Rosetta
Mars Express
Venus Express

MaRS/ RSI/ VeRa

Archive Generation, Validation and Transfer Plan

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Prepared by

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Approved by

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Document Change Record

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ACRONYMS

A/D	Analog/Digital
AGC	Automatic Gain Control
AGVTP	Archive Generation, Validation and Transfer Plan
AOL	Amplitude Open Loop
ATDF	Archival Tracking Data Format
CD-ROM	Compact Disk - Read Only Memory
CL	Closed-Loop
DDS	Data Delivery System
DSN	Deep Space Network
DVD	Digital Versatile Disk
ESA	European Space Agency
ESOC	European Space Operation Center
ESTEC	European Space Technology Center
FOL	Frequency Open Loop
G/S	Ground Station
HGA	High Gain Antenna
IFMS	Intermediate Frequency Modulation System
JPL	Jet Propulsion Laboratory
LCP	Left Circular Polarization
LGA	Low Gain Antenna
LOS	Line Of Sight
MaRS	Mars Express Radio Science Experiment
MGA	Medium Gain Antenna
MGS	Mars Global Surveyor
MSP	Master Science Plan
NASA	National Aeronautics and Space Administration
NNO	New Norcia
ODF	Orbit Data File
ODR	Original Data Record
OL	Open-Loop
ONED	one-way dual-frequency mode
ONES	One-way single-frequency mode
PDS	Planetary Data System (NASA)
POL	Polarization Open Loop
PSA	Planetary Science Archive (ESA).
RCP	Right Circular Polarization
RSI	Rosetta Radio Science Investigation
RSR	Radio Science Receiver

RX	Receiver
S/C	Spacecraft
SIS	Software Interface Specification
S-TX	S-Band Transmitter
SPICE	Space Planet Instrument C-Matrix Events
TBC	To Be Confirmed
TBD	To Be Determined
TNF	Tracking and Navigation File
TWOD	Two-way dual-frequency mode
TWOS	Two-way single-frequency mode
UBW	Universität der Bundeswehr München
USO	Ultra Stable Oszillator
VeRa	Venus Express Radio Science Experiment
VEX	Venus Express
X-TX	X-band Transmitter

Contents

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1 INTRODUCTION

1.1 Scope

This document and its content are consistent with the Experimenter to Archive Interface Control Document (EAICD) of ESA's Planetary Science Archive (PSA).
It presents the Archive Generation, Validation and Transfer Plan (AGVTP) for the Rosetta Orbiter Radio Science (RSI) Experiment, the Mars Express Orbiter Radio Science (MaRS) Experiment and the Venus Express Radio Science Experiment (VeRa).
It describes the data flow, the different data types and levels, the directory structures for the different data volumes, and the delivery and distribution plans. Further it contains information about the Volume, Dataset and File Formats, the used Standards in Data Product Generation (PDS, Time, Coordinates), the process of Data Validation, the Volume and Dataset Name Specifications and finally there are shown some Example PDS Label files for the different Data types of data level 1a, 1b and 2.

1.2 Referenced Documents

The following documents are referenced in the AGVTP and may be referred to if more information is needed.

Reference Number	Title	Issue Number	Date
ESA-MEX-TN-4008	Mars Express Archive Generation, Validation and Transfer Plan	1	12.6.2001
RO-EST-PL-5011	ROSETTA Archive Generation, Validation and Transfer Plan	2.0	27.10.2003
MEX-MRS-IGM-IS-3016 ROS-RSI-IGM-IS-3087 VEX-VRA-IGM-IS-3009	Radio Science File Naming Convention and Radio Science File Formats	3.0	4.6.2003
JPL D-7669, Part 2	Planetary Data System, Standards Reference	3.5	15.10.2002
GRST-TTC-GS-ICD-0518-TOSG	IFMS-to-OCC Interface Control Document	1.0	14-Mar-2000
JPL D-16765 (159-SCIENCE)	Radio Science Receiver RSR	Draft	5.2.2001
TRK-2-34	DSMS Tracking System Data Archival Data (Description of the TNF data files)	B	30.4.2000
TRK-2-18	Orbit Data File Interface	change 3	15.06.2000
RO-UoB-IF-1234	Experimenter To Planetary Science Archive Interface Control Document (EAICD)	Draft 5	7.11.2003
VEX-VERA-UBW-TN-3040	Reference Systems and Techniques Used for the Simulation and Prediction of Atmospheric and Ionospheric Sounding Measurements at Planet Venus	2.3	12.11.2003

1.3 <u>Document Overview</u>

The AGVTP consists of ten major sections with several subsections that follow the introduction.

Section 2	describes instruments and the science objectives
Section 3	the operational scenarios
Section 4	the data flows
Section 5	the archive structure and formats
Section 6	the Data Delivery Schedules
Section 7	the Standards used in Data Product Generation
Section 8	Data Validation
Section 9	MaRS, RSI and VeRa Volumes and Datasets Organization, Formats and Name Specification

2 INSTRUMENT OVERVIEWS

2.1 Mars Express Orbiter Radio Science Experiment

MaRS makes use of the onboard radio subsystem, which is primarily responsible for the communication link between the S/C and the ground stations on Earth.
Mars Express Orbiter is capable of receiving and transmitting radio signals via two dedicated antenna systems:
High Gain Antenna (HGA), a fixed parabolic dish of 1.80m diameter and two Low Gain Antennas (LGA), front and rear, S- Band only. The transponders consist of an S- band and X- band receiver and transmitter each. The S/C is capable of receiving two uplink signals at S- band (2100 MHz) via the LGAs , or non-simultaneously at either X- Band (7100 MHz) or S- Band via the HGA and transmit simultaneously two downlink signals at S- Band (2300 MHz) and X- Band (8400 MHz) or at S- Band only via the LGAs.
The HGA is the main antenna for receiving telecommands from and transmitting telemetry to the ground. The LGAs are used during the commissioning phase just after launch and for emergency operations.
A simultaneous and coherent dual-frequency downlink at X-band and S-band via the High Gain Antenna (HGA) is required to separate the contributions from the classical Doppler shift and the dispersive media effects caused by the motion of the spacecraft with respect to the Earth and the propagation of the signals through the dispersive media, respectively.
The experiment relies on the observation of the phase, amplitude, polarization and propagation times of radio signals transmitted from the spacecraft and received with ground station antennas on Earth. The radio signals are affected by the medium through which the signals propagate (atmospheres, ionospheres, interplanetary medium, solar corona), by the gravitational influence of the planet on the spacecraft and finally by the performance of the various systems involved both on the spacecraft and on ground.

2.1.1 Science objectives

As part of the Mars Express Orbiter payload, the Mars Express Orbiter Radio Science experiment (MaRS) will perform the following experiments:

a. radio sounding of the neutral Martian atmosphere (occultation experiment) to derive vertical density, pressure and temperature profiles as a function of height (height resolution better than 100 meter)
b. radio sounding of the ionosphere (occultation experiment) to derive vertical ionospheric electron density profiles and to derive a description of the global behavior of the Martian ionosphere through its diurnal and seasonal variations depending also on solar wind conditions
c. determination of dielectric and scattering properties of the Martian surface in specific target areas by a bistatic radar experiment

d. determination of gravity anomalies in conjunction with simultaneous observations using the camera HRSC as a base for three dimensional (3D) topography for the investigation of the structure and evolution of the Martian crust and lithosphere
e. radio sounding of the solar corona during the superior conjunction of the planet Mars with the Sun
f. the determination of the mass of Phobos

2.1.2 Instrument Modes

The MaRS experiment has four different operational modes:

1. **TWOD**: two-way, dual-frequency coherent mode:
   X- band uplink or S-band uplink
   S- and X- band downlink simultaneously.
   Applicable for science objective a), b), d),e)

2. **TWOS**: two-way, single-frequency mode:
   X- band uplink
   X- band downlink
   Applicable for science objective d), e) and f)

3. **ONED**: One-way, dual frequency mode:
   No uplink
   S- and X- band downlink simultaneously
   Applicable for science objective c)

4. **ONES**: One-way, single frequency mode:
   No uplink
   X- band downlink
   Applicable for science objective c)

The dual-frequency downlink at X-band and S-band is used to separate classical and dispersive Doppler shifts and therefore to correct the observed frequency shift by the plasma contribution due to the propagation through the interplanetary medium.

The different kind of data types with respect to the two different ground station systems are shown in the Table 2.1-1.

GROUND STATION SYSTEMS	Description	
IFMS (ESA)	CL	Closed-loop data: Doppler and Ranging at selected sample rates
	OL	Open-loop data: Downconverted received sky frequency A/D converted at very high sample rates RCP at two frequencies RCP and LCP at one frequency
DSN (NASA)	ODF	Orbit Data File(Closed-loop) Doppler and Ranging
	RSR	Radio- Science Receiver (Open-loop) 2 or 4 channels LCP & RCP polarizations

Table 2.1-1 : MaRS, RSI and VeRa data types

2.2 Rosetta Radio Science Investigation (RSI)

RSI makes use of the onboard radio subsystem, which is primarily responsible for the communication link between the s/c and the ground stations on Earth. The Rosetta radio subsystem is especially equipped with an Ultra- Stable Oscillator (USO), which significantly improves the sensitivity and accuracy of the one-way radio link measurements.
Rosetta is capable of receiving and transmitting radio signals via three dedicated antenna systems:
High Gain Antenna (HGA), a fully steer able parabolic dish of 2.20m diameter
Medium Gain Antenna (MGA), a fixed parabolic dish of 0.60m diameter
two Low Gain Antennas (LGA), front and rear, S- Band only
The transponders consist of an S- band and X- band receiver and transmitter each. The s/c is capable of receiving two uplink signals at S- band (2100 MHz) via the LGAs , or non-simultaneously at either X- Band (7100 MHz) or S- Band via the HGA and transmit simultaneously two downlink signals at S- Band (2300 MHz) and X-Band (8400 MHz) or at S- Band only via the LGAs.
The HGA is the main antenna for receiving telecommands from and transmitting telemetry to the ground. The LGAs are used during the commissioning phase just after launch and for emergency operations. The MGA is considered as a back-up.

2.2.1 Science objectives

The Rosetta RSI experiment has identified primary and secondary science objectives at the comet, the asteroids flybys and during cruise.
The science objectives are divided into categories:

a) cometary gravity field investigations
b) comet nucleus investigations
c) cometary coma investigations
d) asteroid mass and bulk density

as the prime science objectives, and as the secondary science objectives:

e) solar corona sounding
f) a search for gravitational waves

2.2.2 Instrument modes

The Rosetta RSI experiment has four different operational modes:

1. **TWOD**: two-way, dual-frequency coherent mode:

   X- band uplink; S-band uplink for objective e)
   S- and X- band downlink simultaneously.
   Applicable for science objective a), b), d),e) and f)
2. **TWOS**: two-way, single-frequency mode:

   X- band uplink

X- band downlink
Applicable for science objective a)

3. **<u>ONED</u>**: One-way, dual frequency mode:

   No uplink
   S- and X- band downlink simultaneously
   Applicable for science objective c) (plasma and dust investigations of cometary's coma)

4. **<u>ONES</u>**: One-way, single frequency mode:

   No uplink
   X- band downlink
   Applicable for the bistatic radar experiment to determine the surface roughness of the comet

The different RSI data types are the same as for MaRS and VeRa and are shown in the Table 2.1-1.

2.3 Venus Express Radio Science Experiment (VeRa)

VeRa makes use of the onboard radio subsystem, which is very similar to the radio subsystem of Mars Express. The main difference is that Venus Express, like Rosetta, is especially equipped with an Ultra- Stable Oscillator (USO).

2.3.1 Science objectives

As part of the Venus Express payload, the Venus Express Radio Science experiment will perform the following experiments:

a. radio sounding of the neutral Venutian atmosphere (occultation experiment) to derive vertical density, pressure and temperature profiles as a function of height (height resolution better than 100 meter)
b. radio sounding of the ionosphere (occultation experiment) to derive vertical ionospheric electron density profiles and to derive a description of the global behavior of the Venutian ionosphere through its diurnal and seasonal variations depending also on solar wind conditions
c. determination of dielectric and scattering properties of the Venutian surface in specific target areas by a bistatic radar experiment
d. determination of gravity anomalies (tbc)
e. radio sounding of the solar corona during the superior conjunction of the planet Venus with the Sun

2.3.2 Instrument Modes

The VeRa experiment has four different operational modes:

1. **TWOD**: two-way, dual-frequency coherent mode:
   X- band uplink; S-band uplink
   S- and X- band downlink simultaneously.
   Applicable for science objective d) und e)

1. **TWOS**: two-way, single-frequency mode:
   X- band uplink
   X- band downlink
   Applicable for science objective e)

3. **ONED**: One-way, dual frequency mode:
   No uplink
   S- and X- band downlink simultaneously
   Applicable for science objective a) b) c)

4. **ONES**: One-way, single frequency mode:

No uplink
X- band downlink
Applicable for science objective c)

The dual-frequency downlink at X-band and S-band is used to separate classical and dispersive Doppler shifts and therefore to correct the observed frequency shift by the plasma contribution due to the propagation through the interplanetary medium.

The different VeRa data types are the same as for MaRS and RSI and are shown in the Table 2.1-1.

