NASA Heliophysics Division Project Data Management Plan Template

**Project Data Management Plan Template**

1. Template Instructions
   1. The Project Data Management Plan (PDMP) is the interface document between NASA, the mission systems, and the instrument teams that describes the science and ancillary data associated with the mission and how the data will be managed. This document describes how the mission will meet the Level-1 requirements (found within the Program Level Requirements Appendix (PLRA)) that address the preparation and distribution of processed science data for the general community.
   2. The science teams (instrument providers and Project Scientists) for each mission will develop a PDMP that defines the data, processing approach and implementation, data and documentation products, open source science data availability, software management, and storage and archival strategies. It will also define the access method(s) for the heliophysics scientific community.
   3. The project shall coordinate with and obtain feedback from the applicable Archive(s) on the development of and any updates to the PDMP.
      1. This template contains representative tables with example content. The project shall work with the applicable Archive(s) to ensure that the appropriate level of detail is captured.
   4. The PDMP shall be developed and available according to the timeline for the Science Data Management Plan within the Project Plan Control Plans Maturity Matrix in NPR 7120.5, or at the discretion of the Program Scientist. Typically, the PDMP will be available in draft form at the time of Preliminary Design Review for the mission and signed at the time of the Operational Readiness Review. The PDMP may be revised at the Flight Readiness Review/Mission Readiness Review as well as the next Senior Review or at the discretion of the Program Scientist.
   5. Each data provider will be expected to generate and make available metadata and other supporting material on the data products, spacecraft, and instrumentation appropriate to their investigation. The details of these will be defined during discussions with the Project and Program personnel during the drafting of the PDMP. The intent of such metadata and materials will be to make the data correctly and independently usable for science investigations.
   6. Baselined (signed) PDMPs, as well as any updates, shall be distributed to applicable NASA Heliophysics Data Facilities or Centers and be accessible by the public via the Heliophysics Digital Resource Library (HDRL).
2. Project Data Management Plan Title Page
3. Signature Page

|  |  |
| --- | --- |
| [*Project Name*] Project Data Management Plan | |
| [*short title or acronym*] | |
|  | |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Project Manager | Date |
|  |  |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Project Scientist *<for Directed missions>* | Date |
|  |  |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Principal Investigator *<for each instrument>* | Date |
|  |  |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Archive Project Scientist | Date |
|  |  |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| HQ Program Scientist | Date |
|  |  |
| By signing this document, signatories are certifying that the content herein is acceptable direction for managing the project’s data and that they will ensure its implementation by those over whom they have authority. | |
| **Copy to:** HQ Program Executive | |

1. Change History Log

|  |  |  |
| --- | --- | --- |
| **Revision** | **Effective Date** | **Description of Changes** |
| Baseline | mm/dd/yyyy | Original |
| Revision 1 | mm/dd/yyyy | <<Include brief overview of any changes made from ‘Original version’ to this version by section.>> |

1. Project Data Management Plan Content

**[Project Name] PROJECT DATA MANAGEMENT PLAN**

**[short title or acronym]**

# Introduction

## Purpose and Scope

*This section provides a brief description/listing of the specific aspects of data management covered by this plan.*

## Plan Development, Maintenance, and Management Responsibility

*This section* *identifies who within the project/mission is responsible for maintaining the PDMP along with who should be providing assistance in doing so. Ideally, the instrument teams aid with updating information on their respective instruments within the PDMP.*

## Change Control

*This section* *identifies any change control or configuration management plans and processes that apply to this document. It also identifies any key milestones or reviews that draft and/or final versions of the document are tied to.*

## About This Document

*This section* *provides a brief overview of what each section of the document covers.*

## Relevant Documents

*This section* *identifies (in tabular format) any other project/mission documentation with higher-level guiding requirements or that provide more detail or context. The Program Level Requirements Appendix (PLRA) version(s) and date(s) that this documentation captures data products for shall be listed. See example below:*

|  |  |  |
| --- | --- | --- |
| **Title** | **Document Number** | **Publication Date** |
| SDO Mission Requirements Document | 464-SYS-REQ-0004 | 18 Nov 2005 |
| Interface Control Document between the SDO Data Distribution System (DDS) and the Science Operations Centers | 464-GS-ICD-0010 | 16 Jun 2006 |
| Interface Control Document between the SDO Mission Operations Center (MOC) and the Science Operations Centers | 464-GS-ICD-0001 | 27 April 2006 [Baseline]  15 Jun 2007 [Revision 1] |
| … |  |  |

