NASA Office of Data Science
and Informatics (ODSI)
Marshall Space Flight Center

Open Science Data Management Plan (OSDMP) Guide for Airborne and Field Investigators

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OSDMP Guide for Airborne & Field Investigators

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OSDMP Guide for Airborne & Field Investigators

Introduction

An Open Science Data Management Plan (OSDMP) is a living document that details how scientifically useful data, software, and findings from a NASA-funded effort are to be managed, preserved, and released. This includes aspects of data acquisition, processing, analysis, stewardship, distribution, and archiving of science data. Each organization funded by NASA is required to prepare an OSDMP at the time of funding and to maintain their OSDMP as a living document, to be reviewed periodically during the investigation[1] and ensuring the plan is up-to-date.

NASA's Earth Science Data and Information Systems (ESDIS) provides an OSDMP Template for Data Producers[2] in a formal layout, with specific sections for all NASA Earth Science Data Producers writing such an OSDMP.

The NASA Airborne Data Management Group (ADMG) was created, in part, to interface with airborne data producers, data managers, investigation personnel, and NASA data repository(ies) (often called Distributed Active Archive Centers, or DAACs) to smooth the transition of project data from collection to the NASA data repository for stewardship and distribution. One of ADMG's roles is to provide guidance for airborne and field investigators through the process of OSDMP production. This document serves as a guide, alongside the OSDMP template, to clarify section requirements and provide additional context in line with procedural adjustments since the publication of the template. Data producers may contact ADMG directly (admg@uah.edu) for assistance with OSDMP development. An ADMG team member can arrange to meet with you privately (virtually) to discuss your particular project and aid in tailoring the OSDMP template to most effectively communicate your investigation's information.

ADMG has developed this **OSDMP Guide for Airborne and Field Investigators to be used in conjunction with the OSDMP template.** This guide provides information beyond that which is included in the general OSDMP template in order to give airborne and field (or "suborbital") data managers and data producers a clearer, suborbital-specific description of how to develop the OSDMP. Airborne investigation OSDMPs can be somewhat lengthy as they often include many platforms, instruments, and data products. Clear organization of component information is imperative for the OSDMP to be effective (and note that referencing other documents and/or resources is encouraged to avoid repetition of effort when possible). The Investigation Data Manager is required to collate information from all instrument and data product scientists in order to deliver one OSDMP for the entire investigation. ADMG is available to help data managers successfully complete this process.

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[1] In this document, the term "investigation" is used for a funded airborne study that may also have a ground or field component and can include model data as support or products. The term investigation has synonyms throughout NASA that include campaign, field campaign, field investigation, field project, or mission.

[2] The OSDMP template is available on Earthdata site here, under the "OSDMP for ESD-Funded Data Producers" subheading - requires a free Earthdata login.

Important Definitions for OSDMP Preparation

The definitions below are provided to promote clarity of the material in this document and in the OSDMP template:

Initial OSDMP Document: The minimal required OSDMP that must be produced for formal approval at time of Investigation Confirmation Review (ICR). Note: this may also be referred to as a "baseline OSDMP," however "initial" is used herein to avoid confusion with baseline/threshold science criteria.

Ancillary Data: Data which are not obtained from the sensor itself and primarily serve for the processing of instrument data. Ancillary refers to data that exist purely to facilitate data processing[3].

Auxiliary Data: Data which enhance processing and utilization of the Earth observing instrument data. Auxiliary data are not captured by the same data collection process as the instrument data. Auxiliary data include data collected by any other platform or process and are datasets in their own right[3].

Data Acquisition: A description of all data source(s) for a given product, and how these data are obtained and transferred to data processing software. Data acquisition includes identification of any additional sources that may be needed to produce a data product.

Data Processing: For airborne and field investigations, this is a description of how the source data are utilized to produce a data product, the software used (with reference to the theory behind the software), and the procedures and steps followed. This also includes describing the outcomes - product data formats and adherence to standards.

Data Analysis: In the context of an OSDMP, this term means what will be done (or has already been done) to determine the quality of the data products delivered to the NASA data repository (ie, the procedures that have or will be followed). For airborne investigations that have many instruments previously flown on other investigations, the data analysis may have already been performed, and one can refer to published papers identifying how the data have been compared to other data and what this says about data product quality. If this is a new instrument, **describe the plans** for any assessment of the data. *This is not the same as your scientific data analysis.* You are not expected to state the results of any analysis in the OSDMP.

Data Quality: This term refers to plans for assessing quality (data analysis), the collection of data quality results, and delivery of the information to the NASA data repository for distribution with the data products. It describes how data products will be assessed and **how any known issues or limitations are communicated** to the data product users.

