

Mars Atmosphere and Volatile Evolution (MAVEN) Mission

ANCILLARY DATA

PDS Archive

Software Interface Specification

Rev. 1.3

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**Ancillary Data**

**PDS Archive**

**Software Interface Specification**

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Contents

[1 Introduction 1](#_Toc49959564)

[1.1 Distribution List 1](#_Toc49959565)

[1.2 Document Change Log 1](#_Toc49959566)

[1.3 Abbreviations 2](#_Toc49959567)

[1.4 Glossary 4](#_Toc49959568)

[1.5 MAVEN Mission Overview 6](#_Toc49959569)

[1.5.1 Mission Objectives 6](#_Toc49959570)

[1.5.2 Payload 7](#_Toc49959571)

[1.6 SIS Content Overview 8](#_Toc49959572)

[1.7 Scope of this document 8](#_Toc49959573)

[1.8 Applicable Documents 8](#_Toc49959574)

[1.9 Audience 8](#_Toc49959575)

[2 ANC Data Description 11](#_Toc49959576)

[2.1 Measured Parameters 11](#_Toc49959577)

[3 Data Overview 15](#_Toc49959578)

[3.1 Data Processing Levels 15](#_Toc49959579)

[3.2 Products 16](#_Toc49959580)

[3.3 Product Organization 16](#_Toc49959581)

[3.3.1 Collection and Basic Product Types 17](#_Toc49959582)

[3.4 Bundle Products 17](#_Toc49959583)

[3.5 Data Flow 18](#_Toc49959584)

[4 Archive Generation 20](#_Toc49959585)

[4.1 Data Processing and Production Pipeline 20](#_Toc49959586)

[4.1.1 PDS Peer Review 20](#_Toc49959587)

[4.2 Data Transfer Methods and Delivery Schedule 22](#_Toc49959588)

[4.3 Data Product and Archive Volume Size Estimates 23](#_Toc49959589)

[4.4 Data Validation 23](#_Toc49959590)

[4.5 Backups and duplicates 24](#_Toc49959591)

[4.6 Archive organization and naming 24](#_Toc49959592)

[4.7 Logical Identifiers 24](#_Toc49959593)

[4.7.1 LID Formation 25](#_Toc49959594)

[4.7.2 VID Formation 26](#_Toc49959595)

[4.8 ANC Archive Contents 26](#_Toc49959596)

[4.8.1 ANC DRF Bundle 26](#_Toc49959597)

[4.8.2 ANC Events 28](#_Toc49959598)

[5 Archive product formats 29](#_Toc49959599)

[5.1 Data File Formats 29](#_Toc49959600)

[5.1.1 EPS DRF data file structure 29](#_Toc49959601)

[5.1.2 GNC DRF data file structure 29](#_Toc49959602)

[5.1.3 NGMS DRF data file structure 30](#_Toc49959603)

[5.1.4 PF DRF data file structure 31](#_Toc49959604)

[5.1.5 RS DRF data file structure 33](#_Toc49959605)

[5.1.6 USM DRF data file structure 33](#_Toc49959606)

[5.1.7 SASM DRF file structure 35](#_Toc49959607)

[5.1.8 PTE file structure 35](#_Toc49959608)

[5.1.9 IMU file structure 37](#_Toc49959609)

[5.1.10 Event data file structure 37](#_Toc49959610)

[5.2 PDS Labels 38](#_Toc49959611)

[5.2.1 XML Documents 38](#_Toc49959612)

[5.3 Delivery Package 38](#_Toc49959613)

[5.3.1 The Package 39](#_Toc49959614)

[5.3.2 Transfer Manifest 39](#_Toc49959615)

[5.3.3 Checksum Manifest 39](#_Toc49959616)

[Appendix A Support staff and cognizant persons 40](#_Toc49959617)

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[Appendix B Sample Bundle Product Label 41](#_Toc49959623)

[Appendix C Sample Collection Product Label 48](#_Toc49959624)

[Appendix D Sample Data Product Labels 51](#_Toc49959625)

[D.1 Sample DRF Label 51](#_Toc49959626)

[D.2 Sample IMU Label 55](#_Toc49959627)

[D.3 Sample Events Label 59](#_Toc49959628)

[Appendix E PDS Delivery Package Manifest File Record Structures 63](#_Toc49959629)

[E.1 Transfer Package Directory Structure 63](#_Toc49959630)

[/maven/data/anc/eng/eps/ 63](#_Toc49959631)

[/maven/data/anc/eng/gnc/ 63](#_Toc49959632)

[/maven/data/anc/eng/imu/ 63](#_Toc49959633)

[E.2 Transfer Manifest Record Structure 63](#_Toc49959634)

[E.3 Checksum Manifest Record Structure 63](#_Toc49959635)

**List of Figures**

Figure 1: A graphical depiction of the relationship among bundles, collections, and basic products. 16

Figure 2: MAVEN Ground Data System responsibilities and data flow. Note that this figure includes portions of the MAVEN GDS which are not directly connected with archiving, and are therefore not described in Section 3.5 above. 19

Figure 3: Duplication and dissemination of ANC archive products at PDS/PPI. 24

**List of Tables**

Table 1: Distribution list 1

Table 2: Document change log 1

Table 3: Abbreviations and their meaning 2

Table 4: List of Mission Events 11

Table 5: List of Science Events 14

Table 6: Data processing level designations 15

Table 7: Collection Product types 17

Table 8: ANC Bundles 18

Table 9: MAVEN PDS review schedule 21

Table 10: Archive Bundle Delivery Schedule 22

Table 11: DRF file type and ANC collections 26

Table 12: ANC Calibrated Science Data Documents 27

Table 13: ANC Events Collection 28

Table 14: EPS DRF data file record structure 29

Table 15: GNC DRF data file record structure 29

Table 16: NGMS DRF data file record structure 30

Table 17: PF DRF data file record structure 31

Table 18: RS DRF data file record structure 33

Table 19: USM DRF data file record structure 34

Table 20: RS DRF data file record structure 35

Table 21: PTE DRF data file record structure 35

Table 22: IMU data file record structure 37

Table 23: Event data file record structure 37

Table 24: Archive support staff 40

# Introduction

This software interface specification (SIS) describes the format and content of the MAVEN Ancillary Data (ANC) Planetary Data System (PDS) data archive. It includes descriptions of the data products and associated metadata, and the archive format, content, and generation pipeline.

## Distribution List

Table 1: Distribution list

| **Name** | **Organization** | **Email** |
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## Document Change Log

Table 2: Document change log

|  |  |  |  |
| --- | --- | --- | --- |
| **Version** | **Change** | **Date** | **Affected portion** |
| 0.1 | Initial draft | 2014-Feb-20 | All |
| 1.0 | First released version | 2014-Mar-24 | All |
| 1.1 | Second released version | 2014-Dec-02 | Changes:  removed TBD table  added reference to Juno DRF SIS  Table 8: updated schedule  5.2.1: added SASM1-3, PTE, IMU, TRK files |
| 1.2 | Third released version | 2017-Jan-11 | Changes:  -Added tables for Event Ids in Section 2  -Added a note about missing data in DRFs in section 5.1  -Made changes throughout document to reflect that events are now split between “mission” and “science” event files. |
| 1.3 | Peer review lien resolution version | 2020-Sep-09 | Changes:   * Section 1.8: Updated Applicable Documents list * Removed references to Juno DRF SIS (the SIS is ITAR restricted) * Section 5.1: Revised to describe PPI DRF editing * Appendices B-D: Added sample labels |

## Abbreviations

Table 3: Abbreviations and their meaning

| **Abbreviation** | **Meaning** |
| --- | --- |
| ASCII | American Standard Code for Information Interchange |
| Atmos | PDS Atmospheres Node (NMSU, Las Cruces, NM) |
| CCSDS | Consultative Committee for Space Data Systems |
| CDR | Calibrated Data Record |
| CFDP | CCSDS File Delivery Protocol |
| CK | C-matrix Kernel (NAIF orientation data) |
| CODMAC | Committee on Data Management, Archiving, and Computing |
| CRC | Cyclic Redundancy Check |
| CU | University of Colorado (Boulder, CO) |
| DAP | Data Analysis Product |
| DDR | Derived Data Record |
| DMAS | Data Management and Storage |
| DPF | Data Processing Facility |
| DRF | Data Return File |
| E&PO | Education and Public Outreach |
| EDR | Experiment Data Record |
| EUV | Extreme Ultraviolet; also used for the EUV Monitor, part of LPW (SSL) |
| FEI | File Exchange Interface |
| FOV | Field of View |
| FTP | File Transfer Protocol |
| GB | Gigabyte(s) |
| GSFC | Goddard Space Flight Center (Greenbelt, MD) |
| HK | Housekeeping |
| HTML | Hypertext Markup Language |
| ICD | Interface Control Document |
| IM | Information Model |
| IMU | Inertial Measurement Unit |
| ISO | International Standards Organization |
| ITF | Instrument Team Facility |
| IUVS | Imaging Ultraviolet Spectrograph (LASP) |
| JPL | Jet Propulsion Laboratory (Pasadena, CA) |
| LASP | Laboratory for Atmosphere and Space Physics (CU) |
| LID | Logical Identifier |
| LIDVID | Versioned Logical Identifer |
| LPW | Langmuir Probe and Waves instrument (SSL) |
| MAG | Magnetometer instrument (GSFC) |
| MAVEN | Mars Atmosphere and Volatile EvolutioN |
| MB | Megabyte(s) |
| MD5 | Message-Digest Algorithm 5 |
| MOI | Mars Orbit Insertion |
| MOS | Mission Operations System |
| MSA | Mission Support Area |
| NAIF | Navigation and Ancillary Information Facility (JPL) |
| NASA | National Aeronautics and Space Administration |
| NGIMS | Neutral Gas and Ion Mass Spectrometer (GSFC) |
| NMSU | New Mexico State University (Las Cruces, NM) |
| NSSDC | National Space Science Data Center (GSFC) |
| PCK | Planetary Constants Kernel (NAIF) |
| PDS | Planetary Data System |
| PDS4 | Planetary Data System Version 4 |
| PF | Particles and Fields (instruments) |
| PPI | PDS Planetary Plasma Interactions Node (UCLA) |
| PTE | Periapsis Timing Estimator |
| RS | Remote Sensing (instruments) |
| SASM | Solar Array Switch Module |
| SCET | Spacecraft Event Time |
| SDC | Science Data Center (LASP) |
| SCLK | Spacecraft Clock |
| SEP | Solar Energetic Particle instrument (SSL) |
| SIS | Software Interface Specification |
| SOC | Science Operations Center (LASP) |
| SPE | Solar Particle Event |
| SPICE | Spacecraft, Planet, Instrument, C-matrix, and Events (NAIF data format) |
| SPK | Spacecraft and Planetary ephemeris Kernel (NAIF) |
| SSL | Space Sciences Laboratory (UCB) |
| STATIC | Supra-Thermal And Thermal Ion Composition instrument (SSL) |
| SWEA | Solar Wind Electron Analyzer (SSL) |
| SWIA | Solar Wind Ion Analyzer (SSL) |
| TBC | To Be Confirmed |
| TBD | To Be Determined |
| UCB | University of California, Berkeley |
| UCLA | University of California, Los Angeles |
| URN | Uniform Resource Name |
| UV | Ultraviolet |
| XML | eXtensible Markup Language |

## Glossary

**Archive –** A place in which public records or historical documents are preserved; also the material preserved – often used in plural. The term may be capitalized when referring to all of PDS holdings – the PDS Archive.

**Basic Product** – The simplest product in PDS4; one or more data objects (and their description objects), which constitute (typically) a single observation, document, etc. The only PDS4 products that are *not* basic products are collection and bundle products.

**Bundle** **Product** – A list of related collections. For example, a bundle could list a collection of raw data obtained by an instrument during its mission lifetime, a collection of the calibration products associated with the instrument, and a collection of all documentation relevant to the first two collections.

**Class** – The set of attributes (including a name and identifier) which describes an item defined in the PDS Information Model. A class is generic – a template from which individual items may be constructed.

**Collection** **Product** – A list of closely related basic products of a single type (e.g. observational data, browse, documents, etc.). A collection is itself a product (because it is simply a list, with its label), but it is not a *basic* product.

**Data Object –** A generic term for an object that is described by a description object. Data objects include both digital and non-digital objects.

**Description Object –** An object that describes another object. As appropriate, it will have structural and descriptive components. In PDS4 a ‘description object’ is a digital object – a string of bits with a predefined structure.

**Digital Object –** An object which consists of real electronically stored (digital) data.

**Identifier** – A unique character string by which a product, object, or other entity may be identified and located. Identifiers can be global, in which case they are unique across all of PDS (and its federation partners). A local identifier must be unique within a label.

**Label –** The aggregation of one or more description objects such that the aggregation describes a single PDS product. In the PDS4 implementation, labels are constructed using XML.

**Logical Identifier** (**LID**) – An identifier which identifies the set of all versions of a product.

**Versioned Logical Identifier (LIDVID)** – The concatenation of a logical identifier with a version identifier, providing a unique identifier for each version of product.

**Manifest** - A list of contents.

**Metadata** – Data about data – for example, a ‘description object’ contains information (metadata) about an ‘object.’

**Non-Digital Object –** An object which does not consist of digital data. Non-digital objects include both physical objects like instruments, spacecraft, and planets, and non-physical objects like missions, and institutions. Non-digital objects are labeled in PDS in order to define a unique identifier (LID) by which they may be referenced across the system.