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3 MARS, RSI AND VERA OPERATIONAL SCENARIOS

3.1 Data Processing

The MaRS, RSI and VeRa data processing depends on the ground station receiving system (DSN or NNO) and its raw data type (closed-loop or open loop):
The IFMS data from New Norcia (NNO) will be transferred to ESOC and stored at ESOC on the Data Delivery System (DDS). It will then be transferred via ftp from the DDS in Darmstadt to Cologne. The closed-loop IFMS data files are raw tracking data and contain Doppler and Ranging data recordings at selected sample rates. The exact format of the open-loop IFMS data is still tbd, but it consist of the down-converted and A/D converted received sky frequency at very high sample rates.
The data from the three different DSN ground stations will be collected by the JPL Radio-Science Group (RSG) and by the Stanford Radio Science Team for delivery to Cologne (data delivery from Stanford to Cologne as soon as available).
The DSN data are closed-loop Orbit Data Files (ODFs) and open-loop Radio-Science Receiver (RSR) files. The latter are very similar to the IFMS open-loop data files and consist of down-converted received sky frequency, A/D converted at very high sample rates (up to 50000 Hz). These data files will be sent via JPL to Stanford for processing up to level 2 and will be collected in Cologne for further archiving. The processed RSR files consist first of frequency resolution and intensity estimates probably at a sub-second resolution (tbc) for radio occultations and second for surface scattering, there will be power spectra (and voltage cross-spectra when two polarizations are collected), averaged over a few seconds (tbc), for each band.

All raw tracking data files and the processed data up to level 2 will be collected in Cologne. After a final check the processed data will be delivered to the Co-Is and after the propriety phase to PSA.

The following scientific analysis and interpretation of the processed data product is up to the Co-I and his science objective. Lists of collaborating institutes for MaRS, RSI and VeRa are shown in the Table 3.2-1, Table 3.2-2 and Table 3.2-3.

3.2 Collaborating Institutes

3.2.1 MaRS

Name	Institute
M- Paetzold (PI)	Institut für Meteorologie und Geophysik, Universität zu Köln, Germany
B. Häusler, S. Remus	Institut für Raumfahrttechnik, Universität der Bundeswehr, Munich, Germany
W. Ian Axford	Max- Planck- Institut für Sonnensystemforschung, Katlenburg- Lindau, Germany
J.-P. Barriot	Observatoire Midi Pyrenees, Toulouse, France
Jean- Claude Cerisier	CETP, 4 Ave. Neptune, Saint Maur Cedex, France
T. Hagfors	Max- Planck- Institut für Sonnensystemforschung, Katlenburg- Lindau, Germany
G.L. Tyler, R. Simpson, D. Hinson,	Dep. of Electrical Engineering, Stanford University, Palo Alto, USA
P. Janle	Institut für Geophysik, Universität zu Kiel, Kiel, Germany
G. Kirchengast	Institut für Geophysik u. Meteorologie, Karl-Franzens-Universität,Graz, Austria
V. Dehant	Observatoire Royale, Bruexelles

Table 3.2-1: List of collaborating institutes for MaRS

3.2.2 RSI

Name	Institute
M- Paetzold (PI)	Institut für Meteorologie und Geophysik, Universität zu Köln, Germany
B. Häusler, S. Remus	Institut für Raumfahrttechnik, Universität der Bundeswehr, Munich, Germany
K. Aksnes	Insitute for Theoretical Astrophysics, University of Oslo, Norway
J.D. Anderson S.W. Asmar B.T. Tsurutani	Jet Propulsion Laboratory,California Institute of Technology, Pasadena, USA
J.-P. Barriot	Observatoire Midi Pyrenees, Toulouse, France
M.K. Bird	Radioastronomisches Institut, Universität zu Bonn, Bonn, Germany
H. Boehnhardt	Max- Planck- Institut für Sonnensystemforschung, Katlenburg- Lindau, Germany
N. Thomas	Universität Bern, Berne, Swizerland
E. Grün	Max- Planck- Institut für Kernphysik, Heidelberg, Germany
W.H. Ip	National Central University, Taipei, Taiwan
E. Marouf	Dep. of Electrical Engineering, San Jose State University, San Jose, California, USA
T. Morley	ESA-ESOC, Darmstadt, Germany

Table 3.2-2: List of collaborating institutes for RSI

3.2.3 VeRa

Name	Institute
B. Häusler (Principal Investigator), S. Remus	Institut für Raumfahrttechnik, Universität der Bundeswehr, Munich, Germany
M- Paetzold (Co-PI)	Institut für Meteorologie und Geophysik, Universität zu Köln, Germany
G.L. Tyler, R. Simpson, D. Hinson,	Dep. of Electrical Engineering, Stanford University, Palo Alto, USA
M. Bird	Universität Bonn, Germany
R. Treumann	Max-Planck Institut für Extraterrestrische Physik, Garching, Germany

Table 3.2-3: List of collaborating institutes for VeRa

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4 MARS, RSI AND VERA DATA FLOW

4.1 Data Flow

The data flow for the MaRS, RSI and VeRa experiments is shown in Figures 4.1-1 to 4.1-3.

4.2 Points of contact

4.2.1 Point of contact for PSA archiving

Cologne is the single point of contact for the PSA archive team.

Function	Name	Adress	E-mail	Telephone/ Fax
Principal Investigator	Martin Pätzold	Institut für Geophysik und Meteorologie, Universität zu Köln, Albertus-Magnus-Platz, D-50923 Köln, Germany	paetzold@geo.uni-koeln.de	phone: (49)-221-470-3385 Fax: (49)-221-470-5198
Data Manager	Markus Fels	Institut für Geophysik und Meteorologie, Universität zu Köln, Albertus-Magnus-Platz, D-50923 Köln, Germany	fels@geo.uni-koeln.de	phone: (49)-221-470-4035 Fax: (49)-221-470-5198

4.2.2 Points of contact for data forwarding

site	Name	Adress	E-mail	Telephone/ Fax
Stanford University	Richard A. Simpson	Dept. of Electrical Engineering, Stanford University, Packard Building 350, Serra Mall, Stanford, CA 94305-9515, USA	rsimpson@magellan.stanford.edu	phone: (1)-650-723-3525 Fax: (1)-650-723-9251
JPL	Sami W. Asmar	Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena CA 91009, USA	sami.w.asmar@jpl.nasa.gov	phone: (1)-818-354-6288 Fax: (1)-818-393-9282
ESOC DDS	TBD	Esoc, Robert- Bosch- Str. 5, Darmstadt, Germany	mex.dds@esa.int (Mars Express) rosetta.dds@esa.int (Rosetta) TBD (Venus Express)	

4.2.3 Points of contact for data distribution

Function	Name	Adress	E-mail	Telephone/ Fax
Data Manager	Markus Fels	Institut für Geophysik und Meteorologie, Universität zu Köln, Albertus-Magnus-Platz, D-50923 Köln, Germany	fels@geo.uni-koeln.de	phone: (49)-221-470-4035 Fax: (49)-221-470-5198

4.3 Data Level Definition

4.3.1 Level 1a data

Level 1a raw tracking data (closed-loop and open-loop) will be recorded directly in the ground stations.
New Norcia (NNO):
Closed-loop IFMS data will be forwarded to the DDS at ESOC and ftped to the home institute in Cologne.
The open-loop IFMS data will be sent on hard media (probably DVDs) from the ground station in New Norcia directly to Cologne.

Deep Space Network (DSN):
ODF (closed-loop) and RSR (open-loop) data will be collected by JPL and transferred to Stanford University and finally send to Cologne on CD-ROMs.

4.3.2 Level 1b and 2 data

Level 1b data are processed from level 1a (raw tracking data) into an ASCII formatted file. Cologne is processing IFMS and ODF data, Stanford University processes RSR data up to level 2 and forwards raw and processed data to Cologne for archiving.

Level 2 data are calibrated data after further processing. The file format is in ASCII. This data level can be used for further scientific interpretation and will be available to the Co-Is along with the required ancillary data as soon as available with a propriety phase of at least six months.

Level 1a to level 2 data will be archived in Cologne once all tracking and ancillary data of a campaign are available. Target date for PDS delivery is six months after the last data of a specific campaign have been recorded.

4.3.3 Level 3 data

Derived scientific data products (see Table 4.3-1) by the Co-Is will be archived in Cologne. A certain scientific data set will be available to the public on request after the first major publication of this data set.

4.3.4 CODMAC level definition

In the keywords DATA_SET_ID and PROCESSING_LEVEL_ID within the data labels, CODMAC level are used instead of PSA level. In all other file names and documents we keep the PSA data level definition as described above. For a comparison between the two data level definition see Table 4.3-2.

	Science Data Product	**Description**
MaRS	Gravity	LOS accelerations
	Occultations	Atmospheric profiles Ionospheric profiles
	Bistatic radar	dielectric constant surface roughness
	Solar Corona	Doppler or phase time series Total electron content Change in electron content Electron density
RSI	Gravity	Low orbit LOS accelerations Gravity field coefficients LOS accelerations (asteroids)
	Mass flux	Doppler time series LOS accelerations Derived mass flux
	Occultations	Dust scatter spectra Ionospheric profiles
	Bistatic radar	dielectric constant surface roughness refractivity
	Solar Corona	Doppler or phase time series Total electron content Change in electron content Electron density
VeRa	Gravity	LOS accelerations
	Occultations	Atmospheric profiles Ionospheric profiles
	Bistatic radar	dielectric constant surface roughness
	Solar Corona	Doppler or phase time series Total electron content Change in electron content Electron density

Table 4.3-1: Examples for Science Data products (Data Level 3)

CODMAC level	PSA level	Description
1	1a	raw data
2	1b	edited raw data
3	2	calibrated data
5	3	derived scientific data

