

NASA Science Mission Directorate

Earth Science Division

Applied Sciences Program

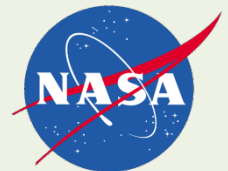


HyspIRI Science Workshop: Applications & Missions

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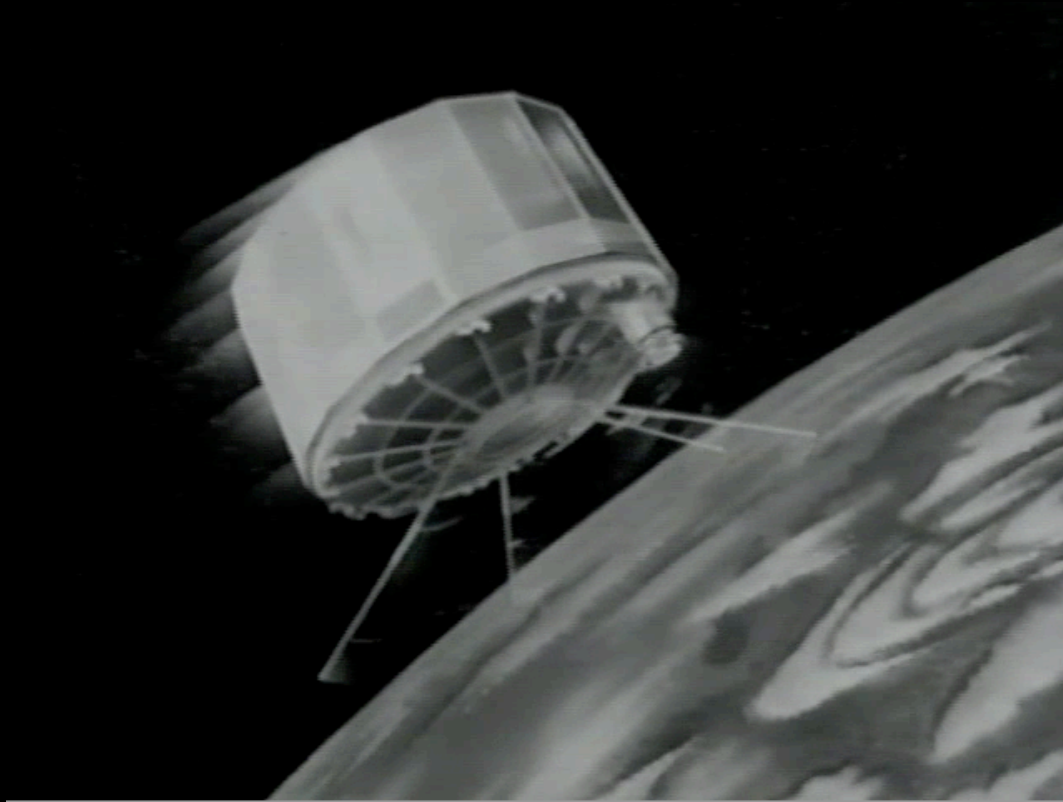
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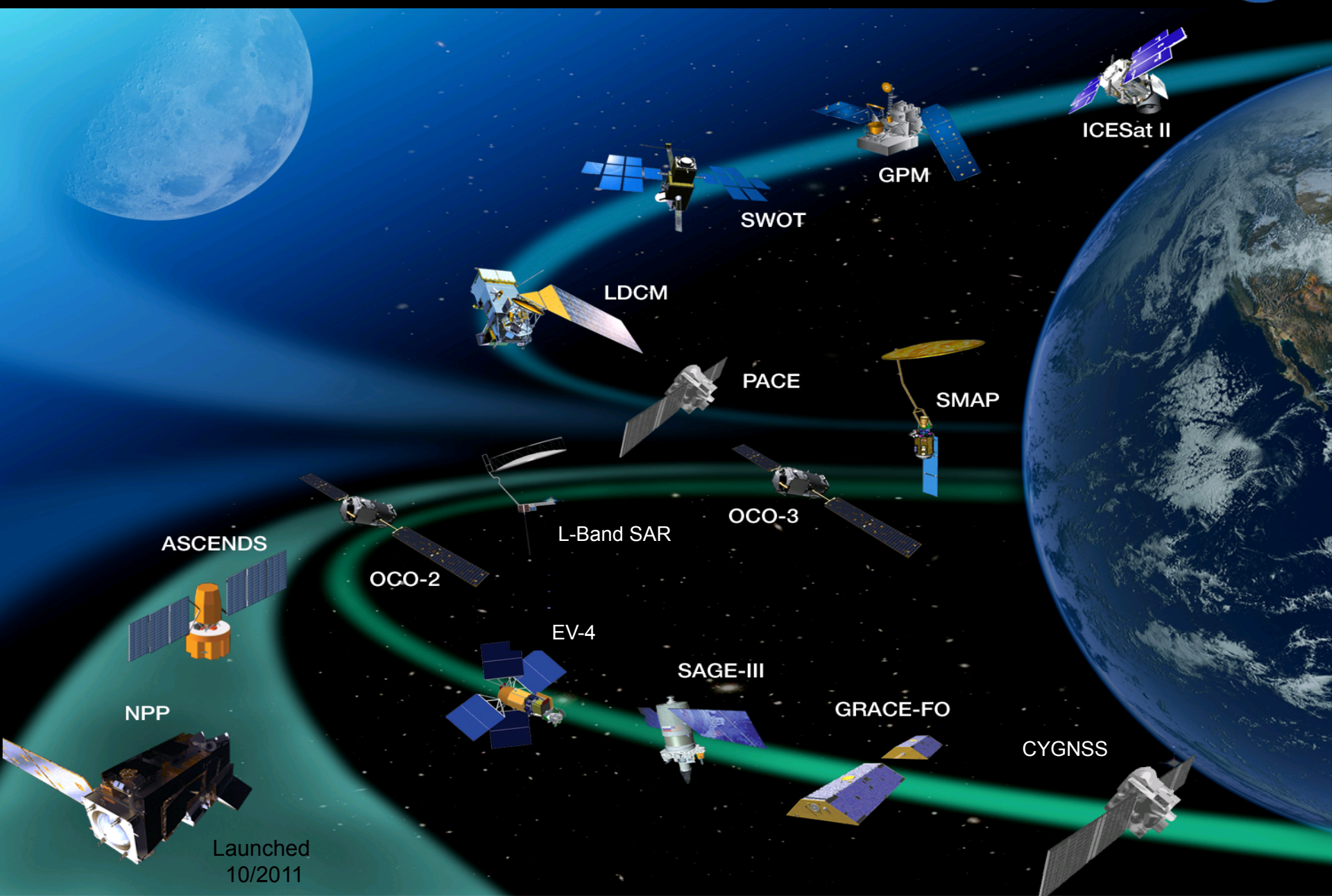




