**Appendix I. Open Science and Data Management Plan Template**

**Template Change Log**

|  |  |  |
| --- | --- | --- |
| **Revision** | **Effective Date** | **Description of Changes** |
| Baseline  |  March 17, 2025 | Original  |
|  |  |  |
|  |  |  |

**Table of Contents**

[I.1 Template Instructions 2](#_Toc184633021)

[I.2 Title Page 4](#_Toc184633022)

[I.3 Open Science and Data Management Plan 5](#_Toc184633023)

[0.0 Preface 5](#_Toc184633024)

[1.0 Introduction 7](#_Toc184633025)

[2.0 Mission Overview 7](#_Toc184633026)

[3.0 Open Science 8](#_Toc184633027)

[4.0 Science Instrumentation 11](#_Toc184633028)

[5.0 Data Management 13](#_Toc184633029)

[6.0 Scientific Software Management 19](#_Toc184633030)

[Appendix A: References 23](#_Toc184633031)

[Appendix B: Abbreviations and Acronyms 24](#_Toc184633032)

[Appendix C. OSDMP Compliance Matrix 25](#_Toc184633033)

# I.1 Template Instructions

1. The Open Science and Data Management Plan (OSDMP) is the interface document between NASA, flight projects, and instrument teams that describes how scientific information associated with the project will be managed and shared openly. The OSDMP describes how the project will meet the Level-1 requirements (found within the Program Level Requirements Appendix, PLRA) that address the preparation and distribution of processed science data, the development of scientific software as open source, and the open accessibility of mission publications and materials produced for public scientific meetings. The OSDMP is a requirement for flight projects within the Scientific Mission Directorate and a Best Practice for flight projects in other directorates when applicable.
2. Each section in the OSDMP is required unless it is not applicable to the project or is marked as optional in this Appendix. If a section is not applicable to a particular project, indicate in the appropriate section and provide a rationale. If a section is applicable but the project desires to omit the section or parts of a section, then a waiver needs to be obtained from the Office of the Chief Science Data Officer in accordance with the requirement tailoring process for NPR 7120.5, NASA Space Flight Program and Project Management Requirements. Approvals are documented in Part 4.0, Waivers or Deviations Log, of the Program Plan.
3. The Compliance Matrix for the OSDMP is attached to the OSDMP and included as an Appendix in this document. If the format of the completed OSDMP differs from this template, a cross-reference table indicating the location for each template paragraph must be provided with the document when it is submitted for review.
4. The approval signatures of the Program Manager and Project Manager certify that the OSDMP implements all of the Agency’s applicable institutional requirements or that the authority responsible for those requirements has agreed to the modification of those requirements contained in the OSDMP. The SMD Chief Science Data Officer and the relevant SMD Division Data Officer concur that the OSDMP meets those requirements. Divisions may include additional signatories to the document, including data repository representatives, Program Scientists, or Program Executives for the purposes of review and/or concurrence.
5. The project delivers a preliminary version of the OSDMP at the Preliminary Design Review (PDR). The OSDMP is baselined and signed at the Critical Design Review (CDR).
6. A public version of the OSDMP shall be made available after being approved at CDR. At a minimum, the OSDMP shall be made publicly available in the NASA STI Repository. Projects should make the OSDMP available via their websites, preprint services, or other community appropriate repositories. The OSDMP should be a citable document and be provided with a persistent identifier such as a Digital Object Identifier (DOI).
7. The project maintains the OSDMP as a living document throughout the project life cycle and submits the OSDMP to Headquarters at appropriate life cycle reviews for evaluation and archiving. The project is encouraged to build the OSDMP from existing publicly available information such as existing mission websites, documentation, and/or publications that describe the mission.
8. Unless otherwise specified, this template document uses terms as defined in SPD-41a: Scientific Information Policy for the Science Mission Directorate.
9. The OSDMP shall not include any restricted information. Restricted information should be included in non-public documents that may be referenced by the OSDMP, if necessary.
10. Projects that did not complete their KDP-B review by March 2023 are required to be compliant with SPD-41a. Projects that have not passed CDR and have already started to develop their Science Data Management Plan as of the Effective Date of this document are not required to follow this template. However, these projects still must provide the necessary information to assess compliance with SPD-41a requirements.
11. The OSDMP template will be reviewed one year after adoption and then at least every three years.

# I.2 Title Page

The first page of the OSDMP is the title page. It includes “<Project Name> Open Science and Data Management Plan (OSDMP)”, version, and date.

The title page, or an immediately following signatures page, should include the signatures of thosethat approve, concur, and review the document. This includes the Project Manager, Program Manager, SMD Chief Science Data Officer, and relevant SMD Division Data Officer. Divisions may include additional signatories to the document, including data repository representatives, Program Scientists, or Program Executives for the purposes of review and/or concurrence.

