Earth Science Data Systems (ESDS) Program, HQ SMD

Spaceborne Mission/Instrument Science Data Requirements

Version 5

Program-Level Requirements Appendix (PLRA)
Spaceborne Mission/Instrument – Science Data Requirements

The Program-Level Requirements Appendix (PLRA) is an appendix to the Flight Element (Earth Systematic Mission (ESM) or Earth System Science Pathfinder (ESSP)) Program Plan. The PLRA identifies the Level 1 mission, science, and programmatic requirements for the development and operation of the science mission/instrument. Section 4.5 of the PLRA identifies the Level 1 mission science data requirements.

Change History Log

Revision	Effective Date	Description of Changes
2.0	8/17/18	Baseline document
2.1	5/3/19	Corrected table numbering; added Appendix A Abbreviations and Acronyms
3.0	9/26/2019	Updated with Open Source Software Policy
		Updated with reference to Table 4.5.2
		Updated text clarifying Table 4.5.1
3.1		Added definition of latency below Table 4.5.1
		Updated links
3.2		Updated definition of latency below Table 4.5.1
3.3	12/12/2022	Updated for compliance with SPD-41a Open Source Science policy guidance. Updated links.

Spaceborne Mission/Instrument – Science Data Requirements

4.5 MISSION DATA REQUIREMENTS

4.5.1 OPEN SCIENCE DATA MANAGEMENT

a) The <<project name>> shall produce the standard science data products listed in Table 4.5.1. Standard data products are fully validated against Level 1 requirements.
b) Science data products shall be developed to be interoperable in accordance with the ESDSWG Data Product Developer's Guide specified at: https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices/data-product-development-guide-for-data-producers
c) Documents listed in Table 4.5.2 shall be delivered to the designated archive(s) and updated per the schedule in the table.
d) All data and the standard science data products listed in Table 4.5.1, along with the scientific source code for algorithm software, coefficients, and ancillary data used to generate these products shall be delivered to the designated archive(s) in accordance with the NASA Earth Science Data and Information Policy specified at https://www.earthdata.nasa.gov/data-and-information-policy.
e) The project shall develop an Open Science and Data Management Plan in accordance with SPD-41a and Earth Science Data Management Plan guidance: https://www.earthdata.nasa.gov/engage/data-management-guidance
f) Public release of these data shall conform to the NASA Earth Science Data and Information Policy. There shall be no period of exclusive access to science data, calibration/validation, and ancillary data in accordance with the NASA Earth Science Data and Information Policy. 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.
g) All source code used to generate the standard products listed in Table 4.5.1 shall be developed in accordance with the NASA Earth Science Open Source Policy at https://www.earthdata.nasa.gov/engage/open-data-services-and-software/esds-open-source-policy and documented in Table 4.5.3.
h) Mission software and source code shall be released as open source software and shall be developed in the open and made easily discoverable in a publicly accessible, version-controlled platform (or repository) that is widely recognized by the community and that allows for contributions and engagement from the community. It shall be reported by the developers of the software to the designated archive so it can be indexed as part of the NASA catalog of software, and also reported to invention.nasa.gov.
i) Source code and open source software shall be citable using a persistent identifier. Designated archives may provide guidance on best practices for Earth Science citation.
j) The source code shall be delivered to the designated archive(s) at the time of the initial data delivery specified in Table 4.5.1.

k) Updated source code shall be delivered to the designated archive(s) throughout the lifetime of the project as new versions of software are developed in coordination with the designated archive(s).
l) Science algorithms used to generate the standard science data products listed in Table 4.5.1 shall be documented in Algorithm Theoretical Basis Documents (ATBDs) and delivered to the designated archive(s) at the time of the initial data delivery.
m) Updated ATBDs shall be delivered to the designated archive(s) throughout the lifetime of the project. ATBDs shall be periodically reviewed after launch and include representation from the designated archive(s). Peer-reviewed ATBD publications shall be open source, but that shall not be considered as an acceptable method for updating an ATBD.
n) ATBDs shall be published in the open. Projects may use tools to facilitate this process such as the NASA Earthdata Algorithm Publication Tool (https://impact.earthdata.nasa.gov/project/apt.html).
o) Project shall provide a singular point of consolidated access to public repositories for mission source code.
p) The <<project name>> shall coordinate with the <<designated archive(s)>> regarding the release of product versions, to ensure completeness and accuracy of quality information, validation status, and metadata of the <<project/instrument name(s)>> science data products.
q) The <<project name>> shall coordinate with the <<designated archive(s)>> on the data and information to be transferred at <<project name>> closeout.

4.5.1.1 SCIENCE DATA REQUIREMENTS

a) The <<project/instrument name(s)>> science data product formats shall conform to the <<standard selected from the ESD-approved Data System Standards - https://earthdata.nasa.gov/esdis/esco/standards-and-practices#data-formats>>.
b) The <<project/instrument name(s)>> shall work with the metadata specialist at the designated archive(s) to meet Earth Observing System Data and Information System (EOSDIS) metadata requirements for all science data products. Base Reference for ESDS Program Standards and Practices guidance published at https://earthdata.nasa.gov/esdis/esco/standards-and-practices#metadata.
c) A baseline of science product metadata version shall be documented with the designated archive(s) before launch.
d) For all standard data products that can be meaningfully represented as images, <<project name>> shall coordinate with the designated archive(s) to generate full-resolution browse products, as defined in https://www.earthdata.nasa.gov/learn/pathfinders/gis-pathfinder/find-data.
e) The <<project name>> shall transfer to the <<designated archive(s)>> all the information and documentation required for long-term preservation of knowledge about the products resulting from <<project name>>, as defined in the NASA Earth Science Data Preservation Content Specification document published at https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices#data-quality and shall baseline to a specific initial version.
f) Table 4.5.1 for Data Products shall be reviewed for final updates with the designated archive(s) 2 months prior to ORR and then again periodically after launch.