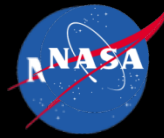
A flying ladies' hat box?



Planned Earth Science Missions (2012-2023)



Applied Sciences Program

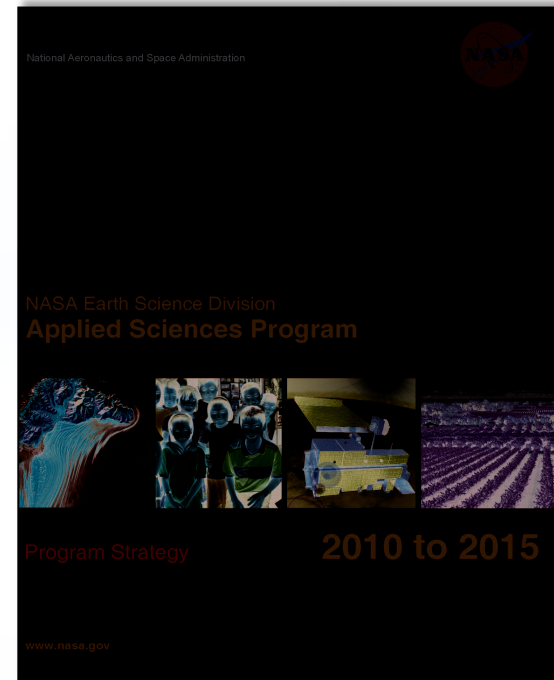


Discovering and demonstrating innovative and practical applications of Earth Science

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)