Table 4.3-2: Comparison between CODMAC level and PSA level

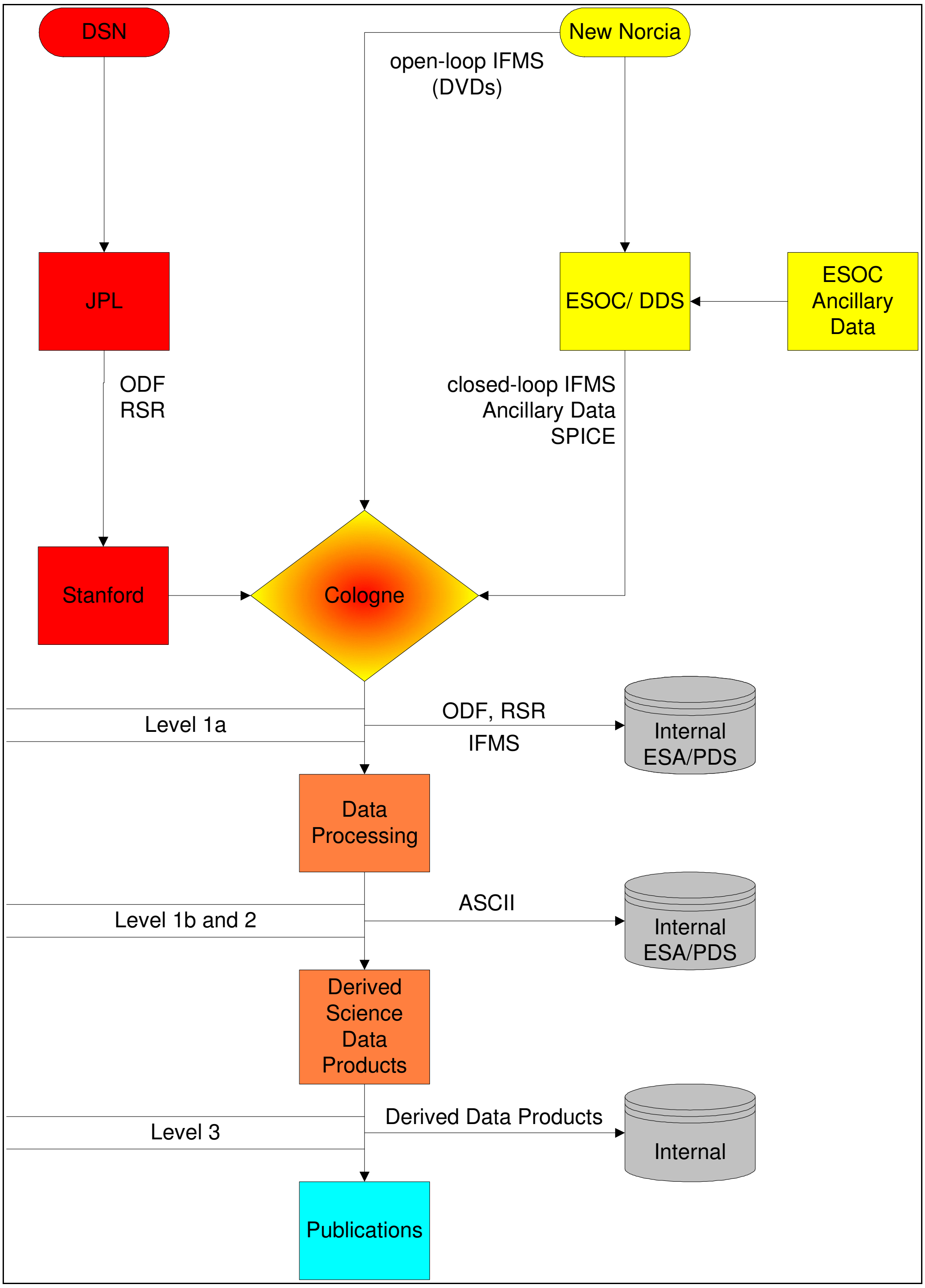


Figure 4.1-1: MaRS Data Flow

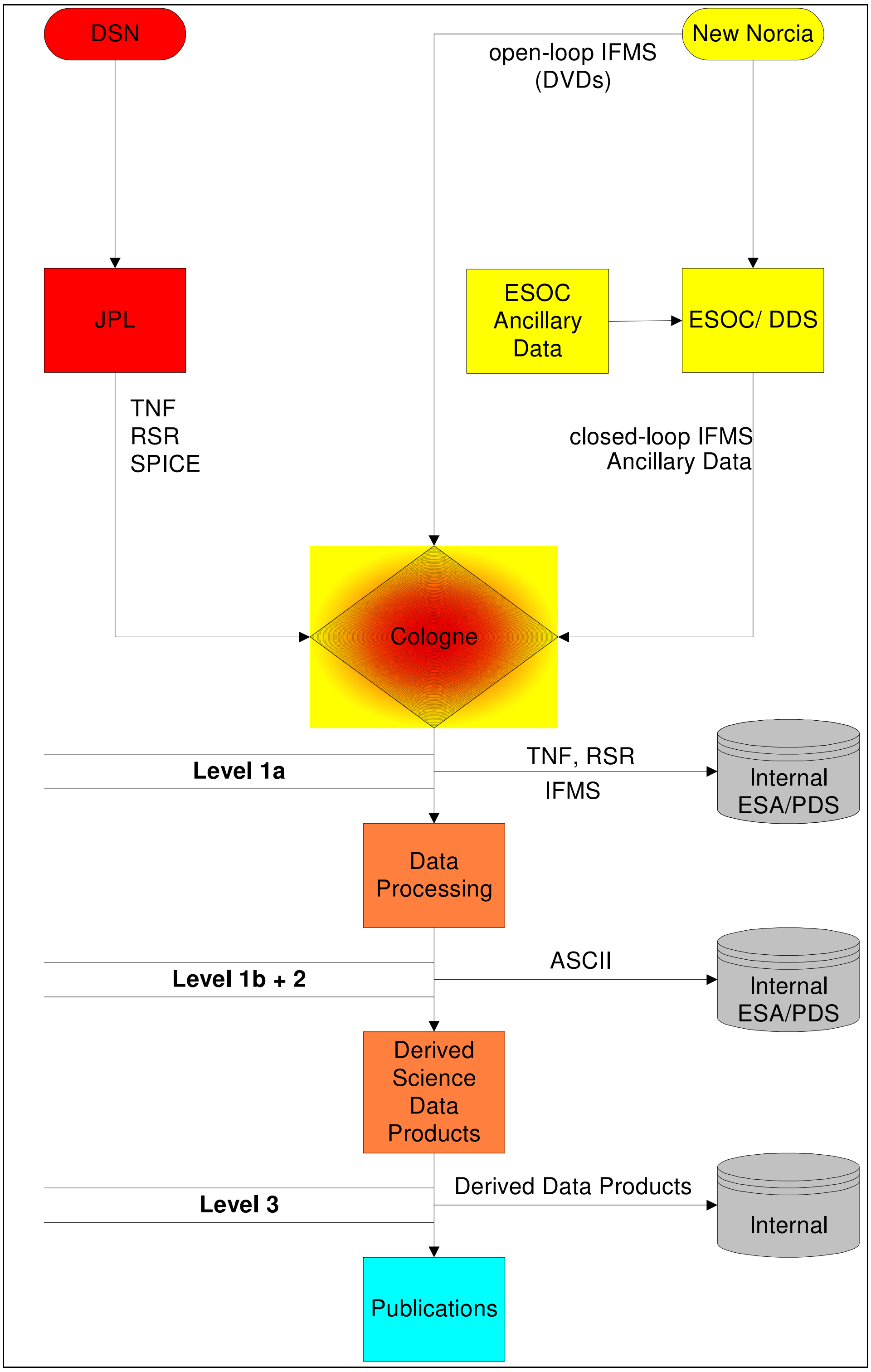


Figure 4.1-2: RSI Data Flow

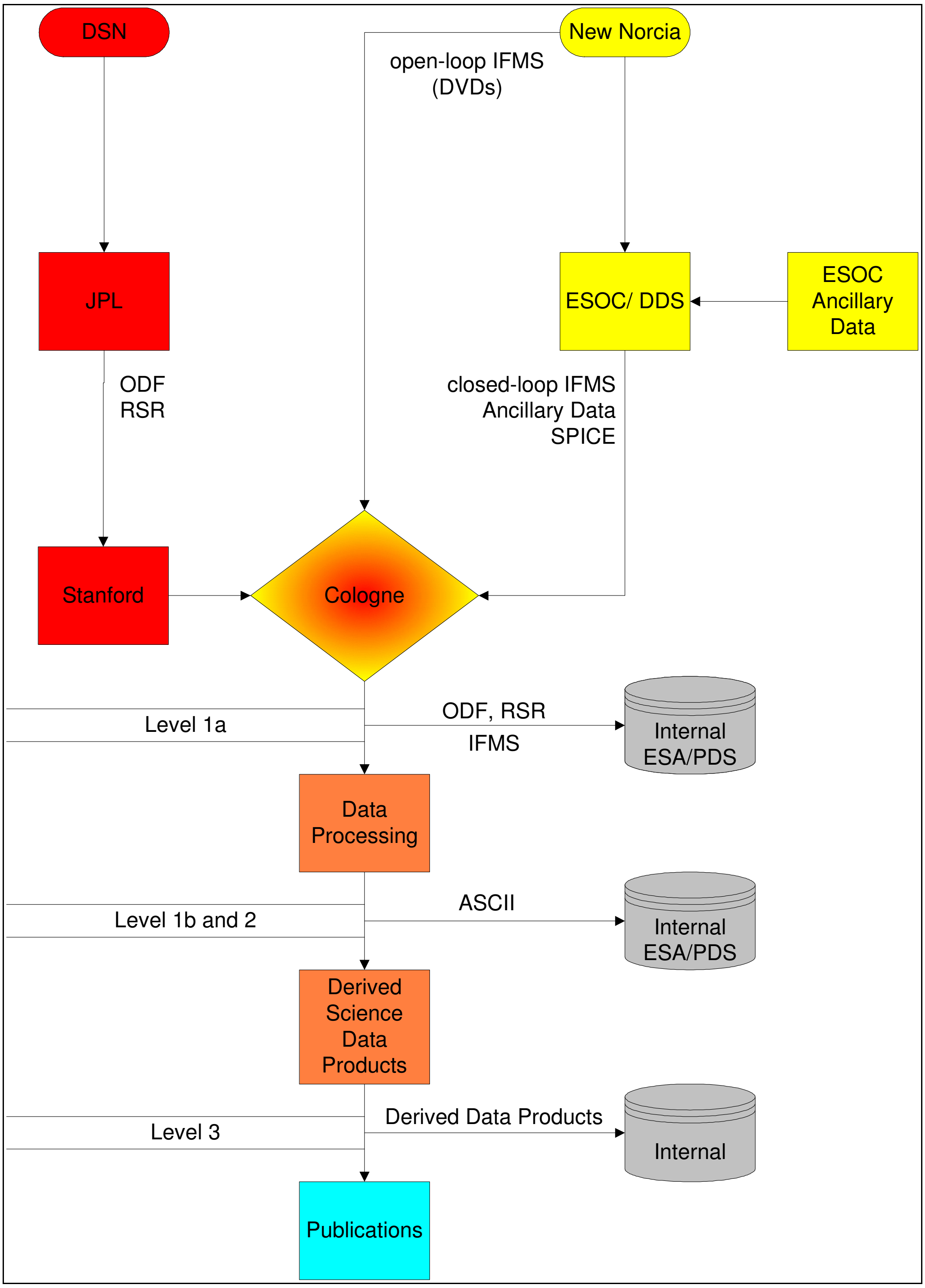


Figure 4.1-3: VeRa Data Flow

4.4 MaRS, RSI and VeRA Archiving Functions

4.4.1 Archive Content

The complete data set size of each investigation is expected to be approximately 200GB for MaRS, 1000GB for RSI and tbd for VeRa. The storage media of the archival data set are CD-ROMs and DVD-ROMs. The data set will be divided in single volumes with respect to the science objectives. Level 1a, level1b and level 2 data will be stored on the same medium (if medium space allows), separated into special data directories. All these directories will be separated again into directories for different types of data, e.g. open loop separate from closed loop and so on. Within directories, the data will be ordered by time, using special subdirectories if appropriate. Please note that not all possible directories have to be present. For example, one data set may contain closed loop data but no open loop data thus there is no need for an open loop subdirectory. The same is true for data coming from IFMS and DSN.
Level 3 and higher Level data will be stored on separate data volumes.

4.4.2 Expected Number of file products

The following lists can only give an estimate and overview of the to be archived file products and file numbers. The MEX commissioning has shown that operational constraints and events will change the operations plan and will have an impact on the actual number of data takings.

4.4.2.1 Rosetta RSI
Tbd

4.4.2.2 Venus Express VeRa
Tbd

4.4.2.3 Mars Express MaRS

4.4.2.3.1 ESA IFMS

Science Objective	Data Level	Number of data files	Number of Label files	number of expected file starts	number of files	number of files per data taking	number of data takings	total number of files to be archived
Commissioning 1	L1a	15	15	4	120	324	5	1620
	L1b	30	15	4	180			
	L2	4	4	3	24			
Commissioning 2	L1a	15	15	4	120	324	1	324
	L1b	30	15	4	180			
	L2	4	4	3	24			
Gravity	L1a	15	15	1	30	83	300	24900
	L1b	30	15	1	45			
	L2	4	4	1	8			
Occultation	L1a	15	15	5	150	415	750	311250
	L1b	30	15	5	225			
	L2	4	4	2	40			
Solar Corona	L1a	15	15	2	60	158	120	18960
	L1b	30	15	2	90			
	L2	4	4	1	8			

4.4.2.4 Rosetta RSI

4.4.2.4.1 ESA IFMS

Science Objective	Data Level	Number of data files	Number of Label files	number of expected file starts	number of files	number of files per data taking	number of data takings	total number of files to be archived
	L1a	15	15	4	120			
	L1b	30	15	4	180			
Commissioning 1	L2	4	4	3	24	324		
	L1a	15	15	4	120			
	L1b	30	15	4	180			
Commissioning 2	L2	4	4	3	24	324		
	L1a							
	L1b							
Commissioning 3	L2							
	L1a							
	L1b							
	L2							
	L1a							
	L1b							
	L2							

4.4.2.4.2 DSN

TBD

4.4.3 Single Raw Data File (level 1a) Volume

4.4.3.1 Closed-loop

IFMS	Calculation (bytes)	One hour data recording @ 1 second sampling time
Overhead		18 kBytes
Ranging	110 x number of samples /hour	396 kBytes
Doppler	220 x number of samples/hour	792 kBytes
Meteo	100 x number of samples/hour	6 kbytes (1 min sampling time)

DSN ODF	Calculation (bytes)	One hour data recording @ 1 second sampling time
		1.11 MB/hour

4.4.3.2 Open-Loop

IFMS	Calculation (bytes)	Event volume
Occultation	6 bytes*5000 samples/s	54 Mbyte (2x15 min)
Bistatic radar	6 bytes*50000 samples/s	2160 Mbyte (2 hours)
Solar corona	6 bytes*5000 samples/s*	648 MByte (6 hours)

RSR	Calculation (bytes)	Event volume (tracking pass)
Occultations	0.5 Mbytes / minute each channel	15 Mbytes total (duration 2x 15 minutes) each channel
Bistatic radar	12.5 Mbytes / minute each channel	750 Mbytes total (duration 1 hour) each channel
Solar corona	0.5 Mbytes / minute each channel	195 Mbytes total (6.5 hours) each channel

* 1000 samples/s implemented in the Rosetta RSI user manual, but 5000 samples/s aspired

The number of available tracking passes for each science objective is given in Table 4.4-1.

Investigation	Science Objective	# of tracking passes	duration	Total data volume
MaRS	Gravity	TBD		
	Occultations	1500		
	Bistatic radar	200		
	Solar Corona	240		
RSI	Gravity	TBD		
	Mass flux	TBD		
	Occultations	TBD		
	Bistatic radar	TBD		
	Solar Corona	TBD		
VeRa	Gravity	TBD		
	Occultations	TBD		
	Bistatic radar	TBD		
	Solar Corona	TBD		

Table 4.4-1: Estimate for available tracking passes for each science objective

5 ARCHIVE STRUCTURE AND FORMATS

MaRS, RSI and VeRA will issue two kinds of data volumes:

a) Data level 1a and 1b: Observational data (level 1b) processed from the raw data (level 1a) as received and structured by the receiving system of the ground stations
   Data level 2: Calibrated data derived from the processed data files (level 1b)
b) Data Level 3: Science Data derived from Level 2 data

Data of levels 1a, 1b and 2 will be stored on the same data volume separated into different subdirectories, if enough free capacity on the data volume is available. Level 3 and higher Level data will be stored on separate data volumes.

Subdirectories appearing in Table 5.1-1 to 5.1-3 but in practice will not contain observed data or ancillary data of any level on the physical archive volume, will not be created.

