HyspIRI Science Workshop:
Applications & Missions

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A flying ladies’ hat box?
Planned Earth Science Missions (2012-2023)

Launched 10/2011
Discovering and demonstrating innovative and practical applications of Earth Science

The Applied Sciences Program funds projects that enable uses of Earth observations in organizations’ policy, business, and management decisions.

**Applications**
Hands-on projects and studies to prove-out and demonstrate applications ideas targeted at integrating Earth observations in specific decision-making activities (e.g., economic, resource management, health)

**Capacity Building**
Projects and activities to build skills, users, and capabilities in the US and developing countries on how to access and apply environmental satellite data to benefit society
Discovering and demonstrating innovative and practical applications of Earth Science

The Applied Sciences Program funds projects that enable uses of Earth observations in organizations’ policy, business, and management decisions.

Accelerate Applications
Enable identification of applications early in satellite mission lifecycle and facilitate effective ways to integrate end-user needs (e.g., non-research uses) into satellite mission planning and throughout the mission life cycle.
The national strategy outlined here has as its overarching objective a program of scientific discovery and development of applications that will enhance economic competitiveness, protect life and property, and assist in the stewardship of the planet for this and future generations.

*Earth Science Decadal Survey 2007*
The Challenge

To effectively include the consideration of mission-enabled applications within the framework of the existing mission development process, increase the applications value, and increase ultimate return from the missions.

Over the past several years ESD has implemented several changes into our mission development activities to work to achieve these objectives

» Created role of Program Applications lead for missions
» Added language and content to the mission Level 1 requirements document (PLRA)
» Added content to the mission Science Definition Teams
» Initiated a system study of data latency
» Early Adopters (SMAP. Potentially ICESat-2, others)
» Community workshops and other approaches
ESD created the new role of PA
Applications equivalent of Program Executive (PE) and Program Scientist (PS)

Responsibilities
Ensure consideration is given to the applications value of the mission and use of the data products by end users (other than research community) during mission planning & requirements development.

» Support Mission Project team to develop the applications aspects of the mission
» Organize the relevant applications communities to imagine and anticipate possible applications.
» Encourage applications involvement in science definition teams or science study teams
» Organize events/workshops for applications communities
» Alert management to situations in which the applications value of the mission might increase/decrease
Level 1 Requirements document identifies the mission, science and programmatic (implementing organization, funding and schedule) requirements for the development and operation of the mission, including the baseline and threshold science requirements.

Statement in *Level 1 Requirements* document:

“Science implies research, applied research, and applications for the purposes of this requirements document.”

The level 1 documents also clearly define the data product latency requirements for the missions.

Note: The emphasis on research, applied research, and applications is not expected to be split evenly.
SMAP Applications and Mission Planning

- SMAP has an Applications Working Group
- Formal SMAP Applications Plan
- Applications-focused workshops in 2009 & 2011

SMAP Early Adopters Program

- Organizations that have clearly defined needs for SMAP-like data products.
- Early Adopters expected to apply their own resources to evaluate and demonstrate the utility of SMAP data for their particular system or model.
- SMAP selected ~15 organizations in 2011-2012 and developed a Memorandum of Agreement with each.
Data latency is a major factor in the utility of data products for applied and operational uses and some scientific investigations. Many missions have data products that may be extremely valuable if they can reach the applied communities quickly after collection.

Study purpose is to assess needs as well as options for meeting latency desires on the missions without unduly driving-up the mission costs. Study is in two parts.

**Latency & User Needs.** Assess the probable data latency targets and needs by a range of users for the suite of ESD planned missions.

**Latency & Technical Capabilities.** Examine possible methods and mechanisms for delivering data that meets the data latency targets.
Applications Involvement
Generally, more involvement of the applications community in satellite missions where the applications opportunities are more apparent.

Applications and Science
Applications community has had similar science needs and questions.

Need for Familiarity with Mission Development Process
Generally, much of the applications community is relatively unfamiliar with the satellite development process, phases, timeline, and lexicon that NASA and the satellite community use.

Often Focused on Data Access, Formats, Latency
Applications users have focused on expressing their needs regarding operational capabilities, such as latency and access and data formats, rather than observation types or measurement specifications.
Building Abilities
ESD is building capacity to involve applications users’ views. User communities learning *how and when* to engage a NASA that is open to their input.

Type & Level of Engagement in Mission Phases
More engagement at the early, pre-Phase A period is generally more profitable. In Phases C-D, better to focus on definition of a few key products so ready at launch to use.

Expectations on Applications Users
What are responsibilities of and expectations on the applications community in the missions? Applications users’ feedback on products may identify needs to improve the data products, which benefits all users of the products.
Applications Value of Missions

Missions & Applications

ESD is interested in assessing which of the approaches to date are working and which are not – and whether there are other steps we have not taken that could be beneficial.

» What is coming from the applications involvement in mission planning?
» How do we measure the “applications value” of a mission?
» Have the missions that engaged the applications community increased the applications value of their mission?
» Has an increased applications value affected (degraded or enhanced) the scientific value?
» Have the efforts to increase applications value impacted the mission’s development?
» What are responsibilities of and expectations on the applications community in the missions (e.g., feedback on data, support cal/val)?
### Example

**Matrix for assessing benefits**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Realized benefits</th>
<th>Options benefits</th>
<th>Knowledge benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic benefits</td>
<td></td>
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<td></td>
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<tr>
<td>Environmental benefits</td>
<td></td>
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<tr>
<td>Security benefits</td>
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</tbody>
</table>

Applications Integration into Mission Life Cycle

Form an ad-hoc science team with expert policy/community guidance of “valued” product development.

Pre-Formulation or Pre-proposal phase
Work normally conducted at the Centers per HQ direction

Detailed design and Development
Application Workshop III
Early Adopter research results, Mini focus groups feedback loops and publications of test data. (Large Policy workshop)

Fabrication, Test and Integration
Application Workshop IV
Update, information and community feedback. EA Presentations and Publication. Success stories/Lessons learned

Validation Period
Application Workshop V
Delivery of Science products is synced to the community involvement. Funded collaborations

Begin Science Operation

Science Products

Application Workshop II
Feedback workshop of mission design study. Identification of potential Early Adopters. Data requirements discussed

Mission Approved
PDR

Mission Formulation
Work conducted at the implementing Center

Mission Selected

Select SDT

Begin Applied Science Work Phase II-Coordination with Mission Operations and Support

Science team Formation

R & A Work

Thematic Leaders
(Science and Policy) assigned to Science Team.

Mission design studies
Budget development

Basic design begins
Applications Value of HyspIRI

Mission Studies

ESD and Applied Sciences is interested in supporting important studies on activities, factors, etc. that can inform on ways to understand and increase the applications value of HyspIRI.

Studies might inform and support mission design trade-offs, Science (and Applications) Traceability Matrix, Mission Concept Review, etc.

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