[3]Definitions extracted from ISO 19165-2:2018 Geographic information — Preservation of digital data and metadata — Part 2: Content specifications for Earth observation data and derived digital products. Definitions of ancillary and auxiliary on page 2.

OSDMP Responsibilities and Audience

Each suborbital investigation is responsible for submitting one OSDMP that provides an overview of the entire investigation, a description of the instruments flown, the data collected, and the products to be provided to the NASA data repository for distribution and long-term stewardship. The plans for data collection, processing, checking, and delivering those data products and the documentation, software, and support data utilized must be described. Additionally, as part of compliance with NASA Science Mission Directorate (SMD)'s Science Information Policy (SPD-41a), the OSDMP must include descriptions of Open Science activities.

The *initial OSDMP must be completed and formally approved by the ICR*. The initial OSDMP must be updated as needed throughout the investigation, and finalized during the investigation close-out period. It is the responsibility of the Investigation Project Manager, Principal Investigator (PI), and the Investigation Data Manager to deliver the OSDMP on time. When reviewing the OSDMP template, be aware that airborne and field investigations are considered Principal Investigator controlled, thus you should follow items marked for <<PI-controlled>>. This includes mission/flight project-funded investigation datasets like GPM-GV (a series of ground validation campaigns).

OSDMP Audience: The OSDMP is structured to provide essential data information to NASA Earth Science Data System (ESDS), NASA ESDIS, the SubOrbtial Archive Readiness Team (SOAR), NASA data repository personnel, and anyone involved with handling and storing data from your investigation. Your OSDMP will be reviewed prior to the Confirmation Assessment Meeting (CAM) and should be formally approved by ESDS by the ICR. At the ICR, the ESDS Program Executive (or Point of Contact) approves the document. The OSDMP is then cataloged and maintained in the ESDIS Library.

Timelines

An important aspect of the OSDMP is that it is designed to be a *living document:* It is created prior to the CAM and ICR, updated throughout the project as needed to keep it in line with the actual data product deliveries, and finalized after project completion to be preserved with the data archived by the NASA data repository. *A draft initial OSDMP should be provided for review at least two weeks prior to the CAM,* allowing for thorough review by ADMG, SOAR, ESDIS and obtaining formal approval from ESDS by the ICR.

The OSDMP will be reviewed at investigation close-out, but may require additional changes after close-out if newly derived or merged products are added to the investigation collection, or if new versions of existing products are supplied at a later date. *Important investigation-specific due dates will be discussed and set with project and data managers during the investigation spin-up phase.*

At any point during the investigation, the OSDMP can be updated as needed. The OSDMP is valid for no more than 5 years without review and update. This requirement holds until the investigation is completed and all data products have been delivered to the NASA data

repository. All changes must be noted in a change log located at the front of the document per the specified version control requirements listed in the OSDMP template.

Completion of the initial OSDMP document may require a significant amount of time depending on whether existing knowledge of data product format, content, metadata, quality, instrument, and measurement descriptions already exist elsewhere from previous flights or investigations. Detailed documentation that is publicly available can be referenced and pointed to from within the OSDMP (ADMG strongly encourages this to reduce repetitive effort). The more complete and thorough the OSDMP is when created at this early phase, the less time, effort, and cost will be required later in the project when only minor corrections/updates are needed.

Preparing to Create Your OSDMP

Before beginning, be sure to obtain and read the Open Science and Data Management Plan (OSDMP) Template for Data Producers available from ESDIS[4]. In addition, refer to the various standards and specifications documents in the reference section of the OSDMP template and in the Appendix of this document.

The OSDMP template format can be adapted to handle the complexity of suborbital field investigations. All OSDMPs must be versioned and contain a change log (what, when, and by whom) at the top of the document. The OSDMP is a living document that will be amended over time and finalized at the completion of the investigation.

Airborne and field investigations are highly heterogeneous projects that include many instruments and data products produced at various NASA processing levels and maturity levels. Suborbital investigations often make use of ancillary or auxiliary data obtained from other sources. These additional products must also be described in the OSDMP. The large number of data products requires careful planning for how to best organize information in the OSDMP. ADMG recommends summarizing the data product lists in tables sorted by aircraft, ground, and other data. All required material listed in the OSDMP template should be included, with the use of 'N/A' preferred over omitting a section. Special instructions are provided below for each OSDMP section. Utilize figures, tables and links to additional material as needed to summarize information.