# I.3 Open Science and Data Management Plan

## 0.0 Preface

This section describes the processes for configuration control of the OSDMP, referencing any relevant project configuration management procedures or guidelines. This section includes a point of contact for questions related to the OSDMP.

### 0.1 Change History Log

This section provides the revision status, effective date, and a brief description of the changes. Include the following table.

**Table <#>: Change History Log**

|  |  |  |
| --- | --- | --- |
| **Revision** | **Effective Date** | **Description of Changes** |
|  |  |  |
|  |  |  |
|  |  |  |

### 0.2 Table of TBDs/TBRs

This section provides a list of any requirements that are still to be completed in preliminary versions of the OSDMP. This can include any items To Be Decided (TBD) or To Be Required (TBR). This section can be removed if all items have been resolved. Include the following table. The “Due Date” may be a milestone or review.

**Table <#>: TBDs/TBRs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Action Item No.** | **Location** | **Summary** | **Individual/ Organization Actionee** | **Due Date** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

### 0.3 Table of Tailored Requirements

This section provides a list of any requirements related to the OSDMP or relevant scientific information requirements that have been tailored for the project. This can either be at the project or division level. This section may be removed if no items have been tailored. Include the following table.

**Table <#>: Tailored Requirements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item No.** | **Requirement** | **Summary** | **Approval Date** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |

## 1.0 Introduction

This section provides an overview of the OSDMP document including its scope, responsibilities for the OSDMP, and related documents. Each section in the Introduction is required.

### 1.1 Purpose and Scope

This section provides a brief description of the specific aspects of open science and data management covered by this plan. This may include the preparation and distribution of processed science data, the development of scientific software for the mission, and the open accessibility of mission publications and public scientific meetings.

### OSDMP Development, Maintenance, and Management Responsibility

This section identifies who within the project is responsible for developing and maintaining the OSDMP and who should provide assistance.

### Applicable Documents

This section identifies (in tabular format) program documentation and NASA policies that establish higher-level guiding requirements for the project. This includes policies that are relevant to the development of the OSDMP (e.g., relevant NPRs, SPD-41a, SMD Division Data Policies) and program documentation (i.e. the relevant Program Level Requirements Appendix (PLRA) version(s) and date(s).)

**Table <#>: Applicable Documents to this OSDMP**

|  |  |
| --- | --- |
| **Document Name** | **Publication Date**  |
|  |  |
|  |  |
|  |  |

##

## 2.0 Mission Overview

This section briefly summarizes the mission, spacecraft, and/or instruments to provide their role and importance within the context of the SMD portfolio. Each section in the Mission Overview is required. These sections should be brief and reference other sections or relevant documents with more information.

### 2.1 Mission Objectives

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

### 2.2 Launch, Orbit, and Operations

This section notes the launch date for the mission and expected duration of the mission. It provides a timeline of key operational activities in the project life cycle such as orbital maneuvers, checkout, commissioning, and when primary project data collection occurs.

## 3.0 Open Science

This section describes plans to ensure that the production and dissemination of mission scientific information follow the open science principles of availability, transparency, reproducibility, and collaboration. Subsections summarize plans to share scientific data, software, publications, and materials from public scientific meetings. Sections are marked if they are optional.

**3.1 Roles and Responsibilities**

This section describes the project roles that are responsible for implementing the elements of open science and data management described in the OSDMP.

Projects are responsible for defining these roles. This includes activities assigned to parties that are external to the mission team, such as distribution of the data by a NASA data repository as designated by a division.

### 3.2 Data Management

This section briefly summarizes the processes around scientific data products to be shared openly through the project life cycle, which must include observation, auxiliary, calibration, and ground data. This section references appropriate sections of the more extensive data management plan in Section 5.

A data product is defined as a processed collection of one or more parameters packaged with associated ancillary and labeling data.

This section must include the following information:

* A brief description of the delivery of the data. This should include when data will be delivered after launch and when data will be normally delivered relative to observations. For Level 1 data and above, the maximum data latency after being obtained must be as short as possible. There may be a period for calibration and validation. This period must be as short as possible and no longer than six months. Any limitations in meeting these expectations must be described for the purposes of obtaining a waiver if needed. A more extensive timeline should be included in Section 5.
* For Level 1 and above, data must be made available without fee or restriction of use. If they are not, then any limitation or cost on the data must be described for the purposes of obtaining a waiver if needed.
* A description of any scientific data that will not be shared or will have restricted access.
* A description of the license for the data. The data should be licensed as [CC0 1.0 Universal](https://creativecommons.org/publicdomain/zero/1.0/). If another license is used, the OSDMP must describe the data license and provide justification for its use.
* A brief description of how the data will be findable, such that the data can be retrieved, downloaded, indexed, and searched. More extensive discussion of data accessibility should be included in Section 5. This includes identifying the data repository to be used.
* A brief description of how the data collection will be citable in alignment with the best practices of the community. A more extensive description should be included in Section 5 including the use of persistent identifiers.

