR, Institute of Planetary Research' /
INSTRUME= 'Rosetta Lander Rolis' /
COMMENT   Raw unprocessed image data
COMPRESS=                   11 / Rolis compression rate code
ROL-ISB = 'Rolis Image Status Block information' / --- treat with care ---
BUFNO   =                    1 / Rolis-ISB image buffer number
FLAGS   = 'Exposed,Wavelet,Transmitted' / Rolis-ISB imaging flags
RTIME   = '  000 00:07:00,804' / Rolis-ISB instrument time
LOBT    = ' 1732 22:55:33,562' / Rolis-ISB Lander onboard time
EXPTIME = '         2000 msec' / Rolis-ISB exposure time
LED     = '   IR,warmup=2 sec' / Rolis-ISB LED status
IFL-POS = '            closed' / Rolis-ISB infinity lens position
AVRG    =                16028 / Rolis-ISB image average
DMA-ERR =                    0 / Rolis-ISB DMA error counter (missing rows)
CH-TEMP1= '          -77.94 C' / ROLIS-ISB Camera temperature before exposure
CH-TEMP2= '          -77.74 C' / ROLIS-ISB Camera temperature after exposure
FILTER  =                    0 / Rolis-ISB Image filter (unused=0)
ERR-CODE=                    0 / Rolis-ISB Error code (unused=0)
END
```

The FLAGS keyword describes the history/ finalization of data processing steps (as Exposed, Wavelet, Transmitted)

4.3.2.3.2 Image object

```
OBJECT                      = IMAGE
   LINES                      = 1024
   LINE_SAMPLES               = 1024
   SAMPLE_TYPE                = MSB_UNSIGNED_INTEGER
   SAMPLE_BITS                = 16
   UNIT                       = "DATA_NUMBER"
END_OBJECT                  = IMAGE
```

4.3.2.4 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.3 Calibrated Image Product Design (level 3)

4.3.3.1 File Characteristics Data Elements

The ROLIS level 3 data products are FITS images with the same HK parameters as level 2 products.

4.3.4 Calibrated Image Product Design (level 5)

Level 5 data consist of higher-level derived data products. Such data are foreseen for the post-landing close-up data sequences. In particular, in case the quality of the acquired data is adequate, it is foreseen to produce RGB color composites.

5 Appendix A : Available Software to read PDS files

Housekeeping and science PDS files can be read with the PDS table verifier tool “tbtool” and readpds (Small Bodies Node tool). Furthermore, “NasaView” software is used to read images.

6 Appendix B : Example of ROLIS label (level 2 raw image)

```
PDS_VERSION_ID       = PDS3
LABEL_REVISION_NOTE  = "V1.0"

/* Science data for both housekeeping and science */

/* IDENTIFICATION & DESCRIPTIVE DATA ELEMENTS */
/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 2880
FILE_RECORDS         = 730


/* DATA OBJECT POINTERS  */

^IMAGE_HEADER = ("ROL_FS2_070522152638_336_05.FIT",1 <BYTES>)
^IMAGE        = ("ROL_FS2_070522152638_336_05.FIT",2881 <BYTES>)


DATA_SET_ID             = "RL-M-ROLIS-2-MARS-V1.0"
DATA_SET_NAME           = "ROSETTA-LANDER MARS ROLIS 2 MARS V1.0"
PI_PDS_USER_ID          = MOTTOLA
PRODUCT_ID              = "ROL_FS2_070522152638_336_05"
PROCESSING_LEVEL_ID     = "2"
PRODUCT_CREATION_TIME   = 2012-05-11T08:26:37
PRODUCT_TYPE            = EDR
DATA_QUALITY_ID         = "0"
DATA_QUALITY_DESC       = "0 : IMAGE VERY WELL EXPOSED"

MISSION_NAME            = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME      = "MARS SWING-BY"
MISSION_ID              = ROSETTA
INSTRUMENT_HOST_NAME    = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID      = RL
OBSERVATION_TYPE    = "PASSIVE CHECKOUT 5"

START_TIME             = 2007-05-22T15:26:38.000
STOP_TIME              = 2007-05-22T15:27:08.000
SPACECRAFT_CLOCK_START_COUNT = "2/138468367.31"
SPACECRAFT_CLOCK_STOP_COUNT  = "2/138468368.29"

PRODUCER_ID          = "SONC"
PRODUCER_FULL_NAME   = "SCIENCE OPERATIONS AND NAVIGATION CENTER"
PRODUCER_INSTITUTION_NAME = "CNES"

INSTRUMENT_ID        = ROLIS
INSTRUMENT_NAME      = "ROSETTA LANDER IMAGING SYSTEM - DESCENT AND
                        CLOSEUP IMAGER"
INSTRUMENT_TYPE      = "IMAGING CAMERA"
TARGET_NAME          = "MARS"
TARGET_TYPE          = "PLANET"