**Object** – A single instance of a class defined in the PDS Information Model.

**PDS Information Model –** The set of rules governing the structure and content of PDS metadata. While the Information Model (IM) has been implemented in XML for PDS4, the model itself is implementation independent.

**Product** – One or more tagged objects (digital, non-digital, or both) grouped together and having a single PDS-unique identifier. In the PDS4 implementation, the descriptions are combined into a single XML label. Although it may be possible to locate individual objects within PDS (and to find specific bit strings within digital objects), PDS4 defines ‘products’ to be the smallest granular unit of addressable data within its complete holdings.

**Tagged Object** – An entity categorized by the PDS Information Model, and described by a PDS label.

**Registry** – A data base that provides services for sharing content and metadata.

**Repository** – A place, room, or container where something is deposited or stored (often for safety).

**XML** – eXtensible Markup Language.

**XML schema** – The definition of an XML document, specifying required and optional XML

elements, their order, and parent-child relationships.

## MAVEN Mission Overview

The MAVEN mission is scheduled to launch on an Atlas V between November 18 and December 7, 2013. After a ten-month ballistic cruise phase, Mars orbit insertion will occur on or after September 22, 2014. Following a 5-week transition phase, the spacecraft will orbit Mars at a 75° inclination, with a 4.5 hour period and periapsis altitude of 140-170 km (density corridor of 0.05-0.15 kg/km3). Over a one-Earth-year period, periapsis will precess over a wide range of latitude and local time, while MAVEN obtains detailed measurements of the upper atmosphere, ionosphere, planetary corona, solar wind, interplanetary/Mars magnetic fields, solar EUV and solar energetic particles, thus defining the interactions between the Sun and Mars. MAVEN will explore down to the homopause during a series of five 5-day “deep dip” campaigns for which periapsis will be lowered to an atmospheric density of 2 kg/km3 (~125 km altitude) in order to sample the transition from the collisional lower atmosphere to the collisionless upper atmosphere. These five campaigns will be interspersed though the mission to sample the subsolar region, the dawn and dusk terminators, the anti-solar region, and the north pole.

### Mission Objectives

The primary science objectives of the MAVEN project will be to provide a comprehensive picture of the present state of the upper atmosphere and ionosphere of Mars and the processes controlling them and to determine how loss of volatiles to outer space in the present epoch varies with changing solar conditions. Knowing how these processes respond to the Sun’s energy inputs will enable scientists, for the first time, to reliably project processes backward in time to study atmosphere and volatile evolution. MAVEN will deliver definitive answers to high-priority science questions about atmospheric loss (including water) to space that will greatly enhance our understanding of the climate history of Mars. Measurements made by MAVEN will allow us to determine the role that escape to space has played in the evolution of the Mars atmosphere, an essential component of the quest to “follow the water” on Mars. MAVEN will accomplish this by achieving science objectives that answer three key science questions:

* What is the current state of the upper atmosphere and what processes control it?
* What is the escape rate at the present epoch and how does it relate to the controlling processes?
* What has the total loss to space been through time?

MAVEN will achieve these objectives by measuring the structure, composition, and variability of the Martian upper atmosphere, and it will separate the roles of different loss mechanisms for both neutrals and ions. MAVEN will sample all relevant regions of the Martian atmosphere/ionosphere system—from the termination of the well-mixed portion of the atmosphere (the “homopause”), through the diffusive region and main ionosphere layer, up into the collisionless exosphere, and through the magnetosphere and into the solar wind and downstream tail of the planet where loss of neutrals and ionization occurs to space—at all relevant latitudes and local solar times. To allow a meaningful projection of escape back in time, measurements of escaping species will be made simultaneously with measurements of the energy drivers and the controlling magnetic field over a range of solar conditions. Together with measurements of the isotope ratios of major species, which constrain the net loss to space over time, this approach will allow thorough identification of the role that atmospheric escape plays today and to extrapolate to earlier epochs.

### Payload

MAVEN will use the following science instruments to measure the Martian upper atmospheric and ionospheric properties, the magnetic field environment, the solar wind, and solar radiation and particle inputs:

* NGIMS Package:
  + Neutral Gas and Ion Mass Spectrometer (NGIMS) measures the composition, isotope ratios, and scale heights of thermal ions and neutrals.
* RS Package:
  + Imaging Ultraviolet Spectrograph (IUVS) remotely measures UV spectra in four modes: limb scans, planetary mapping, coronal mapping and stellar occultations. These measurements provide the global composition, isotope ratios, and structure of the upper atmosphere, ionosphere, and corona.
* PF Package:
  + Supra-Thermal and Thermal Ion Composition (STATIC) instrument measures the velocity distributions and mass composition of thermal and suprathermal ions from below escape energy to pickup ion energies.
  + Solar Energetic Particle (SEP) instrument measures the energy spectrum and angular distribution of solar energetic electrons (30 keV – 1 MeV) and ions (30 keV – 12 MeV).
  + Solar Wind Ion Analyzer (SWIA) measures solar wind and magnetosheath ion density, temperature, and bulk flow velocity. These measurements are used to determine the charge exchange rate and the solar wind dynamic pressure.
  + Solar Wind Electron Analyzer (SWEA) measures energy and angular distributions of 5 eV to 5 keV solar wind, magnetosheath, and auroral electrons, as well as ionospheric photoelectrons. These measurements are used to constrain the plasma environment, magnetic field topology and electron impact ionization rate.
  + Langmuir Probe and Waves (LPW) instrument measures the electron density and temperature and electric field in the Mars environment. The instrument includes an EUV Monitor that measures the EUV input into Mars atmosphere in three broadband energy channels.
  + Magnetometer (MAG) measures the vector magnetic field in all regions traversed by MAVEN in its orbit.

## SIS Content Overview

Section 2 describes the ancillary data required for science processing. Section 3 gives an overview of data organization and data flow. Section 4 describes data archive generation, delivery, and validation. Section 4.6 describes the archive structure and archive production responsibilities. Section 5 describes the file formats used in the archive, including the data product record structures. Individuals involved with generating the archive volumes are listed in Appendix A. Appendix B contains a description of the MAVEN science data file naming conventions. Appendix C, Appendix D, and Appendix D contain sample PDS product labels. Appendix E describes ANC archive product PDS deliveries formats and conventions.

## Scope of this document

The specifications in this SIS apply to all ANC products submitted for archive to the Planetary Data System (PDS), for all phases of the MAVEN mission. This document includes descriptions of archive products that are produced by both the SDC and by PDS.

## Applicable Documents

1. The PDS4 Data Provider’s Handbook, Version 1.13.0, October 23, 2019.
2. Planetary Data System Standards Reference, Version 1.13.0, October 24, 2019, JPL D-7669, Part 2.
3. PDS4 Dictionary Document, Version 1.13.0, December 2019.
4. PDS4 Information Model Specification, Version 1.13.0.0, December 2019.
5. Mars Atmosphere and Volatile Evolution (MAVEN) Science Data Management Plan, Rev. C, doc. no.MAVEN-SOPS-PLAN-0068.
6. King, T., and J. Mafi, Archive of MAVEN CDF in PDS4, July 16, 2013.
7. Juno Software Interface Specification: Data Return File (DRF): SIS\_DRF\_MVN.pdf

## Audience

This document serves both as a SIS and Interface Control Document (ICD). It describes both the archiving procedure and responsibilities, and data archive conventions and format. It is designed to be used both by the instrument teams in generating the archive, and by those wishing to understand the format and content of the ANC PDS data product archive collection. Typically, these individuals would include scientists, data analysts, and software engineers.

# ANC Data Description

The ancillary data to be archived includes two different datasets: all spacecraft and instrument data which is required for science processing, and a time-ordered list of mission events. This dataset does not include science data from the instruments, which will be archived in the instrument archives, or SPICE kernels, which are archived separately at NAIF. Due to ITAR restrictions, this archive does not include all spacecraft and instrument housekeeping data, but only that which is applicable to the science processing. MAVEN was granted an ITAR 125.4(b)(13) exemption by the GSFC Export Control Office for spacecraft and instrument engineering data that is needed for science processing. Descriptions of instrument and spacecraft calibration are covered in the instrument SISs and the spacecraft documentation

MAVEN spacecraft and ancillary data files are contained in Data Return Files (DRFs), which are ASCII files generated by the Mission Support Area and delivered to the Science Operations Center (SOC) for distribution to the MAVEN team.

The MAVEN Mission Events List will be captured in a set of ASCII files generated from a database stored at the SDC. Events include spacecraft and instrument events collected by the Payload Operations Center (POC), and geophysical events submitted by the science team.

## Measured Parameters

The complete set of ancillary data to be used for science processing is documented in MVN-OIA-21.

A list of events to be collected in the Events List is given in Table 4 and Table 5 below, with the caveat that part of the point of the event list is to capture unexpected events that may affect the science data. There are two types of events: Mission Events and Science Events. Mission Events are collected by the POC, either routinely or intermittently in the case of anomalies, while Science Events are external events not related to the spacecraft and instrument operations which may have some impact on the science data. These external events are collected and input in the database by the MAVEN science team. The event list is not intended to be exhaustive, but is intended as a useful reference in case of unexplained quirks in the science data.

Table 4: List of Mission Events

|  |  |  |
| --- | --- | --- |
| **event\_type\_id** | **Description** | **Source** |
| 1 | RSP instrument power on event | Integrated Report (IR) |
| 2 | RSP instrument power off event | IR |
| 3 | MAG1 instrument power off event | IR |
| 4 | MAG2 instrument power off event | IR |
| 5 | SWIA instrument power off event | IR |
| 6 | SWEA instrument power off event | IR |
| 7 | SWEA instrument power on event | IR |
| 8 | LPW and EUV instrument power off event | IR |
| 9 | LPW and EUV instrument power on event | IR |
| 10 | STATIC instrument power off event | IR |
| 11 | STATIC instrument power on event | IR |
| 12 | SEP1 and SEP2 instrument power off event | IR |
| 13 | SEP1 and SEP2 instrument power on event | IR |
| 14 | MAG1 instrument power on event | IR |
| 15 | MAG2 instrument power on event | IR |
| 16 | SWIA instrument power on event | IR |
| 17 | NGIMS instrument power on event | IR |
| 18 | NGIMS instrument power off event | IR |
| 19 | RSP High Voltage is off | IR |
| 20 | SEP1 attenuator armed | IR |
| 21 | SEP2 attenuator armed | IR |
| 22 | Reaction wheel momentum desaturation event start | IR |
| 23 | Start of thruster firing – Trajectory Change Maneuver (TCM) | IR |
| 24 | Start of MOI thruster firing – Trajectory Change Maneuver (TCM) | IR |
| 25 | Spacecraft attitude slew event started | IR |
| 26 | DSN Earth comm pass event started | IR |
| 27 | Start of orbit | IR |
| 28 | Start of apoapse orbit segment | IR |
| 29 | Start of periapse orbit segment | IR |
| 30 | Start of inbound side orbit segment | IR |
| 31 | Start of outbound side orbit segment | IR |
| 32 | RSP High Voltage Commanded On | IR |
| 33 | SEP1 attenuator disarmed | IR |
| 34 | SEP2 attenuator disarmed | IR |
| 35 | Reaction wheel momentum desaturation event ended | IR |
| 36 | End of thruster firing – Trajectory Change Maneuver (TCM) | IR |
| 37 | End of MOI thruster firing – Trajectory Change Maneuver (TCM) | IR |
| 38 | Spacecraft slew event ended | IR |
| 39 | DSN Earth comm pass event ended | IR |
| 40 | Spacecraft entered eclipse | SPICE |
| 41 | Spacecraft exited eclipse | SPICE |
| 42 | EUV Aperture allowed to open | IR |
| 43 | EUV Aperture closed | IR |
| 44 | SWEA High Voltage disarmed | IR |
| 45 | SWIA High Voltage disarmed | IR |
| 46 | SWIA High Voltage armed | IR |
| 47 | SWEA High Voltage armed | IR |
| 48 | STATIC High Voltage armed | IR |
| 49 | STATIC High Voltage disarmed | IR |
| 81 | Launch time for MAVEN | Manual Insert |
| 101 | RSP/PFP powered off preceding spacecraft reset | Manual Insert |
| 102 | Ground commanded reset (heartbeat termination) | Manual Insert |
| 103 | Spacecraft entered safemode | Manual Insert |
| 104 | Spacecraft exited safemode | Manual Insert |
| 105 | Start of solar conjunction | Manual Insert |
| 106 | Solar conjunction exit | Manual Insert |
| 161 | Deep Dip Operations in progress | Manual Insert |
| 162 | Orbital trim maneuver start | Manual Insert |
| 163 | Orbital trim maneuver end | Manual Insert |
| 164 | MAG roll | Manual Insert |
| 181 | IUVS Stellar Occultation campaign in progress | Manual Insert |
| 241 | Close approach to Phobos | Manual Insert |
| 261 | PFP EEPROM | Manual Insert |
| 262 | Official start of science | Manual Insert |
| 263 | APP powered off event | Manual Insert |
| 264 | NGIMS library update | Manual Insert |

Table 5: List of Science Events

|  |  |  |
| --- | --- | --- |
| **id** | **Event type** | **Source** |
| 1 | CME, Flare | Manual Insert |
| 2 | CME, SEP | Manual Insert |
| 3 | Flare, SEP | Manual Insert |
| 118 | CME, FLARE | Manual Insert |
| 119 | Flare | Manual Insert |
| 157 | Dust Storm Onset | Manual Insert |
| 158 | Dust Storm Cessation | Manual Insert |
| 203 | Aurora | Manual Insert |
| 205 | solar wind stream, SEP | Manual Insert |

# Data Overview

This section provides a high level description of archive organization under the PDS4 Information Model (IM) as well as the flow of the data from the spacecraft through delivery to PDS. Unless specified elsewhere in this document, the MAVEN ANC archive conforms with version 1.1.0.1 of the PDS4 IM [4].