### 3.3 Scientific Software Management

This section briefly describes the scope of scientific software to be developed throughout the project life cycle. The scope of the software described in this section should include software with scientific value that is developed by the project, which may include software developed for operations, planning, data acquisition, processing, simulations, modelling, and analysis. This section references appropriate sections of the more extensive description of scientific software in Section 6 of this document and/or the project’s Software Management Plan.

The section must include the following information:

* The process for open development and release of unrestricted scientific software for the mission.
* The publicly accessible, version controlled platform to be used for development.
* The software licenses used for the project. If there are no other restrictions, publicly available SMD-funded software should be released under a permissive license that has broad acceptance in the community.
* If commercial software is used in ways that would impact scientific analysis, a description of how this may impact reproducibility and accessibility of the scientific products.
* A brief description of how scientific software will be archived and made citable.

More extensive discussion of these practices should be included in Section 6 as appropriate.

#### 3.3.1 Process for Community Engagement

This section describes processes for managing community input into the project’s scientific software development and contributing to existing open-source software projects. Projects are not required to accept contributions from the public.

This includes the provision of a Code of Conduct and Guidelines for Contributors for the projects. These documents may reference public versions or be included in an appendix.

Projects must describe their process for using and contributing to existing open-source software projects. Reuse and contributions to existing open-source software should be prioritized over the development of new software.

#### 3.3.2 Restricted Scientific Software

This section describes the identification and handling of any scientific software that is not able to be developed openly due to Federal law or guidance, NASA policy, intellectual property considerations, or security concern (i.e., restricted software, as defined in SPD-41a Appendix B). This section may reference other documents including the project’s Software Management Plan or a list of developed software.

If appropriate, this section may include a table that details types of restricted software and the applicable restriction that prevents open development, referencing the NPR 7150.2 software classification level. The restricted software, itself, should not be listed in this document.

Restricted software does not need to be described in the remainder of this document, as the remainder of the text refers to unrestricted software that is appropriate for open development.

If there is no restricted scientific software, this should be clearly stated in this section. Reference the Software Management Plan for any further details, as appropriate.

### 3.4 Publications

This section describes the types of publications to be produced, which may include peer reviewed manuscripts, documents describing algorithms for data calibration and validation (e.g., Algorithm Theoretical Basis Documents, ATBD, or Calibration and Measurement Algorithms Documents, CMAD) technical reports, publications produced for science events, and books. This section shall include an overview of the methods to be used to make publications openly accessible to the public at the time of publication (e.g., publishing in a journal that provides open access). This can include any further requirements in the latest version of NPD 2200.1, Management of NASA Scientific and Technical Information; NPR 2200.2, Requirements for Documentation, Approval and Dissemination of Scientific and Technical Information. As appropriate, this section may also reference the project’s Knowledge Management Plan (NPR 7120.6 Knowledge Policy for Programs and Projects).

Publications produced by the project must be made available in the NASA STI Repository.

Publications produced by the project that are made publicly available must have a persistent identifier.

Peer reviewed publications that describe the mission must be published as open access. Projects are also encouraged to make peer reviewed publications available as preprints, via their websites, or in other venues to increase their accessibility.

**3.4.1 Scientific Publication Summary**

This section is a summary table that includes the types of publications to be produced, the schedule for their release to the public, and the methods for archiving and providing public access.

**Table <#>: <Project> Publication Products**

|  |  |  |  |
| --- | --- | --- | --- |
| **Publication Type** | **Description** | **Publication Schedule** | **Repository**  |
|  |   |   |   |
|  |  |  |  |

### 3.5 Public Scientific Meetings

This section describes plans to enable broad participation in public scientific meetings for which the project is the primary sponsor (e.g., research and applications community workshops, symposium, or meetings). Plans to provide public access to publications produced for science meetings for which the project is the primary sponsor should be included in the publication sharing plan described in Section 3.4.

### 3.6 Additional Open Science Activities [optional]

This section describes additional open science activities associated with the project (if not described elsewhere in the OSDMP). This section is only required if there are additional open science activities. This may include: providing project personnel with open science training or capacity building, citizen science activities, and/or contributions to or involvement in open-science communities. This may be a single section or multiple sections for additional activities.

### 3.7 Physical Samples [optional; Required if appropriate]

The section briefly describes the processes for handling and sharing of physical samples returned as part of the mission. This section is only required if the mission returns physical samples. This must reference the Physical Sample Plan or other applicable documents. An additional section may be included in this document for more detailed descriptions.

## 4.0 Science Instrumentation

This section summarizes each instrument or investigation to which this OSDMP applies.

This section includes one 4.x subsection per instrument. This section and each subsection are required as part of the OSDMP. Subsubsections and tables are required unless they are not applicable to the instrument. Projects may include additional capabilities if the feature produces data that might have scientific utility (e.g., mission telemetry or other engineering capability).

