



**NASA HEADQUARTERS
SCIENCE MISSION DIRECTORATE (SMD)**

EARTH SCIENCE DIVISION

**DIRECTIVE ON PROJECT
APPLICATIONS PROGRAM**

Approved by:

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Date



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1. PURPOSE

The purpose of this document is to establish the guidelines for implementing a Project Applications Program (PAP) within the Earth Science Division (ESD). The intent is for each project to propose a project specific applications program in accordance with this document. Proposed project specific applications programs will be presented to ESD for approval in conjunction with Key Decision Point for Phase B (KDP-B). The guidelines in this document may be tailored to accommodate project focus, community interest and funding or schedule considerations. However, all activities should be focused on developing and encouraging project specific Community of Practice members (participants who are familiar with NASA, currently use NASA products and have a clear, well defined need for mission data products), and Community of Potential members (participants who are unfamiliar with NASA and NASA mission capabilities, but have the potential to benefit from the mission products in their applications).

2. PROJECT APPLICATIONS PROGRAM GOAL

The primary goal of the PAP is to maximize the benefit of the ESD's investment by enhancing the applications value and overall societal benefits of the project through:

- Scoping and developing applied research and applications as part of the overall mission concept;
- Demonstrating the project's benefit to society and contribution to the achievement of societal outcomes;
- Identifying specific product applications and Communities of Potential to better understand the impacts and benefit from using project products and models;
- Increasing the utility of data products; and
- Fostering a Community of Practice who can work with the project throughout the mission life cycle.

3. PROJECT DIRECTION LANGUAGE

3.1 Formulation Authorization Direction (FAD) Language

The project will evaluate and propose a project specific applications program in accordance with the "ESD Directive on Project Applications Program." The ESD KDP-B will approve the final plan.

3.2 Program Level Requirements Appendix (PLRA) Language

The project will implement an approved applications program in accordance with the "ESD Guidelines for Implementing a Project Applications Program".



4. PROJECT APPLICATIONS PROGRAM ACTIVITIES

This section will describe the project applications program activities by project phase (as defined in the current version of NASA Procedural Requirements (NPR) 7120.5E). Each phase includes the implementation of activities that are relevant to the maturity of mission products with respect to the project objectives for product applications. Deliverables by phase can be found in the table shown below in [Appendix A](#).

4.1 Pre-Phase A

Purpose: To enhance overall science objectives and societal benefits from the project's data, and establish characterization of the Communities of Practice and Potential. Initiate a team for the integration and inclusion of applications in the project concept review, and for articulation at the Key Decision Point for Phase A (KDP-A).

Focus: To determine and clarify the applications dimension of the overall project concept and initiation to amass the applications communities (Community of Potential and Community of Practice).

Implementation Activities: Perform assessments to determine what results techniques and products are useful to the applications community, as a result of associated research. A strong characterization of the Communities of Practice and Potential will enhance overall science objectives and societal benefits from the project's data. Produce a Community Assessment and Report.

Guidance: There are a number of people and organizations that may supply information or capabilities such as the Project Manager, the Project Scientists, the Science Team lead, the Project Science Data Systems Representative, the NASA Distributed Active Archive Centers (DAAC), and the Project Applications Coordinator (PAC). Additionally, it is expected that the Program Executive (PE), the Program Scientist (PS) and the Program Applications (PA) lead will be engaged in supporting the project's applications activities.

4.2 Phase A

Purpose: To integrate the PAP into the overall project science implementation. ESD will approve the proposed PAP prior to the project's KDP-B.

Focus: To develop and initiate the implementation of an ESD approved PAP as part of the overall projects science activities.

Implementation Activities: Plan and begin implementation of the PAP.



Guidance: The Community Assessment and Report (from Pre-Phase A) can inform the development of the Project's Application Plan by helping to focus on applications that work in concert with the overall science focus.

4.3 Phase B

Purpose: To implement the approved project's approved applications plan. Progress of the implementation should be included in standard project science activity and reporting. ESD will confirm progress status, and Phase C and D activities prior to the project's Key Decision Point for Phase C (KDP-C).

Focus: To increase the awareness of applications and regularly communicate project decisions and progress to the Community of Practice members in supporting their use of planned project data products.

Implementation Activities: Engage the community, communicate project products, communicate science advances, identify and work with applications of high potential, and establish an Early Adopter (EA) Program. PAP implementation progress should be included in standard project science activity and reporting.

Guidance: It is expected that the level of effort and activity will increase over previous phases of the project.

4.4 Phases C & D

Purpose: To keep the Communities of Practice and Potential engaged with the project and prepare to use project data upon commencement of operations. Progress will be provided to ESD prior to the project's Key Decision Point for Phase D (KDP-D) and Key Decision Point for Phase E (KDP-E).