Planning for data production, management, preservation, and release requires thinking through various questions about how the data will be collected, handled, produced, described, delivered, and supported both during the investigation and after project completion. The Investigation Data Manager and PI will work in collaboration with the SOAR team and NASA data repository to determine specific data requirements and standards. These questions[5] can get you started thinking about important details needed for the OSDMP:

[4]The OSDMP template is available on Earthdata site here, under the "OSDMP for ESD-Funded Data Producers" subheading - requires a free Earthdata login.

[5]Ideas for this list have been adapted from a variety of DMP guides available online, including the DataONE Primer on Data Management, the Questionnaire to Help with Creation of a Data Management Plan produced by the Virginia Tech University Libraries (https://guides.lib.vt.edu/RDM/Plan), and other university data management plan websites.

- What details are needed for others to effectively use your data?
- Are you following required standards for file names, formats and metadata?
- How will the needed metadata be generated and checked?
- Are you using common and accepted terminology?
- Are domain-specific terms defined?
- What tools and data are needed to produce your data?
- Which data can not be distributed publicly and why?
- How will you define versions of your data products?
- How will/have you work/ed with your SOAR team representative to follow preservation requirements?
- What data and software would be needed in the future to reproduce your data products? What are the plans to deliver these data and software to the NASA data repository?
- Who are the expected user communities of your data, beyond your science team?
- What do you want included in data product citations?
- Who is to be the main contact for your data product (now and in the future)?

General Considerations

ADMG recommends keeping these points in mind while constructing your OSDMP:

- In the template, the term that applies to nearly all airborne investigations is <<PI-controlled>>.
- The level of detail needed for the initial OSDMP document is indicated in each section of this guide as a checklist. Generally, additional details will need to be added to your OSDMP over time, as more becomes known during the course of the investigation.
- It is important to remember that if material called for in the template is available from other documents or websites, you are encouraged to refer to those documents (and/or give links), provided that you add a brief description of what information is contained there. It is not necessary to repeat information given elsewhere.
- All acronyms must be identified in an appendix to the OSDMP. ADMG suggests including unfamiliar acronyms specific to the investigation within the OSDMP text for clarity.

Suggestions for Specific OSDMP Sections

Each subsection below corresponds to OSDMP sections, as outlined in the OSDMP template from ESDIS. Note that ADMG has prepared this guide in alignment with recent OSDMP guidance for NASA Missions from SMD, issued since the publication of the template (March 2025 vs June 2020). The sections as outlined below reflect amendments to the organization from the ESDIS OSDMP template to comply with current SMD guidance on the inclusion of specific Open Science aspects. Data producers may contact ADMG (admg@uah.edu) for clarifications and assistance with OSDMP development.

Section 1: Introduction

This section is rather self-explanatory. It must contain a brief (1-2 sentence) introduction to the investigation, as well as:

- **Section 1.1 Purpose and Scope of the OSDMP:** A short paragraph describing the purpose of the OSDMP document
- **Section 1.2 Development, Maintenance, and Management Responsibility for the OSDMP:** Identification of those responsible for creating and updating the OSDMP throughout the course of the investigation
- **Section 1.3 Contextual Background of Data Processing:** Approximately a paragraph summarizing the data processing approach. The contextual background of the data processing system for airborne and field investigations may be simply stated as: "Instrument PIs perform initial data processing and deliver data products to the team data manager for delivery to the NASA data repository."

All the requested information for Section 1 is required for the initial OSDMP document.

Checklist: Information required in Section 1 of the initial OSDMP:

- ❏ Investigation introduction
- ❏ Purpose of OSDMP document
- ❏ Responsible parties with organization and contact information
- ❏ Data processing approach summary

Section 2: Investigation Overview

This section is designed to introduce the investigation with an overall summary, brief history and context, and the investigation science objectives and goals. Much (if not all) of this information can likely be taken from the investigation proposal or the Investigation Implementation Plan (IIP). However, because the investigation proposal is not a publicly available document, the actual text with this information needs to be included in the OSDMP text. Copy and pasting of content is fine, as long as the source document is mentioned.

Next, provide a summary table containing the primary instruments used in the investigation for both *in situ* and remote sensing. It is helpful to organize by platform, as this is usually how instrument packages are grouped for their respective aircraft.

Following the instrument table, include descriptive paragraphs for each primary instrument in the table. A primary instrument is defined as one that is essential to the investigation scientific goals and necessary for deriving the desired parameters.

For additional data, such as ground observations and model products to be used during the course of the investigation (or afterwards during processing), describe the data source and the data content utilized and for what purpose.

The initial OSDMP should contain all information in Section 2 in enough detail to give a clear picture of the sources of data products that will be explained in Section 3.