5.1 Volume Format

5.1.1 MaRS

5.1.1.1 Top-Level Directory Structure for a MaRS level 1a, 1b and 2 data volume

5.1.1.1.1 Table

<table>
<tr><td rowspan="3">ROOT</td><td colspan="2">AAREADME.TXT</td><td colspan="2">description of volume contents</td></tr>
<tr><td colspan="2">ERRATA.TXT</td><td colspan="2">overview of anomalies and errors</td></tr>
<tr><td colspan="2">VOLDESC.CAT</td><td colspan="2">description of the contents of the logical volume</td></tr>
<tr><td rowspan="7">CATALOG</td><td colspan="2">CATINFO.TXT</td><td colspan="2">text description of the directory contents</td></tr>
<tr><td colspan="2">MISSION.CAT</td><td colspan="2">PDS catalog object for Mission</td></tr>
<tr><td colspan="2">INST.CAT</td><td colspan="2">brief description of the radio systems of the s/c and the ground stations</td></tr>
<tr><td colspan="2">INSTHOST.CAT</td><td colspan="2">brief description of the Instrument Host</td></tr>
<tr><td colspan="2">DATASET.CAT</td><td colspan="2">brief description of the reduced MaRS data</td></tr>
<tr><td colspan="2">PERSON.CAT</td><td colspan="2">description of key persons involved in MaRS</td></tr>
<tr><td colspan="2">REF.CAT</td><td colspan="2">collection of references uses in the inst.cat and dataset.cat</td></tr>
<tr><td rowspan="10">CALIB</td><td colspan="2">CALINFO.TXT</td><td colspan="2">text description of the directory contents</td></tr>
<tr><td rowspan="4">CLOSED_
LOOP</td><td>DSN</td><td colspan="2">Closed-loop calibration data of the DSN ground stations</td></tr>
<tr><td rowspan="3">IFMS</td><td>RCL</td><td>Range Calibration data files</td></tr>
<tr><td>DCL</td><td>Doppler Calibration data files</td></tr>
<tr><td>MET</td><td>Meteo data files</td></tr>
<tr><td rowspan="4">OPEN_
LOOP</td><td>DSN</td><td colspan="2">Open-loop calibration data of the DSN ground stations</td></tr>
<tr><td rowspan="3">IFMS</td><td>RCL</td><td>Range Calibration data files</td></tr>
<tr><td>DCL</td><td>Doppler Calibration data files</td></tr>
<tr><td>MET</td><td>Meteo data files</td></tr>
<tr><td colspan="2">UPLINK_FREQ_CORRECT.TAB</td><td colspan="2">Data files with wrong and corrected uplink frequency.</td></tr>
<tr><td rowspan="4">DOCUMENT</td><td colspan="2">DOCINFO.TXT</td><td colspan="2">description of contents the Document Directory</td></tr>
<tr><td colspan="2" rowspan="3">MRS_DOC</td><td colspan="2">M32ESOCL1B_RCL_021202_00.PDF
Group delay stability specifications & measurements at New Norcia</td></tr>
<tr><td colspan="2">M32ESOCL1B_RCL_030522_00.PDF
Range calibrations at New Norcia and Kourou</td></tr>
<tr><td colspan="2">M32UNBWL1B_RCL_030801_00.PDF
Transponder group velocities (in german)</td></tr>
</table>

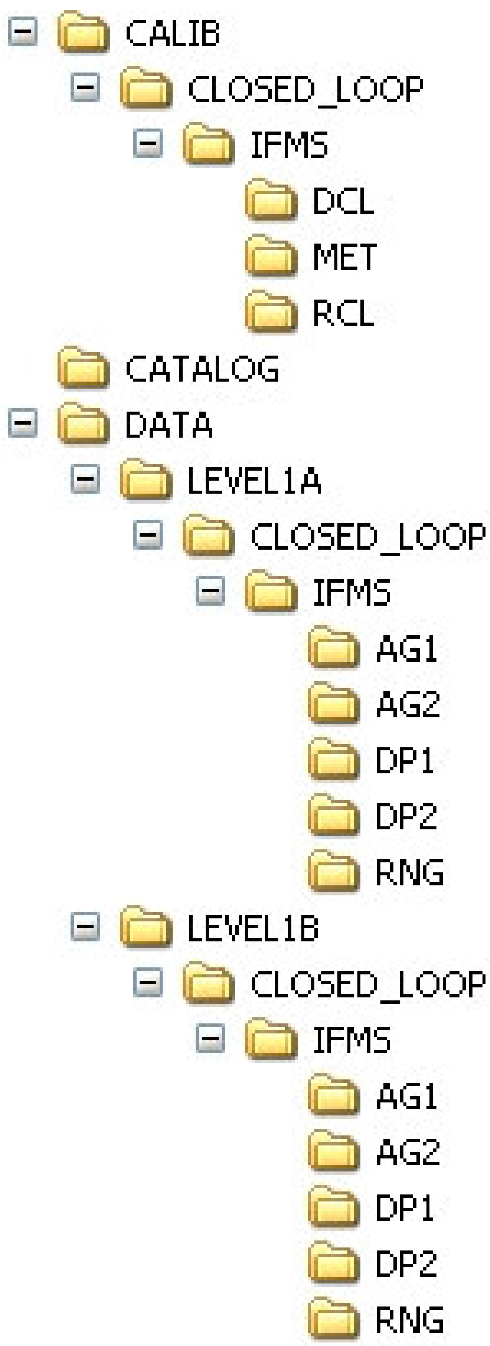
		MEX-MRS-IGM-IS-301.PDF *MaRS Data Archive Plan*
		MEX-MRS-IGM-IS-3019.PDF *MaRS File Naming Convention*
		MEX-MRS-IGM-IS-3016_APP_A.ASC *MaRS File Naming Convention Appendix A, Example PDS labels*
		MEX-MRS-IGM-MA-3008.PDF MaRS User Manual
		MARS_OPS_LOGBOOK_04.PDF *status of all planned radio science operations to date*
		MEX_MRS_IGM_DS_3035.PDF *IFMS Doppler Processing Software Documentation: Level 1a to Level 2*
		MEX_MRS_IGM_DS_3036PDF *IFMS Ranging Processing Software Documentation: Level 1a to Level 2.*
		MEX-MRS-IGM-LI-3028.PDF *List of MaRS Team members.*
	ESA_DOC	IFMS_OCCFTP *documentation of IFMS data format*
		MEX_ESC_ID_5003_FDSICD.PDF *file format description of ESOC Flight Dynamics files (ancillary files)*
		MEX-ESC-IF-5003_APPENDIX_C *documentation of DDS configuration*
		MEX-ESC-IF-5003_APPENDIX_I *definition of XML-schema for the data delivery interface*
		MEX-ESC-IF-5003_APPENDIX_H *content description of ESOC Flight Dynamics files (ancillary files)*
		MEX-ESC-IF-5003_(DDID) *data delivery interface document*
		RO-EST-IF-5010 *specifications of operational interfaces and procedures*
	DSN_DOC	DSN_ODF_TRK-2-18.PDF *Documentation of Tracking System Interfaces and Orbit Data File Interface*
		JPL_D-16765_RSR.PDF *documentation of RSR data format*
		DSN_WEA_FORMAT_TRK_2_24.PDF *Specification of DSN weather file.*
		DSN_MEDIA_CAL_TRK_2_23.PDF *Specification of DSN media calibration data.*
INDEX	INDXINFO.TXT	*description of the contents of the Index Directory*
	INDEX.LBL	*detached PDS label to describe INDEX.TAB*
	INDEX.TAB	*PDS table, listing all data files included in the volume*

EXTRAS	EXTRINFO.TXT			text description of the directory contents	
	ANCILLARY			ESOC	*Relevant DDS files to describe the observation geometry*
				SPICE	*Relevant SPICE Kernels to describe the observation geometry*
				UNI_BW	*Relevant PREDICT files from the Uni BW Munich*
				MRS / LOG-FILES	*Logfiles of Level 2 processing*
DATA	LEVEL1A	CLOSED_LOOP	DSN	ODF	Orbit Data Files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
		OPEN_LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
	LEVEL1B	CLOSED_LOOP	DSN	ODF	Orbit Data Files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
		OPEN_LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
	LEVEL2	CLOSED_	DSN	ODF	Orbit Data Files

		LOOP	IFMS	DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
		OPEN_ LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files

Table 5.1-1: Top-Level Directory Structure for a MaRS processed data volume (level 1a, 1b, 2)

5.1.1.1.2 Diagram



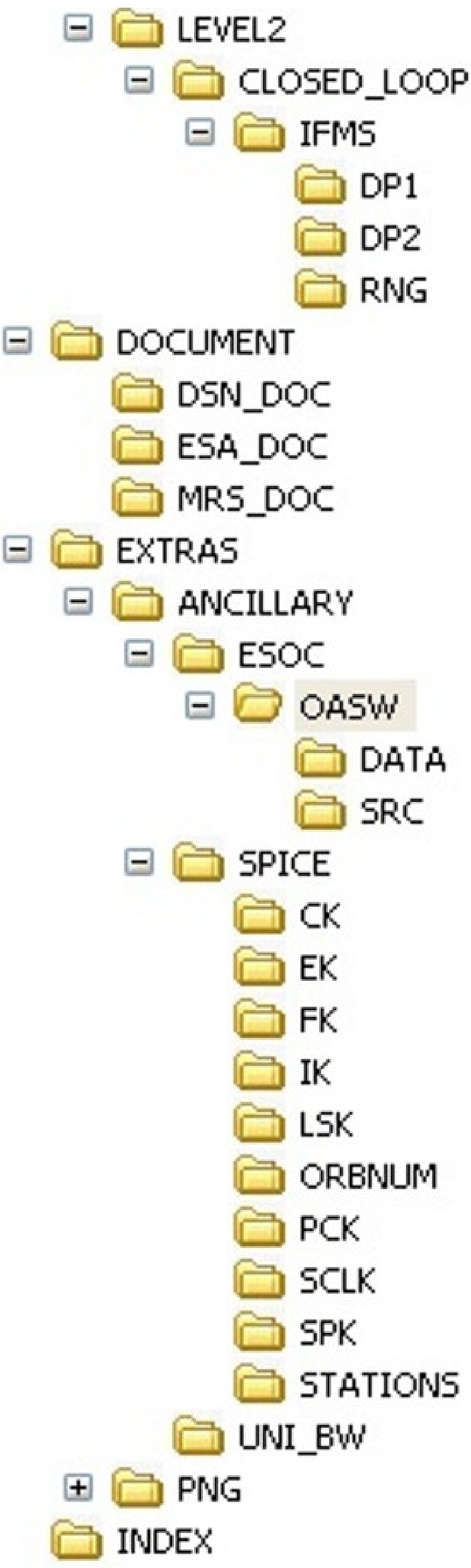


Figure 5.1-1: Top-Level Directory Structure for a MaRS processed data volume (level 1a, 1b, 2)

5.1.2 RSI

5.1.2.1 Top-Level Directory Structure for a RSI Level 1a, 1b and 2 data volume

5.1.2.1.1 Table

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 radio systems of the s/c and the ground stations*
	INSTHOST.CAT		*brief description of the Instrument Host*
	DATASET.CAT		*brief description of the reduced RSI data*
	PERSON.CAT		*description of key persons involved in RSI*
	REF.CAT		*collection of references uses in the inst.cat and dataset.cat*
CALIB	CALINFO.TXT		*text description of the directory contents*
	CLOSED_ LOOP	DSN	Closed-loop calibration data of the DSN ground stations
		IFMS	RCL Range Calibration data files
			DCL Doppler Calibration data files
			MET Meteo data files
	OPEN_ LOOP	DSN	Open-loop calibration data of the DSN ground stations
		IFMS	RCL Range Calibration data files
			DCL Doppler Calibration data files
			MET Meteo data files
	UPLINK_FREQ_CORRECT.TAB		*Data files with wrong and corrected uplink frequency.*
DOCUMENT	DOCINFO.TXT		*description of contents the Document Directory*
	RSI_DOC		M32ESOCL1B_RCL_021202_00.PDF *Group delay stability specifications & measurements at New Norcia*
			M32ESOCL1B_RCL_030522_00.PDF *Range calibrations at New Norcia and Kourou*
			M32UNBWL1B_RCL_030801_00.PDF *Transponder group velocities (in german)*
			ROS-RSI-IGM-IS-3079 *RSI Data Archive Plan*

		ROS-RSI-IGM-IS-3087 *MaRS File Naming Convention*
		ROS-RSI-IGM-IS-3087_APP_A.ASC *MaRS File Naming Convention Appendix A, Example PDS labels*
		ROS-RSI-IGM-MA-3081 RSI User Manual
		RSI_OPS_LOGBOOK *status of all planned radio science operations to date*
		ROS_RSI_IGM_DS_3118 *IFMS Doppler Processing Software Documentation: Level 1a to Level 2*
		ROS_RSI_IGM_DS_3119 *IFMS Ranging Processing Software Documentation: Level 1a to Level 2.*
		ROS-RSI-IGM-LI_3116 *List of RSI Team members.*
	ESA_DOC	IFMS_OCCFTP *documentation of IFMS data format*
		RO_ESC_ID_5003_FDSICD.PDF *file format description of ESOC Flight Dynamics files (ancillary files)*
		RO-ESC-IF-5003_APPENDIX_C *documentation of DDS configuration*
		RO-ESC-IF-5003_APPENDIX_I *definition of XML-schema for the data delivery interface*
		RO-ESC-IF-5003_APPENDIX_H *content description of ESOC Flight Dynamics files (ancillary files)*
		RO-ESC-IF-5003_(DDID) *data delivery interface document*
		RO-EST-IF-5010 *specifications of operational interfaces and procedures*
	DSN_DOC	DSN_ODF_TRK-2-18.PDF *Documentation of Tracking System Interfaces and Orbit Data File Interface*
		JPL_D-16765_RSR.PDF *documentation of RSR data format*
		DSN_WEA_FORMAT_TRK_2_24.PDF *Specification of DSN weather file.*
		DSN_MEDIA_CAL_TRK_2_23.PDF *Specification of DSN media calibration data.*
INDEX	INDXINFO.TXT	*description of the contents of the Index Directory*
	INDEX.LBL	*detached PDS label to describe INDEX.TAB*
	INDEX.TAB	*PDS table, listing all data files included in the volume*
EXTRAS	EXTRINFO.TXT	text description of the directory contents

	ANCILLARY			ESOC		*Relevant DDS files to describe the observation geometry*
				SPICE		*Relevant SPICE Kernels to describe the observation geometry*
				UNI_BW		*Relevant PREDICT files from the Uni BW Munich*
				MRS	LOG-FILES	*Logfiles of Level 2 processing*
DATA	LEVEL1A	CLOSED_LOOP	DSN	ODF		Orbit Data Files
			IFMS	AG1		Auto Gain Control 1 data files
				AG2		Auto Gain Control 2 data files
				DP1		Doppler 1 data files
				DP2		Doppler 2 data files
				RNG		Ranging data files
		OPEN_LOOP	DSN	RSR		Radio-Science Receiver data files
			IFMS	AG1		Auto Gain Control 1 data files
				AG2		Auto Gain Control 2 data files
				DP1		Doppler 1 data files
				DP2		Doppler 2 data files
				RNG		Ranging data files
	LEVEL1B	CLOSED_LOOP	DSN	ODF		Orbit Data Files
			IFMS	AG1		Auto Gain Control 1 data files
				AG2		Auto Gain Control 2 data files
				DP1		Doppler 1 data files
				DP2		Doppler 2 data files
				RNG		Ranging data files
		OPEN_LOOP	DSN	RSR		Radio-Science Receiver data files
			IFMS	AG1		Auto Gain Control 1 data files
				AG2		Auto Gain Control 2 data files
				DP1		Doppler 1 data files
				DP2		Doppler 2 data files
				RNG		Ranging data files
	LEVEL2	CLOSED_LOOP	DSN	ODF		Orbit Data Files
			IFMS	DP1		Doppler 1 data files
				DP2		Doppler 2 data files