When completing tables in this section, projects should use and reference discipline standards for describing observables and metadata if they exist.

The following summary table is required and includes all 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. The Identifier for the instrument should be a permanent identifier following discipline best practice, if available. The Type should describe the type of instrument such as remote sensing, in-situ, imaging, spectroscopic, etc. as appropriate for the discipline. The ORCID should be provided for the Principal Investigator of the instrument. The primary reference should be given for the instrument either to a website or publication.

**Table <#>: <Project> Instrument List**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name**  | **Identifier** | **Type** | **PI** (ORCID) | **PI Organization**  | **Reference** |
|  |  |   |   |   |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

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

### 4.1 <Instrument/Investigation Name>

### The section provides a brief description on the objectives of the instrument and reference documents that described the instrument in more detail.

#### 4.1.1 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 may provide a schematic of the conceptual design and requirements for the instrument. 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.

#### 4.1.2 Instrument Observation Capabilities

This subsection summarizes the required observation parameters of the instrument (what the instrument cando). This includes a summary of the specific instrument parameters, such as number of detectors, field of view, wavelengths measured, time resolution, data rate, etc. For in situ instruments, the measurement capabilities should be specified. Projects may update this table as appropriate to describe their instrument or additional capabilities. Projects may include additional tables for extended phases of the mission, functionality of the mission, or changes that may occur over the lifetime of the mission.

The project must include the data rate of the instrument. At a minimum, the project must provide the median and maximum expected data rates for the instrument. Further information about the data cadence or timeline should be provided in Section 5.

**Table <#>: < Instrument> Capability**

|  |  |
| --- | --- |
| **Capability**  | **Value**  |
| Number and Type of Detectors  |  |
| Sensitive Area  |   |
| Field of View  |  |
| Time Resolution  |   |
| Energy/Wavelength Range  |  |
| Energy/Wavelength Resolution  |  |
| Positioning  |  |
| Sensitivity  |   |
| Data Rate (Max) |  |
| Data Rate (Median) |  |

#### 4.1.3 Onboard Data Acquisition and Processing

This subsection briefly describes what data is obtained onboard by the instrument, how it is obtained, any variation in data acquisition modes, and if there is any onboard data processing. This section must not include any restricted information. It should reference other documentation as needed.

If not described in Section 5 Data Management, this section includes the ancillary data inputs required to generate data products. Optionally, a data flow diagram may be included that shows the sources of data needed for product generation.

##

## 5.0 Data Management

This section provides a detailed description of data management processes. This section and each subsection are required as part of the OSDMP unless they are marked as optional. Subsubsections and tables are required unless they are not applicable to the instrument or mission. Projects may update tables as applicable to the mission.

### 5.1 Data Product Summary

This section includes a summary table of data products, mapped by instrument and data level.

#### 5.1.1 <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 they may include intermediate data levels. Levels of data are as defined in SPD-41a Appendix E.

From Level 1 and above, data must be released in non-proprietary, machine readable, modifiable, and open formats, as defined in SPD-41a. Use of other formats for the data must be justified.

The “source” of the data should identify the group responsible for producing the data product (e.g., SOC, science team).

***Table <#>: <Instrument> Data Level Definitions***

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Level** | **Data Format** | **Brief Description** | **Source** |
| L0 |  |  |  |
| L1 |  |  |  |
| L2 |  |  |  |
| …  |   |   |   |

Any associated auxiliary data products to be generated and maintained shall also be described. The “source” of the data should identify the group responsible for producing the data product.

***Table <#>: <Instrument> Auxiliary Data Definitions***

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Product** | **Data Format** | **Brief Description** | **Source** |
|  |  |  |  |
|  |  |  |  |

#### 5.1.2 <Instrument or element name> Science Data Parameters

This subsection summarizes the key parameters of the data products. This includes the timeline for delivery and daily volume. The “First Delivery” relates to when the product will be first made publicly available relative to launch. The “Latency” refers to the time between receiving the data on the ground and the release of the public data products. Projects may adjust this table as appropriate.

***Table <#>: <Instrument> Key Data Parameters***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DataLevel** | **Time Resolution** | **Time Span** | **Processing Cadence** | **Daily Volume**  | **First Delivery** | **Latency**  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

#### 5.1.3 <Instrument or element name> Science Data Metadata

Mission data shall include robust, standards-compliant metadata that clearly and explicitly describe the data. This section describes the metadata standards and any unique metadata to be used for the data from the instrument.

#### 5.1.4 <Instrument or element name> Data Quality

This section describes the plans and processes used for assessing data product quality, including conveying information about data quality to the data repository or users.

### 5.2 Ground System

This section provides details on each element on the ground that project data is routed through. This section lists the elements (e.g., DSN, MOC, SOC) that make up the mission’s ground system. This section must not contain restricted information.