# Mission Overview

*This section briefly summarizes the mission, spacecraft, and/or instruments to provide its role and importance within the context of the SMD portfolio.*

## Mission Objectives

*This section describes the science objective(s) of the mission. It shall also identify other mission stakeholders, partner agencies, and their science contributions.*

## Launch, Orbit, and Operations

*This section notes the launch date for the mission. It summarizes key operational activities such as orbital maneuvers, checkout, and commissioning in order to provide checkpoints for potentially flagging initial flaws in the data as well as to provide a timeline of when primary project data collection occurs within the mission life cycle. This section also describes how the mission will operationally fulfil its science goals. It identifies the entities involved with the handling of the mission’s science data.*

# Science Instrumentation

*This section summarizes each instrument or investigation that this PDMP applies to (one 3.x subsection per instrument). Include a summary table that includes all of the mission’s instruments and key details as shown in the example below. If the instrument has multiple operational/observation modes, those shall be described here.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inst. Name** | **In situ or Remote Sensing?** | **Mass (kg)** | **Power (W)** | **Data Rate (Mbps)** | **PI** | **PI Organization** | **Inst. Status** |
| AIA | Remote sensing | 155 | 188 | 67 | Alan Title | LMSAL |  |
| EVE | Remote sensing | 55 | 76 | 7 | Tom Woods | LASP |  |
| … |  |  |  |  |  |  |  |

*Partner instruments/hosted payloads and the data they produce shall be subject to the terms of their applicable Memorandum of Understanding (MOU).*

## <Instrument/Investigation Name>

### Instrument Measurement Requirements

*This subsection summarizes the required measurement parameters of the instrument (what the instrument* ***MUST*** *do)*

|  |  |
| --- | --- |
| **Measurement Parameter** | **Value** |
| Parameter Measured | Spectral irradiance covering 0.1-105 nm and 121.6 nm every 10 seconds [Baseline]  Spectral irradiance covering 37-105 nm and 121.6 nm every 10 seconds [Updated 27 May 2014] |
| Energy/Wavelength Range | 0.1 to 105 nm [Baseline]  37 to 105 nm [Updated 27 May 2014] |
| Energy/Wavelength Resolution | 0.1 nm (5-105 nm); 1 nm (0.1-5 nm) [Baseline]  0.1 nm (37-105 nm); 1 nm (0.1-5 nm) [Updated 27 May 2014] |

### Instrument Description

*This subsection* *describes the primary scientific objectives of the instrument, its hardware, physical configuration, etc. This subsection lists the major elements of the instrument and provides a schematic of the conceptual design. Known issues due to external factors that could impact any long-term comparison or analysis (e.g., optical distortion due to gradual radiation degradation) should be captured.*

### Instrument Observation Requirements

*This subsection summarizes the required observation parameters of the instrument (what the instrument* ***CAN*** *do). Not applicable for in situ measurements.*

### Instrument Observation Capabilities

*This subsection* *summarizes specific instrument parameters, such as number of detectors, field of view, wavelengths measured, time resolution, data rate, etc. For in situ instruments, specify the measurement capabilities.*