## Data Processing Levels

A number of different systems may be used to describe data processing level. This document refers to data by their PDS4 processing level. Table 6 provides a description of these levels along with the equivalent designations used in other systems.

Table 6: Data processing level designations

| **PDS4 processing level** | **PDS4 processing level description** | **MAVEN Processing Level** | **CODMAC Level** | **NASA Level** |
| --- | --- | --- | --- | --- |
| Raw | Original data from an instrument. If compression, reformatting, packetization\*, or other translation has been applied to facilitate data transmission or storage, those processes are reversed so that the archived data are in a PDS approved archive format. | 0 | 1 | 0 |
| Reduced | Data that have been processed beyond the raw stage but which are not yet entirely independent of the instrument. | 1 | 2 | 1A |
| Calibrated | Data converted to physical units entirely independent of the instrument. | 2 | 3 | 1B |
| Derived | Results that have been distilled from one or more calibrated data products (for example, maps, gravity or magnetic fields, or ring particle size distributions). Supplementary data, such as calibration tables or tables of viewing geometry, used to interpret observational data should also be classified as ‘derived’ data if not easily matched to one of the other three categories. | 3+ | 4+ | 2+ |

\* PDS does not accept packetized data (CODMAC level 1/NASA level 0) as fulfilling the requirement for the archive of raw data. The PDS/PPI node, however, has agreed to an exception for the MAVEN mission with the understanding that the MAVEN packetized data are not compressed, and may be described as fixed width binary tables. Typically the minimum reduction level accepted by PDS for “raw” data is CODMAC level 2, or NASA level 1A.

## Products

A PDS product consists of one or more digital and/or non-digital objects, and an accompanying PDS label file. Labeled digital objects are data products (i.e. electronically stored files). Labeled non-digital objects are physical and conceptual entities which have been described by a PDS label. PDS labels provide identification and description information for labeled objects. The PDS label defines a Logical Identifier (LID) by which any PDS labeled product is referenced throughout the system. In PDS4 labels are XML formatted ASCII files. More information on the formatting of PDS labels is provided in Section 5.1.7. More information on the usage of LIDs and the formation of MAVEN LIDs is provided in Section 4.7.

## Product Organization

The highest level of organization for PDS archive is the bundle. A bundle is a list of one or more related collection products which may be of different types. A collection is a list of one or more related basic products which are all of the same type. Figure 1 below illustrates these relationships.

**Bundle**

**Collection A**

**Basic Product A1**

**Basic Product A2**

**Basic Product A3**

**Basic Product A*N***

**…**

**Collection B**

**Basic Product B1**

**Basic Product B2**

**Basic Product B3**

**Basic Product B*N***

**…**

**Collection C**

**Basic Product C1**

**Basic Product C2**

**Basic Product C3**

**Basic Product C*N***

**…**

Figure 1: A graphical depiction of the relationship among bundles, collections, and basic products.

Bundles and collections are logical structures, not necessarily tied to any physical directory structure or organization. Bundle and collection membership is established by a member inventory list. Bundle member inventory lists are provided in the bundle product labels themselves. Collection member inventory lists are provided in separate collection inventory table files. Sample bundle and collection labels are provided in Appendix B and Appendix C, respectively.

### Collection and Basic Product Types

Collections are limited to a single type of basic products. The types of archive collections that are defined in PDS4 are listed in Table 7.

Table 7: Collection Product types

|  |  |
| --- | --- |
| **Collection Type** | **Description** |
| Browse | Contains products intended for data characterization, search, and viewing, and not for scientific research or publication. |
| Calibration | Contains data and files necessary for the calibration of basic products. |
| Context | Contains products which provide for the unique identification of objects which form the context for scientific observations (*e.g.* spacecraft, observatories, instruments, targets, etc.). |
| Document | Contains electronic document products which are part of the PDS Archive. |
| Data | Contains scientific data products intended for research and publication. |
| SPICE | Contains NAIF SPICE kernels. |
| XML\_Schema | Contains XML schemas and related products which may be used for generating and validating PDS4 labels. |

## Bundle Products

The ANC data archive is organized into two bundles. A description of each bundle is provided in Table 8. A more detailed description of the contents and format of each bundle is provided in Section 4.8.

Table 8: ANC Bundles

| **Bundle Logical Identifier** | **PDS4 Reduction Level** | **Description** | **Data Provider** |
| --- | --- | --- | --- |
| urn:nasa:pds:maven.anc.drf | Calibrated | All ancillary DRF files. | SDC |
| urn:nasa:pds:maven.anc.events | Document | Mission Event List | SDC |

## Data Flow

This section describes only those portions of the MAVEN data flow that are directly connected to archiving. A full description of MAVEN data flow is provided in the MAVEN Science Data Management Plan [5]. A graphical representation of the full MAVEN data flow is provided in Figure 2 below.

The ancillary DRF files will be generated by the Mission Support Area (MSA) and delivered to the Science Operations Center (SOC) on a regular basis beginning at launch and continuing throughout the mission. During the mapping phase, deliveries will be made biweekly with the science data. The SOC makes no changes to these files, but delivers them directly to the ITFs for science processing, and to the PDS for archiving.

The event database will be updated with automated data from the POC weekly, after receipt of all data from the MSA needed to generate events. Events will be generated from reconstructed data rather than predicts. Geophysical events will be added as they happen.

The SOC will maintain an active archive of all ancillary MAVEN data required for science processing, and will provide the MAVEN science team with direct access through the life of the MAVEN mission. After the end of the MAVEN project, PDS will be the sole long-term archive for all public MAVEN data.

Data bundles intended for the archive are identified in Table 8.

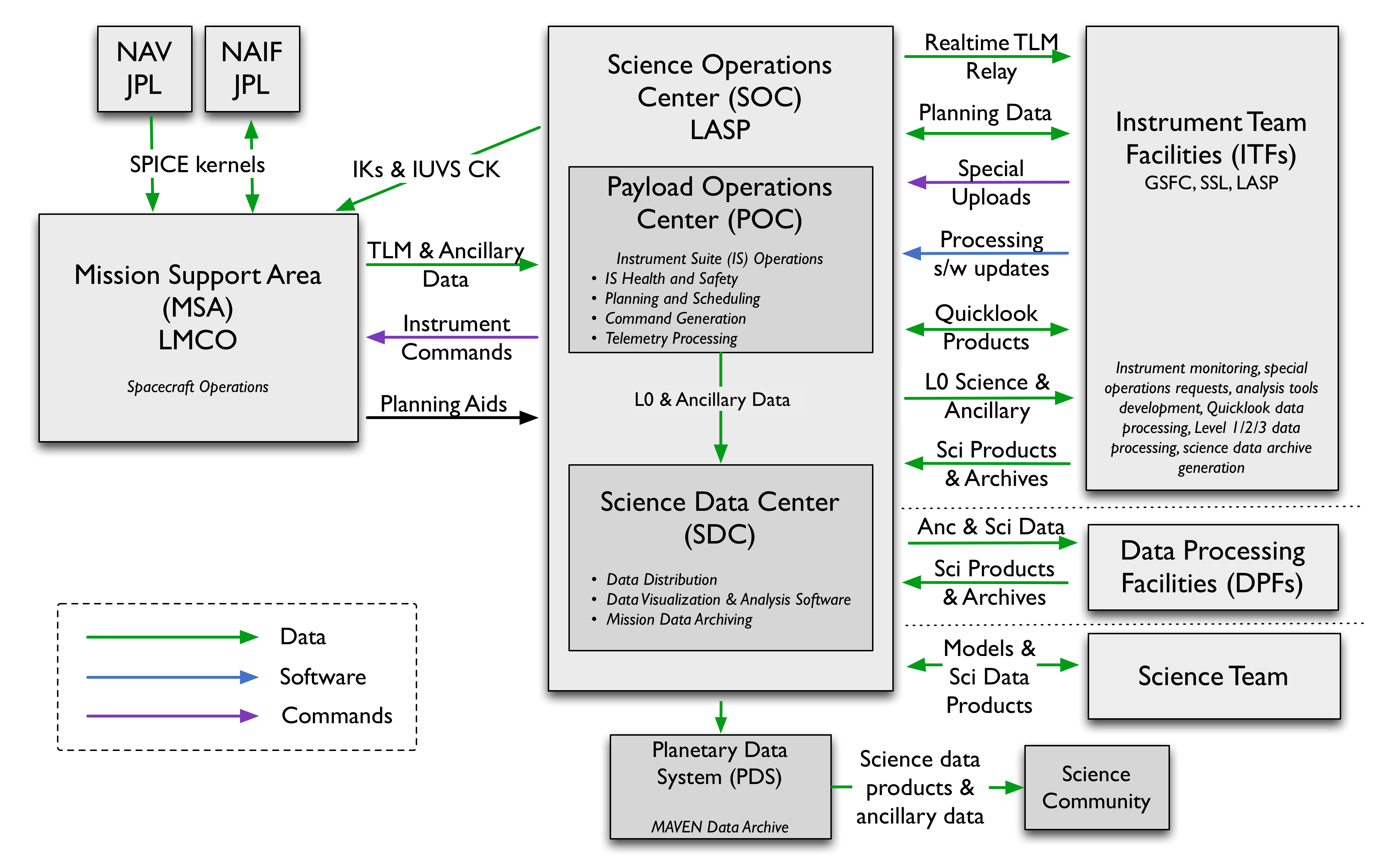


Figure 2: MAVEN Ground Data System responsibilities and data flow. Note that this figure includes portions of the MAVEN GDS which are not directly connected with archiving, and are therefore not described in Section 3.5 above.

# Archive Generation

The ANC archive products are produced by the MSA and SOC with the support of the PDS Planetary Plasma Interactions (PPI) Node at the University of California, Los Angeles (UCLA). The archive volume creation process described in this section sets out the roles and responsibilities of each of these groups. The assignment of tasks has been agreed upon by all parties. Archived data received by the PPI Node from the SOC are made available to PDS users electronically as soon as practicable but no later two weeks after the delivery and validation of the data.

## Data Processing and Production Pipeline

The following sections describe the process by which data products in each of the ANC bundles listed in Table 8 are produced.

### PDS Peer Review

The PPI node will conduct a full peer review of all of the data types in the ANC archive. The review data will consist of fully formed bundles populated with candidate final versions of the data and other products and the associated metadata.

Table 9: MAVEN PDS review schedule

| **Date** | **Activity** | **Responsible Team** |
| --- | --- | --- |
| 2014-May  through  2014-Aug | Calibrated and derived data product, archive structure, and SIS peer review | SDC |
| 2014-Nov-15 | Start of Science Operations |  |
| 2015-Mar-16 | Delivery #1 Due to PDS: Calibrated & Derived 2014-11-15 – 2015-02-15 plus cruise data and calibrations | ITF/SDC |
| 2015-Mar  through  2015-Apr | Calibrated and derived data peer review | PDS |
| 2015-May-15 | Delivery #1 Release to the Public (Start of Science Ops + 6 months) | PDS |
| 2015-Jul-29 | Delivery #2 Due to PDS:  Calibrated & Derived: 2015-02-16 – 2015-05-15 | ITF/SOC |
| 2015-Aug-14 | Delivery #2 Release | PDS |
| 2015-Oct-30 | Delivery #3 Due to PDS:  Calibrated & Derived: 2015-05-16 – 2015-08-15 | ITF/SOC |
| 2015-Nov-16 | Delivery #3 Release | PDS |
| 2016-Jan-29 | Delivery #4 Due to PDS:  Calibrated & Derived: 2015-08-16 – 2015-11-15 | ITF/SOC |
| 2016-Feb-15 | Delivery #4 Release | PDS |
| 2016-Apr-15 | Delivery #5 Due to PDS:  Raw: Launch through EOM | ITF/SOC |
| 2016-May-16 | Delivery #5 Release | PDS |

Reviews will include a preliminary delivery of sample products for validation and comment by PDS PPI and Engineering node personnel. The data provider will then address the comments coming out of the preliminary review, and generate a full archive delivery to be used for the peer review.

Reviewers will include MAVEN Project and SOC representatives, researchers from outside of the MAVEN project, and PDS personnel from the Engineering and PPI nodes. Reviewers will examine the sample data products to determine whether the data meet the stated science objectives of the instrument and the needs of the scientific community and to verify that the accompanying metadata are accurate and complete. The peer review committee will identify any liens on the data that must be resolved before the data can be ‘certified’ by PDS, a process by which data are made public as minor errors are corrected.

In addition to verifying the validity of the review data, this review will be used to verify that the data production pipeline by which the archive products are generated is robust. Additional deliveries made using this same pipeline will be validated at the PPI node, but will not require additional external review.

As expertise with the instrument and data develops the SOC may decide that changes to the structure or content of its archive products are warranted. Any changes to the archive products or to the data production pipeline will require an additional round of review to verify that the revised products still meet the original scientific and archival requirements or whether those criteria have been appropriately modified. Whether subsequent reviews require external reviewers will be decided on a case-by-case basis and will depend upon the nature of the changes. A comprehensive record of modifications to the archive structure and content is kept in the Modification\_History element of the collection and bundle products.