Additional requirements may be added to this section to provide greater specificity to the science data requirements.

Table 4.5.1. <<project name>> Data Products

Data Product	Description including if Provisional, Beta, or Simulated	First data delivery after IOC	Maximum data latency after first release	When Will the Product be Publicly Available?
Level 1	<<Level 1 description>>	<x months>	<a hours, days>	<Planned Timeframe>
Level 2	<<Level 2 description>>	<y months>	<b hours, days>	<Planned Timeframe>
Level 3	<<Level 3 description>>	<z months>	<c hours, days>	<Planned Timeframe>
Near Real Time (NRT) and Level #	<<Description>>	<w months>	<<Time Bias>>	<Planned Timeframe>

Authors are encouraged to reference Data Maturity Levels: https://www.earthdata.nasa.gov/engage/open-data-services-and-software/data-information-policy/data-maturity-levels
Data latency is defined as the time elapsed between imaging, data retrieval, or satellite observation and the time data are available for public access via the internet.
Delivery in Table 4.5.1 refers to the delivery of data from the Science Processing System to the designated archive(s). The details shall be jointly determined by the project, Program Scientist, and ESD Data Systems Manager. Note – the data delivery schedule shall be established such that there is NO period of exclusive access to the data.

Table 4.5.2. <<project name>> Milestones Related to Science Data, Metadata and Documentation

(NOTE: This table may be more appropriate in project plan or elsewhere. In the event this table will be included outside of the PLRA please document the location in the PLRA.)

Item	Description	Deliver to	Delivery Schedule
ESDIS-Flight Project Inter-Project Agreement	Agreement outlining respective projects' responsibilities regarding science data production, archiving and distribution	PE for ESDS	At or before KDP-B
Preliminary and Final Open Science and Data Management Plan (OSDMP)	Preliminary and Baseline version of document following guidance at https://www.earthdata.nasa.gov/engage/data-management-guidance	PE for ESDS and Program Scientist	Preliminary: 2 months before KDP-C Baseline: 1 month prior to ORR
ATBD	Algorithm Theoretical Basis Documents for products indicated in table 4.5.1.	Program Scientist	Preliminary: 1 month prior to SRR. Baseline: 3 months before KDP-C
Designated Archive Interface Control Document	ICD between <<Project's>> science data processing system and a designated archive	ESDIS Project	KDP-D
Preservation Content Identification	List of items compatible with Preservation Content Specification at: https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices/preservation-content-spec	ESD Designated Archive	KDP-E
Processed and/or reprocessed data products	Standard Products listed in table 4.5.1	ESD Designated Archive	On-going during Operations Phase after initial data delivery

			indicated in table 4.5.1
Product Quality Assessment	Information about quality of data products as they are generated and assessed; data quality guides and updates	ESD Designated Archive	On-going during Operations Phase after initial data delivery indicated in table 4.5.1
Source code and Software	Source code implementing product generation algorithms	ESD Designated Archive	With initial data delivery and update each time a new version is used
Preservation Content	All project related and science data related preservation content as specified in Preservation Content Specification at: https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices/preservation-content-spec	ESD Designated Archive	At Project closeout

Table 4.5.3. <<Project Name>> Open Source Software, Source Code, and Algorithm Repositories

Open Source Software / Source Code / Algorithms	Description	Corresponding Data Deliverable	Approved Open Repository and Top-Level Location
<<Name>>	<<Software description>>	<Corresponding data deliverable>	<Name; Location>
<<Name>>	<<Source Code description>>	<Corresponding data deliverable>	<Name; Location>
<<Name>>	<<Algorithm description>>	<Corresponding data deliverable>	<Name; Location>

4.5.2 APPLIED SCIENCE DATA REQUIREMENTS

After the designated archive selection is finalized the <<project name>> shall work with the ESD assigned Project Applications Lead and the designated archive(s) to organize and host a <<instrument/project name>> data product application workshop annually. The workshop shall publicly share information on <<instrument/project name>> science data applications and define potential applications that can be supported with existing <<project name>> data requirements. Results will be provided to the <<project name>> science team and at other <<project name>> workshops and meetings as well a published in the open with a public comment period.

4.5.3 VARIANCE

Approval for variance to science data requirements should be requested by the mission / instrument / project manager from the ESDS Program Executive and the SMD Chief Science Data Officer in accordance with the approved variance policy in SPD-41a. These individuals may delegate their responsibility, as needed. If available, the recommendations of any peer review panels will be considered as part of assessing the reasonableness of a variance.

Appendix A Abbreviations and Acronyms

ATBD	Algorithm Theoretical Basis Document
DMP	Data Management Plan
ESD	Earth Science Division
ESDS	Earth Science Data Systems Program
ESDIS	Earth Science Data Information System
ESM	Earth Systematic Mission
ESSP	Earth System Science Pathfinder Program
IOC	Instruments Operations Checkout
ICD	Interface Control Document
KDP	Key Decision Point
PE	Program Executive