| **Observation Parameter** | **Value** | | |
| --- | --- | --- | --- |
| **Prime Mission** | **Extension 1** | **Extension 2** |
| Observable | EUV | EUV | EUV |
| Number and Type of Detectors | 2 1024 x 2048 CCDs  2 Si photodiodes in MEGS;  9 Si photodiodes in ESP | 2 1024 x 2048 CCDs  2 Si photodiodes in MEGS;  8 Si photodiodes in ESP | 2 1024 x 2048 CCDs  7 Si photodiodes in ESP |
| Sensitive Area | 2048 (wavelength/spectrum) x 1024 (slit image) for each CCD | 2048 (wavelength/spectrum) x 1024 (slit image) for each CCD | 2048 (wavelength/spectrum) x 1024 (slit image) for each CCD |
| Field of View | 2° ± 1° | 2° ± 1° | 2° ± 1° |
| Time Resolution | ≤ 20 sec between spectra | ≤ 20 sec between spectra | ≤ 20 sec between spectra |
| Positioning | Uncertainty < 60” over 10 second intervals | Uncertainty < 60” over 10 second intervals | Uncertainty < 60” over 10 second intervals |
| Sensitivity |  |  |  |
| Data Rate | Science data (Ka-band): 7 Mbps  HK (S-band): 2 kbps | Science data (Ka-band): 7 Mbps  HK (S-band): 2 kbps | Science data (Ka-band): 7 Mbps  HK (S-band): 2 kbps |

### Data Acquisition

*This subsection* *describes what data is obtained by the instrument, how it’s obtained, any variation in data acquisition modes, etc.*

# Data Products

*A summary table of data products, mapped by data level and instrument, shall be included.*

| **Data Level** | **<Inst 1>** | **<Inst 2>** | **<Inst 3>** | **<Inst 4>** |
| --- | --- | --- | --- | --- |
| L0 | Raw CCSDS data packets, real-time Level 0 files and SSR binary files. | Time-ordered raw data, with communication artifacts removed | Raw images with header information, in instrument units | Raw CCSDS data packets, real-time Level 0 files and SSR binary files. |
| L1 | Uncompressed and decommutated L0 + Time-tagged waveform and spectral data in telemetry and engineering units [V, dBs, nT] in spacecraft coordinate system. Daily CDF files. Quick Look and daily/orbital summary plots. | Uncalibrated: 2-minute cadence pixel data and FFIs | Calibrated images (using best-available calibrations) | FITS files with uncompressed images. Image values are in raw counts (DN). |
| L2 | L1 + Time-tagged waveform and spectral data in fully calibrated physical units [V, mV/m, nT, (V/m)2/Hz, nT2/Hz] in spacecraft and heliophysical coordinate systems. Daily CDF files. Quick Look and daily/orbital summary plots. | Calibrated: 2-minute cadence pixel data and FFIs | Irradiance curves, reconstructed temperature maps, etc. | FITS files with calibrations applied. Image values are in units of brightness. FITS files of the background image computed for each calibrated image |
| L3 | … | Simple Aperture Photometry Light Curves and Centroids |  |  |
| L4 |  |  |  |  |

## <Instrument or element name> Science Data Products

*This section includes a summary list of the mission’s instruments*

|  |  |  |  |
| --- | --- | --- | --- |
| **Inst. Name** | **Parameters Measured**  **[Baseline performance]** | **Instrument Type** | **Instrument Status** |
| AIA | Images of the Sun in seven EUV wavelengths every 10 seconds, with 3 UV and visible channels every 30 seconds | Camera | ACTIVE\* |
| EVE | Spectral irradiance covering 0.1-105 nm and 121.6 nm every 10 seconds | Spectrometer | INACTIVE. MEGS-A and SAM powered down due to anomaly. No measurements from 6-37 nm after 26 May 2014. |
| HMI | Line-of-sight velocity and magnetic field (vector and longitudinal) | Imager: Optical | ACTIVE |
| **…** |  |  |  |

*\* Status may also be indicated using a Green/Yellow/Red rating with accompanying details and rating criteria*

### <Instrument or element name> Data Products Functional Description

*This subsection* *details the science data products produced by a particular mission instrument or ground system element (e.g., SOC). The mission-specific data levels should be defined, and the steps needed to process each level of data shall be described. A reference to the general data level definitions located in the Scientific Information Policy for the Science Mission Directorate should be included.*

*Data Level Definitions*

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Level** | **Data Format** | **Brief Description** | **Source** |
| Level 0 | Google Protocol Buffer | Time-ordered raw data, with communication artifacts removed | POC |
| Level 1 | FITS | Uncalibrated: 2-minute cadence pixel data and FFIs | SPOC |
| Level 2 | FITS | Calibrated: 2-minute cadence pixel data and FFIs | SPOC |
| … |  |  |  |