The instrument team and other researchers are encouraged to archive additional ANC products that cover specific observations or data-taking activities. The schedule and structure of any additional archives are not covered by this document and should be worked out with the PPI node.

## Data Transfer Methods and Delivery Schedule

The SOC is responsible for delivering data products to the PDS for long-term archiving. While ITFs are primarily responsible for the design and generation of calibrated and derived data archives, the archival process is managed by the SOC. The SOC (in coordination with the ITFs) will also be primarily responsible for the design and generation of the raw data archive. The first PDS delivery will take place within 6 months of the start of science operations. Additional deliveries will occur every following 3 months and one final delivery will be made after the end of the mission. Science data are delivered to the PDS within 6 months of its collection. If it becomes necessary to reprocess data which have already been delivered to the archive, the ITFs will reprocess the data and deliver them to the SDC for inclusion in the next archive delivery. A summary of this schedule is provided in Table 10 below.

Table 10: Archive Bundle Delivery Schedule

|  |  |  |  |
| --- | --- | --- | --- |
| Bundle Logical Identifier | First Delivery to PDS | Delivery Schedule | Estimated Delivery Size |
| urn:nasa:pds:maven.anc.drf | No later than 6 months after the start of science operations | Every 3 months | 4 GB |
| urn:nasa:pds:maven.anc.events | No later than 6 months after the start of science operations | Every 3 months | < 1 GB |

Each delivery will comprise both data and ancillary data files organized into directory structures consistent with the archive design described in Section 4.6, and combined into a deliverable file(s) using file archive and compression software. When these files are unpacked at the PPI Node in the appropriate location, the constituent files will be organized into the archive structure.

Archive deliveries are made in the form of a “delivery package”. Delivery packages include all of the data being transferred along with a transfer manifest, which helps to identify all of the products included in the delivery, and a checksum manifest which helps to insure that integrity of the data is maintained through the delivery. The format of these files is described in Section 5.3.

Data are transferred electronically (using the *ssh* protocol) from the SOC to an agreed upon location within the PPI file system. PPI will provide the SOC a user account for this purpose. Each delivery package is made in the form of a compressed *tar* or *zip* archive. Only those files that have changed since the last delivery are included. The PPI operator will decompress the data, and verify that the archive is complete using the transfer and MD5 checksum manifests that were included in the delivery package. Archive delivery status will be tracked using a system defined by the PPI node.

Following receipt of a data delivery, PPI will reorganize the data into its PDS archive structure within its online data system. PPI will also update any of the required files associated with a PDS archive as necessitated by the data reorganization. Newly delivered data are made available publicly through the PPI online system once accompanying labels and other documentation have been validated. It is anticipated that this validation process will require no more than fourteen working days from receipt of the data by PPI. However, the first few data deliveries may require more time for the PPI Node to process before the data are made publicly available.

The MAVEN prime mission begins approximately 5 weeks following MOI and lasts for 1 Earth-year. Table 9 shows the data delivery schedule for the entire mission.

## Data Product and Archive Volume Size Estimates

ANC data products consist of files that span several UT days. Files vary in size depending on the telemetry rate and allocation; the maximum single file size is generally about 5 MB. A single archive delivery will span three months, with 11 files covering each day, adding up to a total volume per delivery of approximately 4 GB.

The Mission Events files will span three months and be labeled as such in the filename. The Science Events file will be a single list that is continually appended. File sizes are approximately 2 MB per 3 month period, but will vary depending on the number of events that actually occur.

## Data Validation

Routine data deliveries to the PDS are validated at the PPI node to ensure that the delivery meets PDS standards, and that the data conform to the SIS as approved in the peer review. As long as there are no changes to the data product formats, or data production pipeline, no additional external review will be conducted.

## Backups and duplicates

The PPI Node keeps three copies of each archive product. One copy is the primary online archive copy, another is an onsite backup copy, and the final copy is an off-site backup copy. Once the archive products are fully validated and approved for inclusion in the archive, copies of the products are sent to the National Space Science Data Center (NSSDC) for long-term archive in a NASA-approved deep-storage facility. The PPI Node may maintain additional copies of the archive products, either on or off-site as deemed necessary. The process for the dissemination and preservation of ANC data is illustrated in Figure 3.

MAVEN SOC

Deep Archive (NSSDC)

PDS Planetary Plasma Interactions (PDS-PPI) Node

Peer Review

Committee

PDS-PPI Node Mirror Site

Data Users

PDS-PPI Public Web Pages

Review Data

Validation Report

Archive Delivery

Delivery Receipt

Backup Copy

Archive Assurance

Validated Data

Figure 3: Duplication and dissemination of ANC archive products at PDS/PPI.

## Archive organization and naming

This section describes the basic organization of an ANC bundle, and the naming conventions used for the product logical identifiers, and bundle, collection, and basic product filenames.

## Logical Identifiers

Every product in PDS is assigned an identifier which allows it to be uniquely identified across the system. This identifier is referred to as a Logical Identifier or LID. A LIDVID (Versioned Logical Identifier) includes product version information, and allows different versions of a specific product to be referenced uniquely. A product’s LID and VID are defined as separate attributes in the product label. LIDs and VIDs are assigned by the entity generating the labels and are formed according to the conventions described in sections 4.7.1 and 4.7.2 below. The uniqueness of a product’s LIDVID may be verified using the PDS Registry and Harvest tools.

### LID Formation

LIDs take the form of a Uniform Resource Name (URN). LIDs are restricted to ASCII lower case letters, digits, dash, underscore, and period. Colons are also used, but only to separate prescribed components of the LID. Within one of these prescribed components dash, underscore, or period are used as separators. LIDs are limited in length to 255 characters.

MAVEN ANC LIDs are formed according to the following conventions:

* Bundle LIDs are formed by appending a bundle specific ID to the MAVEN [INST] base ID:

urn:nasa:pds:maven.anc.<bundle ID>

Since all PDS bundle LIDs are constructed this way, the combination of maven.anc.bundle must be unique across all products archived with the PDS.

* Collection LIDs are formed by appending a collection specific ID to the collection’s parent bundle LID:

urn:nasa:pds:maven.anc.<bundle ID>:<collection ID>

Since the collection LID is based on the bundle LID, which is unique across PDS, the only additional condition is that the collection ID must be unique across the bundle. Collection IDs correspond to the collection type (e.g. “browse”, “data”, “document”, etc.). Additional descriptive information may be appended to the collection type (e.g. “data-raw”, “data-calibrated”, etc.) to insure that multiple collections of the same type within a single bundle have unique LIDs.

* Basic product LIDs are formed by appending a product specific ID to the product’s parent collection LID:

urn:nasa:pds:maven.anc.<bundle ID>:<collection ID>:<product ID>

Since the product LID is based on the collection LID, which is unique across PDS, the only additional condition is that the product ID must be unique across the collection. Product IDs are based on the filenames, e.g. sci\_anc\_eps14\_061\_062:

sci\_anc ancillary data for science use

eps ancillary data type (see Table 11)

14 2-digit year (14 = 2014)

061\_062 3-digit day of year; files span several days

A list of ANC bundle LIDs is provided in Table 8. Collection LIDs are listed in Table 11.

### VID Formation

Product version ID’s consist of major and minor components separated by a “.” (M.n). Both components of the VID are integer values. The major component is initialized to a value of “1”, and the minor component is initialized to a value of “0”. The minor component resets to “0” when the major component is incremented.

## ANC Archive Contents

The ANC archive includes the two bundles listed in Table 8. The following sections describe the contents of each of these bundles in greater detail.

### ANC DRF Bundle

The DRF bundle contains all ancillary files generated by the MSA, containing ancillary spacecraft and instrument data in the DRF format as defined by the MAVEN DRF SIS. There are sixteen such files, covering each day of the mission. The time span of each file varies from one to seven days, depending on the telemetry group. Each file a time-ordered ASCII table divided into columns, where each column is a telemetry channel. There will be one collection for each of these sixteen files, which are identified in Table 11.

The filename convention for the IMU files is:

mvn\_imu<YY>\_<DOY1>\_<DOY2>.txt

The filename convention for all other files are:

sci\_anc\_<type><YY>\_<DOY1>\_<DOY2>.drf

where <YY> is the last two digits of the year where the file begins, <DOY1> is the day of the year where the file starts, <DOY2> is the day of the year where the file ends. Note that files may span across a year, so if <DOY1> is greater than <DOY2>, assume that <DOY2> represents the day in the following year.

<type> is one of the Filetypes located below in Table 11:

Table 11: DRF file type and ANC collections

|  |  |  |
| --- | --- | --- |
| **Filetype** | **Description** | **Collection LID** |
| eps | Electrical Power System | urn:nasa:pds:maven.anc:data.drf.eps |
| gnc | Guidance Navigation and Control | urn:nasa:pds:maven.anc:data.drf.gnc |
| ngms | NGIMS instrument data | urn:nasa:pds:maven.anc:data.drf.ngms |
| pf | PF instrument data | urn:nasa:pds:maven.anc:data.drf.pf |
| rs | RS instrument data | urn:nasa:pds:maven.anc:data.drf.rs |
| usm1 | Universal Switching Module 1 | urn:nasa:pds:maven.anc:data.drf.usm1 |
| usm2 | Universal Switching Module 2 | urn:nasa:pds:maven.anc:data.drf.usm2 |
| usm3 | Universal Switching Module 3 | urn:nasa:pds:maven.anc:data.drf.usm3 |
| usm4 | Universal Switching Module 4 | urn:nasa:pds:maven.anc:data.drf.usm4 |
| usm5 | Universal Switching Module 5 | urn:nasa:pds:maven.anc:data.drf.usm5 |
| usm6 | Universal Switching Module 6 | urn:nasa:pds:maven.anc:data.drf.usm6 |
| sasm1 | Solar Array Switch Module | urn:nasa:pds:maven.anc:data.drf.sasm1 |
| sasm2 | urn:nasa:pds:maven.anc:data.drf.sasm2 |
| sasm3 | urn:nasa:pds:maven.anc:data.drf.sasm3 |
| pte | Periapsis Timing Estimator | urn:nasa:pds:maven.anc:data.drf.pte |
| imu | Inertial Measurement Unit | urn:nasa:pds:maven.anc:data.imu |

#### ANC DRF Collection Contents

Each collection is effectively the same, varying only in the contents of the DRF files.

#### ANC DRF Document Collection

The ANC DRF document collection contains documents which are useful for understanding and using the ANC DRF bundle. Table 12 contains a list of the documents included in this collection, along with the LID, and responsible group. Following this a brief description of each document is also provided.

Table 12: ANC Calibrated Science Data Documents

| **Document Name** | **LID** | **Responsiblility** |
| --- | --- | --- |
| MAVEN Science Data Management Plan | urn:nasa:pds:maven:document:sdmp | MAVEN Project |
| MAVEN ANC Archive SIS | urn:nasa:pds:maven.anc:document:sis | SOC |
| MAVEN Mission Description | urn:nasa:pds:maven:document:mission.description | MAVEN Project |
| MAVEN Spacecraft Description | urn:nasa:pds:maven:document:spacecraft.description | MAVEN Project |

**MAVEN Science Data Management Plan** – describes the data requirements for the MAVEN mission and the plan by which the MAVEN data system will meet those requirements

**MAVEN ANC Archive SIS** – describes the format and content of the ANC PDS data archive, including descriptions of the data products and associated metadata, and the archive format, content, and generation pipeline (this document)

**MAVEN Mission Description** – describes the MAVEN mission.

**MAVEN Spacecraft Description** – describes the MAVEN spacecraft.

While responsibility for the individual documents varies, the document collection itself is managed by the PDS/PPI node.

### ANC Events

The ANC Events bundle contains time-ordered ASCII files listing all events. These files are generated by querying a database at the SDC.

Table 13: ANC Events Collection

| **Collection LID** | **Description** |
| --- | --- |
| urn:nasa:pds:maven.anc:data.events | Mission events in a single ASCII file for the three-month time range covered by each delivery. Science events in a a single ASCII file covering one or more three-month delivery intervals. |

#### ANC Mission Events

This collection contains the mission event files, which describe instrument/spacecraft related events. These files are ASCII tables in which the first column is the event start time in UTC. The filename convention will include the date range covered by each file. The data will be comma-separated ASCII with column headings for each column. The contributor responsible for each event will be identified in the data. These files will be generated by the SDC, which is responsible for distributing and archiving them.

#### ANC Science Events

This collection contains the science event files, which describe external events relevant to the mission such as solar flares and aurora. These files are ASCII tables in which the first column is the event start time in UTC. The data will be comma-separated ASCII with column headings for each column. The contributor responsible for each event will be identified in the data. These files will be generated by the SDC, which is responsible for distributing and archiving them.

# Archive product formats

Data that comprise the ANC archives are formatted in accordance with PDS specifications [see *Planetary Science Data Dictionary* [4], *PDS Data Provider’s Handbook* [2], and *PDS Standards Reference* [3]. This section provides details on the formats used for each of the products included in the archive.

## Data File Formats

This section describes the format and record structure of each of the data file types.

The ANC DRF data product is an ASCII data file with an attached header followed by a time series (table). The header internally documents the file contents. Each file also is described by a PDS label file (\*.xml).

Note that due to asynchronies in the telemetry collection, many DRF files contained empty values at the start of the files. Since spaces are not a valid PDS4 missing constant value for numeric fields, records containing empty values have been removed. In some cases this resulted in the removal of all of the data records, in which the case the data file itself has been removed.