Checklist: Information required in Section 2 of the initial OSDMP:

- ❏ Investigation summary
  - ❏ Context for investigation
  - ❏ Investigation history (where applicable)
  - ❏ Investigation science objectives and goals

- ❏ Investigation instruments summary table
    - ❏ Include: acronym, full name, intended platform, and measurements
        - ❏ ADMG strongly encourages inclusion and use of (and/or a mapping to) emerging standard/conventional variable names relevant for the science domain, e.g., the Atmospheric Composition Variable Standard Names
- ❏ Describe each primary instrument (for example, in an investigation studying atmospheric radiation and dynamics, the Advanced Microwave Precipitation Radiometer (AMPR) could be a primary instrument, while operationally maintained ground rain gauges would not primary instruments and could be excluded from description, but would need to be included in the instrument table). Instrument descriptions should include:
    - ❏ Measurement range
    - ❏ Expected quality of measurement: include a quantitative description of accuracy and whether accuracy varies spatially
    - ❏ Processing software (if used)
    - ❏ Data handling procedures to get data from observation to field archive
    - ❏ For ground instruments, provide location(s) and site description(s), placement and removal dates, and information on data gaps (down time or data loss, with reasons - to be added as possible when the OSDMP is updated)
- ❏ Describe any needed auxiliary data (if necessary)
    - ❏ Description
    - ❏ Data source
    - ❏ How to be used within the investigation
    - ❏ Stated quality of data
    - ❏ Intentions/plans for publishing with the investigation data collection, if necessary (this can also be coordinated with SOAR and/or the NASA data repository)

Section 3: Data Product Summary

This will be the bulk of your OSDMP. This section identifies the individual data products to be delivered to the SOAR team and NASA data repository. This section is best approached using tables to organize the data products either by instrument, aircraft, or product type - whichever makes the most sense in the case of your investigation, provided the approach is consistent and clear. Details of each data product are to be included and must contain the items listed in Section 3 of the OSDMP template (also see the checklist below).

All information known at the time of ICR must be included with statements identifying when the remaining unknown information will be added.

After the data product tables, add the information described in the OSDMP template subsections 3.1 - 3.4 (Data Acquisition, Data Processing, Data Analysis, and Data Quality). You can organize your OSDMP in a manner that is most convenient for your specific investigation, depending on the scenario, one of several options may be a simpler approach:

- Subsections within Section 3 to describe each item (Data Acquisition, Data Processing, Data Analysis, and Data Quality) for the entire investigation
- A series of subsections within Section 3 for each data product: An iterative set of 3.x.1, 3.x.2, 3.x.3, 3.x.4 for each [x] data product

- Include acquisition, processing, analysis, and quality details within individual instrument's measurement description in Section 2

However you choose to approach these items, be sure the requested information is clearly conveyed. For example, the measurement qualities (measurement range and accuracy) could be described for each instrument in Section 2, or listed by data product in the table or the data product description in Section 3 depending on how you organize the information. Include a description of how the data are acquired (OSDMP template Section 3.1) and how data products are produced (OSDMP template Section 3.2). Diagrams can be used as needed to present this information (eg, data flow from measurement collection to processing, data production, and delivery to the NASA data repository, with indication of software and other needed data). Ancillary and auxiliary data necessary for data product creation must be mentioned for each data product, as well as the plans for obtaining that additional data.

*A **field site list** is absolutely necessary for investigations placing ground instrumentation.* The list can be a simple table with the minimal information mentioned in the field measurement components section of this guide, or it can be more elaborate with full site characterization details, if warranted. The details of actual field instrument placement or data collection sites must be added to the OSDMP by investigation close-out.

It is important to describe the *plan(s)* for how the data will be assessed for validity and quality prior to delivery to the NASA data repository (OSDMP template Section 3.3, Data Analysis). Recall that "data analysis" within the context of the OSDMP is *not the same concept as scientific data analysis*. The OSDMP data analysis plan should discuss how data product files will be checked to ensure the data are within the acceptable range, the files have only valid characters (if text), and the data files are complete and can be read/accessed. It is advisable to include checksums for binary files so that the NASA data repository can determine that files have been transferred correctly. Checksum values can be listed in a separate file delivered with the data. There are various kinds of Checksums. Coordinate with the SOAR for a preferred method, such as the common MD5, if necessary. Identify what parties will be responsible for what part of the data assessment.