				RNG	Ranging data files
		OPEN_ LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files

Table 5.1-2: Top-Level Directory Structure for a RSI processed data volume (level 1a, 1b,2)

5.1.2.1.2 Diagram

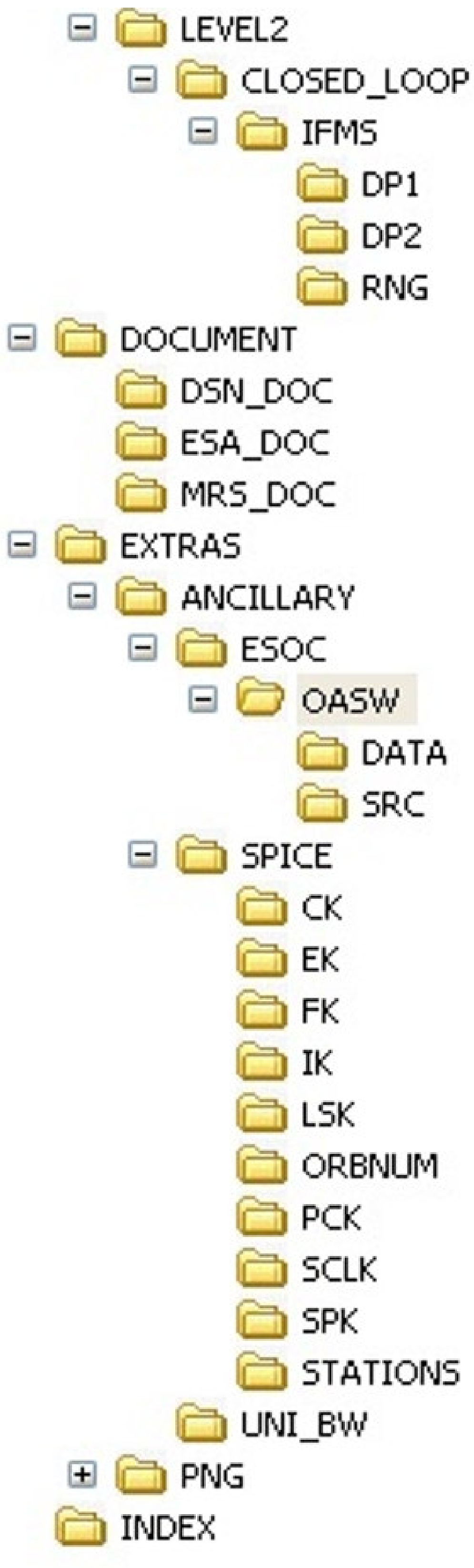


Figure 5.1-2: Top-Level Directory Structure for a RSI processed data volume (level 1a,1b ,2)

5.1.3 VeRA

5.1.3.1 Top-Level Directory Structure for a VeRa Level 1a, 1b and 2 data volume

5.1.3.1.1 Table

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 radio systems of the s/c and the ground stations*	
	INSTHOST.CAT		*brief description of the Instrument Host*	
	DATASET.CAT		*brief description of the reduced RSI data*	
	PERSON.CAT		*description of key persons involved in RSI*	
	REF.CAT		*collection of references uses in the inst.cat and dataset.cat*	
CALIB	CALINFO.TXT		*text description of the directory contents*	
	CLOSED_ LOOP	DSN	Closed-loop calibration data of the DSN ground stations	
		IFMS	RCL	Range Calibration data files
			DCL	Doppler Calibration data files
			MET	Meteo data files
	OPEN_ LOOP	DSN	Open-loop calibration data of the DSN ground stations	
		IFMS	RCL	Range Calibration data files
			DCL	Doppler Calibration data files
			MET	Meteo data files
	UPLINK_FREQ_CORRECT.TAB		*Data files with wrong and corrected uplink frequency.*	
DOCUMENT	DOCINFO.TXT		*description of contents the Document Directory*	
	VRA_DOC		M32ESOCL1B_RCL_021202_00.PDF *Group delay stability specifications & measurements at New Norcia*	
			M32ESOCL1B_RCL_030522_00.PDF *Range calibrations at New Norcia and Kourou*	
			M32UNBWL1B_RCL_030801_00.PDF *Transponder group velocities (in german)*	
			VEX-VRA-IGM-IS-3007 *VeRA Data Archive Plan*	

		VEX-VRA-IGM-IS-3009 *VeRA File Naming Convention*
		VEX-VRA-IGM-IS-3009_APP_A.ASC *VeRA File Naming Convention Appendix A, Example PDS labels*
		VEX-VRA-IGM-MA-3005 VeRA User Manual
		VRA_OPS_LOGBOOK *status of all planned radio science operations to date*
		VEX_VRA_IGM_DS_3011 *IFMS Doppler Processing Software Documentation: Level 1a to Level 2*
		VEX_VRA_IGM_DS_3012 *IFMS Ranging Processing Software Documentation: Level 1a to Level 2.*
		VEX_VRA_IGM-LI_3013 *List of VeRA Team members.*
	ESA_DOC	IFMS_OCCFTP *documentation of IFMS data format*
		VEX_ESC_ID_5003_FDSICD.PDF *file format description of ESOC Flight Dynamics files (ancillary files)*
		VEX-ESC-IF-5003_APPENDIX_C *documentation of DDS configuration*
		VEX-ESC-IF-5003_APPENDIX_I *definition of XML-schema for the data delivery interface*
		VEX-ESC-IF-5003_APPENDIX_H *content description of ESOC Flight Dynamics files (ancillary files)*
		VEX-ESC-IF-5003_(DDID) *data delivery interface document*
		VEX-EST-IF-5010 *specifications of operational interfaces and procedures*
	DSN_DOC	DSN_ODF_TRK-2-18.PDF *Documentation of Tracking System Interfaces and Orbit Data File Interface*
		JPL_D-16765_RSR.PDF *documentation of RSR data format*
		DSN_WEA_FORMAT_TRK_2_24.PDF *Specification of DSN weather file.*
		DSN_MEDIA_CAL_TRK_2_23.PDF *Specification of DSN media calibration data.*
INDEX	INDXINFO.TXT	*description of the contents of the Index Directory*
	INDEX.LBL	*detached PDS label to describe INDEX.TAB*
	INDEX.TAB	*PDS table, listing all data files included in the volume*
EXTRAS	EXTRINFO.TXT	text description of the directory contents

	ANCILLARY			ESOC	*Relevant DDS files to describe the observation geometry*
				SPICE	*Relevant SPICE Kernels to describe the observation geometry*
				UNI_BW	*Relevant PREDICT files from the Uni BW Munich*
				MRS LOG-FILES	*Logfiles of Level 2 processing*
DATA	LEVEL1A	CLOSED_LOOP	DSN	ODF	Orbit Data Files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
		OPEN_LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
	LEVEL1B	CLOSED_LOOP	DSN	ODF	Orbit Data Files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
		OPEN_LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	AG1	Auto Gain Control 1 data files
				AG2	Auto Gain Control 2 data files
				DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files
	LEVEL2	CLOSED_LOOP	DSN	ODF	Orbit Data Files
			IFMS	DP1	Doppler 1 data files
				DP2	Doppler 2 data files

				RNG	Ranging data files
		OPEN_ LOOP	DSN	RSR	Radio-Science Receiver data files
			IFMS	DP1	Doppler 1 data files
				DP2	Doppler 2 data files
				RNG	Ranging data files

Table 5.1-3: Top-Level Directory Structure for a VeRa processed data volume (level 1a, 1b, 2)

5.1.3.1.2 Diagram

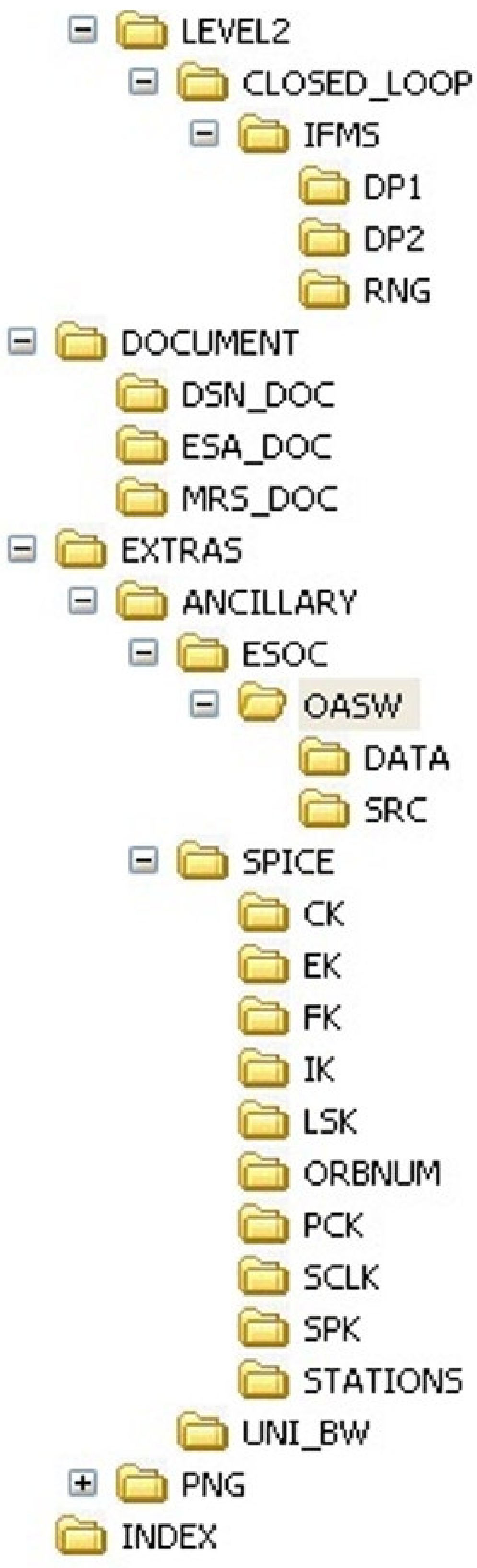


Figure 5.1-3: Top-Level Directory Structure for a VeRa processed data volume (level 1a, 1b, 2)

6 DATA DELIVERY SCHEDULE

This section summarise the preliminary schedule for delivery of data to the PSA. These are deliveries from the MaRS, RSI and VeRA archiving team lead by the PIs Martin Pätzold (MaRS, RSI) and Bernd Häusler (VeRa) to the PSA. Deliveries will be made from the Radio-Science archive team to the PSA at ESTEC for final assembly into the appropriate ESA mission archives.

6.1 MaRS

6.1.1 MaRS observation timeline

An overview of the MaRS observation timeline during the nominal mission is given in Figure 6.1-1 and Table 6.1-1.

Event	Date
Commissioning 1	July 2003
Commissioning 2	Oct 2003
Orbit Commissioning	Jan/ Feb 2004
OCP1	March - August 2004
SCP1	August - October 2004-
Gravity+ BSR	October – December 2004
OCP2	Dec – Feb 2005
OCP3	TBD
OCP4	TBD
SCP2	Sep- Nov 2006
Gravity+ BSR	TBD
SCP3	TBD
Gravity+ BSR	TBD

Table 6.1-1: MaRS observation timeline (tbc)

ID	Vorgangsname	Duratior
1	**MaRS Commissioning**	**198d**
2	Launch	1d
3	Commissioning 1 (July)	16d
4	Commissioning 2 (Octob	13d
5	Orbit Commissioning	42d
6	**Occultations**	**430d**
7	OCP 1	99d
8	OCP2	41d
9	OCP3	41d
10	OCP4	82d
11	**Solar Conjunctions**	**47d**
12	SCP1	47d
13	**Phobos Flybys**	**1d**
14	Orbit 678	1d
15	Orbit 679	1d
16	**Occultations**	**406d**
17	OCP4	126d
18	OCP5	54d
19	OCP6	27d
20	**Solar Conjunctions**	**49d**
21	SCP2	49d