Focus: To engage with the community, communicate project products, and identify and work with applications of high potential in an EA Program. The EA's Program (a part of the overall Project Applications Plan) is the primary focus of activities and products.

Implementation Activities: Engage the community, communicate project products, communicate science advances, identify and work with applications of high potential and establish an EA Program. Project Application Plan implementation progress should be included in standard project science activity and reporting.

Guidance: It is expected that the level of effort and activity will increase over previous phases of the project. Inclusion of DACCs and other data processing organizations during these phases, will help with transition of the applied communities from development to operations.



4.5 Phase E Prime/Extended

Purpose: To encourage and document high value applications of project data products and document the societal impact of applications realized during the on-orbit phase of the project.

Focus: To support the transition of the EA's Program, support the development of new users for the project's operational data sets, and document EA Program case studies.

Implementation Activities: Evaluate EA Program metrics and promote data applications and lessons learned. The EA Program can be extended into this phase through the release of fully validated project data. Exchange data between research and applications communities on the advances and increases of societal use of the project data sets, and provide support to the ESD Senior Review requests. Information on the Senior Review can be found in [Section 5](#) shown below.

Guidance: It is expected that the level of effort and activity will decrease after the start of operations, however interaction with the applications communities continues to be part of the overall project.

5. SENIOR REVIEW

To prepare for the Senior Review, the Applications Program should work with the project leadership to document the societal benefit that is realized due to the project data products. Quantification of these benefits through socio-economic studies and applied research will be presented as part of the project's extended mission proposal. Evidence should include case studies and testimonials along with documentation. Documentation should include multiple sources in addition to peer reviewed journals such as; movies, quad charts, press releases, and articles in the popular press.



APPENDIX A: PROJECT PRODUCTS BY DEVELOPMENT PHASE

NASA Earth Science Division Guidelines for a Project Applications Program					
	Pre-Phase A	Phase A	Phase B	Phases C & D	Phase E
Project Life Cycle Phases	Concept Studies	Concept and Technology Development	Preliminary Design and Technology Completion	Final Design, Fabrication, System Assembly, Test and Launch	Operations and Sustainment
Purpose	Scope the applications portion of the mission concept	Articulate the applications plan for the mission	Implement the plan and build the applications user base	Engage Communities, articulate key applications benefits, support applications readiness and receive feedback	Realize and communicate the applications and societal benefits
Activities	Conduct Mission Studies	Generate a Project Applications Plan	Launch an EA Program	Conduct periodic EA meetings, Hold EA workshops and benchmark meeting	Conduct periodic EA meetings
	Characterize the applications value of the mission	Articulate audiences and implementation activities	Conduct workshops to inform communities about the mission	Receive feedback from EAs	Communicate societal benefits of the mission
	Identify and characterize applications communities	Develop the Applications Traceability Matrix (ATM) to inform the Science Traceability Matrix (STM)	Build awareness and receive input and feedback	Build awareness and encourage applications ideas and readiness	Conduct socioeconomic analysis of select EAs and conduct impact workshops
	Support MCR and design trade-offs	Conduct workshops to inform and build user community	Inform remaining design elements	Identify and maintain key applications for mission communications and outreach	Inform the Community of Practice of the status of the mission, data products, reprocessing, Science Team meetings and other items
	Consult with other projects to scope approaches to applications	Gather input and examine alternative to develop Project Applications Plan	Make open call(s) for EAs	Make open call(s) for EAs	Enable use of beta data by EAs and receive feedback
	Develop information to inform the FAD and PLRA	Compile contact information to support communications with users	Articulate DAAC support for applications users	Conduct events and data workshops to engage communities and build familiarity with access	Conduct events and data workshops to engage communities and build familiarity with access
	Inform concept discussions	Initiate use cases to examine uses in design	Identify simulated data products for testing in decision systems	Conduct case studies with EAs	Revisit Community Assessment Report and reassess user communities and opportunities
			Continue use cases to examine uses in-depth	Support efforts to test and practice with simulated data	Assess and report on the Project Applications Program (PAP) and Plan
Deliverables	Project Studies	Project Applications Plan	Updated applications plan and Applications Traceability Matrix	Updated applications plan and Applications Traceability Matrix	Updated Community Assessment Report
	Community Assessment and Report	Applications Traceability Matrix	Applications Posters	EA telecons and case studies	EA telecons and case studies
		Applications Workshop and report	Applications Workshop(s) and report(s)	Applications Workshop(s) and report(s)	Applications Workshop(s), short courses and report(s)
		Community Contact List	DAAC Engagement summary	Data workshops and short courses	Socioeconomic analyses and reports
		Use Cases/Case Studies	Use Cases/Case Studies	Baseline report for Senior Review	Information for Senior Review Submissions
Events	MAR: Conduct a Mission Applications Review prior to MCR	SRR: Systems Requirements Review	PDR: Preliminary Design Review	CDR: Critical Design Review	Commissioning
	MCR: Articulate applications as part of the overall mission concept			SIR: Systems Integration Review	Data Availability
				ORR: Operations Readiness Review	
				MRR: Mission Readiness Review	
	KDP-A	KDP-B	KDP-C	KDP-D/KDP-E	KDP-F