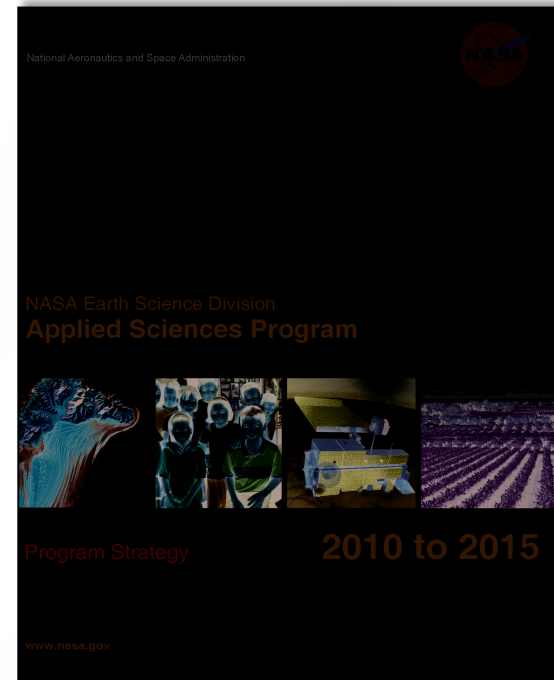
<http://AppliedSciences.NASA.gov>

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

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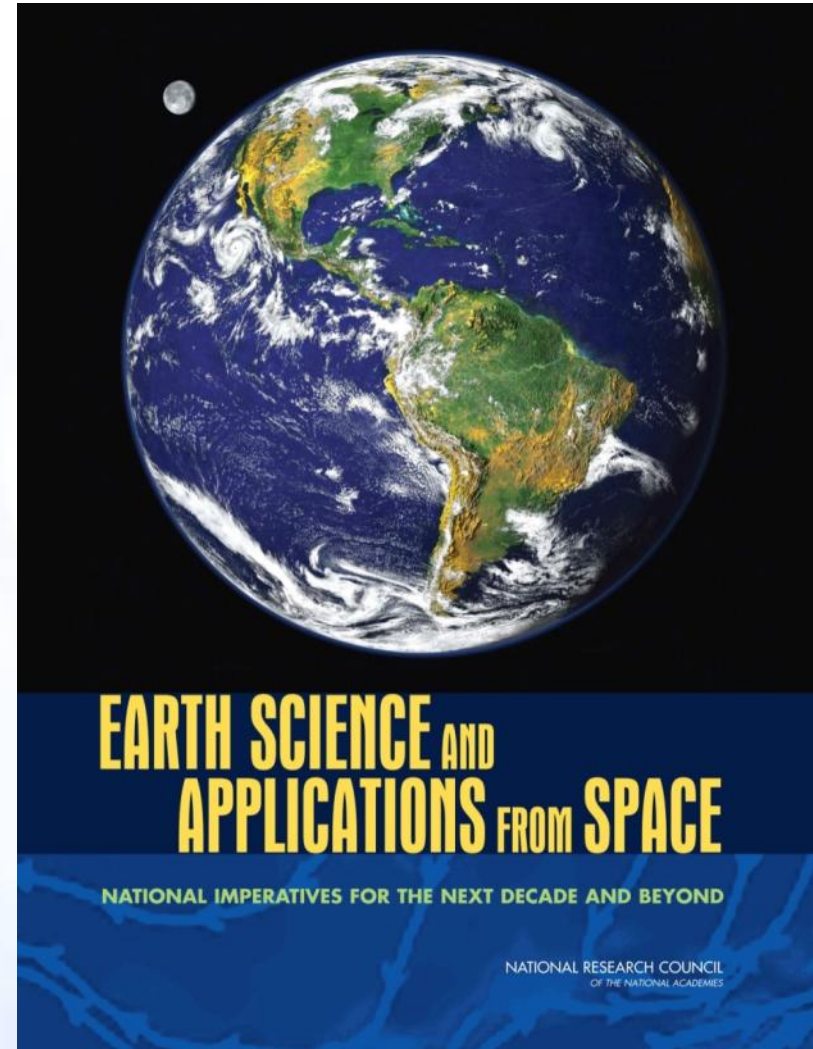
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Accelerate Applications

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



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

Mission Program Applications (PA) lead



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



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:

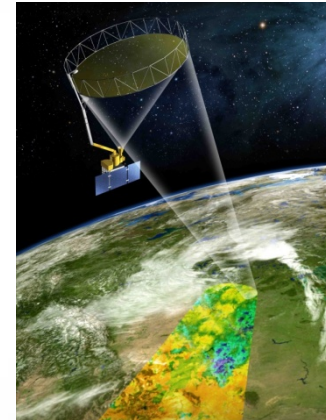
“Science implies research, applied research, and applications for the purposes of this requirements document.”

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.

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)?

Applications Value of Missions



Example

	Realized benefits	Options benefits	Knowledge benefits
Economic benefits			
Environmental benefits			
Security benefits			

Matrix for assessing benefits

Source: Macauley and Diner, 2007. Ascribing societal benefit to applied remote sensing data products. Based on table in: National Research Council. 2001. *Energy Research at DOE: Was it Worth It?* (Washington, DC: National Academies Press).

Applications Integration into Mission Life Cycle



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

Application Workshop I
present the "Community Of User" to mission and Define the scientific and Policy needs

Select SDT

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

Early science requirements

Measurement concepts/
instrument

Mission concept

Pre-Formulation or Pre-proposal phase

Work normally conducted at the Centers per HQ direction

Mission
Selected

Concept and measurement
requirements/
refinement

Mission design
studies

Budget
development

Mission Formulation

Work conducted at the implementing Center

PDR

Represents Program Phase

Φ1

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

Early Adopter
/SDT Workshop

Φ2

Detailed design and
Development

CDR

Fabrication, Test and
Integration

LRR

Ship and Launch

Φ3

Begin on Orbit Operation

Validation Period

Begin Science Operation

Science
Products

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

Application Workshop V
Delivery of Science products is synced to the community Involvement. Funded collaborations

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

Science team
Formation

R & A Work

Φ4

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

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 HysplRI.

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

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