#### 5.2.1 <Ground system element name>

This section provides additional details for the ground system element, such as its primary function, responsibilities, architecture, and security. Develop a separate section for each element. This section should reference documents that have more details.

### 5.3 Data Flow

This section provides details on the transfer of data between flight and ground mission elements. This should include the timeline of the data flow relative to launch and the start of operations.

#### 5.3.1 Overview of End-to-End Data Flow

##### 5.3.1.1 Data Flow to Spacecraft

This section 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).

##### 5.3.1.2 Data Flow from Spacecraft

This section 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.

#### 5.3.2 Data Handling and Timeline

This section summarizes the flow of data from the spacecraft, the transfer method (e.g., TCP/IP over Restricted IONet, FTP, etc.), and the timeline for delivery to/from each element (see sample table below). Include the schedule for data delivery to the data repository.

***Table <#>: Data Flow Timeline***

|  |  |  |  |
| --- | --- | --- | --- |
| **Flow** | **Data Product** | **Timeline** | **Transfer Method** |
|  |  |  |  |
|  |  |  |  |
|  |   |   |   |

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. This table is optional.

***Table <#>: Schedule of Data Release [optional]***

|  |  |  |  |
| --- | --- | --- | --- |
| **Campaign** | **Observation Start** | **Observation Stop** | **Timeframe for Calibrated Data Availability** |
|  |   |   |   |
|  |  |  |  |

### 5.4 Data Processing

This section provides a brief description of data processing. This may include the overall architecture of the system, compute expectations, and reprocessing. This should reference documents where this is described in more details.

### 5.5 Data Archiving and Access

This section describes the process for archiving data and how those data repositories may be accessed. This section describes each of the locations/repositories for science data products, any mirroring locations, and roles and responsibilities. This includes which data repository is responsible for data stewardship, storage, and dissemination during and after a mission’s operation.

#### 5.5.1 Data Repository Roles and Responsibilities

This section provides a description of the roles and responsibilities for the project and the data repositories. This section must describe how the project and data repository will interface during and after the lifetime of the mission. This section should be more in-depth than the roles and responsibilities described in Section 3.1.

#### 5.5.2 Data Storage Requirements

An estimate of instrument data storage requirements over the nominal life of the mission should be provided.

***Table <#>: Prime Mission Data Volumes***

|  |
| --- |
| **Prime Mission (Prime mission start date – Prime mission end date)** |
| **Instrument/Data Set** | **Annual****(Uncompressed)** | **5-Year Total****(Uncompressed)** |
| **<Instrument 1>** |
| Level 0 Data |  |  |
| Level 1 Data |  |  |
| Higher level Products |  |  |
| <Inst 1> Total |  |  |
| **<Instrument 2>** |
| Level 0 Data |  |  |
| … |  |  |
| Total |  |  |
| Level 0 Data  |  |  |
| … |  |  |

Revised estimates for extended mission phases shall be provided at the Senior Review. The following table is optional for reviews that are prior to Senior Review.

***Table <#>: Extended Mission Data Volumes [optional]***

|  |
| --- |
| **Extended (Extended mission start date – Extended mission end date)** |
| **Instrument/Data Set** | **Annual****(Uncompressed)** | **5-Year Total****(Uncompressed)** |
| **<Instrument 1>** |
| Level 0 Data |  |  |
| Level 1 Data |  |  |
| Higher level Products |  |  |
| <Inst 1> Total |  |  |
| **<Instrument 2>** |
| Level 0 Data |  |  |
| … |  |  |
| Total |  |  |
| Level 0 Data  |  |  |
| … |  |  |

#### 5.5.2 Data Archiving Process

This section describes the overall archiving process for the data. This includes the following:

* The implementation of any data repository-specific requirements shall be explained. This may include naming conventions, file verification processes, compressions, or other requirements.
* This section must describe how the data will be made citable using a persistent identifier such as a Digital Object Identifier.
* This section should include the compute architecture needed for data storage.

#### 5.5.3 Data Access

This section provides a description of data access. This includes the methods and interfaces for discovery or access to the data, any requirements or restrictions for the team or public access to the data (e.g., accounts), or any additional tools provided to support data access.

This section identifies any software available to help users search the data catalog and access 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.

#### 5.5.4 Documentation

This section describes how the project will make documentation of data products available, including relevant data standards and metadata schemes. If listed, any documentation or user guides shall indicate when they were last updated.