^INSTRUMENT_CALIBRATION_DESC = "ROLIS_CALIBRATION_DESC.TXT"

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = ( -158182621.5, 158830490.3,  77310929.2)
```

```
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = (   17015826.3,  60758285.6,  27594864.9)
SC_TARGET_VELOCITY_VECTOR = (         -0.4,         8.7,         4.0)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =    68863026.7 <km>
SUB_SPACECRAFT_LATITUDE =    -4.04 <deg>
SUB_SPACECRAFT_LONGITUDE =    81.96 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */

INSTRUMENT_MODE_ID                = "SINGLE IMAGE"
INSTRUMENT_MODE_DESC               = "Possible values are :
                                      descent imaging ring-buffer-mode;
                                      single image mode;
                                      Full-Frame image stripe;"

/* Rolis Image Status Block Information */

EXPOSURE_DURATION          = 30000 <MILLISECOND>
INST_CMPRS_NAME                 = "WAVELET"

/* DESCRIPTION OF OBJECTS CONTAINED IN FILE */

OBJECT                     = IMAGE_HEADER
   BYTES                     = 2880
   HEADER_TYPE               = FITS
   INTERCHANGE_FORMAT        = BINARY
   RECORDS                   = 1
   DESCRIPTION              = "FITS format defined in NASA/Science Office
                              Standards Technology 100-1.0"
END_OBJECT                 = IMAGE_HEADER

OBJECT                     = IMAGE
   LINES                     = 1024
   LINE_SAMPLES              = 1024
   SAMPLE_TYPE               = MSB_UNSIGNED_INTEGER
   SAMPLE_BITS               = 16
   UNIT                      = "DATA_NUMBER"
END_OBJECT                 = IMAGE

END
```

7 Appendix C : Example of ROLIS labels (level 2 raw stripe image)

```
PDS_VERSION_ID       = PDS3
LABEL_REVISION_NOTE  = "V1.0"

/* Science data for both housekeeping and science */

/* IDENTIFICATION & DESCRIPTIVE DATA ELEMENTS */
/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 2880
FILE_RECORDS         = 24


/* DATA OBJECT POINTERS  */

^IMAGE_HEADER = ("ROL_FS2_060829190232_335_00.FIT",1 <BYTES>)
^IMAGE        = ("ROL_FS2_060829190232_335_00.FIT",2881 <BYTES>)


DATA_SET_ID             = "RL-M-ROLIS-2-MARS-V1.0"
DATA_SET_NAME           = "ROSETTA-LANDER MARS ROLIS 2 MARS V1.0"
PI_PDS_USER_ID          = MOTTOLA
PRODUCT_ID              = "ROL_FS2_060829190232_335_00"
PROCESSING_LEVEL_ID     = "2"
PRODUCT_CREATION_TIME   = 2012-05-11T08:26:48
PRODUCT_TYPE            = EDR
DATA_QUALITY_ID         = "0"
DATA_QUALITY_DESC       = "0 : IMAGE VERY WELL EXPOSED"

MISSION_NAME            = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME      = "MARS SWING-BY"
MISSION_ID              = ROSETTA
INSTRUMENT_HOST_NAME    = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID      = RL
OBSERVATION_TYPE    = "PASSIVE CHECKOUT 3"

START_TIME             = 2006-08-29T19:02:32.000
STOP_TIME              = 2006-08-29T19:03:32.000
SPACECRAFT_CLOCK_START_COUNT = "1/115498926.00"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/115498927.28"

PRODUCER_ID          = "SONC"
PRODUCER_FULL_NAME   = "SCIENCE OPERATIONS AND NAVIGATION CENTER"
PRODUCER_INSTITUTION_NAME = "CNES"

INSTRUMENT_ID        = ROLIS
INSTRUMENT_NAME      = "ROSETTA LANDER IMAGING SYSTEM - DESCENT AND
                        CLOSEUP IMAGER"
INSTRUMENT_TYPE      = "IMAGING CAMERA"
TARGET_NAME          = "MARS"
TARGET_TYPE          = "PLANET"

^INSTRUMENT_CALIBRATION_DESC = "ROLIS_CALIBRATION_DESC.TXT"

/* GEOMETRY PARAMETERS */
```

```
/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (   67232451.0,-129217630.2, -59192546.5)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ( -178052115.8,-149626903.2, -61926442.7)
SC_TARGET_VELOCITY_VECTOR = (         29.6,        -3.6,        -1.5)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =   240674087.5 <km>
SUB_SPACECRAFT_LATITUDE =    16.23 <deg>
SUB_SPACECRAFT_LONGITUDE =   277.27 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* DATA OBJECT DEFINITION  */