One of the data quality requirements (OSDMP template Section 3.4) is the Algorithm Theoretical Basis Document (ATBD). *It is not expected that every instrument flown or placed in the field for an investigation will have a formal ATBD* to describe the algorithms used in data processing. In the event such documents, over the course of the investigation, do become available for data from the primary instruments, link to them in a later OSDMP update. For airborne investigations, links can also be provided to peer-reviewed publications describing the algorithms and data processing techniques. Provide a digital copy of ATBDs or publications for delivery to the NASA data repository by/before the investigation close-out, when all preservation materials are due.

While there is flexibility in terms of duration and scope of the quality assessments for airborne and field investigation data, the data quality does still need to be assessed and communicated to the data users (beyond the original science team). There are many components of **data quality** (see details in the OSDMP template appendix), and not all are relevant to suborbital

investigations, but those that are include: errors/uncertainties, quality flags/indicators within data files, and standards followed and how they will be checked.

It is important to remember that your data will not be useful and will not be utilized appropriately if future users do not know the limitations and appropriate applications. How will that information be provided to the user, and whose responsibility it is to prepare that information, must be explained in the OSDMP.

Be sure to describe the plans for updating the data and documentation in the event that problems with the data are later identified after completion of the investigation.

The OSDMP template's Sections 3.5 and 3.6 (Data Distribution and Archiving, Data Product Documentation) may be completed as for the entire investigation (not per individual data product). These are intended to be paragraphs summarizing data stewardship and documentation plans, identifying all data documentation and preservation materials to be delivered to the NASA data repository.

Work with your SOAR team contact(s) to ensure your team are providing appropriate data preservation content throughout the investigation - these materials are often arduous to track down after the investigation ends, but can be very simple to provide during the active phases of the investigation (often, even by a simple email).

Checklist: Information required in Section 3 of the initial OSDMP:

- ❏ Data product summary table containing
  - ❏ Data product name
  - ❏ Data product processing level and design (point, swath, gridded, etc)
  - ❏ Product format and metadata standards used
  - ❏ Estimated data product volume (in GB, for whole campaign)
  - ❏ Measurements/parameters/variables in product
    - ❏ ADMG strongly encourages inclusion and use of (and/or a mapping to) emerging standard/conventional variable names relevant for the science domain, e.g., the Atmospheric Composition Variable Standard Names
  - ❏ Data product spatial and temporal resolution, and if/how these vary
- ❏ For each data product, include the
  - ❏ Data source(s) (as described in Section 2 on investigation instrumentation)
  - ❏ Data acquisition workflow (eg, a diagram showing instrument observation -> portable drive data transfer -> PI or Science Team member computer for product creation -> investigation field archive -> NASA data repository). Include how you will ensure data transfer accurately.
  - ❏ List of any ancillary or auxiliary data necessary to generate the data product
  - ❏ Paragraph or figure describing the processing needed to create the product
  - ❏ Link to ATBD or peer-reviewed paper describing algorithms used, as appropriate, or if more appropriate to provide at instrument level, include the links to papers or ATBDs (may be included in Section 2 where instrument is described).
  - ❏ Paragraph describing how the data product will be assessed and evaluated for data validity and quality, and how uncertainties and poor data quality will be communicated to the user

- ❏ A few paragraphs on data quality describing:
  - ❏ Quality flags used in the data product and what they indicate
  - ❏ Plans for reporting known issues and limitations to the SOAR team and/or the NASA data repository for distribution to users, including the responsible parties for communicating the data quality - both during the investigation and after completion
  - ❏ Plans for data quality assessment
- ❏ For entire data collection, include
  - ❏ Paragraph describing plans and processes for collecting and delivering all preservation materials to the NASA data repository for archival [Section 3.5]
  - ❏ Table or paragraph summarizing how and when data product documents will be delivered to the NASA data repository - including ATBDs (if available), user guides, file specifications, validation and quality info [Section 3.6]

Section 4: Open Science Activities

While the OSDMP template does not explicitly include this section, ADMG has added it in this OSDMP guide to align with NASA SMD's OSDMP guidance issued since the publication of the OSDMP template. This section details compliance with NASA's Science Information Policy (detailed in SPD-41a), and should include plans for how scientifically usable data and findings are disseminated in accordance with the open science principles of availability, transparency, reproducibility, and collaboration. For the initial OSDMP document, ADMG strongly recommends including at least one paragraph to satisfy each of the following subsections:

- **Section 4.1: Data Sharing** This section of the OSDMP should briefly describe plans for working with the SOAR team and/or NASA data repository to ensure timely transfer and publication. All scientifically useful data generated by NASA-funded activities are to be made publicly available. Your IIP, and other sections of your OSDMP, will necessarily include details of how your data are getting to the NASA data repository - you may refer to these (or copy/paste and note source). As part of ESDIS's data publication process, your data product(s) will each be given a DOI (among other stewardship tasks, depending on the level of service). It is the NASA data repository's responsibility to ensure these data are published and publicly accessible; data producers are responsible for transferring data and relevant preservation materials in a timely manner.
- **Section 4.2: Software Management** NASA has an open source policy requiring all software developed as part of research and technology awards be made publicly available as Open Source Software (OSS). This policy requires scientifically relevant code (code that is critical for the derivation of disseminated science findings) be delivered to a publicly accessible repository supportive of community and developer reuse. Such code repository services or platforms should support: communication features (commenting, review, etc), issue tracking for bug reports and feature requests, a version control system, repository browsing. NASA ESDS and ADMG recommend software be developed using NASA's Github repository. In addition, NASA preservation guidelines indicate that software used to create data products be archived by ESDIS along with the data. Delivery of software must be made by investigation close-out. This section of your

OSDMP should be a paragraph describing plans to maintain a public repository and/or delivering product-specific code to the SOAR team and/or NASA data repository.
    - Investigation data producers should also consider long term software archival, which is generally *not* supported by platforms like GitHub or GitLab. ADMG notes that while the NASA data repository can archive such code (depending on the prescribed level of service), provided it is made available in a timely manner, other long term repository solutions (such as Zenodo or Software Heritage) can provide this type of support and enable long-term public access.
    - Sharing of investigation-developed software must be done under a clearly designated license. If there are no restrictions in place (eg, no ITAR or EAR concerns), publicly available software should be released under a permissive license (eg: BSD, Apache).
- **Section 4.3: Findings and Publications** This section of your OSDMP should describe plans to make investigation findings openly accessible. "Findings" include but are not limited to: peer-reviewed journal publications, book chapters, scientific conference presentation materials, technical reports, and algorithm descriptions for data calibration and validation. SMD's guidance notes: "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", and "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…to increase their accessibility."

Checklist: Information required in Section 4 of the initial OSDMP:

- ❏ Plans for ensuring scientifically useful investigation data (ie: data products produced by the field campaign) are made publicly accessible (in practical terms, getting your data and supporting materials to the NASA data repository on time should accomplish this).
- ❏ Description of plans for disseminating any scientifically useful software produced over the course of the investigation, including under what (or what type) of license
    - ❏ Helpful to include considerations for long-term archiving of such software
- ❏ Plans for how investigation science findings will be widely disseminated
- ❏ Responsible parties for adherence to Open Science activities listed in this section (ADMG suggests this be the Investigation Data Manager)

Section 5: References

This section contains all references mentioned in the OSDMP. No particular formatting style is required, only that the chosen format is consistently applied. The reference list should be updated as needed throughout the investigation, and thoroughly reviewed and updated at investigation close-out. You can organize the references by instrument or data product to subset the long list, or just provide an alphabetical or enumerated list.

Checklist: Information required in Section 5 of the initial OSDMP:

- ❏ List of all references cited in your OSDMP document presented with a consistent format

Section 6: Acronyms

The final piece of your OSDMP is to contain a table with all acronyms utilized in the document and their meanings. Very well known acronyms, such as NASA or NOAA, may (but do not strictly need to) be included.

Checklist: Information required in Section 6 of the initial OSDMP:

- ❏ Alphabetized list of acronyms and description for all but the most common acronyms (such as NASA, NOAA, NSF) used in the OSDMP document

Additional Considerations

The sections below provide additional details that are often related to content for the various OSDMP sections described above.

"Raw" or Source Data and Documentation

There are often questions about "raw" instrument data - the measurements made by an instrument with little or no additional processing - often referred to as Level 0 data. These data products must be archived at the NASA data repository, but may or may not be published or distributed. Details will be worked out with the NASA repository and SOAR team. These "raw" or Level-0 data often have very limited users and may not be made publicly available - only available by request. Be sure to address the plans for delivery of these data in your OSDMP.

Data Quality

Be sure to read the appendix in the OSDMP template, particularly the Data Quality section. The purpose of the OSDMP Data Quality Section (3.4) is to **identify and describe the plans for assessing and communicating the quality of data products** both during and at completion of the investigation. Include how the data quality information will be communicated to the NASA data repository (or SOAR team) and, therefore, data product users. Will the information be shared in supplemental documents? What minimal information about quality will be provided in the data files as quality metadata or variable quality? In addition, the investigation should justify the expected quality of data from instruments used in the investigation and how they will determine the acceptable quality of data products delivered to the NASA data repository for distribution. Note that not *all* information in the OSDMP template appendix is relevant to PI-lead investigations. Use good judgement in what is needed for future users to appropriately understand and use your data products.