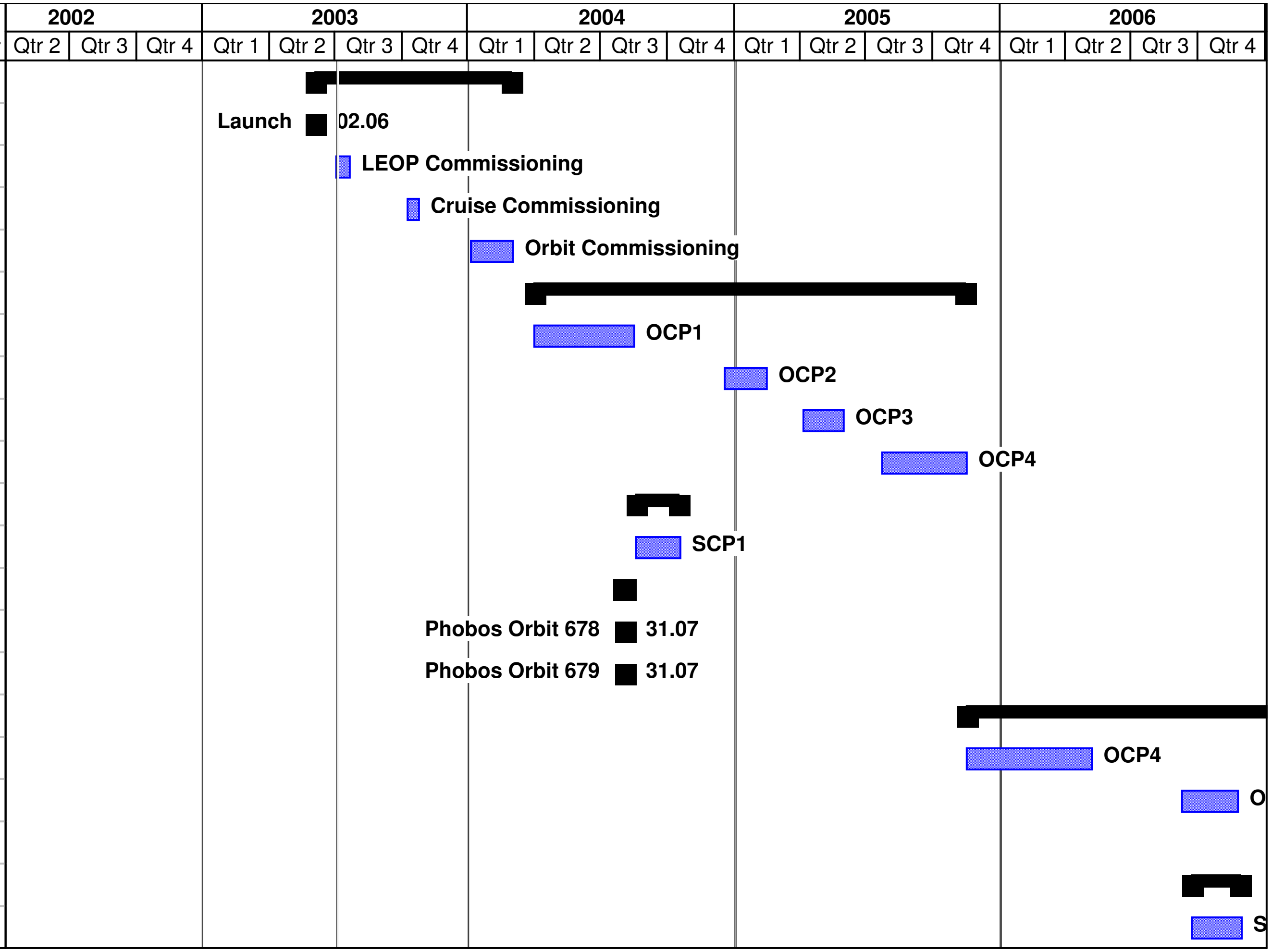


Figure 6.1-1: MaRS observation timeline (tbc)

6.1.2 Commissioning

6.1.2.1 Near-Earth Commissioning

Date:	June/July 2003
Delivery date:	April 2004
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.1.2.2 Cruise Commissioning

Date:	October 2003
Delivery date:	April 2004
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.1.2.3 Mars Orbit Commissioning

Date:	January- February 2004
Delivery date:	August 2004
Data volume:	Tbd.
Data type:	level 1a level 1b and 2 Gravity BIstatic Radar

6.1.3 Prime Mission

Objective:	Occultations OCP1
Date:	March 2004- August 2004
Delivery date:	April 2005
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Solar corona SCP1
Date:	August 2004- October 2004
Delivery date:	May 2005
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Occultations OCP2
Date:	December 2004 - February 2005
Delivery date:	August 2005
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Bistatic Radar
Date:	Scheduled by MSP
Delivery date:	6 months after last observation of a phase
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Gravity
Date:	Scheduled by MSP
Delivery date:	End of nominal mission (at latest)
Data volume:	Tbd.
Data type:	Closed-loop
Data type:	level 1a level 1b and 2

Objective:	Occultations OCP3
Date:	April 2005 – May 2005
Delivery date:	December 2005
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Phobos
Date:	Scheduled by MSP
Delivery date:	After all Phobos flybys
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.1.4 Extended Mission

Objective:	Occultations OCC4
Date:	July 2005- May 2006
Delivery date:	November 2006
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Occultations OCC5
Date:	September 2006 - November 2006
Delivery date:	May 2007
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Occultations OCC6
Date:	April 2007- June 2007
Delivery date:	December 2007
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Solar corona SCP2
Date:	September 2006 – November 2006
Delivery date:	May 2007
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Bistatic Radar
Date:	Tbd.
Delivery date:	Tbd.
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Phobos
Date:	Scheduled by MSP
Delivery date:	After all Phobos flybys
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Gravity
Date:	Tbd.
Delivery date:	Tbd.
Data volume:	Tbd.
Data type:	Closed-loop
Data type:	level 1a level 1b and 2

6.2 RSI

6.2.1 RSI observation time line

tbd

6.2.2 Commissioning

6.2.2.1 Near-Earth Commissioning

Date:	March 2004
Delivery date:	September 2004
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.2.2.2 Cruise Commissioning 1

Date:	May 2004
Delivery date:	November 2004
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.2.2.3 Cruise Commissioning 2

Date:	September 2004
Delivery date:	March 2005
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.2.3 Cruise Phase

Objective:	Solar corona C1
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	asteroid flyby tbd
Date:	tbd

Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Solar corona C2
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	asteroid flyby 2 tbd
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Solar corona C3
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Solar corona C4
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

6.2.4 Prime Mission

Objective:	Gravity Field
Date:	tbd
Delivery date:	tbd
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Bistatic Radar Campaigns
Date:	Tbd
Delivery date:	Tbd + 6 months
Data volume:	Tbd.
Data type:	level 1a level 1b and 2

Objective:	Occultations
Date:	Tbd
Delivery date:	Tbd + 6 months
Data volume:	Tbd
Data type:	level 1a level 1b and 2

Objective:	Plasma
Date:	Tbd
Delivery date:	Tbd + 6 months
Data volume:	Tbd
Data type:	level 1a level 1b and 2

Objective:	Mass flux
Date:	Tbd
Delivery date:	Tbd + 6 months
Data volume:	Tbd
Data type:	level 1a level 1b and 2

Objective:	Dust
Date:	Tbd
Delivery date:	Tbd + 6 months
Data volume:	Tbd
Data type:	level 1a level 1b and 2

6.3 <u>VeRa</u>

6.3.1 VeRa observation timeline

Tbd

6.3.2 Commissioning

Tbd

6.3.3 Cruise Phase

Tbd

6.3.4 Prime Mission

Tbd

7 STANDARDS USED IN MARS, RSI AND VERA DATA PRODUCT GENERATION

7.1 PDS Standards

The Standards for generating and Validation of the Data Volumes and Datasets are based on the standards provided by the JPL's Planetary Data System Version 3.5. For further informations see Document *Planetary Data System, Standards Refere-nce, JPL D-7669, Part 2.*

7.2 Time Standards

MaRS, RSI and VeRa data products makes use of different Time and Reference system. For our data processing and archiving the most important Time Systems are:

1. Coordinated Universal Time (UTC)
2. Ephemeris Time (ET)

The scientific success of a Radio Science Experiment depends critically on a common understanding about the conventions for the reference and time systems. The following sections give an overview of the time standards necessary to understand the above mentioned Time systems and to convert to other common Time Systems. It should be noted that radio science data are generated and recorded at ground stations. Thus the times given in the data and label files are ground station and not onboard time.

7.2.1 Coordinated Universal Time (UTC)

Coordinated Universal Time (UTC) is obtained from atomic clocks running at the same rate as TT (see section 7.2.3.3) or TAI (see section 7.2.3.2). The UTC time scale is always within 0.7 seconds of UT1 (see section 7.2.3.5). By the use of leap seconds, care is taken to ensure that this difference is never exceeded. However, because of the introduction of the leap seconds it becomes clear that this time scale is not steady.
The International Earth Rotation Service (IERS) can add leap seconds and is normally doing this at the end of June or December of each year if necessary. The actual UTC can only be determined for a previous point in time but predictions for the future are published by the IERS. This fact should be noted when future missions are planned on the base of the UTC time standard.
UTC can be obtained by the difference of the predicted value DUT1 or the past value ΔUT between UT1 and UTC published in the IERS Bulletin A (http://maia.usno.navy.mil/) which contains previous leap seconds and predictions :

$$\mathrm{UTC} = \mathrm{UT1} - \mathrm{DUT1} \quad \text{or} \quad \mathrm{UTC} = \mathrm{UT} - \Delta\mathrm{UT}$$

This relation is needed to obtain UT1 (UT) from UTC.

7.2.2 Dynamical Time Scale T_{eph} for the JPL DE 405 Ephemeris

In a general relativistic framework, time is not an absolute quantity but depends on the location and motion of a clock. Therefor unlike UTC T_{eph} is not based on the rotation of the earth around its axis. T_{eph} refers to the center of mass of the solar system and is the independent variable of *barycentric planetary ephemerides*. It should be noted that during the years 1984 – 2003 the time scale of ephemerides referred to the barycenter of the solar system was the relativistic time scale Barycentric Dynamic Time TDB (see section 7.2.3.1).
From 2004 onwards this time scale for the JPL DE 405 ephemeris will be replaced by T_{eph}. For practical purposes the length of the ephemeris second can be taken as equal to the length of the TDB second. T_{eph} is approximately equal to TDB, but not exactly. On the other hand, T_{eph} is mathematically and physically equivalent to the newly-defined TCB (see section 7.2.3.7), differing from it by only an offset and a constant rate. Within the accuracy required by MaRS, RSI and VeRa we use: T_{eph} ~ TDB.
T_{eph} is then defined as seconds past J2000, with J2000 being 12 h 1 January TDB.

7.2.3 Other Time Standards

7.2.3.1 Barycentric Dynamic Time (TDB)

Since the differences compared to TT are fairly small, the corrections can be determined by the following approximation :

$$\mathrm{TDB} = \mathrm{TT} + 0.001658^{s} \cdot \sin g + 0.000014^{s} \cdot \sin(2g)$$

with g being the mean anomaly of the Earth in its orbit given by

$$g = 357.53 + 0.9856003 \cdot \left(\mathrm{JD}\left(\mathrm{UT1}\right) - 2451545.0\right) \quad [\mathrm{deg}]$$

7.2.3.2 International Atomic Time (TAI)

TAI provides the practical realization of a uniform time scale based on atomic clocks. This time is measured at the surface of the Earth. Since this time scale is a steady one, it differs from UTC by an integral number of leap seconds introduced up the current point in time:

$$\mathrm{TAI} = \mathrm{UTC} + \mathrm{LS}$$

where LS is the number of leap seconds. The unit of TAI is the SI second.

7.2.3.3 Terrestrial Dynamic Time (TT)

Terrestial Time (TT) – formerly Terrestrial Dynamical Time (TDT) - is to be understood as time measured on the geoid. It has conceptionally a uniform time scale. TT is the independent variable of *geocentric ephemerides*. TT replaced Ephemeris Time (ET) in 1984. The difference between TT and the atomic time scale (TAI) is a constant value of 32.184 seconds:

$$\mathrm{TT} = \mathrm{TAI} + 32.184^{s}$$

One therefore obtains also the relationship:

$$\mathrm{UTC} = \mathrm{TT} - 32.184^{s} - \mathrm{LS}$$

TT does not take into account relativistic corrections. It is used as an independent argument of geocentric ephemeris.

7.2.3.4 GMT (UT)

Time is traditionally measured in days of 86400 SI seconds. Each day has 24 hours counted from 0^h at midnight. The motion of the real sun was replaced by the concept of a fictitious mean sun that moves uniformly in right ascension defining the Greenwich Mean Time (GMT) or Universal Time (UT). Greenwich Mean Sidereal Time (GMST), however, is the Greenwich hour angle of the vernal equinox, i. e. it denotes the angle between mean vernal equinox of date and the Greenwich meridian.
The mean vernal equinox is based on a reference system which takes into account the secular effects, i.e. the precession of the Earth´s equator but not periodic effects such as the nutation of the Earth´s axis.
In terms of SI seconds, the length of a sidereal day (i. e. the Earth's spin period) amounts 23^h 56^m $4^s.091 \pm 0^s.005$ (corresponding to a factor 1/1.00273790935) making it about four minutes shorter than a 24^h solar day. Hence, sidereal time and mean solar time have different "rates".

7.2.3.5 Universal Time (UT1)

Universal Time UT1 is the presently adopted realization of a mean solar time scale (constant average length of a solar day of 24 hours) with UT1 = UT. As a result, the length of one second of UT1 is not constant because of the apparent motion of the sun and the rotation of the Earth. UT1 is therefore defined as a function of sidereal time.
For any particular day, 0 h UT1 is defined as the instant at which Greenwich Mean Sidereal Time (GMST) has the value:

$$\mathrm{GMST}\left(0^h\,\mathrm{UT1}\right) = 24110^s.54841 + 8640184^s.812866 \cdot T_o$$
$$+ 0^s.093104 \cdot T_o^2 - 0^s.0000062 \cdot T_o^3$$

For an arbitrary time of the day, the expression may be generalized to obtain the Greenwich hour angle GHA by multiplying this time with the factor 1.00273790935, adding this result to GMST and convert it into degrees (if so desired)

$$\mathrm{GMST}\ \left(\mathrm{UT1}\right) = 24110^s.54841 + 8640184^s.812866\mathrm{T_o} + 1.00273790935\mathrm{UT1} + 0^s.093104\mathrm{T}^2\ \text{-}\ 0^s.0000062 \cdot T^3$$

where T is the time in Julian centuries since the 1st of January 2000, 12 h, i.e. 2000 Jan. 1.5 :

$$\mathrm{T} = \frac{\mathrm{JD(UT1)} - 2451545}{36525}$$

and JD is the Julian Date.

Ecliptic and Earth equator at 2000 Jan 1.5 define the *J2000 system*.