## 6.0 Scientific Software Management

This section describes the management and development of unrestricted scientific software. Per NASA Policy Directive NPD 7120.4 - NASA Engineering and Program/Project Management Policy Directive to “Utilize a disciplined software engineering approach … supporting all NASA missions, programs, and projects. … NASAs procedural requirements for software engineering are found in NPR 7150.2 and apply to all of the Agencies investment areas containing software systems and subsystems.” Thus, all software, including scientific software, must meet the requirements in NPR7150.2, but this document imposes additional considerations that must be met. This section may reference the Software Development/Management Plan and other documents, as appropriate, which should be a document dually used to capture these requirements as well as those in NPR7150.2. This section may reference the Software Management/Development Plan and other documents, as appropriate. This section briefly describes the scope of scientific software products to be developed by the project, which may include software developed for operations, planning, data acquisition, processing, simulation, modelling, and analysis depending on their scientific value. This section may also address the relationship of the software projects to higher-level projects, the system context for the software products, a summarized concept of operation, and the relationship of this scientific software management plan to other plans (e.g., the NPR 7150.2-specified Software Management/Development Plan). This section and subsections are required.

This section does not include discussion of any restricted software. Restricted software includes, but is not limited to, software described as restricted in project requirements, systems as defined in NASA-STD-1006A including those for command and control, ITAR or export-controlled software, or software with limited release due to security requirements or intellectual property considerations. If necessary, discussion of restricted software must occur in other documents and be referenced here.

### 6.1 Software Lifecycle

This section describes the scientific software lifecycle through the development processes. A project may have a single development process, or it may have multiple development processes for different types of software. If there are multiple development processes for different types of software (see Appendix F of SPD-41a for types of software), then each type of software should be described in its own subsection.

#### 6.1.1 Software Identification

This section describes the approach for acquisition of scientific software including identification of software to be reused, open-source software to be used and/or contributed to, and software to be developed.

Using and contributing to existing open-source projects should be prioritized.

#### 6.1.2 Software Design Process

This section describes the approach for the design of scientific software. The design of the software may include contributions from the community.

#### 6.1.3 Software Development Process

This section describes the approach for developing scientific software that may include community contributions. This should include processes for development, documentation, tools, version control, development operations, or other practices to ensure the quality of the software. This can also include management of safety, security, privacy, and other critical requirements of the software products or services.

Unrestricted scientific software must be developed openly in a publicly accessible, version-controlled platform that allows for contributions and engagement from the community. Projects are not required to accept contributions from the public.

#### 6.1.4 Verification and Validation

This section describes the approach for scientific software testing, including type of review, testing, testing frequency, and documentation of those tests or reviews. If the scientific software will be part of the project’s formal verification and validation process, this section should reference the relevant documents such as the Software Management Plan.

#### 6.1.5 Release of Software

This section describes the approach for release of the scientific software. This can include decisions on when to release, conventions for versioning, and the review process for release. Guidelines for sharing different types of software are provided in SPD-41a Appendix F. The practice of archiving releases should be described in the next section.

When released, software packages should follow the best practices of the relevant communities.

If there are no other restrictions, publicly available SMD-funded software should be released under a permissive license that has broad acceptance in the community.

#### 6.1.6 Archiving Software

This section identifies the long term repository to be used to archive publicly available scientific software, including the schedule at which updated versions of the software will be delivered to a long term repository throughout the project. Version control platforms, such as GitHub or GitLab, do not provide long term archiving of software.

* Each publicly released version of the software must be made available in a publicly accessible long term software repository such as Zenodo, Software Heritage, or a NASA-designated repository.
* Software packages must be assigned a persistent identifier, such as a Digital Object Identifier (DOI) or Software Heritage persistent Identifier (SWHID). This section must describe how persistent identifiers will be obtained.
* Software packages must be made discoverable. This section must include submitting newly developed software packages to the [NASA catalog of software](https://software.nasa.gov/) at [invention.nasa.gov](https://invention.nasa.gov/).

This section can include additional methods for making the software citable such as peer reviewed publications describing the software.

### 6.2 Description of Scientific Algorithms

This section briefly describes the scientific algorithms to be developed by the project. This should include the process to identify, develop, and test scientific algorithms. For some projects, specific algorithms may not have been developed by CDR or may only be developed at later stages of the mission. This section should be updated as those algorithms are identified. This section may have multiple subsections based on the number of algorithms. As appropriate, this section may reference the Algorithm Theoretical Basis Document (ATBD), Calibration and Measurement Algorithms Document (CMAD), or equivalent.

### 6.3 Scientific Software Table

This section summarizes the unrestricted scientific software (as defined in SPD-41a Appendix B) to be developed by the project that is appropriate for open-source development. Include a summary table of the categories of unrestricted software that will be developed as open-source, referencing the NPR 7150.2 software classification level. This may reference the project list of project software or the Software Management Plan.