Other Field Measurement Components

Airborne measurements are often part of a field investigation that can consist of ground-based instruments, ocean surface/subsurface measurements, and human-made field observations. The use of such measurement data requires additional information that is often best presented using a table in the OSDMP.

The table below provides minimal metadata by platform type. Note that since various standards can be used, the table below provides the type of metadata, not the metadata of any one standard.

ISO 19156:2011, which describes the conceptual model for observations and measurements, separates classes for the feature of interest, the procedure, the observed property, the result, and the act of observation itself. Places and times associated with each class can be distinct if needed. Sampling features are also covered in the ISO standard. The standard has been widely used in environmental monitoring, climate and weather, ocean observations, soils, and geology applications.

There are many other observation metadata elements beyond the types listed below. This table identifies the basic necessary metadata for an initial OSDMP document. Any other pertinent information can be included in subsequent updates.

Metadata Type	Surface Point Measurements	Ground-based Remote Sensing Instruments	Human-collected Field Observations
EXAMPLES	rain gauge, stream flow gauge,	ground radar, radiosondes, lidar	soil type, soil moisture, snow surveys
locations of instrument	Required	Required	Required
location determination method and coordinate system	Required	Required	Required
location accuracy	Required	Required	Required
names of sites	Required	Required	Required
number, acronym, or code for sites	Required	Required	Required
instruments at sites	Required	Required	If Appropriate
instrument details	Required	Required	If Appropriate
instrument makers	Required	Required	If Appropriate
internal instrument software processing	Required	Required	If Appropriate
expected instrument measurement precision (from maker)	Required	Required	If Appropriate
measurement time period and frequency	Required	Required	Required

measurement range	Required	Required	If Appropriate
measured values	Required	Required	Required
variables derived from observations	Required	Required	Required
instrument operation status over time of investigation	Required	If Appropriate	N/A
site photos	Recommended	Recommended	Recommended
identification of team personnel collecting information if manual	N/A	N/A	Recommended

Metadata Assistance

The term metadata can be used to refer to the data details within a file or the data product information entered into a catalog or database. Both types of metadata are required to make data discoverable and usable. If you are new to the process of making data files with detailed metadata, the SOAR team can provide help with determining what information is needed to describe a data product or with implementing metadata standards. Contact your assigned SOAR team member for assistance; if necessary, a specialized metadata expert can answer specific questions. The Appendix to this guide includes links to documents describing metadata and file format standards. There is a list of tools available for checking metadata compliance in the template. We suggest that, before the investigation begins, you make a sample file for each data product containing the required metadata. Use a compliance checker to confirm that the file metadata are in agreement with requirements. This can be completed without actual measured data in the files.

Conclusion

We recognize that within the airborne and field communities, specific OSDMP aspects may require different implementation approaches. For example, the air composition investigations tend to have a large number of chemical products to present which may make it easier to organize OSDMP information by data product, instead of instrument or platform. This is why this guide lists possible approaches to choose from instead of specifying any one method for completion of the OSDMP, particularly Sections 2 and 3.

The key to OSDMP production is to include as much as is known about the instruments, data handling, data products, and data quality assessment as early as possible. As it is a living document, the OSDMP will become more complete and detailed over time, but it is important to *remember to address every item*, if only by simply stating “these details are not yet known but will be added after <some specified stage or time>”. Do not ignore needed information. Identify that the information is needed, but is not yet known.

Should you have questions, contact ADMG or the SOAR team for assistance. This guide can not, and is not meant to, answer every possible question or scenario for OSDMP creation.

Links will be verified each time this document is updated. If you notice any link errors, or if you have suggestions for additional information to include in this guide, please let ADMG know.

Post-Investigation Updates and Data Product Additions

The initial OSDMP document should include a discussion of any possible need for post-mission data product updates and potential new products, and that you will work with the SOAR team and/or NASA data repository to inform them of and deliver such products in a reasonable time frame. Also, it is imperative to acknowledge the need to provide continued data assistance via a primary contact person for the post-mission years. Be certain to *identify who that point of contact will be*.

In preparation for investigation closeout, the OSDMP must be updated to include specifics of how preservation requirements will be met and to address in detail the continued interactions expected with the SOAR team as part of that process.

Working with the SOAR team and NASA Data Repository

NASA ESDIS is entering a transformative time frame and will be evolving away from the separate DAAC model used in the past. Amid this time, the SOAR team functions essentially as a previously DAAC-appointed contact would. ADMG (who generated this guide) will provide initial assistance with OSDMP drafting ahead of CAM/ICR milestone meetings. ADMG leadership is also part of the SubOrbtial Archive Readiness (SOAR) team. In addition to ADMG, your investigation will be assigned a primary SOAR contact.