### EPS DRF data file structure

Table 14: EPS DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| SA1pyISC | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 07. SASM 1 +Y ISC current. In DN and EU. |
| SASM\_TotalC | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 13. In DN and EU. |
| SA2myISC | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 22. SASM -Y ISC current. In DN and EU. |

### GNC DRF data file structure

Table 15: GNC DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| ATT\_QU\_I2B\_1, ATT\_QU\_I2B\_2, ATT\_QU\_I2B\_3, ATT\_QU\_I2B\_4 | The 4 elements of current spacecraft attitude quaternion based on the current AD state running, phased as inertial to body. |
| ATT\_QU\_I2B\_T | ADS spacecraft time stamp (SCLK) of current spacecraft attitude quaternion based on the current AD state running, phased as inertial to body. |
| ATT\_RAT\_BF\_X, ATT\_RAT\_BF\_Y, ATT\_RAT\_BF\_Z | The current spacecraft angular rates in the spacecraft body frame based on the current AD state running. |
| APIG\_ANGLE | The APP (articulated payload platform) measured inner gimbal axis angle for the sensor in use on the inner gimbal axis. |
| APOG\_ANGLE | The APP (articulated payload platform) measured outer gimbal axis angle for the sensor in use on the outer gimbal axis. |
| APIG\_APP\_RAT | The measured APP (articulated payload platform) inner gimbal axis rate for the sensor in use on the inner gimbal axis. |
| APOG\_APP\_RAT | The measured APP (articulated payload platform) outer gimbal axis rate for the sensor in use on the outer gimbal axis. |
| RW1\_SPD\_DGTL RW2\_SPD\_DGTL, RW3\_SPD\_DGTL, RW4\_SPD\_DGTL | The reaction wheel rotational speed as determined by digital tachometer and filtered with a configurable digital speed filter. Data is returned in engineering units (rad/sec) and reflects both positive and negative rotation. |
| ACC\_BOD\_VECX, ACC\_BOD\_VECY, ACC\_BOD\_VECZ | The X, Y, and Z-axis component of spacecraft linear acceleration as measured by the IMUs in the spacecraft body frame. |
| RW1\_SPD\_PTE, RW2\_SPD\_PTE, RW3\_SPD\_PTE, RW4\_SPD\_PTE | Reaction wheel 1-4 rotational speeds as determined by digital tachometer and filtered with a configurable digital speed for PTE filter. Data is returned in engineering units (rad/sec) and reflects both positive and negative rotation. |

### NGMS DRF data file structure

Table 16: NGMS DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| NGM\_AGC\_T | The NGM engineering data, AGC temperature (derived into EU). |
| NGM\_DET\_T | The NGM engineering data, DET board temperature (derived into EU). |
| NGM\_RF\_T | The NGM engineering data, RF board temperature (derived into EU). |
| NGM\_CDH\_T | The NGM engineering data, CDH board temperature (derived into EU). |
| NGM\_CTL\_T | The NGM engineering data, CTL board temperature (derived into EU). |
| NGM\_PS\_T | The NGM engineering data, PS board temperature (derived into EU). |
| NGM\_AGC\_TdN | The NGM engineering data, AGC temperature (in DN). |
| NGM\_DET\_Tdn | The NGM engineering data, DET board temperature (in DN). |
| NGM\_RF\_Tdn | The NGM engineering data, RF board temperature (in DN). |
| NGM\_CDH\_Tdn | The NGM engineering data, CDH board temperature (in DN). |
| NGM\_CTL\_Tdn | The NGM engineering data, CTL board temperature (in DN). |
| NGM\_PS\_Tdn | The NGM engineering data, PS board temperature (in DN). |
| NgmInMe1Tcio | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 40. NGIMS internal MEB 1 temperature. Corresponds to C-0240 (NgmInMe1Tcio). In DN and EU. |
| NgmInBk1T, NgmInBk2T | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 51. NGIMS internal bakeout 1 temperature. Corresponds to C-0251 (NgmInBk1Tcio).  In DN and EU. |
| NgmInMe2Tcio | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 46. NGIMS internal MEB 2 temperature. Corresponds to C-0446 (NgmInMe2Tcio). In DN and EU. |

### PF DRF data file structure

Table 17: PF DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| SP\_PF\_PFull | The percent of the the downlink managed MMM soft partition assigned to PF (particles and fields) data that is full on not sent data. |
| PfpBpT1 | PFDPU baseplate temperatures in DN and EU.  CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 16. PFDPU baseplate temperature 1. Corresponds to C-0216 (PfpBpT1cio). |
| StatInT1 | STATIC internal temperatures in DN and EU.  CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 21. STATIC internal temperature 1. Corresponds to C-0221 (StatInT1cio). |
| Pfp1InT | PFDPU 1 internal temperatures in DN and EU.  CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 27. PFDPU 1 internal temperature. |
| SweaInT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 34. SWEA internal temperature 1. Corresponds to C-0234 (SweaInT1cio). In DN and EU. |
| Sep1InT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 36. SEP 1 internal temperature 1. Corresponds to C-0236 (Sep1InT1cio). In DN and EU. |
| EuvInT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 39. EUV internal temperature 1. Corresponds to C-0239 (EuvInT1cio). In DN and EU. |
| Lpw2BomT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 42. LPW 2 boom temperature 1. Corresponds to C-0242 (Lpw2BomT1cio). In DN and EU. |
| Lpw1BomT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 50. LPW 1 boom temperature 1. Corresponds to C-0250 (Lpw1BomT1cio). In DN and EU. |
| Sep2InT1 | CDH AAC 1 (analog acquisition card 1) AIP (analog input passive) channel 61. SEP 2 internal temperature 1. Corresponds to C-0261 (Sep2InTcio). In DN and EU. |
| PfpBpT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 16. PFDPU baseplate temperature 1. Corresponds to C-0416 (PfpBpT2cio). In DN and EU. |
| SwiaInT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 28. SWIA internal temperature 2. Corresponds to C-0428 (SwiaInT2cio). In DN and EU. |
| SweaInT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 30. SWEA internal temperature 2. Corresponds to C-0430 (SweaInT2cio). In DN and EU. |
| StatInT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 32. STATIC internal temperature 2. Corresponds to C-0432 (StatInT2cio). In DN and EU. |
| Sep1InT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 34. SEP 1 internal temperature 2. Corresponds to C-0434 (Sep1InT2cio). In DN and EU. |
| EuvInT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 37. EUV internal temperature 2. Corresponds to C-0437 (EuvInT2cio). In DN and EU. |
| Pfp2InT | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 39. PFDPU 2 internal temperature. In DN and EU. |
| Lpw1BomT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 40. LPW 1 boom temperature 2. Corresponds to C-0440 (Lpw2BomT2cio). In DN and EU. |
| Sep2InT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 54. SEP 2 internal temperature 2. Corresponds to C-0454 (Sep2InT2cio). In DN and EU. |
| Lpw2BomT2 | CDH AAC 2 (analog acquisition card 2) AIP (analog input passive) channel 58. LPW 2 boom temperature 2. Corresponds to C-0458 (Lpw2BomT2cio). In DN and EU. |
| Mag1InT | CDH AAC 1 (analog acquisition card 1) AIV (analog input voltage) channel 26. MAG 1 internal temperature in EU (see T-0326 for the DN value). |
| Mag2InT | CDH AAC 2 (analog acquisition card 2) AIV (analog input voltage) channel 31. MAG 2 internal temperature in EU (see T-0531 for the DN value). |
| Bus28V\_1\_V Bus28V\_2\_V | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 12 and 27. Bus 28V voltage 1 and voltage 2 signal. In DN and EU. |
| Mag1HtrMonV Mag2HtrMonV | CDH AAC 1 (analog acquisition card 1) AIV (analog input voltage) channel 26. MAG 1 heater monitor voltage.  CDH AAC 2 (analog acquisition card 2) AIV (analog input voltage) channel 31. MAG 2 heater monitor voltage.  In DN and EU. |

### RS DRF data file structure

Table 18: RS DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| RspInSrT1, RspInSrT2 | RSDPU internal survival temperatures. |
| IuvsInST1, IuvsInST2 | IUVS internal survival temperatures. |

### USM DRF data file structure

The USM DRF files contain switch status information. The list of telemetry names in each file is given here; complete descriptions are in the USM\_tlm\_names.xlsx spreadsheet which will be archived with the USM collection.

Table 19: USM DRF data file record structure

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **USM1** | **USM2** | **USM3** | **USM4** | **USM5** | **USM6** |
| USM1usD0\_POS  POS\_TcmTCbH1  POS\_RWA2\_PH  POS\_ST\_1 USM1usD1\_POS POS\_MoiTCbH1 POS\_IMUexPH POS\_PFDPU\_1 USM1usD2\_POS POS\_ST1exPH POS\_CDH\_PH POS\_HeLZ1PH POS\_USM1\_L09 POS\_RWA1\_PH USM1usD3\_POS POS\_TagIG\_PH POS\_ST2exPH POS\_USM1\_L13 POS\_PrTnkPH1 USM1usD4\_POS POS\_SDST\_1 POS\_SDSTexPH POS\_HeTnk\_H1 POS\_USM1\_L18 POS\_USM1\_L19 USM1usD5\_POS POS\_USM1\_L20 POS\_RS\_isH1 POS\_EUT\_Sw1P POS\_EUT\_Sw2P USM1usLT\_POS POS\_MAG1\_InH POS\_LSO\_1 POS\_USM1\_LT2 POS\_PLZ1\_PH POS\_PLZ2\_PH POS\_USM1\_LT5 USM1usLC\_POS POS\_WTS1pos1 POS\_WTS1pos2 POS\_RWA1rON POS\_RWA1rOFF POS\_RWA4\_PH POS\_USM1\_LC5 USM1usHC\_POS POS\_RWA\_1 | USM2usD0\_POS POS\_TcmTCbH2 POS\_RWA2\_SH POS\_ST\_2 USM2usD1\_POS POS\_MoiTCbH2 POS\_IMUexSH POS\_PFDPU\_2 USM2usD2\_POS POS\_ST1exSH POS\_CDH\_SH POS\_HeLZ1SH POS\_USM2\_L09 POS\_RWA1\_SH USM2usD3\_POS POS\_TagIG\_SH POS\_ST2exSH POS\_USM2\_L13 POS\_PrTnkSH1 USM2usD4\_POS POS\_SDST\_2 POS\_SDSTexSH POS\_HeTnk\_H2 POS\_USM2\_L18 POS\_USM2\_L19 USM2usD5\_POS POS\_USM2\_L20 POS\_RS\_isH2 POS\_EUT\_Sw1S POS\_EUT\_Sw2S USM2usLT\_POS POS\_MAG2\_InH POS\_LSO\_2 POS\_USM2\_LT2 POS\_PLZ1\_SH POS\_PLZ2\_SH POS\_USM2\_LT5 USM2usLC\_POS POS\_WTS2pos1 POS\_WTS2pos2 POS\_RWA2rON POS\_RWA2rOFF POS\_RWA4\_SH POS\_USM2\_LC5 USM2usHC\_POS POS\_RWA\_2 | USM3usD0\_POS POS\_SWEAinPH POS\_STATinPH POS\_PrTnkPH2 POS\_AppDmpPH POS\_USM3\_L04 USM3usD1\_POS POS\_SEP1inPH POS\_RWA3\_PH POS\_Batt1iH1 USM3usD2\_POS POS\_USM3\_L08 POS\_SEP2inPH POS\_NGM\_Sw1P POS\_NGM\_Sw2P USM3usD3\_POS POS\_TcmTvPH POS\_LPW1BmPH POS\_LPW2BmPH POS\_TWTAbpPH USM3usD4\_POS POS\_SWIAinPH POS\_Cb2367PH POS\_PAPU\_PH POS\_PIA\_PH USM3usD5\_POS POS\_IMU\_1 POS\_SAibDmPH POS\_Tv3456PH POS\_IUVSisH1 USM3usLT\_POS POS\_PF1Act POS\_LSO\_3 POS\_USM3\_LT2 POS\_USM3\_LT3 POS\_USM3\_LT4 POS\_USM3\_LT5 USM3usLC\_POS POS\_WTS3pos1 POS\_WTS3pos2 POS\_RWA3rON POS\_RWA3rOFF POS\_PrXdcrP POS\_USM3\_LC5 USM3usHC\_POS POS\_TWTA\_1 | USM4usD0\_POS POS\_SWEAinSH POS\_STATinSH POS\_PrTnkSH2 POS\_AppDmpSH POS\_USM4\_L04 USM4usD1\_POS POS\_SEP1inSH POS\_RWA3\_SH POS\_Batt1iH2 USM4usD2\_POS POS\_USM4\_L08 POS\_SEP2inSH POS\_NGM\_Sw1S POS\_NGM\_Sw2S USM4usD3\_POS POS\_TcmTvSH POS\_LPW1BmSH POS\_LPW2BmSH POS\_TWTAbpSH USM4usD4\_POS POS\_SWIAinSH POS\_Cb2367SH POS\_PAPU\_SH POS\_PIA\_SH USM4usD5\_POS POS\_IMU\_2 POS\_SAibDmSH POS\_Tv3456SH POS\_IUVSisH2 USM4usLT\_POS POS\_PF2Act POS\_USM4\_LT1 POS\_USM4\_LT2 POS\_USM4\_LT3 POS\_USM4\_LT4 POS\_USM4\_LT5 USM4usLC\_POS POS\_WTS4pos1 POS\_WTS4pos2 POS\_RWA4rON POS\_RWA4rOFF POS\_PrXdcrS POS\_USM4\_LC5 USM4usHC\_POS POS\_TWTA\_2 | USM5usD0\_POS POS\_Batt2iH1 POS\_USM5\_L01 POS\_Tv1278PH POS\_PrTnkPH3 POS\_USM5\_L04 USM5usD1\_POS POS\_PF\_bpPH POS\_PLZ3\_PH POS\_PLZ4\_PH USM5usD2\_POS POS\_NGM\_isH1 POS\_PLZ9\_PH POS\_RSDPU\_P USM5usD3\_POS POS\_SAobDmPH POS\_HeLZ2PH POS\_USM5\_L15 POS\_TagOG\_PH POS\_TAME\_1 USM5usD4\_POS POS\_Cb1458PH POS\_EUTexPH POS\_PCAplaPH USM5usD5\_POS POS\_EUV\_inPH POS\_NGM\_ibH1 POS\_SWEAdmPH USM5usLT\_POS POS\_PLZ5\_PH POS\_PLZ6\_PH POS\_PLZ7\_PH POS\_PLZ8\_PH POS\_MoiTvPH POS\_MoiTplPH USM5usLC\_POS POS\_USM5\_LC0 POS\_USM5\_LC1 POS\_LPW1brP POS\_LPW2brP POS\_LPW1brrP POS\_LPW2brrP POS\_USM5\_LC4 POS\_USM5\_LC5 USM5usHC\_POS POS\_RWA\_3 | USM6usD0\_POS POS\_Batt2iH2 POS\_USM6\_L01 POS\_Tv1278SH POS\_PrTnkSH3 POS\_USM6\_L04 USM6usD1\_POS POS\_PF\_bpSH POS\_PLZ3\_SH POS\_PLZ4\_SH USM6usD2\_POS POS\_NGM\_isH2 POS\_PLZ9\_SH POS\_RSDPU\_S USM6usD3\_POS POS\_SAobDmSH POS\_HeLZ2SH POS\_USM6\_L15 POS\_TagOG\_SH POS\_TAME\_2 USM6usD4\_POS POS\_Cb1458SH POS\_EUTexSH POS\_PCAplaSH USM6usD5\_POS POS\_EUV\_inSH POS\_NGM\_ibH2 POS\_SWEAdmSH USM6usLT\_POS POS\_PLZ5\_SH POS\_PLZ6\_SH POS\_PLZ7\_SH POS\_PLZ8\_SH POS\_MoiTvSH POS\_MoiTplSH USM6usLC\_POS POS\_USM6\_LC0 POS\_USM6\_LC1 POS\_LPW1brS POS\_LPW2brS POS\_LPW1brrS POS\_LPW2brrS POS\_USM6\_LC4 POS\_USM6\_LC5 USM6usHC\_POS POS\_RWA\_4 |