INSTRUMENT_MODE_ID                = "FULL-FRAME IMAGE"
INSTRUMENT_MODE_DESC               = "Possible values are :
                                      descent imaging ring-buffer-mode;
                                      single image mode;
                                      Full-Frame image stripe;"

/* Rolis Image Status Block Information */

EXPOSURE_DURATION          = 60000 <MILLISECOND>
INST_CMPRS_NAME                 = "NONE"

/* DESCRIPTION OF OBJECTS CONTAINED IN FILE */

OBJECT                     = IMAGE_HEADER
   BYTES                     = 2880
   HEADER_TYPE               = FITS
   INTERCHANGE_FORMAT        = BINARY
   RECORDS                   = 1
   DESCRIPTION              = "FITS format defined in NASA/Science Office
                              Standards Technology 100-1.0"
END_OBJECT                 = IMAGE_HEADER

OBJECT                     = IMAGE
   LINES                     = 30
   LINE_SAMPLES              = 1066
   SAMPLE_TYPE               = MSB_UNSIGNED_INTEGER
   SAMPLE_BITS               = 16
   UNIT                      = "DATA_NUMBER"
END_OBJECT                 = IMAGE

END
```

8 Appendix D : Example of Directory Listing of Data Set RL-E-ROLIS-2-EAR2-V1.0

```
                          |-AAREADME.TXT
                          |
                          |              |-BROWINFO.TXT
                          |              |-ROL_FSP_070929225605_336_I01.LBL
                          |              |-ROL_FSP_070929225605_336_I01.PNG
                          |              |-ROL_FSP_070929225810_336_I01.LBL
                          |-BROWSE------|-ROL_FSP_070929225810_336_I01.PNG
                          |              |-ROL_FSP_070929230016_336_I01.LBL
                          |              |-ROL_FSP_070929230016_336_I01.PNG
                          |              |-ROL_FSP_070929230221_336_I01.LBL
                          |              |-ROL_FSP_070929230221_336_I01.PNG
                          |              |-ROL_FSP_070929230424_336_I01.LBL
                          |              |-ROL_FSP_070929230424_336_I01.PNG
                          |              |-ROL_FSP_070929230537_336_I01.LBL
                          |              |-ROL_FSP_070929230537_336_I01.PNG
                          |
                          |              |-CATINFO.TXT
                          |              |-DATASET.CAT
                          |-CATALOG-----|-INST.CAT
                          |              |-INSTHOST.CAT
                          |              |-MISSION.CAT
                          |              |-PERSON.CAT
                          |              |-REF.CAT
                          |              |-SOFTWARE.CAT
                          |
                          |              |-ROL_FS2_070929225605_336_00.LBL
                          |              |-ROL_FS2_070929225605_336_00.FIT
                          |              |-ROL_FS2_070929225810_336_01.LBL
                          |-DATA--------|-ROL_FS2_070929225810_336_01.FIT
                          |              |-ROL_FS2_070929230016_336_02.LBL
                          |              |-ROL_FS2_070929230016_336_02.FIT
                          |              |-ROL_FS2_070929230221_336_03.LBL
|- RL-E-ROLIS-2-EAR2-V1.0-|              |-ROL_FS2_070929230221_336_03.FIT
                          |              |-ROL_FS2_070929230424_336_04.LBL
                          |              |-ROL_FS2_070929230424_336_04.FIT
                          |              |-ROL_FS2_070929230537_336_05.LBL
                          |              |-ROL_FS2_070929230537_336_05.FIT
                          |
                          |              |-DOCINFO.TXT
                          |              |-EAICD_ROLIS.LBL
                          |              |-EAICD_ROLIS.PDF
                          |-DOCUMENT----|-CIVAROLIS_IME_ADP.LBL
                          |              |-CIVAROLIS_IME_ADP.PDF
                          |              |-ROLIS_CALIBRATION_DESC.LBL
                          |              |-ROLIS_CALIBRATION_DESC.TXT
                          |              |-TIMELINE_EAR2.TXT
                          |              |-TIMELINE_EAR2_DESC.TXT
                          |              |-TIMELINE_EAR2_PC#6.LBL
                          |              |-TIMELINE_EAR2_PC#6.PNG
                          |              |-TIMELINE_EAR2_SWINGBY.LBL
                          |              |-TIMELINE_EAR2_SWINGBY.PNG
                          |
                          |              |-BROWSE_INDEX.LBL
                          |              |-BROWSE_INDEX.TAB
                          |-INDEX-------|-INDXINFO.TXT
                          |              |-INDEX.LBL
```

```
|              |-INDEX.TAB
|
|-VOLDESC.CAT
```