**Table <#>: <Project> Open-Source Software, Source Code, and Algorithms**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Open-Source Software/Source Code/Algorithms** | **Description** | **Classification** | **Release timeline** | **Approved Open Repository and Top-Level Location** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

# Appendix A: References

*This appendix to the OSDMP template should be replaced with documents referenced in the mission OSDMP. This may include documents developed by the project, relevant documentation from data repositories or partners, or citations to the scientific literature. The current entries are documents referenced in the OSDMP template.*

[M-16-21](https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2016/m_16_21.pdf) Office of Management and Budget Memorandum: Federal Source Code Policy: Achieving Efficiency, Transparency, and Innovation through Reusable and Open Source Software

[NPD 2200.1](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=2200&s=1D) Management of NASA Scientific and Technical Information

[NPD 2091.1](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=2091&s=1C) Inventions Made by Government Employees

[NPR 7120.5F](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=7120&s=5E) NASA Space Flight Program and Project Management Requirements

[NPR 7120.6](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=7120&s=6A) Knowledge Policy for Programs and Projects

[NPR 7123.1D](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=7123&s=1B) Systems Engineering Processes and Requirements

[NPR 7150.2D](https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=7150&s=2B) NASA Software Engineering Requirements

[SPD-41a](https://smd-cms.nasa.gov/wp-content/uploads/2023/08/smd-information-policy-spd-41a.pdf) Scientific Information Policy for the Science Mission Directorate

# Appendix B: Abbreviations and Acronyms

*This appendix should be updated to include the abbreviations and acronyms used in the OSDMP.*

|  |  |
| --- | --- |
| DSN | Deep Space Network |
| MOC | Mission Operations Center |
| NPR | NASA Procedural Requirements |
| NTRS | NASA Science and Technical Information Repository |
| OCSDO | Office of the Chief Science Data Officer |
| OSDMP | Open Science and Data Management Plan |
| POC | Payload Operations Center |
| PLRA | Program Level Requirements Appendix |
| SPD-41a | SMD Policy Document 41a  |
| SMD | Science Mission Directorate |
| SOC | Science Operations Center |
| TBD | To be Decided  |
| TBR | To be Required |