### SASM DRF file structure

The Solar Array Switch Module (SASM) files are DRF files containing information about the state of the solar arrays. There are SASM 1, 2, and 3 files.

Table 20: RS DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| SASM\_SA\_SW00, SASM\_SA\_SW01, SASM\_SA\_SW02, SASM\_SA\_SW03, SASM\_SA\_SW04, SASM\_SA\_SW05, SASM\_SA\_SW06, SASM\_SA\_SW07, SASM\_SA\_SW08, SASM\_SA\_SW09, SASM\_SA\_SW10, SASM\_SA\_SW11, SASM\_SA\_SW12, SASM\_SA\_SW13, SASM\_SA\_SW14, SASM\_SA\_SW15, SASM\_SA\_SW16, SASM\_SA\_SW17, SASM\_SA\_SW18, SASM\_SA\_SW19 | The SASM (solar array switch module) solar array switch 00 through 15 register switch 00, 01, 02…19 status. See the SASM Design Description Document DDD-913G0194050-001 for additional details. |
| SA1pyISC | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 07. SASM 1 +Y ISC current. Corresponds to C-0107 (SA1pyISCcio). In DN and EU |
| SA1pyVOC | PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 08. SASM 1 solar array plus Y, VOC voltage. Corresponds to C-0108 (SA1pyVOCcio). In DN and EU. |

### PTE file structure

The Periapsis Timing Estimator (PTE) DRF files contain information about the estimated periapsis times.

Table 21: PTE DRF data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| SCET ## | Spacecraft Event Time in yy/ddd-hh:mm:ss.fff ## will be a one or two digit number that represents the number of channels (i.e. the number of other columns in the file) |
| GV\_PteCumPDT | Indicates the cumulative periapse time correction. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV\_PteCurPTi | Indicates the SCLK time of the current periapsis. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV\_PteCurPer | Indicates the current orbital period. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV\_PteLstPTi | Indicates the SCLK time of the last periapsis. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV\_PteMxHtRt | Indicates the maximum heating rate. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV\_PteNxtPTi | Indicates the SCLK time of the next periapsis. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) flight software. |
| GV042\_SPARE | Spare global variable 042. |
| GV\_PteAbmCmd | Indicates that an apoapsis up burn in needed. Set by the AHR IN (inertial navigation) PTE (periapsis time estimator) software. |
| PTE\_CUM\_ACCL | The accumulated acceleration calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_ACCUM\_DV | The accumulated delta velocity calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_CUR\_PER | The current orbital period calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_NEXT\_PER | The time of next periapsis calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_PER\_RDUC | The orbital period reduction calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_P\_T\_CORR | The periapsis time correction calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_RAW\_CORR | The periapsis time raw correction calculated by AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_START\_T | The time at which the AHR IN (inertial navigation) PTE (periapsis time estimator) was started. |
| PTE\_STATUS | Indicates the status of the AHR IN (inertial navigation) PTE (periapsis time estimator). |
| PTE\_VAL\_DATA | The number of valid data sets counted by the AHR IN (inertial navigation) PTE (periapsis time estimator) counted at a rate of 10 Hz. |
| PTE\_MxAcDens | Indicates the maximum atmospheric density as calculated by AHR IN (inertial navigation) using the accelerometers. |
| PTE\_MxRwDens | Indicates the maximum atmospheric density as calculated by AHR IN (inertial navigation) using the reaction wheels. |
| PTE\_PTTindex | Indicates the index into the PTT (periapsis time table) of the currentl periapse time and orbit period. |
| PTE\_RwAxis | Indicated the PTE (periapsis time estimator) reaction wheel axis. |

### IMU file structure

The IMU data products are ASCII data files with an attached header followed by a time series (table). The header internally documents the file contents. Each file also is described by a PDS label file (\*.xml).

The first lines of the file contain information about when the data was prepared. For example:

Date: Wed Jun 17 03:10:32 UTC 2015

is the start of a file generated on June 17th 2015. Notice, however, that all files generated on and after July 12th 2016 contain a different header format:

File: mvn\_imu.dat.txt created by report\_imu\_dump.groovy rev 1.19 on Wed Jul 13 02:09:48 UTC 2016

All files after this date also have an additional empty line at the top of the file, directly after the date information.

Table 22: IMU data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| IMU\_TIME\_@\_TONE | Base time without GIF card delta correction |
| IMU\_TIME | Corrected IMU time (this is the one to use) |
| GIFCT | GIF card delta time |
| FRMCNT | Frame count |
| STATWD | IMU Status Word |
| XANGLE | Cumulative change in direction for the X, Y, and Z gyros with 1 count being 1e-6 radians. Orientations with respect to the MVN body frame are given in the Coordinate Systems Definitions Document, MAV-RP-10-0100 |
| YANGLE |
| ZANGLE |
| XACCEL | Cumulative change in velocity of the X, Y, and Z accelerometers. Orientation and location are in the Coordinate Systems Definitions Document. Each count is 7.53e-5 m/s. |
| YACCEL |
| ZACCEL |
| MUX | Mux data word |

### Event data file structure

Event files are ASCII spreadsheets with data organized in columns.

Table 23: Event data file record structure

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| id | Event ID: unique ID for each event. |
| event\_type\_id | Event type code (See Table 4 and Table 5). |
| start\_time | Event start time. |
| end\_time | Event end time. |
| source | Event source: Manual entry, MAVEN Integrated Report, or SPICE kernels. |
| description | Text description of event. |
| discussion | Notes from POC event database. |
| modified\_time | Event creation time.   Note: Column does not exist in the ops events files |

## PDS Labels

PDS labels are ASCII text files written, in the eXtensible Markup Language (XML). All product labels are detached from the digital files (if any) containing the data objects they describe (except Product\_Bundle). There is one label for every product. Each product, however, may contain one or more data objects. The data objects of a given product may all reside in a single file, or they may be stored in multiple separate files. PDS4 label files must end with the file extension “.xml”.

The structure of PDS label files is governed by the XML documents described in Section 5.2.1.

### XML Documents

For the MAVEN mission PDS labels will conform to the PDS master schema based upon the 1.1.0.1 version of the PDS Information Model for structure, and the 1.1.0.1 version of the PDS schematron for content. By use of an XML editor these documents may be used to validate the structure and content of the product labels.

The PDS master schema and schematron documents are produced, managed, and supplied to MAVEN by the PDS. In addition to these documents, the MAVEN mission has produced additional XML documents which govern the products in this archive. These documents contain attribute and parameter definitions specific to the MAVEN mission. A list of the XML documents associated with this archive is included in this document in the XML\_Schema collection section for each bundle.

Examples of PDS labels required for the ANC archive are shown in Appendix B (bundle products), Appendix C (collection products), and Appendix D (basic products).

## Delivery Package

Data transfers, whether from data providers to PDS or from PDS to data users or to the deep archive, are accomplished using delivery packages. Delivery packages include the following required elements:

1. The package which consists of a compressed bundle of the products being transferred.
2. A transfer manifest which maps each product’s LIDVID to the physical location of the product label in the package after uncompression.
3. A checksum manifest which lists the MD5 checksum of each file included in the package after uncompression.

ANC archive delivery packages (including the transfer and checksum manifests) for delivery to PDS are produced at the MAVEN SDC.

### The Package

The directory structure used in for the delivery package is described in the Appendix in Section E.1. Delivery packages are compressed using zip and are transferred electronically using the ssh protocol.

### Transfer Manifest

The “transfer manifest” is a file provided with each transfer to, from, or within PDS. The transfer manifest is external to the delivery package. It contains an entry for each label file in the package, and maps the product LIDVID to the file specification name for the associated product’s label file. Details of the structure of the transfer manifest are provided in Section 0.

The transfer manifest is external to the delivery package, and is not an archive product. As a result, it does not require a PDS label.

### Checksum Manifest

The checksum manifest contains an MD5 checksum for every file included as part of the delivery package. This includes both the PDS product labels and the files containing the digital objects which they describe. The format used for a checksum manifest is the standard output generated by the md5deep utility. Details of the structure of the checksum manifest are provided in section E.3.

The checksum manifest is external to the delivery package, and is not an archive product. As a result, it does not require a PDS label.

1. Support staff and cognizant persons

Table 24: Archive support staff

|  |  |  |  |
| --- | --- | --- | --- |
| SDC | | | |
| **Name** | **Address** | **Phone** | **Email** |
| **Alexandria DeWolfe**  SDC Manager | LASP, University of Colorado  1234 Innovation Drive  Boulder, CO 80303 | 303-492-6835 | alex.dewolfe@lasp.  colorado.edu |
|  | | | |
| **UCLA** | | | |
| **Name** | **Address** | **Phone** | **Email** |
| **Dr. Steven Joy** PPI Operations Manager | IGPP, University of California 405 Hilgard Avenue Los Angeles, CA 90095-1567 USA | +001 310 825 3506 | sjoy@igpp.ucla.edu |
| **Mr. Joseph Mafi** PPI Data Engineer | IGPP, University of California 405 Hilgard Avenue Los Angeles, CA 90095-1567 USA | +001 310 206 6073 | jmafi@igpp.ucla.edu |

1. Sample Bundle Product Label

This section provides a sample bundle product label. This is a copy of the label for Version 1.20 of the MAVEN Ancillary Bundle. However, for the sake of brevity, a number of instances of the <Modification\_Detail> class from the original label have been omitted.