*Any associated metadata products to be generated and maintained shall also be described. Details should also include the cadence (e.g., hourly, daily, etc.) for processing of data products.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Product** | **Brief Description** | **Source** | **Host** |
| Uncalibrated Full-Frame Images (FFIs) | FITS data files containing the uncalibrated pixels on a single CCD per 30 minute cadence observations. FFIs are provided for each camera individually and are contained in a single FITS file. | POC | MAST |
| Light Curves (LCs) | FITS binary table files for science targets observed as 2-minute cadence in a single observing sector that contains a primary header, a light curve extension containing the simple aperture time-series photometry (SAP), systematic-corrected aperture time-series photometry (PDC\_SAP), and additional data like associated uncertainties, centroid values, and an aperture extension. | SPOC | MAST |
| … |  |  |  |

### <Instrument or element name> Science Data Distribution

*This subsection* *summarizes the data products and key parameters (possibly in tabular format, see example below).*

| **Level** | **Components** | **Time Resolution** | **Time Span** | **Processing Cadence** | **Daily Volume (MB)** | **Public release of day N data** | **Date Modified** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| L2 | ~~MEGS-A, B~~  MEGS-B | 10 sec | 1 hour | After L1 | ~~1200~~  600 | Hour 23-24 on day N+1 | 15 Dec 2009 [Baseline]  26 May 2014 [MEGS-A failure] |
| L3 | ESP~~, SAM, MEGS-A~~, MEGS-B, MEGS-P | 1 day | 1 day | 1/day | ~~0.026~~  0.015 | Hour 0-1 on day N+2 | 15 Dec 2009 [Baseline]  26 May 2014 [MEGS-A/SAM failure] |

*This subsection also provides details on data storage, including storage medium and available space/volume, file format(s), backup and archival strategy, and data catalogues*

# Ground System

*This section provides details on each element on the ground that project data is routed through.*

## Ground System Architecture

*This section* *lists the elements (e.g., DSN, MOC, SOC) that make up the mission’s ground system.*

## <Ground system element name>

*This section* *provides additional details for the ground system element, such as its primary function and responsibilities. Develop a separate section for each element.*

# Data Flow

*This section provides details on the transfer of data between [flight and ground] mission elements.*

## Overview of End-to-End Data Flow

### Data Flow to Spacecraft

*This subsection* *describes the transfer (e.g., Guest Observer Office-to-Science Office, Science Office-to-POC, POC-to-MOC, MOC-to-Network) of information as it evolves from a desired observation to a spacecraft command, including the development of intermediate products (e.g., objects of interest, candidate target lists, pixel masks, target tables, instrument and spacecraft commands).*

### Data Flow from Spacecraft

*This subsection* *describes the transfer (e.g., Network-to-FDF, Network-to-POC, POC-to-SOC, etc.) of return data and the development of products along each step (e.g., raw telemetry, Level 0 data, light curves, calibrated images, etc.) as well as transfer timeframe and expected processing time.*

## Data Handling and Timeline

*This section* *summarizes the flow of data from the spacecraft as well as the transfer method (e.g., TCP/IP over Restricted IONet, FTP, etc.) along with the timeline for delivery to/from each element (see sample below).*

|  |  |  |  |
| --- | --- | --- | --- |
| **Flow** | **Data Product** | **Timeline** | **Transfer Method** |
| DSN to MOC | Ka-band data  *Primary Science*  *Ancillary Data*  *Inst. HK* | 1 day of downlink | VPN |
| DSN to POC | S-band data  *Playback spacecraft HK*  *Playback Inst HK*  *Realtime TLM* | <10 seconds of downlink | TCP/IP via RIONet |
| … |  |  |  |

*If available, a more detailed breakdown of the release schedule for calibrated data by campaign (e.g., Launch + xx, by orbit, by perihelion passage, etc.) may be provided*

|  |  |  |  |
| --- | --- | --- | --- |
| **Campaign** | **Observation Start** | **Observation Stop** | **Timeframe for Calibrated Data Availability** |
| C001 | Launch + 2 months | Launch + 3 months | 6 months after start of C001 |
| … |  |  |  |