# Appendix C. OSDMP Compliance Matrix

The OSDMP compliance matrix is to be completed by the project and reviewed as part of the Critical Design Review. Projects should indicate in the “Justification” column how the requirement has been satisfied. If the requirement is satisfied in the OSDMP, the justification should reference the relevant section. If the requirement is not satisfied in the OSDMP, a brief justification or reference should be provided along with any tailoring that is necessary. The “Approval” column is used to indicate approval for tailored requirements.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number** | **Requirement** | **Source** | **Justification** | **Approval** |
| 1 | The project shall develop an OSDMP.  | PLRA |  |  |
|  |  |  |  |  |
| 2 | The OSDMP shall include a table of tailored requirements. | OSDMP Template |  |  |
| 3 | The OSDMP shall include a section providing an overview of the mission. | OSDMPTemplate |  |  |
|  |  |  |  |  |
| 4 | The OSDMP shall include a section providing an overview of the project’s implementation of Open Science practices.  | OSDMP Template |  |  |
| 5 | The OSDMP shall include a section providing roles and responsibilities for implementation of Open Science.  | OSDMP Template |  |  |
| 6 | The OSDMP shall include a section providing an overview of the open science processes for Data Management.  | OSDMP Template |  |  |
| 7 | Mission data including observation, auxiliary, calibration, and ground data are made publicly available.  | SPD-41a |  |  |
| 8 | Data that are Level 1 or above are made freely available.  | SPD-41a |  |  |
| 9 | Any limitations in the availability of data are described in the Data Management section of the OSDMP.  | SPD-41a |  |  |
| 10 | Publicly available data for the mission is made available with a Creative Commons Zero license.  | SPD-41a  |  |  |
| 11 | The mission data will be findable.  | SPD-41a |  |  |
| 12 | Publicly available datasets are made citable.  | SPD-41a |  |  |
| 13 | The OSDMP includes a table summarizing the data products produced by the mission and when they will become publicly available.  | OSDMP template |  |  |
| 14 | There shall be no period of exclusive access to mission data. A period after the data have been obtained may be allowed for activities such as calibration and validation of the data. This period shall be as short as possible and shall not exceed six months. | SPD-41a |  |  |
| 15 | The OSDMP shall include a section providing an overview of the open science processes for Software.  | OSDMP template |  |  |
| 16 | Unrestricted mission scientific software is developed openly.  | SPD-41a |  |  |
| 17 | The project uses a publicly accessible, version controlled platform for development of unrestricted scientific software.  | SPD-41a |  |  |
| 18 | If there are no other restrictions, publicly available SMD-funded software is released under a permissive license that has broad acceptance in the community. | SPD-41a |  |  |
| 19 | The OSDMP shall include a section on community engagement for software development.  | OSDMP template |  |  |
| 20 | The mission software development process includes a code of conduct and guidelines for how to make contributions. | SPD-41a |  |  |
| 21 | The project describes the process for using and contributing to open source software projects.  | M-16-21 |  |  |
| 22 | The OSDMP shall include a section describing the handling of restricted software.  | OSDMP template / NPR 7150.2 |  |  |
| 23 | The OSDMP shall include a section on publications.  | OSDMP template |  |  |
| 24 | Publications shall be made available via the NASA STI Repository. | NPD 2200.1 |  |  |
| 25 | Peer reviewed publications that describe the mission shall be published as open access. | SPD-41a |  |  |
| 27 | Publicly available publications produced by the project shall be citable via a persistent identifier.  | SPD-41a |  |  |
| 27 | The OSDMP shall include a table describing the publications produced by the project and how they will be made available.  | OSDMP template |  |  |
| 28 | The OSDMP shall include a section on public scientific meetings.  | OSDMP template |  |  |
|  |  |  |  |  |
| 29 | The OSDMP shall include a section that summarizes each instrument or investigation to which the OSDMP applies. There will be one subsection for each instrument.  | OSDMP template |  |  |
| 30 | For each instrument, the OSDMP shall include a section describing the instrument. | OSDMP template |  |  |
| 31 | For each instrument, the OSDMP shall include a section describing the observing requirements. | OSDMP template |  |  |
| 32 | For each instrument, the OSDMP shall include a section describing the observing capabilities. | OSDMP template |  |  |
| 33 | For each instrument, the OSDMP shall describe the data rate.  | OSDMP template |  |  |
| 34 | For each instrument, the OSDMP shall include a section describing the on board data acquisition and processing. | OSDMP template |  |  |
|  |  |  |  |  |
| 35 | The OSDMP shall include a section describing the data management.  | OSDMP template |  |  |
| 36 | The OSDMP includes a table of data product mapped by level and instrument.  | OSDMP template |  |  |
| 37 | For each instrument, the OSDMP includes a section on the data product functional description.  | OSDMP template |  |  |
| 38 | Data must be released in non-proprietary, machine readable, modifiable, and open formats.  | SPD-41a |  |  |
| 39 | For each instrument, the OSDMP includes a section on the science data products.  | OSDMP template |  |  |
| 40 | The OSDMP includes a section on data quality.  | OSDMP template |  |  |
| 41 | Mission data shall include robust, standards-compliant metadata that clearly and explicitly describe the data. | SPD-41a |  |  |
| 42 | The OSDMP includes a section describing the Ground System and each of its components.  | OSDMP template |  |  |
| 43 | The OSDMP includes a section describing the data flow between flight and ground mission elements.  | OSDMP template |  |  |
| 44 | The OSDMP includes a table summarizing the flow of data and timeline of delivery for each element.  | OSDMP template |  |  |
| 45 | The OSDMP includes a section describing data archiving and access. | OSDMP template |  |  |
| 46 | The OSDMP includes a table with instrument data storage requirements over the nominal life of the mission. | OSDMP template |  |  |
| 47 | The OSDMP includes a section describing the data repositories where the data will be archived  | OSDMP template |  |  |
| 48 | Mission data will be made available in a SMD data repository. | SPD-41a |  |  |
| 49 | The OSDMP describe a description of the interface between the mission and the data repository. | OSDMP |  |  |
| 50 | Mission data will be made citable using a persistent identifier such as a Digital Object Identifier | SPD-41a |  |  |
| 51 | The OSDMP includes a section describing the data accessibility.  | OSDMP template |  |  |
| 52 | The OSDMP includes a section describing the data documentation.  | OSDMP template |  |  |
|  |  |  |  |  |
| 53 | The OSDMP shall include a section describing scientific software management.  | OSDMP template |  |  |
| 54 | The OSDMP section on scientific software management does not describe any restricted software.  | OSDMP template |  |  |
| 55 | The OSDMP shall include a section describing the scientific software lifecycle.  | OSDMP template |  |  |
| 56 | The OSDMP shall include a section describing the identification of scientific software.  | OSDMP template |  |  |
| 57 | The OSDMP shall include a section describing the design of scientific software.  | OSDMP template |  |  |
| 58 | The OSDMP shall include a section describing the development of scientific software.  | OSDMP template |  |  |
| 59 | The OSDMP shall include a section describing the verification and validation of scientific software.  | OSDMP template |  |  |
| 60 | The OSDMP shall include a section describing the release of scientific software.  | OSDMP template |  |  |
| 61 | The OSDMP shall include a section describing the archiving of scientific software.  | OSDMP template |  |  |
| 62 | Software must be made available in publicly accessible repository. | SPD-41a |  |  |
| 63 | Software packages developed by the project are made citable via a persistent identifier. | SPD-41a |  |  |
| 64 | Newly developed software packages are submitted to inventions.nasa.gov. | NPD 2091.1 |  |  |
| 65 | The OSDMP shall include a section describing the scientific algorithms.  | OSDMP template |  |  |
| 66 | The OSDMP shall include a table of scientific software or a reference to a list of software that includes scientific software.  | OSDMP template / NPR 7150.2 |  |  |
|  |  |  |  |  |
| 67 | The OSDMP does not include any restricted information that would prevent its public release.  | OSDMP template |  |  |