<?xml version="1.0" encoding="UTF-8"?>  
<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.sch"   
 schematypens="http://purl.oclc.org/dsdl/schematron"?>  
<?xml-model href="https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.sch"  
 schematypens="http://purl.oclc.org/dsdl/schematron"?>  
<Product\_Bundle   
 xmlns="http://pds.nasa.gov/pds4/pds/v1"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"  
 xsi:schemaLocation="  
 http://pds.nasa.gov/pds4/pds/v1  
 https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.xsd  
  
 http://pds.nasa.gov/pds4/mission/mvn/v1  
 https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.xsd  
 ">  
 <Identification\_Area>  
 <logical\_identifier>urn:nasa:pds:maven.anc</logical\_identifier>  
 <version\_id>1.20</version\_id>  
 <title>MAVEN Ancillary Bundle</title>  
 <information\_model\_version>1.13.0.0</information\_model\_version>  
 <product\_class>Product\_Bundle</product\_class>  
 <Citation\_Information>  
 <publication\_year>2020</publication\_year>  
 <keyword>DRF</keyword>  
 <description>  
 This bundle contains products associated with the PDS MAVEN  
 Ancillary data archive.  
 </description>  
 </Citation\_Information>  
 <Modification\_History>  
 <Modification\_Detail>  
 <modification\_date>2020-05-21</modification\_date>  
 <version\_id>1.20</version\_id>  
 <description>  
 MAVEN Release 21. Includes an incremental release of MAVEN ancillary DRF, IMU, and   
 event list data, extending total coverage from 2014-11-15 to 2020-02-18 for DRF   
 files, 2014-11-18 to 2020-02-18 for IMU files, and 2013-12-03 to 2020-02-14 for   
 the event lists.  
 </description>  
 </Modification\_Detail>  
 <Modification\_Detail>  
 <modification\_date>2020-02-14</modification\_date>  
 <version\_id>1.19</version\_id>  
 <description>  
 MAVEN Release 20 (2020-02-15). Inclues an incremental release of MAVEN ancillary   
 DRF, IMU, and event list data, extending total coverage from 2014-11-15 to  
 2019-11-18 for DRF files, 2014-11-18 to 2019-11-18 for IMU files, and 2013-12-03   
 to 2019-11-14 for the event lists.  
 </description>  
 </Modification\_Detail>  
 <Modification\_Detail>  
 <modification\_date>2019-11-19</modification\_date>  
 <version\_id>1.18</version\_id>  
 <description>  
 MAVEN Release 19 (2019-11-15). Inclues an incremental release of MAVEN ancillary   
 DRF, IMU, and event list data, extending total coverage from 2014-11-15 to  
 2019-08-19 for DRF files, 2014-11-18 to 2019-08-19 for IMU files, and 2013-12-03   
 to 2019-08-14 for the event lists.  
 </description>  
 </Modification\_Detail>  
 <Modification\_Detail>  
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 <version\_id>1.0</version\_id>  
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 </Modification\_History>  
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 <type>Instrument</type>   
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 <name>Langmuir Probe and Waves Instrument</name>  
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 </Internal\_Reference>  
 </Target\_Identification>  
 <Mission\_Area>  
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 <mission\_phase\_name>Prime Mission</mission\_phase\_name>  
 <mission\_phase\_name>EM-1</mission\_phase\_name>  
 <mission\_phase\_name>EM-2</mission\_phase\_name>  
 <mission\_phase\_name>EM-3</mission\_phase\_name>  
 <mission\_phase\_name>EM-4</mission\_phase\_name>  
 </MAVEN>  
 </Mission\_Area>  
 </Context\_Area>  
 <Reference\_List>  
  
 </Reference\_List>  
 <Bundle>  
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 <description>MAVEN Ancillary Bundle</description>  
 </Bundle>  
 <File\_Area\_Text>  
 <File>  
 <file\_name>readme\_maven\_anc\_1.20.txt</file\_name>  
 <creation\_date\_time>2020-05-21T17:58:26</creation\_date\_time>  
 <md5\_checksum>f3c4d89d16c417a586a7b69d8ce40906</md5\_checksum>  
 </File>  
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 <object\_length unit="byte">12454</object\_length>  
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 <description>  
 This file contains a brief overview of the MAVEN Ancillary Bundle.  
 </description>  
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 </Stream\_Text>  
 </File\_Area\_Text>  
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 </Bundle\_Member\_Entry>  
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 <member\_status>Primary</member\_status>  
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 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
 <lidvid\_reference>urn:nasa:pds:maven.anc:data.drf.pf::1.20</lidvid\_reference>  
 <member\_status>Primary</member\_status>  
 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
 <lidvid\_reference>urn:nasa:pds:maven.anc:data.drf.pte::1.20</lidvid\_reference>  
 <member\_status>Primary</member\_status>  
 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
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 <member\_status>Primary</member\_status>  
 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
 <lidvid\_reference>urn:nasa:pds:maven.anc:data.drf.sasm3::1.20</lidvid\_reference>  
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 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
 <lidvid\_reference>urn:nasa:pds:maven.anc:data.drf.usm1::1.20</lidvid\_reference>  
 <member\_status>Primary</member\_status>  
 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
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 <Bundle\_Member\_Entry>  
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 <member\_status>Primary</member\_status>  
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 <member\_status>Primary</member\_status>  
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 <Bundle\_Member\_Entry>  
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 <Bundle\_Member\_Entry>  
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 <member\_status>Primary</member\_status>  
 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
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 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
 </Bundle\_Member\_Entry>  
 <Bundle\_Member\_Entry>  
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 <reference\_type>bundle\_has\_document\_collection</reference\_type>  
 </Bundle\_Member\_Entry>  
</Product\_Bundle>

1. Sample Collection Product Label

This section provides a sample collection product label. This is a copy of Version 1.20 of the Remote Sensing (IUVS) instrument data DRF Data Collection.

<?xml version="1.0" encoding="UTF-8"?>  
<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.sch"   
 schematypens="http://purl.oclc.org/dsdl/schematron"?>  
<?xml-model href="https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.sch"  
 schematypens="http://purl.oclc.org/dsdl/schematron"?>  
<Product\_Collection  
 xmlns="http://pds.nasa.gov/pds4/pds/v1"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"  
 xsi:schemaLocation="  
 http://pds.nasa.gov/pds4/pds/v1  
 https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.xsd  
  
 http://pds.nasa.gov/pds4/mission/mvn/v1  
 https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.xsd  
 ">  
 <Identification\_Area>  
 <logical\_identifier>urn:nasa:pds:maven.anc:data.drf.rs</logical\_identifier>  
 <version\_id>1.20</version\_id>  
 <title>Remote Sensing (IUVS) instrument data DRF Data Collection</title>  
 <information\_model\_version>1.13.0.0</information\_model\_version>  
 <product\_class>Product\_Collection</product\_class>  
 <Citation\_Information>  
 <author\_list>Harter, B.</author\_list>  
 <publication\_year>2020</publication\_year>  
 <doi>10.17189/1517677</doi>  
 <description>  
 This collection contains MAVEN Remote Sensing (IUVS) Instrument Data Return Files (DRFs).  
 </description>  
 </Citation\_Information>  
 <Modification\_History>  
 <Modification\_Detail>  
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 <version\_id>1.20</version\_id>  
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 </Modification\_History>  
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 <processing\_level>Raw</processing\_level>  
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 <Investigation\_Area>  
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 <type>Mission</type>  
 <Internal\_Reference>  
 <lid\_reference>urn:nasa:pds:context:investigation:mission.maven</lid\_reference>  
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 </Internal\_Reference>  
 </Investigation\_Area>  
 <Observing\_System>  
 <Observing\_System\_Component>  
 <name>MAVEN</name>  
 <type>Spacecraft</type>   
 <Internal\_Reference>  
 <lid\_reference>urn:nasa:pds:context:instrument\_host:spacecraft.maven</lid\_reference>  
 <reference\_type>is\_instrument\_host</reference\_type>  
 </Internal\_Reference>  
 </Observing\_System\_Component>  
 <Observing\_System\_Component>  
 <name>Imaging Ultraviolet Spectrograph</name>  
 <type>Instrument</type>   
 <Internal\_Reference>  
 <lid\_reference>urn:nasa:pds:context:instrument:iuvs.maven</lid\_reference>  
 <reference\_type>is\_instrument</reference\_type>  
 </Internal\_Reference>  
 </Observing\_System\_Component>  
 </Observing\_System>  
 <Target\_Identification>  
 <name>Mars</name>  
 <type>Planet</type>  
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 <reference\_type>collection\_to\_target</reference\_type>  
 </Internal\_Reference>  
 </Target\_Identification>  
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 <mvn:mission\_phase\_name>Prime Mission</mvn:mission\_phase\_name>  
 <mvn:mission\_phase\_name>EM-1</mvn:mission\_phase\_name>  
 <mvn:mission\_phase\_name>EM-2</mvn:mission\_phase\_name>  
 <mvn:mission\_phase\_name>EM-3</mvn:mission\_phase\_name>  
 <mvn:mission\_phase\_name>EM-4</mvn:mission\_phase\_name>  
 </mvn:MAVEN>  
 </Mission\_Area>  
 </Context\_Area>  
 <Reference\_List>  
  
 </Reference\_List>  
 <Collection>  
 <collection\_type>Data</collection\_type>  
 <description>  
 This collection contains MAVEN Remote Sensing (IUVS) Instrument Data Return Files (DRFs).  
 </description>  
 </Collection>  
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 </File>  
 <Inventory>  
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 <records>1127</records>  
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 </Record\_Delimited>  
 <reference\_type>inventory\_has\_member\_product</reference\_type>  
 </Inventory>  
 </File\_Area\_Inventory>  
</Product\_Collection>

1. Sample Data Product Labels

This section provides sample product labels for the various data types described in this document.

* 1. Sample DRF Label

This is a copy of a remote sensing (IUVS) DRF data product label. While the specific content of the data file described here will vary from DRF product type to another, this sample label is representative of the basic layout of DRF data product labels.

<?xml version="1.0" encoding="UTF-8"?>

<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<?xml-model href="https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<Product\_Observational

xmlns="http://pds.nasa.gov/pds4/pds/v1"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"

xsi:schemaLocation="

http://pds.nasa.gov/pds4/pds/v1

https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.xsd

http://pds.nasa.gov/pds4/mission/mvn/v1

https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.xsd

">

<Identification\_Area>

<logical\_identifier>urn:nasa:pds:maven.anc:data.drf.rs:sci\_anc\_rs20\_004\_008</logical\_identifier>

<version\_id>2.0</version\_id>

<title>Remote Sensing (IUVS) instrument data DRF 2020-01-04</title>

<information\_model\_version>1.13.0.0</information\_model\_version>

<product\_class>Product\_Observational</product\_class>

<Citation\_Information>

<publication\_year>2020</publication\_year>

<description>

This is the Remote Sensing (IUVS) instrument data DRF file for 2020-01-04.

</description>

</Citation\_Information>

<Modification\_History>

<Modification\_Detail>

<modification\_date>2020-08-18</modification\_date>

<version\_id>2.0</version\_id>

<description>

The data file has been updated to correct header errors, remove data records at the beginning of the f

ile which contained blank values, and remove truncated records at the end of data files.

</description>

</Modification\_Detail>

</Modification\_History>

</Identification\_Area>

<Observation\_Area>

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</Time\_Coordinates>

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<purpose>Engineering</purpose>

<processing\_level>Raw</processing\_level>

</Primary\_Result\_Summary>

<Investigation\_Area>

<name>Mars Atmosphere and Volatile EvolutioN</name>

<type>Mission</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:investigation:mission.maven</lid\_reference>

<reference\_type>data\_to\_investigation</reference\_type>

</Internal\_Reference>

</Investigation\_Area>

<Observing\_System>

<Observing\_System\_Component>

<name>Mars Atmosphere and Volatile EvolutioN Mission</name>

<type>Spacecraft</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:instrument\_host:spacecraft.maven</lid\_reference>

<reference\_type>is\_instrument\_host</reference\_type>

</Internal\_Reference>

</Observing\_System\_Component>

<Observing\_System\_Component>

<name>Imaging Ultraviolet Spectrograph</name>

<type>Instrument</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:instrument:iuvs.maven</lid\_reference>

<reference\_type>is\_instrument</reference\_type>

</Internal\_Reference>

</Observing\_System\_Component>

</Observing\_System>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

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<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Mission\_Area>

<mvn:MAVEN>

<mvn:mission\_phase\_name>EM-4</mvn:mission\_phase\_name>

</mvn:MAVEN>

</Mission\_Area>

</Observation\_Area>

<File\_Area\_Observational>

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<creation\_date\_time>2020-08-18T02:13:54</creation\_date\_time>

<file\_size unit="byte">464184</file\_size>

<md5\_checksum>ae73853d6587222277caa7fbb7663406</md5\_checksum>

</File>

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</Header>

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<field\_length unit="byte">19</field\_length>

</Field\_Character>

<Field\_Character>

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<field\_location unit="byte">21</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>DN</unit>

<description>

RSDPU internal survival temperature.

</description>

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<Field\_Character>

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<field\_length unit="byte">12</field\_length>

<unit>deg</unit>

<description>

RSDPU internal survival temperature.

</description>

</Field\_Character>

<Field\_Character>

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<unit>DN</unit>

<description>

IUVS internal survival temperature.

</description>

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<Field\_Character>

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<data\_type>ASCII\_Real</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>deg</unit>

<description>

IUVS internal survival temperature.

</description>

</Field\_Character>

<Field\_Character>

<name>IuvsInST2 DN</name>

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<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>DN</unit>

<description>

IUVS internal survival temperature.

</description>

</Field\_Character>

<Field\_Character>

<name>IuvsInST2</name>

<field\_location unit="byte">86</field\_location>

<data\_type>ASCII\_Real</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>deg</unit>

<description>

IUVS internal survival temperature.

</description>

</Field\_Character>

<Field\_Character>

<name>RspInSrT2 DN</name>

<field\_location unit="byte">99</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>DN</unit>

<description>

RSDPU internal survival temperature.

</description>

</Field\_Character>

<Field\_Character>

<name>RspInSrT2</name>

<field\_location unit="byte">112</field\_location>

<data\_type>ASCII\_Real</data\_type>

<field\_length unit="byte">12</field\_length>

<unit>deg</unit>

<description>

RSDPU internal survival temperature.

</description>

</Field\_Character>

</Record\_Character>

</Table\_Character>

</File\_Area\_Observational>

</Product\_Observational>

* 1. Sample IMU Label

This is a copy of an IMU data product label.

