



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

EARTH SCIENCE DIVISION

**DIRECTIVE ON PROJECT APPLICATIONS
PROGRAM TAILORED FOR EARTH
VENTURE (EV) Projects**

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1. PURPOSE

The purpose of this document is to establish targeted guidelines for implementing application efforts; science and activities that are focused to the science objectives of cost capped and time constrained Earth Venture Projects, within the Earth Science Division (ESD). This document is specifically designed for Earth Venture (EV) projects (Earth Venture Mission, Instruments and Suborbital) to propose a project specific Applications Program in accordance with this document. Proposed EV project specific Application Program 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 by an implementation plan or detailed justification for the reasons an applications program cannot be implemented within the project. However, all activities for EVs should be focused on developing and encouraging project specific application science 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). The information and samples presented in this document shall be used as a guide for developing a project unique Project Applications Program (PAP).

2. PROJECT APPLICATIONS PROGRAM GOAL

The primary goal of the Project's Applications Program 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 and implementations as part of the overall mission concept;
- Demonstrating the project's benefit to society and contribution to the achievement of societal outcomes;
- Increasing the utility of data products; and
- Fostering a Community of Practice who will work with the project throughout the mission life cycle.

There are a number of people and organizations that will supply information and 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 Program Applications Scientist (PAS). 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.

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. ORDER OF IMPLEMENTATION AND GUIDELINES

This next section will describe the project Applications Program activities by project phase (as defined in the current version of NASA Procedural Requirements (NPR) 7120). Each phase includes the implementation of research and activities that are relevant to the maturity of mission products in support of the project identified applications objectives. Deliverables by phase can be found in the table shown in [Appendix A](#).

4.1 Phase A (4-6 months)

Purpose: To introduce application goals and activities into the overall project science implementation. ESD will approve the proposed Project Applications Program prior to the project's KDP-B.

Focus: To identify the targeted user community for application focused efforts and initiate the implementation of an ESD approved Project Applications Program as part of the overall projects science activities.

Implementation Activities: Begin implementation of the Project Applications Program by identifying and categorizing user communities of practice and communities of potential through a community assessment (as identified in the project proposal).

Guidance: The Community identified in the Projects Application Opportunity (AO) Proposal should inform the development of the Project's Application Program by helping to focus on applications that work in concert with the overall science focus.

4.2 Phase B (1 to 1.5 years)

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

Focus: To implement an ESD approved PAP as part of the overall projects science activities tailored to the scheduled of the mission. The PAP will clarify the applications dimension of the overall project concept and establish the applications Community of Practice

Guidance: The Project Applications Program will implement outreach and communication techniques most effective for the Community of Practice and sensitive to the schedule and budget constraints for EV project development. A strong characterization of the Communities of Practice and opportunities will expedite the applications and enhance the overall science objectives and societal benefits from the project's data. A valuable and encouraged deliverable is a user matrix that outlines willingness to adopt data, potential impact when using data and potential for integration of data for operations. Listing challenges and limitations for applications and adoption (format challenges, unfamiliar with NASA data, access, etc.) will also expedite any user collaboration selection process and identify opportunities (when applicable).

Implementation Activities:

- Communicate project's potential products and science objectives,
- Communicate science advances and work with applications of high potential,
- Consider the selection of 1 or more Early Adopters that can demonstrate a targeted application(s) of high potential. Working with the EA(s) to introduce mission product requirements into the user organization should begin here. Proxy data to help prepare for format and resolution fits is encouraged,
- PAP implementation progress should be included in standard project science activity and reporting.

4.3 Phase C & D (1-2 years)

Purpose: To make progress on application activities as stated in the POP and keep the Communities of Practice engaged with the project and prepare to use project data upon commencement of operations. Progress of the POP should be included in standard project science activity and reporting. ESD will confirm progress status, and Phase C and D activities half way through implementation.

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 product(s). To engage with the community, communicate project products, and identify and work with applications of high potential with select EAs. Working with select EAs are a primary focus of application s research and activities. Establishing a deep rooted relationship with select Early

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Adopter(s) and having a clear understanding of the EA's organization culture, challenges and plans for adopting EVM products is critical.

Implementation Activities:

- Focused topical engagement of the community with a targeted objective to partner with season and operationally mature EA(s).
- Communicate project products through a workshop or tutorial,
- Communicate science advances, identify and work with applications of high potential.