# Archiving and Data Access

*This section describes the process for archiving data and how those archives may be accessed. An estimate of instrument data storage requirements over the nominal life of the mission should be provided. Revised estimates for extended mission phases shall be provided at the Senior Review.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Prime Mission (Prime mission start date – Prime mission end date)** | | | | |
| **Instrument/Data Set** | **Annual**  **(Uncompressed)** | **5-Year Total**  **(Uncompressed)** | **Annual**  **(Compressed)** | **5-Year Total**  **(Compressed)** |
| **<Instrument 1>** | | | | |
| Level 0 Data | 54 TB | 270 TB | 27 TB | 135 TB |
| Level 1 Data | 0.5 TB | 2.5 T | 0.25 TB | 1.25 TB |
| Space Weather Data | 0.028 TB | 0.14 TB | 0.028 TB | 0.14 TB |
| Higher level Products | 0.5 TB | 2.5 TB | 0.25 TB | 1.25 TB |
| <Inst 1> Total | 55 TB | 275 TB | 27.5 TB | 137.5 TB |
| **<Instrument 2>** | | | | |
| Level 0 Data |  |  |  |  |
| … |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Extended Mission (Extension start date – Extension end date)** | | | | |
| **Instrument/Data Set** | **Annual**  **(Uncompressed)** | **5-Year Total**  **(Uncompressed)** | **Annual**  **(Compressed)** | **5-Year Total**  **(Compressed)** |
| **<Instrument 1>** | | | | |
| Level 0 Data | 54 TB | 270 TB | 27 TB | 135 TB |
| Level 1 Data | 0.5 TB | 2.5 T | 0.25 TB | 1.25 TB |
| Space Weather Data | 0.028 TB | 0.14 TB | 0.028 TB | 0.14 TB |
| Higher level Products | 0.5 TB | 2.5 TB | 0.25 TB | 1.25 TB |
| <Inst 1> Total | 55 TB | 275 TB | 27.5 TB | 137.5 TB |
| **<Instrument 2>** | | | | |
| Level 0 Data |  |  |  |  |
| … |  |  |  |  |

## Current Archive Locations

*This section* *describes each of the locations/repositories for science data products, any mirroring locations, and archival roles and responsibilities—including which archive is the primary data storage and dissemination system during a mission’s operation. The implementation of any archive-specific naming conventions and file verification processes shall be explained (see* [*https://spdf.gsfc.nasa.gov/guidelines/archive\_newdata\_reqt.html*](https://spdf.gsfc.nasa.gov/guidelines/archive_newdata_reqt.html) *for requirements). Any requirements or restrictions for accessing the archives (e.g., accounts) are identified.*

## Data Access and Processing Tools

*This section* *identifies any software available to help users search the archive catalog, access data, and further process the data. Minimum system requirements needed to install (if needed) and use the software shall be provided. This section identifies the capabilities of the software (e.g., browsing, generating light curves, performing analyses, etc.), the language it was developed in, and the file types it can be used with.*

## Documentation and Metadata

*This section* *describes how the project will make documentation of data products and format available. Listings of any software documentation or user guides shall indicate when they were last updated as well as the version of the software they are applicable to. This section also identifies any metadata schemes to be employed (e.g., SPASE).*

## Publication Plan

*This section* *describes the types of publications that are expected to be produced from the HPD-funded scientific activities, including peer reviewed manuscripts, technical reports, conference materials, and books. It should also outline the methods expected to be used to make the publications publicly accessible. For more information about meeting publication and open science requirements, see the SMD Open-Source Science Guidance at* [*http://science.nasa.gov/oss-guidance*](http://science.nasa.gov/oss-guidance)*.*

## Open Science Activities

*This section* *describes additional open science activities associated with the project. This may include:*

* *Holding scientific workshops and meetings openly to enable broad participation*
* *Preregistering research plans in advance of conducting scientific activities*
* *Providing project personnel with open science training or enablement (if not described elsewhere in a proposal)*
* *Integrating open science practices into citizen science activities*
* *Contributions to or involvement in open-science communities*

###### Acronyms