APPENDIX B: PRODUCT DESCRIPTIONS

1. Applications Community Assessment and Report (CAR)

The community assessment is a study that examines mission design and other aspects of the project that have implications for applications to inform the project concept and trade-off studies. The studies that develop from the assessment should be focused on applications aspects to support the Mission Concept Review (MCR) and design trade-offs. For example, this is a key time for the assessment of latency on particular products to determine what approaches the mission might pursue on latency. An assessment of latency needs includes all thematic uses of data, including research, applied research, and applications. This specific type of assessment should be included in the community assessment. An online survey can be used to reach as many individuals as possible, and the results should be published in a peer-reviewed journal (Brown and Escobar 2013) and reports to NASA Headquarters and the user community.

1.1 Community Assessment and Report Elements

The CAR is delivered to the Program Applications Lead (PA), Program Scientist (PS), and Program Executives (PE) at NASA Headquarters for Key Decision Point for Phase A (KDP-A) and the MCR. The CAR involves the following elements:

- Assessment of applications opportunities and importance;
- Characterizations of the Communities of Practice and Potential, including size, discipline and diversity;
- Description of institutions and organizations and their types of decisions;
- Identification of data format(s) familiar to the community;
- Assessment of spatial, temporal, and spectral resolution requirements or desires;
- Description of their decisions and actions and how potential products may have an impact; and
- Assessment of latency needs, format needs and potential operational users with potentially high societal benefit.

2. Project Studies

These studies may be stand-alone or as part of other mission studies in support of the mission concept discussions. For example, such applications-oriented studies can identify specific items about the data, data products, instruments, spacecraft, or ground systems that would impact the applications value of a mission, whereby



informing the mission concept and design trade-off discussions. This feedback is presented in support of the MCR and design tradeoffs so that the project is aware of the potential application uses and needs (latency, direct downloads, spatial resolution, data format, repeat frequency, etc.) prior to locking in a design.

3. Project Applications Plan

The Project Applications Plan outlines the elements of the applications program for the project, its management and deliverables from Phase A through Phase F. The document will present the projects applications audiences and communities, and the plan for how the project will implement the Project Applications Program (PAP) applications. The plan nominally includes the following elements:

- Science objectives from the Program Level Requirements Appendix (PLRA) for the project;
- Summary of results from community assessment;
- Articulation application communities that will be actively engaged by the project, statement of goals, objectives and success criteria for applications;
- Approach(s) and activities to engage the Communities of Practice and Potential such as an Early Adopter (EA) Program;
- Communication strategies for the PAP, such as;
 - Workshops, tutorials and focus sessions.
 - Conferences and symposiums.
 - Data product tutorials and courses.
 - Physical and virtual approaches.
- Formal plan to engage with key members of the Community of Practice, such as an EA Program;
- Plans and activities to assess impact of the project;
- Plans for information collection to support eventual Earth Sciences Division (ESD) Senior Review (after the project exceeds its design life); and
- Milestones and schedule.

4. Applications Traceability Matrix (ATM)

The Applications Traceability Matrix (ATM) is a table that identifies relationships between applications uses and associated measurements and data products. The ATM articulates specific applications questions and applications concepts that can be answered and addressed by the project. For each question, the ATM further articulates the measurement requirements to serve the question, the mission data product, and projected mission performance. The information used to populate the ATM includes methods used to address the question, partners or collaborators involved, the area of application and the societal benefit. The ATM supports and informs the over-arching Science Traceability Matrix (STM). The ATM can be developed in parallel to the STM as the products are finalized.