The most useful relation for computer software is one that uses only JD (UT1):

$$GMST(°) = 280.46061837 + 360.98564736629 \cdot \left(JD - 2451545.0\right) +$$
$$+ 0.000387933T^2 - T^3 / 38710000$$

The difference between UT1 and TT or TAI (atomic clock time, to be explained below) can only be determined retrospectively. This difference is announced by the International Earth Rotation Service (IERS) and is handled in practice by the implementation of leap seconds (maximum of two in one year).
The above formulae contain implicitly the Earth's mean angular rotation $\omega_\oplus$ in degrees per second [3.15].

$$\omega_\oplus\left(rad/s\right) = \left\{1.002737909350795 + 5.9006 \cdot 10^{-11}T - 5.9 \cdot 10^{-15}T^2\right\} \cdot \frac{2\pi}{86400s}$$

7.2.3.6 Geocentric Coordinate Time (TCG)

Geocentric Coordinate Time TCG represents the time coordinate of a four dimensional reference system and differs from TT by a constant scale factor yielding the relation

$$TCG = TT + L_G \cdot (JD - 2443144.5) \cdot 86400\ s$$

$L_G = 6.9692903 * 10^{-10}$

For practical reasons this equation can also be put into the following relation :

TCG = TT + 2.2 s/cy * (year-1977.0)

cy = century

7.2.3.7 Barycentric Coordinate Time (TCB)

The Barycentric Coordinate Time TCB has been introduced to describe the motion of solar system objects in a non rotating relativistic frame centered at the solar system barycenter. TCB and TCG exhibit a rate difference which depends on the gravitational potential of the Sun at the mean Earth-Sun distance 1 AU and the Earth´s orbital velocity. The accumulated TCB-TT time difference amounts to roughly 11 s around epoch J2000.

$$TCB = TCG + L_C \cdot (JD - 2443144.5) \cdot 86400\ s + P$$

(Mc Carthy 1996) and

$$\begin{aligned} \mathrm{P} \approx &+0^s.0016568 \cdot \sin(35999°.37T + 357°.5) \\ &+0^s.0000224 \cdot \sin(32964°.5T + 246°) \\ &+0^s.0000138 \cdot \sin(71998°.7T + 355°) \\ &+0^s.0000048 \cdot \sin(3034°.9T + 25°) \\ &+0^s.0000047 \cdot \sin(34777°.3T + 230°) \end{aligned} \qquad (3.16)$$

$$T = (JD - 2451545.0) / 36525$$

$L_c = 1.4808268457\ 10^{-8}$

The largest contribution is given by the first term. When neglecting the other terms we can approximate P by:

$P = 0.001658^s \sin(g) + 0.000014^s \sin(2g)$

Julian Date (JD)

In astronomical computations, a continuous day count is used which avoids the usage of a calendar. The Julian Date (JD) is the number of days since noon January 1, 4712 BC including fractions of the day.

Modified Julian Date (MJD)

Since the JD has become such a large number, the Modified Julian Date was introduced for convenience. JD was reset at November 17th 1858 which leads to the following equation :

$$MJD = JD - 2400000.5^{d}$$

Note that the count for MJD starts at midnight.

7.3 Coordinate Systems

MaRS, RSI and VeRa make use of different coordinate systems (so called *frames in SPICE) with respect to the* Target body and different science objectives.

There are four different frames classes:

7.3.1 Inertial Frames

Inertial frames do not accelerate with respect to the star background. They are the frames in which Newton's law's of motion apply.

SPICE ACRONYM	DESCRIPTION
J2000	Earth mean equator, dynamical equinox of J2000
MARSIAU	Mars Mean Equator and IAU vector of J2000. The IAU vector at Mars is the point on the mean equator of Mars where the equator ascends through the the eart mean equator. This vector is the cross of Earth mean north with Mars mean north

Table 7.3-1: Inertial Frames

7.3.2 Bodyfixed Frames

Body fixed frames are reference frames that do not move with respect to "surface" features of an object, but do move with respect to inertial frames. The orientation of this frame is typically determined from the International Astronomical Union (IAU) model for the body in question.

SPICE ACRONYM	DESCRIPTION
ITRF93	International Terrestrial Reference Frame 93
IAU_MARS IAU_MARS_BARYCENTER	Mars IAU frame Mars IAU frame (origin in barycenter)
IAU_VENUS IAU_VENUS_BARYCENTER	Venus IAU frame Venus IAU frame (origin in barycenter)
IAU_PHOBOS	Phobos IAU frame
IAU_DEIMOS	Deimos IAU frame

Table 7.3-2: Bodyfixed Frames

7.4 Earth Ellipsoid - Ground Station Coordinates

For the Earth the WGS-84 system is used as a reference ellipsoid to define the Ground Station coordinates. The equation below shows how to compute cartesian coordinates if the geodetic (= geocentric) longitude λ, the geodetic latitude φ and altitude h above the reference ellipsoid with a radius R_{ref} and a flattening f are given:

$$r = \begin{pmatrix} (N+h)\cos\varphi\cos\lambda \\ (N+h)\cos\varphi\sin\lambda \\ \left((1-f)^2 N + h\right)\sin\varphi \end{pmatrix}$$

where

$$N = \frac{R_{ref}}{\sqrt{1 - f\left(2-f\right)\sin^2\varphi}}$$

and 1/f = 298.257223563

The motion of a ground station in an inertial reference system is dominated by the Earth rotation with a velocity of 460 m/s at the equator and the translatory motion of the Earth around the solar system barycenter (~ 30 km/s). When the motion of the ground station is modeled in the inertial *International Celestial Reference System* ICRS, the position $\mathbf{r}_{ITRS}$ of the station in the *International Terrestrial Reference System* (ITRS) has to be transformed using SPICE.

7.4.1 Venus and Mars Ellipsoids

Venus has a spherical shape with an equatorial radius and polar radius of 6051.8 km. For Mars we assume a rotational symmetric ellipsoid. The polar and equatorial semi-major axis have a length of 3376.20 km and 3396.19 km, respectively [3.13].

7.5 Planetary Ephemeris and Planetary Coodinates

The position of the planets are calculated using the JPL/DE405 ephemeris model. The ephemeris data are given in the barycentric time basis TDB and in either the heliocentric or the geocentric J2000 system in a pure geometrical sense, i.e. assuming infinite speed of light.

8 DATA VALIDATION

8.1 PSA Validation Tools

TBD

8.2 Validation Process

TBD

Page left free

9 MARS, RSI AND VERA VOLUMES AND DATASETS ORGANIZATION, FORMATS AND NAME SPECIFICATION

9.1 Definitions and General Concept

9.1.1 Definitions

9.1.1.1 Data Product
A labeled grouping of data resulting from a scientific observation. Examples of data products include spectrum tables, and time series tables. A data product is a component of a data set.

9.1.1.2 Data Set
The accumulation of data products, secondary data, software, and documentation, that completely document and support the use of those data products. A data set is part of a data set collection.

9.1.1.3 Data Set Collection
A data set collection consists of data sets that are related by observation type, discipline, target, or time, and therefore are treated as a unit, archived and distributed as a group (set) for a specific scientific objective and analysis.

9.1.1.4 Volume
A physical unit used to store or distribute data products (e.g. a CD_ROM or DVD disk) which contain directories and files. The directories and files include documentation, software, calibration and geometry information as well as the actual science data. A volume is part of a volume set.

9.1.1.5 Volume Set
A volume set consists of one or more data volumes containing a single data set or collection of related data sets. In certain cases, the volume set can consists of only one volume.

9.1.2 Data- and Volume Set Organization

The general concept for the MaRS, RSI and VeRa Data- and Volume Set Design is shown in Figure 9.1-1.

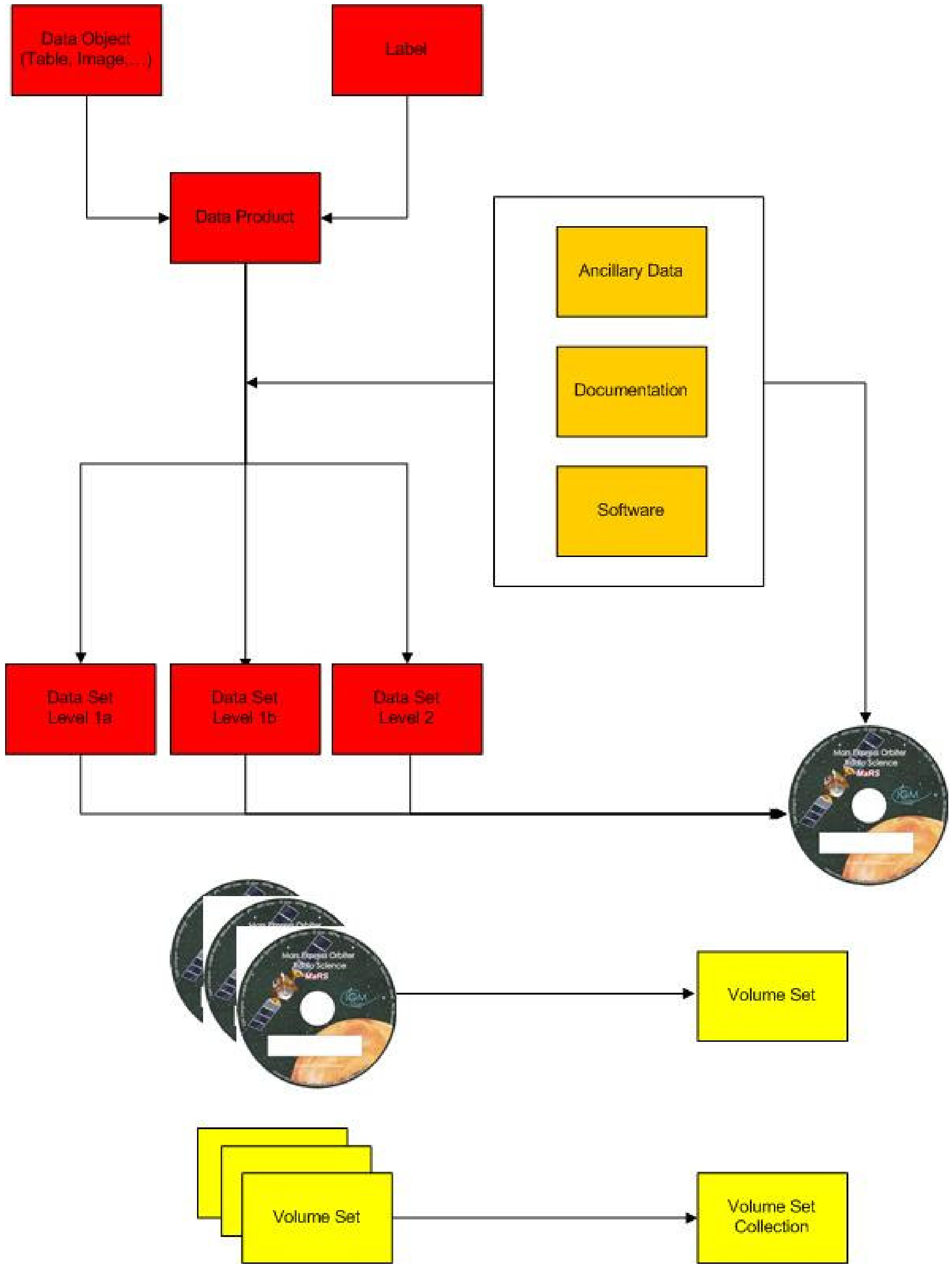


Figure 9.1-1: Data Set Collection, Data Sets and Data Products

9.2 Volume and Dataset Name Specification

9.2.1 Dataset

9.2.1.1 Dataset ID

The Data Set ID is a unique alphanumeric identifier for the MaRS, VeRa and RSI data products. One data set corresponds to one physical data volume and both have the same four digit sequence number. See Table 9-1 for more information.

XXX-Y-ZZZ-U-VVV-NNNN-WWW

Acronym	Description	Example
XXX	Instrument Host ID	MEX ROS VEX
Y	Target ID	M (Mars) V (Venus) C (Comet Churyumov-Gerasimenko) L (asteroid Lutetia) S (asteroid Steins)
ZZZ	Instrument ID	MRS RSI VRA
U	Data level[2] (CODMAC Level)	1 raw data/ESOC/DDS 2 edited raw data 3 calibrated data 5 derived/scientific data 1/2/3 (Data set contains raw, calibrated and Higher Level DATA)
VVV	Data description	CVP commissioning CR1 cruise first part PRM prime mission ENT extended mission
NNNN	A 4 digit sequence number which is identical to the sequence number in the corresponding volume's VOLUME_ID	0123
WWW	Version number	V1.0

Table 9-1: Dataset ID

[2] In the keyword DATA_SET_ID the CODMAC-levels are used instead of PSA-level. In all other file names and documents we keep PSA-level.

Examples:

MEX-M-MRS-1/2/3-PRM-1144-V1.0
ROS-C-RSI-1/2/3-MCO-0099-V2.0
VEX-V-VRA-1/2/3-MCO-0124-V1.0

It should be noted that the MaRS mission phase names used in the data_set_id **do not** correspond to the mission phase names as defined from ESA for Mars Express. However, since the radio science team tries has to archive data for Mars Express as well as for Venus Express and Rosetta, it was granted the use of spacecraft-independent mission phase names which can be used for all three missions.

For the mission_phases definition see

Acronym	Description	Timespan
For Rosetta		
NEV	Near Earth Verification	2004-03-02 at 00:00:00 UTC to 2004-05-31 at 23:59:59 UTC
CR1	Cruise 1	2004-06-01 at 00:00:00 UTC to tbd
FB1	Flyby 1	2005-03-01 at 00:00:00 UTC to 2005-03-31 at 23:59:59 UTC
AS1	Asteroid Flyby 1	2008
AS2	Asteroid Flyby 2	2010
MCO	Mission Comissioning	tbd
PRM	Prime Mission	tbd
ENT	Extended Mission	tbd

Acronym	Description	Timespan
For Venus Express		
NEV	Near Earth Verification	2005-10 to tbd
CR1	Cruise 1	2005-10 to 2006-03
ARR	Arrival	2006-04
MCO	Mission Comissioning	2006-04 to 2006-07
PRM	Prime Mission	2006-08-01 at 00:00:00 UTC to 2007-10-30 at 23:59:59 UTC
ENT	Extended Mission	tbd

Table 9-2.