Guidance: It is expected that the level of effort and activity will increase over previous phases of the project. The EA engagement and partnering is the primary effort for this phase so it is important to scale the work accordingly. Consider the application user service need and data distribution needs (Leveraging existing NASA resources such as SERVIR, DEVELOP, ARSET, LANCE, NASA Direct Readout Laboratory (NDRL) and DAACs are encouraged).

4.4 Phases E (1-2 years)

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. 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: Reporting on the applications and potential opportunities to conduct thematic use case study(ies) with Early Adopter(s) of mission product to demonstrate implementation or utility in a user environment (within the allowable time of the mission's operational). This includes education on mission data, impact assessments and discussion of potential challenges and pitfalls. The focused study will enable future research allow for the EA organization to ingest mission data and provide feedback on the used and potential impacts in the future. During this phase the mission will support the thematic case study(ies) selected and aid in EA's effort to integrate mission data products for their organization. The interaction with the applications communities continues as a constant component of the overall project effort.

Implementation Activities:

- Engage the community, communicate project products, communicate science advances,
- Project Application Plan implementation progress should be included in standard project science activity and reporting,
- Focus on selected EA thematic use case study(ies) that help demonstrate the impact and value of data in a real world environments,
- Document feedback and lessons learned from the EA efforts to help improve the data knowledge and distribution at NASA,

Guidance: It is expected that the level of effort in Phase E will not decrease from the previous phases and is expected to be consistent with the level of efforts from previous phases.

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APPENDIX A: PROJECT PRODUCTS BY DEVELOPMENT PHASE

Project Life Cycle Phase	Phase B	Phases C & D	Phase E
Project Life Cycle Phase Description	Preliminary Design and Technology Completion	Final Design, Fabrication, System Assembly, Test and Launch	Operations and Sustainment
Purpose	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	Launch an EA study(ies)	Conduct periodic EA meetings, Hold EA workshops and benchmark meeting	Conduct periodic EA meetings
	Conduct workshops to inform communities about the mission	Receive feedback from EAs	Communicate societal benefits of the mission
	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
	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
	Make open call(s) for EAs	Enable use of beta data by EAs and receive feedback	Enable use of beta data by EAs and receive feedback
	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
	Identify simulated data products for testing in decision systems	Conduct case studies with select EAs	Assess and report on the Project Applications Program (PAP) and Plan
		Support efforts to test and practice with simulated data	
Deliverables	Updated applications plan and Applications Traceability Matrix	Updated applications plan and Applications Traceability Matrix	Update Matrix for user community challenges and opportunities
	Applications Posters	EA telecons and case studies	EA telecons and case studies
	Applications Workshop(s) and report(s)	Applications Workshop(s) and report(s)	Applications Workshop(s), short courses and report(s)
	DAAC Engagement summary		Impact analyses and reports
	Use Cases/Case Studies		
Events	PDR: Preliminary Design Review	CDR: Critical Design Review	Commissioning
		SIR: Systems Integration Review	Data Availability
		ORR: Operations Readiness Review	
		MRR: Mission Readiness Review	
	KDP-C	KDP-D/KDP-E	

APPENDIX B: PRODUCT DESCRIPTIONS

1. Applications Community Assessment/Professional Review

The community assessment is an evaluation of the EVM's user community. Familiarizing with users, organizations, limitations and challenges helps outline the kind of engagement needed. The assessment helps guide the thematic selection for EA studies and communication strategies as well as resources and collaborators. For example, this is a key tool 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 Elements

The matrix of the assessment 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 matrix involves the following elements:

- Assessment of applications opportunities and importance;
- Characterizations of the Communities of Practice, 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. Thematic Use Case 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

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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.

Thematic Use Case studies conducted by Early Adopters illustrate specific application opportunities, whereby communicating potential value and helping inform the project team, Communities of Practice, Earth Science community, and the broader public about potential benefits of the mission. The Thematic Use Case studies also help identify priority activities to address. Thematic Use Case studies from EAs are meant to serve as an “example project” that can demonstrate both science and societal impact and provide a qualitative assessment of the societal relevance of that science data on a decision process or policy.

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 E. 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; 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

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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 expect to 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.

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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, and 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 Adopters

Early Adopters 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 EAs 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 study 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. 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.

9. 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.

10. 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.

11. 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

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and presented to the user community so familiarity of the DAAC's services is well established by the time the satellite launches.

12. 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.

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.
Program Applications Scientist	<ul style="list-style-type: none"> Funded by the project and leads all application efforts. 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 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 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.