5. Project Application Workshops, Focus Sessions, and Tutorials

Project Application Workshops, Focus Sessions and Tutorials are held to host meetings for a broad array of community and scientific representatives with the project Science Team, project leadership and the applications community. The purpose of these activities is to review the project applications plan, products, and timeline and to highlight potential uses of products. Feedback and guidance collected during the Project Application Workshops, Focus Sessions and Tutorials are captured in report(s) provided by the Project Applications Coordinator (PAC). The project PA at NASA Headquarters will edit the report(s). After all comments and questions are addressed, the report is published to the community via the mission website. The results of this activity are expected to be used to further refine and tailor the PAP. After identification, the project's Distributed Active Archive Centers (DAAC) should be considered for inclusion in all activities.

a. Project Application Workshops

Project Application Workshops are organized by the individuals working with the PAP and are a part of the project communication strategy that fosters communication between the project Science Team and the Community of Practice. Workshops are defined as events that include participants from potential users across potential thematic applications. Workshops are organized annually or every two years and provide feedback to the project about product applications and the thematic areas in which their products may be applied.

b. Focus Sessions

Focus Sessions are concentrated events focused on a thematic topic in the user community. These community-organized events are held at a community institution, and are organized with the assistance of the Project Applications Team (PAT). Project personnel will participate in the Focus Sessions to guide the specific thematic applications needs of the community. The PAC and a member from the Community of Practice will organize the Focus Sessions.

c. Tutorials

Tutorials are organized by the PAT to provide an opportunity of a thematic community to discuss the products and applications of NASA data products and to deepen the knowledge of the Community of Practice on a particular topic. Tutorials combine project product application opportunities and leverage innovation for how to best combine data sets, models and expertise.



6. Event Reports

Event Reports provide a comprehensive description of each Project Application Workshop, Focus Session and Tutorial. They will form the basis for future work, provide a reference for those who could not attend, enable new communities to understand the objectives of the applications program and provide ways to get involved. Event Reports will form a record and are a deliverable from the PAT to the project.

6.1 Community Contact List

The Community Contact List creates a formal database of members from the Communities of Practice and Potential, especially to support information distribution and distribution lists. Information contains the name, email, organizational affiliation, thematic interest of each individual contacted, and other information, such as their participation in events or expressed interest in the mission. This list will be used to communicate mission news, provide updates, schedule meetings and publish opportunities during the mission from Phase A through Phase F.

7. Early Adopter Program

The EA Program promotes applications focused research to provide a fundamental understanding of how project data products can be scaled and integrated into organizations' policy, business, and management activities to improve decision-making efforts. The EA Program accelerates the integration of products into policy, decision-making and scientific support settings by providing specific guidance to EAs who commit to engage in pre-readiness research that incorporates data in their applications. EAs are solicited through an informal letter of interest.

7.1 EA Program Characteristics:

- Each EA will provide an EA research project title with the end user clearly identified and a short abstract describing the societal benefit of the project.
- Each EA will be partnered with a Science Team member who can provide guidance and information on project data product development.
- The EA will receive access to developmental products and interaction with the product developer, enabling them to understand and integrate the new products into their systems.
- The Science Team member will gain a partner who can evaluate products and offer feedback from a functionality perspective as well as potential calibration and validation information.



- The EA will provide the PAT with quantitative metrics and testimonials that explain how the use of a product will improve a policy or decision relevant to their organizational goals and objectives.

8. Use Cases/Case Studies and Report

Use Cases illustrate specific application opportunities, whereby communicating potential value and helping inform the project team, Communities of Practice and Potential, Earth Science community, and the broader public about potential benefits of the mission. The Use Cases also help identify priority activities to address. Use Cases develop into funded Phase E EA case studies after launch. EA case studies are meant to serve as an “example project” that can demonstrate both science and societal impact. The case study provides a qualitative assessment of the societal relevance of that science data on a decision process or policy. For example, the Soil Moisture Active Passive (SMAP) Phase E case studies selected six EA's projects to demonstrate how SMAP science data were ingested and used technically by their organization, while providing feedback about any challenges, changes or improvements to their system processes.

9. Project Application/Product Posters

Project Application/Product Posters are developed after mission products have been defined by the Science Team (usually mid-late Phase B) and printed for distribution during conferences, meetings and by project and Science Team members during the life of the project. The Project Application/Product Poster summarizes the Community of Practice and the high value contributions of potential users of the project data products. The Project Application/Product Poster focuses on product characteristics, science outcomes and latency as known in Phase B.

10. Simulated Products

Simulated Products can be developed during Phase B or Phase C and shared with the Community of Practice so the community has exposure to the product format, and has the opportunity to make necessary modifications to their existing systems and processes to prepare for the eventual ingestion of the data. Simulated Products can also be shared with a select subset of the user community, typically the EAs.

11. Early Adopter Workshop

The EA Workshop brings together all mission EAs and showcases each of the EA projects. Results from pre-launch research are discussed and expected outcomes (using mission products) are presented during workshops and events in Phase B. This workshop is held 6-8 months before launch and then again 1-2 years after launch.