Acronym	Description	Timespan
For Mars Express		
NEV	Near Earth Verification	2003-06-02 at 00:00:00 UTC to 2003-07-31 at 23:59:59 UTC
CR1	Cruise 1	2003-08-01 at 00:00:00 UTC to 2003-12-25 at 23:59:59 UTC

MCO	Mission Comissioning	2003-12-26 at 00:00:00 UTC to 2004-06-30 at 23:59:59 UTC
PRM	Prime Mission	2004-07-01 at 00:00:00 UTC to 2005-11-30 at 23:59:59 UTC
ENT	Extended Mission	tbd

Acronym	Description	Timespan
	For Rosetta	
NEV	Near Earth Verification	2004-03-02 at 00:00:00 UTC to 2004-05-31 at 23:59:59 UTC
CR1	Cruise 1	2004-06-01 at 00:00:00 UTC to tbd
FB1	Flyby 1	2005-03-01 at 00:00:00 UTC to 2005-03-31 at 23:59:59 UTC
AS1	Asteroid Flyby 1	2008
AS2	Asteroid Flyby 2	2010
MCO	Mission Comissioning	tbd
PRM	Prime Mission	tbd
ENT	Extended Mission	tbd

Acronym	Description	Timespan
	For Venus Express	
NEV	Near Earth Verification	2005-10 to tbd
CR1	Cruise 1	2005-10 to 2006-03
ARR	Arrival	2006-04
MCO	Mission Comissioning	2006-04 to 2006-07
PRM	Prime Mission	2006-08-01 at 00:00:00 UTC to 2007-10-30 at 23:59:59 UTC
ENT	Extended Mission	tbd

Table 9-2: Mission phase description

9.2.1.2 Dataset name

The dataset name is the full name of the dataset already identifiable by a dataset id. Dataset names shall be at most 60 characters in length and must be in upper case. See Table 9-3 for more information.

Description	**Example**
Instrument Host Name	MARS EXPRESS ROSETTA ORBITER VENUS EXPRESS
Target name	MARS VENUS 67P (for Comet Churyumov-Gerasimenko) LUTETIA (tbc) STEINS (tbc)
Instrument id	MRS (tbc) RSI (tbc) VRA (tbc)
Data description	MISSION COMMISSIONING CRUISE 1 PRIME MISSION EXTENDED MISSION
A 4 digit sequence number which is identical to the sequence number in the corresponding volume’s VOLUME_ID	0123
Version number	V1.0

Table 9-3: Datset name

Examples:

MARS EXPRESS MARS MRS MISSION COMISSIONING 0123 V1.0
VENUS EXPRESS VENUS VRA PRIME MISSION 0099 V2.0
ROSETTA ORBITER 67P RSI CRUISE 1 1144 V3.0

9.2.2 Dataset Collection

9.2.2.1 Dataset Collection ID

The data set collection ID element is a unique alphanumeric identifier for a collection of related data sets or data products. The data set collection is treated as a single unit, whose components are selected according to a specific scientific purpose. Components are related by observation type, discipline, target, time, or other classifications. See Table 9-2 for more information.

XXX_Y_ZZZ_U_VVV_IIIIIIIII_TTT

Acronym	Description	Example
XXX	Instrument Host ID	MEX ROS VEX
Y	Target ID	M (Mars) V (Venus) C (Comet P/Churyumov-Gerasimenko) A (asteroid tbd)
ZZZ	Instrument ID	MRS RSI VRA
U	Data Level[3]	1 (Raw Data of level 1a and 1b) 2 (Calibrated Data) 3-5 (Higher Level Data) 1/2/3 (Data set contains raw, calibrated and Higher Level DATA)
VVV	Data Description (Acronym)	MCO commissioning CR1 cruise first part PRM prime mission ENT extended mission
IIIIIIIII	Data Description (Detailed)	ROCC Occulation Profiles GRAV Gravity Data RANG Apocenter Ranging BSR Bistatic Radar Spectra PHOBOS Phobos Flyby SUPCON superior solar conjunction INFCON inferior solar conjunction

[3] In the keyword DATA_COLLECTION_ID the CODMAC-levels are used instead of PSA-level. In all other file names and documents we keep PSA-level.

TTT	Version Number	V1.0

Table 9-4: Dataset Collection ID

Examples:

MEX-M-MRS-5-PRM-ROCC-V1.0
ROS-W-RSI-5-MCO-GRAV-V2.0
VEX-V-VRA-5-MCO-BSR-V1.0

9.2.3 Volume

9.2.3.1 Volume ID

The Volume ID provides a unique identifier for a single MaRS, RSI or VeRa data volume, typically a physical CD-ROM or DVD. The volume ID is also called “volume label” by the various CD-ROM recording software packages. The Volume ID is formed using an instrument identifier of 3 characters, followed by an underscore character, followed by a 4 digit sequence number. There can be several version of the same volume, if for example the archiving software changed during the archiving process or errors occurred during the initial production. This is indicated by the Volume Version ID, a string, which consists of a ‘V’ for Version followed by a sequence number indicating the revision number. Please note that the Volume_Version_ID is a independent keyword and is not part of the actual Volume ID. See Table 9-5 for more information.

XXXXXX_ZZZZ VV.V

Acronym	Description	Example
XXXXXX	Mission and Instrument ID	MEXMRS ROSRSI VEXVRA
ZZZZ	4 digit sequence number	0001
VV.V	Volume version ID	V1.0

Table 9-5: Volume ID

Examples:

MEXMRS_0001 V1.0
ROSRSI_0999 V1.0
VEXVRA_0508 V1.0

If a volume is redone because of errors in the initial production or because of a change in the archiving software during the archiving process, the volume ID remains the same, and the Volume Version ID will be incremented.

9.2.3.2 Volume Name

The VOLUME NAME contains the name of the physical data volume (typically a CD-ROM or DVD) already identifiable by its VOLUME ID. Both the VOLUME ID and the VOLUME NAME are printed on the CD-ROM or DVD label (see Figure xx).

xxxxxx_zzzz_yyyy_ddd vv.v

Acronym	Description	Example
xxxxxx	Mission and Instrument ID	MEXMRS ROSRSI VEXVRA
zzzz	4 digit sequence number	0001
yyyy	Year of measurement	2004
ddd	Day of year of measurement	180
vv.v	Volume version ID	V1.0

Table 9-6: Volume name definition

Examples:

MEXMRS_0001_2003_180 V1.0
ROSRSI_0999_2016_355 V1.0
VEXVRA_0508_2008_190 V1.0

9.2.4 Volume Set

A volume set consists of a number of volumes.

9.2.4.1 Volume Set ID

The VOLUME SET ID identifies a data volume or a set of volumes. Volume sets are considered as a single orderable entity. VOLUME SET ID shall be at most 60 characters in length, must be in upper case and separated by underscores. See Table 9-7 for more information.

XXX_YYYY_ZZZ_WWW_UVVV

Acronym	Description	Example
XXX	Abbreviation of the country of origin	GER USA
YYYY	The government branch	UNIK NASA
ZZZ	Discipline within branch	IGM
WWW	Mission and Instrument ID	MEXMRS ROSRSI VEXVRA
UVVV	A 4 digit sequence identifier The “U” digit is be used to represent the volume set U = 0 commissioning / cruise = 1 flybys = 2 prime missions = 3 extended missions the trailing “V”s are wildcards that represent the range of volumes in the set	0099

Table 9-7: Volume Set ID

Examples (tbc):

GER_UNIK_IGM_MEXMRS_0099
USA_NASA_JPL_MEXMRS_0098

9.2.4.2 Volume Set Name

The VOLUME SET NAME provides the full, formal name of a group of data volumes containing a data set or a collection of related data sets. Volume set names shall be at most 60 characters in length and must be in upper case. Volume sets are considered as a single orderable entity. In certain cases, the volume set name can be the same as the volume name, such as when the volume set consists of only one volume.

Spacecraft	Example
Mars Express	MEX: RADIO SCIENCE OCCULTATION MEX: RADIO SCIENCE GLOBAL GRAVITY MEX: RADIO SCIENCE TARGET GRAVITY MEX: RADIO SCIENCE SOLAR CORONA MEX: RADIO SCIENCE PHOBOS FLYBY
Venus Express	tbd
Rosetta	tbd

Examples:

MEX: RADIO SCIENCE OCCULTATION
MEX: RADIO SCIENCE GLOBAL GRAVITY

Both the VOLUME SET ID and the VOLUME SET NAME are printed on the CD-ROM or DVD label (see Figure 9.1-1).

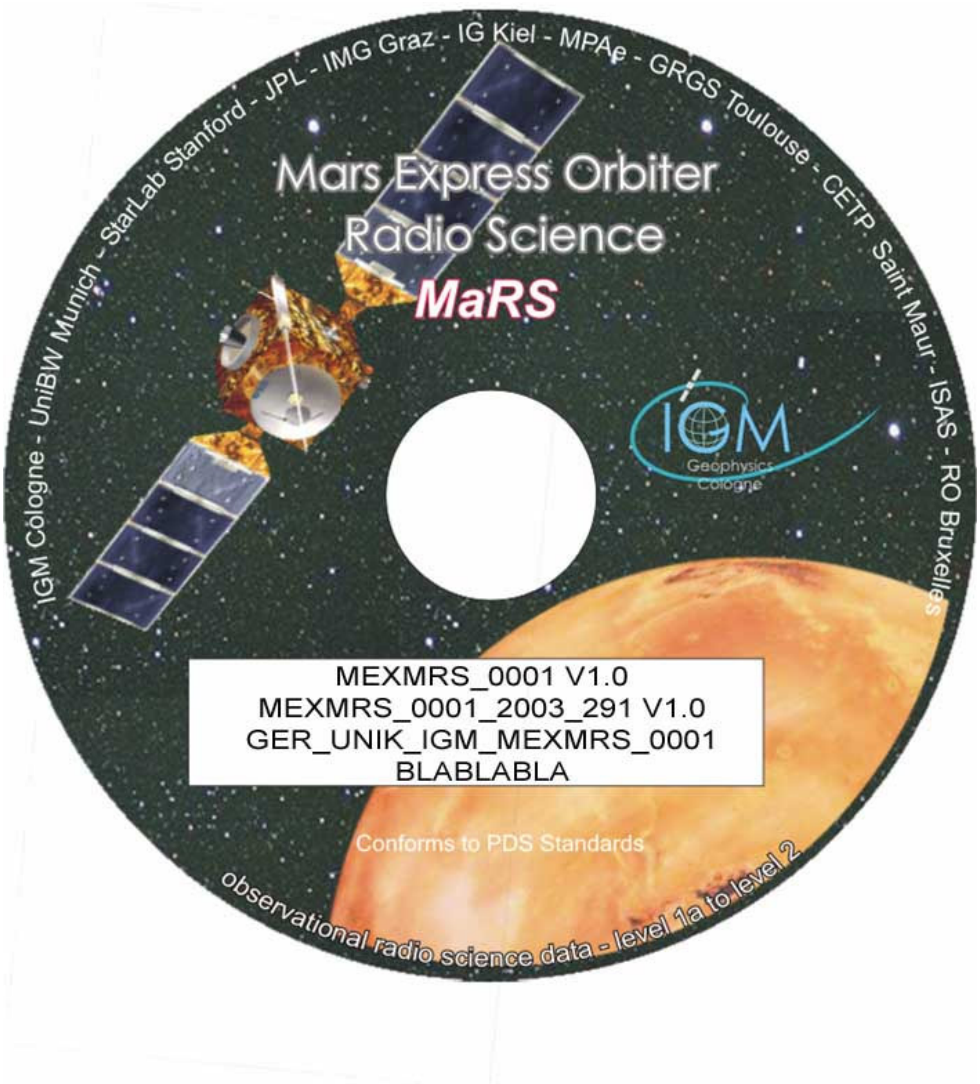


Figure 9-1: Example of a physical archive data volume (CD-ROM or DVD) with appropriate designations printed on the volume label sticker. On the sticker is printed: line 1: Volume_id + Volume_Version_ID, line 2: Volume_name, line 3: Volume_set_id, Line 4:Volume_set_name.

9.2.5 Volume Series

A volume series consists of one or more volume sets that represent data from one or more missions or campaigns.

9.2.5.1 Volume Series Name

The volume_series_name element provides a full, formal name that describes a broad categorization of data products or data sets related to a planetary body or a research campaign. See Table 9-8 for details.

Spacecraft	Example
Mars Express	MISSION TO MARS (tbc)
Venus Express	MISSION TO VENUS (tbc)
Rosetta	MISSION TO SMALL BODIES (tbc)

Table 9-8: Volume Series Name

Examples:

MISSION TO MARS (tbc)
MISSION TO VENUS (tbc)
MISSION TO SMALL BODIES (tbc)

9.3 Formats

9.3.1 Datasets

9.3.1.1 MaRS

See Document *MEX-MRS-IGM-IS-3016* (Radio Science File Naming Convention and Radio Science File Formats)

9.3.1.2 RSI

See Document *ROS-RSI-IGM-IS-3087* (Radio Science File Naming Convention and Radio Science File Formats)

9.3.1.3 VeRa

See Document *VEX-VRA-IGM-IS-3009* (Radio Science File Naming Convention and Radio Science File Formats)

9.3.2 Data Files

For information about the MaRS, RSI and VeRa Level 1a, 1b and 2 Data File Formats see Document *MEX-MRS-IGM-IS-3016* (Radio Science File Naming Convention and Radio Science File Formats)