<?xml version="1.0" encoding="UTF-8"?>

<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<?xml-model href="https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<Product\_Observational

xmlns="http://pds.nasa.gov/pds4/pds/v1"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"

xsi:schemaLocation="

http://pds.nasa.gov/pds4/pds/v1

https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.xsd

http://pds.nasa.gov/pds4/mission/mvn/v1

https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.xsd

">

<Identification\_Area>

<logical\_identifier>urn:nasa:pds:maven.anc:data.imu:mvn\_imu20\_049\_053</logical\_identifier>

<version\_id>1.0</version\_id>

<title>Intertial Measurement Unit 2020-02-18</title>

<information\_model\_version>1.13.0.0</information\_model\_version>

<product\_class>Product\_Observational</product\_class>

<Citation\_Information>

<publication\_year>2020</publication\_year>

<description>

This is the Intertial Measurement Unit file for 2020-02-18.

</description>

</Citation\_Information>

<Modification\_History>

<Modification\_Detail>

<modification\_date>2020-08-10</modification\_date>

<version\_id>1.0</version\_id>

<description>

Initial Version

</description>

</Modification\_Detail>

</Modification\_History>

</Identification\_Area>

<Observation\_Area>

<Time\_Coordinates>

<start\_date\_time>2020-02-18T00:00:00Z</start\_date\_time>

<stop\_date\_time>2020-02-22T00:00:00Z</stop\_date\_time>

</Time\_Coordinates>

<Primary\_Result\_Summary>

<purpose>Engineering</purpose>

<processing\_level>Raw</processing\_level>

</Primary\_Result\_Summary>

<Investigation\_Area>

<name>Mars Atmosphere and Volatile EvolutioN</name>

<type>Mission</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:investigation:mission.maven</lid\_reference>

<reference\_type>data\_to\_investigation</reference\_type>

</Internal\_Reference>

</Investigation\_Area>

<Observing\_System>

<Observing\_System\_Component>

<name>Mars Atmosphere and Volatile EvolutioN Mission</name>

<type>Spacecraft</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:instrument\_host:spacecraft.maven</lid\_reference>

<reference\_type>is\_instrument\_host</reference\_type>

</Internal\_Reference>

</Observing\_System\_Component>

</Observing\_System>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Mission\_Area>

<mvn:MAVEN>

<mvn:mission\_phase\_name>EM-4</mvn:mission\_phase\_name>

</mvn:MAVEN>

</Mission\_Area>

</Observation\_Area>

<File\_Area\_Observational>

<File>

<file\_name>mvn\_imu20\_049\_053.txt</file\_name>

<creation\_date\_time>2020-08-10T18:17:08</creation\_date\_time>

<file\_size unit="byte">7648166</file\_size>

<md5\_checksum>a30b6596183758a9431c7bcbdda5eaa0</md5\_checksum>

</File>

<Header>

<offset unit="byte">0</offset>

<object\_length unit="byte">101</object\_length>

<parsing\_standard\_id>7-Bit ASCII Text</parsing\_standard\_id>

</Header>

<Table\_Character>

<offset unit="byte">101</offset>

<records>74979</records>

<record\_delimiter>Carriage-Return Line-Feed</record\_delimiter>

<Record\_Character>

<fields>12</fields>

<groups>0</groups>

<record\_length unit="byte">102</record\_length>

<Field\_Character>

<name>IMU\_TIME\_TONE</name>

<field\_location unit="byte">1</field\_location>

<data\_type>ASCII\_Real</data\_type>

<field\_length unit="byte">15</field\_length>

</Field\_Character>

<Field\_Character>

<name>IMU\_TIME</name>

<field\_location unit="byte">17</field\_location>

<data\_type>ASCII\_Real</data\_type>

<field\_length unit="byte">15</field\_length>

<description>

Corrected IMU time.

</description>

</Field\_Character>

<Field\_Character>

<name>GIFCT</name>

<field\_location unit="byte">33</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">5</field\_length>

<description>

GIF card delta time.

</description>

</Field\_Character>

<Field\_Character>

<name>FRMCNT</name>

<field\_location unit="byte">39</field\_location>

<data\_type>ASCII\_Numeric\_Base16</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Frame count.

</description>

</Field\_Character>

<Field\_Character>

<name>STATWD</name>

<field\_location unit="byte">46</field\_location>

<data\_type>ASCII\_Numeric\_Base16</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

IMU Status Word.

</description>

</Field\_Character>

<Field\_Character>

<name>XANGLE</name>

<field\_location unit="byte">53</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in direction for the X gyro with 1 count being 1e-6 radians. Orientations wrt the

MVN body frame are given in the Coordinate Systems Definitions Document, MAV-RP-10-0100

</description>

</Field\_Character>

<Field\_Character>

<name>YANGLE</name>

<field\_location unit="byte">60</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in direction for the Y gyro with 1 count being 1e-6 radians. Orientations wrt the

MVN body frame are given in the Coordinate Systems Definitions Document, MAV-RP-10-0100

</description>

</Field\_Character>

<Field\_Character>

<name>ZANGLE</name>

<field\_location unit="byte">67</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in direction for the Z gyro with 1 count being 1e-6 radians. Orientations wrt the

MVN body frame are given in the Coordinate Systems Definitions Document, MAV-RP-10-0100

</description>

</Field\_Character>

<Field\_Character>

<name>XACCEL</name>

<field\_location unit="byte">74</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in velocity of the X accelerometer. Orientation and location are in the Coordinat

e Systems Definitions Document. Each count is 7.53e-5 m/s.

</description>

</Field\_Character>

<Field\_Character>

<name>YACCEL</name>

<field\_location unit="byte">81</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in velocity of the Y accelerometer. Orientation and location are in the Coordinat

e Systems Definitions Document. Each count is 7.53e-5 m/s.

</description>

</Field\_Character>

<Field\_Character>

<name>ZACCEL</name>

<field\_location unit="byte">88</field\_location>

<data\_type>ASCII\_Integer</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

Cumulative change in velocity of the Z accelerometer. Orientation and location are in the Coordinat

e Systems Definitions Document. Each count is 7.53e-5 m/s.

</description>

</Field\_Character>

<Field\_Character>

<name>MUX</name>

<field\_location unit="byte">95</field\_location>

<data\_type>ASCII\_Numeric\_Base16</data\_type>

<field\_length unit="byte">6</field\_length>

<description>

MUX data word.

</description>

</Field\_Character>

</Record\_Character>

</Table\_Character>

</File\_Area\_Observational>

</Product\_Observational>

* 1. Sample Events Label

This is a copy of a Operational (Ops) Events data product label. While the specific content of the data file described here varies from Science Events Lists, this sample label is representative of the basic layout of both types of events data product labels.

<?xml version="1.0" encoding="UTF-8"?>

<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<?xml-model href="https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.sch"

schematypens="http://purl.oclc.org/dsdl/schematron"?>

<Product\_Observational

xmlns="http://pds.nasa.gov/pds4/pds/v1"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v0"

xsi:schemaLocation="

http://pds.nasa.gov/pds4/pds/v1

https://pds.nasa.gov/pds4/pds/v1/PDS4\_PDS\_1D00.xsd

http://pds.nasa.gov/pds4/mission/mvn/v1

https://pds.nasa.gov/pds4/mission/mvn/v1/PDS4\_MVN\_1D00\_1050.xsd

">

<Identification\_Area>

<logical\_identifier>urn:nasa:pds:maven.anc:data.events:ops\_events\_2019-08-15-00-00-00\_2019-11-15

-00-00-00</logical\_identifier>

<version\_id>1.0</version\_id>

<title>MAVEN Operational Events List: 2019-08-15 - 2019-11-14</title>

<information\_model\_version>1.13.0.0</information\_model\_version>

<product\_class>Product\_Observational</product\_class>

<Citation\_Information>

<publication\_year>2020</publication\_year>

<description>

This file contains a time-ordered listing of MAVEN spacecraft operational events,

including spacecraft orbital and other trajectory related milestones, instrument

and spacecraft commanding, DSN downlink times, etc. The events in this file cover

2019-08-15 to 2019-11-14.

</description>

</Citation\_Information>

<Modification\_History>

<Modification\_Detail>

<modification\_date>2020-02-10</modification\_date>

<version\_id>1.0</version\_id>

<description>Initial version.</description>

</Modification\_Detail>

</Modification\_History>

</Identification\_Area>

<Observation\_Area>

<Time\_Coordinates>

<start\_date\_time>2019-08-15T00:01:32Z</start\_date\_time>

<stop\_date\_time>2019-11-14T23:07:40Z</stop\_date\_time>

</Time\_Coordinates>

<Primary\_Result\_Summary>

<purpose>Engineering</purpose>

<processing\_level>Raw</processing\_level>

</Primary\_Result\_Summary>

<Investigation\_Area>

<name>Mars Atmosphere and Volatile EvolutioN Mission</name>

<type>Mission</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:investigation:mission.maven</lid\_reference>

<reference\_type>data\_to\_investigation</reference\_type>

</Internal\_Reference>

</Investigation\_Area>

<Observing\_System>

<Observing\_System\_Component>

<name>MAVEN</name>

<type>Spacecraft</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:instrument\_host:spacecraft.maven</lid\_reference>

<reference\_type>is\_instrument\_host</reference\_type>

</Internal\_Reference>

</Observing\_System\_Component>

</Observing\_System>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Target\_Identification>

<name>Mars</name>

<type>Planet</type>

<Internal\_Reference>

<lid\_reference>urn:nasa:pds:context:target:planet.mars</lid\_reference>

<reference\_type>data\_to\_target</reference\_type>

</Internal\_Reference>

</Target\_Identification>

<Mission\_Area>

<MAVEN xmlns="http://pds.nasa.gov/pds4/mission/mvn/v1">

<mission\_phase\_name>EM-3</mission\_phase\_name>

<mission\_phase\_name>EM-4</mission\_phase\_name>

</MAVEN>

</Mission\_Area>

</Observation\_Area>

<File\_Area\_Observational>

<File>

<file\_name>ops\_events\_2019-08-15-00-00-00\_2019-11-15-00-00-00.csv</file\_name>

<creation\_date\_time>2020-02-10T21:33:56</creation\_date\_time>

<file\_size unit="byte">1723759</file\_size>

<md5\_checksum>95ac8eb6145edbbdd66d8d45c5e02f29</md5\_checksum>

</File>

<Header>

<offset unit="byte">0</offset>

<object\_length unit="byte">68</object\_length>

<parsing\_standard\_id>7-Bit ASCII Text</parsing\_standard\_id>

</Header>

<Table\_Delimited>

<offset unit="byte">68</offset>

<parsing\_standard\_id>PDS DSV 1</parsing\_standard\_id>

<records>6067</records>

<record\_delimiter>Carriage-Return Line-Feed</record\_delimiter>

<field\_delimiter>Comma</field\_delimiter>

<Record\_Delimited>

<fields>7</fields>

<groups>0</groups>

<maximum\_record\_length unit="byte">428</maximum\_record\_length>

<Field\_Delimited>

<name>id</name>

<field\_number>1</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Event ID; a unique event ID number</description>

</Field\_Delimited>

<Field\_Delimited>

<name>event\_type\_id</name>

<field\_number>2</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Event type code</description>

</Field\_Delimited>

<Field\_Delimited>

<name>start\_time</name>

<field\_number>3</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Event start date and time</description>

</Field\_Delimited>

<Field\_Delimited>

<name>end\_time</name>

<field\_number>4</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Event end date and time (may be the same as start\_time for discrete events

)</description>

</Field\_Delimited>

<Field\_Delimited>

<name>source</name>

<field\_number>5</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Event source: science, MAVEN Integrated Report, or SPICE kernels</descript

ion>

</Field\_Delimited>

<Field\_Delimited>

<name>description</name>

<field\_number>6</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Text description of the event</description>

</Field\_Delimited>

<Field\_Delimited>

<name>discussion</name>

<field\_number>7</field\_number>

<data\_type>ASCII\_String</data\_type>

<description>Notes from Payload Operations Center (POC) event database</description>

</Field\_Delimited>

</Record\_Delimited>

</Table\_Delimited>

</File\_Area\_Observational>

</Product\_Observational>

1. PDS Delivery Package Manifest File Record Structures

The delivery package includes two manifest files: a transfer manifest, and MD5 checksum manifest. When delivered as part of a data delivery, these two files are not PDS archive products, and do not require PDS labels files. The format of each of these files is described below.

* 1. Transfer Package Directory Structure

/maven/data/anc/eng/eps/

/maven/data/anc/eng/gnc/

/maven/data/anc/eng/imu/

/maven/data/anc/eng/ngms/

/maven/data/anc/eng/pf/

/maven/data/anc/eng/pte/

/maven/data/anc/eng/rs/

/maven/data/anc/eng/sasm1/

/maven/data/anc/eng/sasm2/

/maven/data/anc/eng/sasm3/

/maven/data/anc/eng/usm1/

/maven/data/anc/eng/usm2/

/maven/data/anc/eng/usm3/

/maven/data/anc/eng/usm4/

/maven/data/anc/eng/usm5/

/maven/data/anc/eng/usm6/

/maven/data/anc/events/

* 1. Transfer Manifest Record Structure

The transfer manifest is defined as a two field fixed-width table where each row of the table describes one of the products in the package. The first field defines the LIDVID of each product in the package. The second field defines the file specification name of the corresponding product label in the package. The file specification name defines the name and location of the product relative to the location of the bundle product.

* 1. Checksum Manifest Record Structure

The checksum manifest consists of two fields: a 32 character hexadecimal (using lowercase letters) MD5, and a file specification from the root directory of the unzipped delivery package to every file included in the package. The file specification uses forward slashes (“/”) as path delimiters. The two fields are separated by two spaces. Manifest records may be of variable length. This is the standard output format for a variety of MD5 checksum tools (*e.g*. md5deep, etc).