12. Early Adopter Benchmark Meeting

The EA Benchmark Meeting is designed to evaluate methods for using project data in societal applications. The meeting should focus on the project EAs and will enable discussion of the methods used by EAs to evaluate the utility of the pre-launch project data in their activities. Each participating EA will provide specific feedback to the project and NASA Headquarters about the value of pre-launch applications efforts to enable integration of project data into their activities. This effort is the baseline for developing case studies in Phase E.

13. Data Workshops

Data Workshops are designed to prepare the Communities of Practice for products (familiarize format and access). The Data Workshops provide hands on instruction for locating, opening and manipulating mission products. The Mission Science Team will distribute Computer scripts (MATLAB, IDL, etc.) and synthetic products (designed for familiarization only) during the Data Workshop. The Data Workshop is a collective effort between the project Science Team, PAC, EAs and the selected DAAC(s) so the attendees become familiar with the project data structure, lessons learned from EAs and the DAAC distribution and user services. During these events the DAAC(s) presence is well known and they collect information to integrate into user services. DAAC's online tools, user services and data access is well advertised and presented to the user community so familiarity of the DAAC's services is well established by the time the satellite launches.

14. Short Courses

Short Courses provide hands-on instruction for where to find, how to open and how to manipulate project data products. Simulated data products developed by the project are used for all Short Courses. Scripts for opening files are developed and provided to those who attend the Short Course. These scripts are also provided to the DAAC(s) for distribution to the community. During Phase C and Phase D the DAAC(s) are invited to all workshops to elicit feedback for user services and demo and update data web tools.

15. Post Launch EA Program

After launch, all EAs will enter into an additional agreement to (1) Provide feedback to the project on the usefulness of simulated and cal/val data and the EAs Program, and (2) Participate in the cost/benefit research proposed by the PAC(s). Select EAs will be approved to use pre-beta data release products through a Phase E pre-beta application process.



- a. The EA will make a request to the PAT for review and approval on a case-by-case basis.
- b. The project's EA Program will continue through the life of the mission and continue to provide feedback to the Mission Science Team.
- c. A report on the EA Program will be submitted for the Senior Review at the end of Phase E.

16. Impact Workshop

The Impact Workshop is held with members of the Community of Practice and EAs. The workshop occurs at the start of Phase E to establish baselines upon which quantitative assessments of the impact of project products on decision-making can be compared. A report or research paper will be written on each organization and individual participating in the Impact Workshop. The report or research paper will document the improvement in the process or procedure of the organization due to the inclusion of project data. The report or research paper is then shared with the project as feedback for how mission data was applied to specific societal applications (Adams et al. 2013).



APPENDIX C: SAMPLE PROJECT APPLICATIONS TEAM

PROJECT APPLICATIONS TEAM ORGANIZATION AND AFFILIATION TO THE PROJECT	
NASA Headquarters Program Applications lead (PA)	<ul style="list-style-type: none"> Provides support and guidance at the program level on goals and objectives for applications.
NASA Headquarters Program Scientist (PS)	<ul style="list-style-type: none"> Provides support and guidance on communities and opportunities that will help expand the mission user community.
NASA Headquarters Program Executive (PE)	<ul style="list-style-type: none"> Confirms that applied science and applications requirements and plans are adequately captured in the project documentation.
Project Manager	<ul style="list-style-type: none"> Supports the project application efforts and weighs in on Project Application Program decision structure changes, modifications or amendments.
Project Science Team Leader	<ul style="list-style-type: none"> Funded by the Project. Provides guidance and sets expectations for project applications based on the mission science objectives.
Project Scientist	<ul style="list-style-type: none"> Funded by the Project. Provides guidance and sets expectations for Project Applications.
Deputy Project Scientist	<ul style="list-style-type: none"> Funded by the Project. Provides guidance and sets expectations for Project Applications.
Project Applications Coordinator	<ul style="list-style-type: none"> Funded by the project. Plans, organizes and executes on all application strategies and activities. This is a full time position that requires research into the applied community and outreach be conducted.
Project Science Team Applications Working Group Chair	<ul style="list-style-type: none"> Funded by the Project through a ROSES solicitation. This is a Science Team member that works in parallel with the Applications Coordinator.
Project Science Data Systems Representative	<ul style="list-style-type: none"> Funded by the Project. Supports project application efforts by providing feedback to mission about data uses, support of EAs and updates with data access tools.
NASA Distributed Active Archive Centers (DAAC) Representative(s)	<ul style="list-style-type: none"> Support the project application efforts by providing feedback to mission about data uses, support of EAs and updates with data access tools.