You should discuss with your SOAR representative the expected data products, data volume estimates, data product format and content, metadata details, needed documentation, and data publication steps and requirements. Some of the information you obtain from these discussions will need to be amended to your living OSDMP.

The SOAR team will work with you to publish, archive, and support your data products and your team during and after the investigation. They are your primary resource for assistance with your data. ADMG is an additional resource to help with problems and/or provide clarifications. For best communication and outcomes, please include both ADMG and your assigned SOAR representative in your correspondence.

Details about the activities involved in performing data intake, backup, publication, distribution, documentation, support, and outreach will be shared by your SOAR contact. The SOAR team will also be completing an ESDIS-specific OSDMP and may seek your assistance with information about your project and the expected data products.

Appendix

Acronyms List

The following acronyms are used in this document:

ADMG	NASA's Airborne Data Management Group [supports NASA ESDS from within ODSI]
ATBD	Algorithm Theoretical Basis Document
CAM	Confirmation Assessment Meeting
DAAC	Distributed Active Archive Center [NASA Earth Science Data Repositories, part of pre-2026 ESDIS structure]
DOI	Digital Object Identifier
EAR	Export Administration Regulations
ESDIS	NASA Earth Science Data and Information System
ESDS	NASA Earth Science Data Systems
ICR	Investigation Confirmation Review
IIP	Investigation Implementation Plan
ITAR	International Traffic in Arms Regulations
MD5	Message-Digest algorithm 5 [a common checksum methodology]
ODSI	NASA's Office of Data Science and Informatics
OSDMP	Open Science Data Management Plan
OSS	Open Source Software
PI	Principal Investigator
SMD	NASA Science Mission Directorate
SOAR	SubOrbital Archive Readiness team [beginning in 2026: serves similar role as DAACs did previously for non-satellite missions]
SPD-41a	NASA SMD Policy Document - 41a [NASA SMD Science Information Policy]
STI	NASA Scientific and Technical Information

General Resources

- Global Change Master Directory (GCMD) Keywords:
  - GCMD Keyword Viewer
  - GCMD Keyword Access (on Earthdata Wiki)
- NASA Data Processing Levels: EOSDIS data products are processed at various levels ranging from Level 0 to Level 4.
- NASA Data Maturity Levels: Understanding the differences between beta, provisional, and validated data.
- Interoperability Recommendations: Guidance to support a pillar of FAIR data principles.
- Panoply Viewer to test visualization of your data: NASA Panoply netCDF, HDF and GRIB Data Viewer
- NASA Data Preservation Requirements: What must be kept, in addition to data, to preserve the data.

Terminology Definitions

- ESDS Glossary - A glossary of phrases with their definition, context, and usage within ESDS
- EOSDIS acronym list - A comprehensive listing of acronyms used within EOSDIS

Metadata Standards and Checkers

- ESDS Standards, Requirements, and References: This page has helpful resource links for **metadata standards, data format standards,** approved ASCII formats, and discovery and access protocols.
- Global Change Master Directory (GCMD) Keywords Community Forum
- Integrated Ocean Observing System's (IOOS) Compliance Checker (for NetCDF, CF, ACDD)
- National Centre for Atmospheric Science (NCAS) CF Compliance Checker
- PODAAC Metadata Compliance Checker (MCC is also avaiCF Checkerlable via GitHub)
- Python Software Foundation NetCDF Compliance Checker

Scripts, Code, Software Guidelines

- NASA Science Information Policy
- NASA GitHub Repository

Data Production Information (from various DAACs)

- NSIDC Page for Data Providers and assigned missions & projects: https://nsidc.org/data/submit-data/submit-nasa-data-nsidc-daac/assigned-data
- ORNL DAAC: Detailed Data Submission Guidelines
- ORNL DAAC: Data Quality Review Checklist
- PO.DAAC: Data Management Best Practices
- GHRSST Data Specification (GDS): Group for High Resolution Sea Surface Temperature (GHRSST) Science Team (2021)

External (Outside NASA) Resources

- FOSTER Open Science: Managing and Sharing Research Data (v2)
- Data Observation Network for Earth (DataONE): Best Practices Guide
- Open Geospatial Consortium
- DMPTool's General Guidance
- Michener, W.K. (2015) Ten Simple Rules for Creating a Good Data Management Plan. PLoS Comput Biol 11(10): e1004525. doi:10.1371/journal.pcbi.1004525
- USGS Data Management Plan Checklist