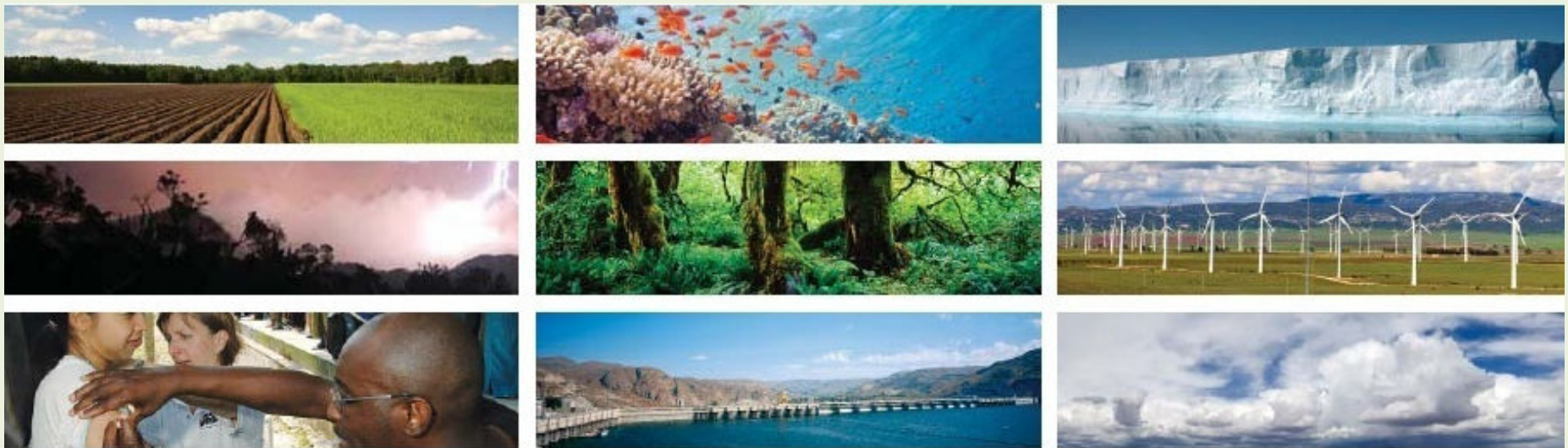
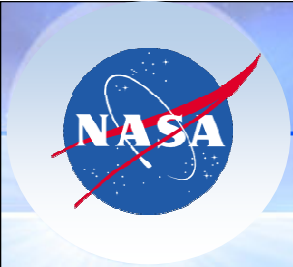


# NASA Science Mission Directorate Earth Science Division



***LANCE UWG Meeting  
February 7-8, 2012***





# Earth Science & Applications

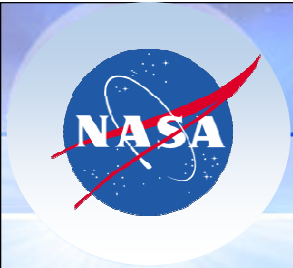
## *Applied Sciences Program*

### **Purpose**

Lead efforts in building knowledge and developing abilities within the Nation and world on how to effectively apply Earth observations.

Research into and development of applications knowledge  
– creation of knowledge and understanding of methods and processes for applying Earth science to serve society

- Role encompasses the transition of this applied knowledge to organizations (including the private sector) that can directly apply it to solve societal issues



# Applied Sciences Program

## Program Strategy

***Discovering and demonstrating innovative and practical applications of Earth Science***

### **Goal 1: Enhance Applications Research**

Identify priority needs, conduct applied research to generate innovative applications, and support projects that demonstrate uses of NASA Earth science.

### **Goal 2: Increase Collaboration**

Pursue partnerships to leverage resources and risks and extend the program's reach and impact.

### **Goal 3: Accelerate Applications**

Enable identification of applications early in satellite mission lifecycle and facilitate effective ways to integrate end-user needs into satellite mission planning.



***AppliedSciences.NASA.gov***



# Applied Sciences Program

## Program Approach

***The Applied Sciences Program funds projects that enable uses of NASA Earth science data in organizations' policy, business, and management decisions.***

### Applications Areas

The program focuses on economic, health, resource management, and

***Proving-Out Applications:  
Demonstration of  
Applications Ideas,  
Realization of  
Socioeconomic Benefits,  
and Transitions***

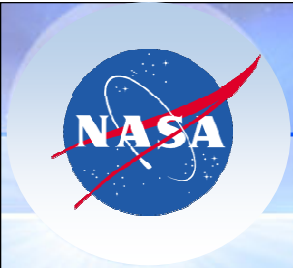
- Feasibility Studies
- Applied Research Teams
- Mission Planning Support

### Capacity Building & Initiatives

The program sponsors specific activities to build skills, users, and

***Building Customers:  
Creating Opportunities  
for New Users &  
Organizations to be  
Aware and Able to Use  
Earth Science***

- Gulf of Mexico Initiative
- Training Modules



# Applied Sciences Program

## Applications Areas (USGEO 9 SBAs)

### Emphasis in 4 Applications Areas



**Health &  
Air Quality**



**Water  
Resources**



**Disasters**

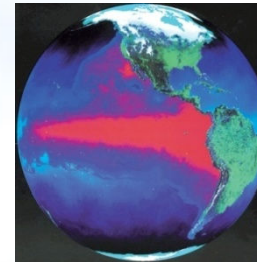


**Ecological  
Forecasting**

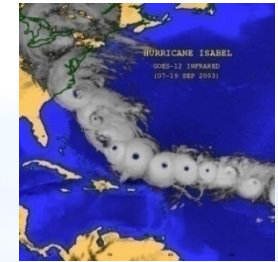
*Seek opportunities to expand to  
5 additional areas*



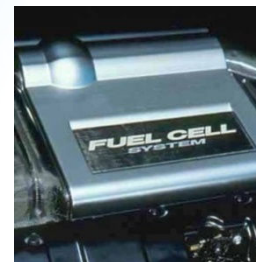
**Agriculture**



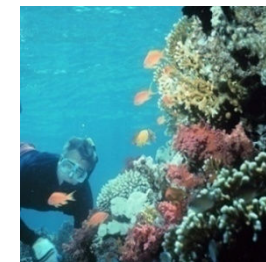
**Climate**



**Weather**



**Energy**



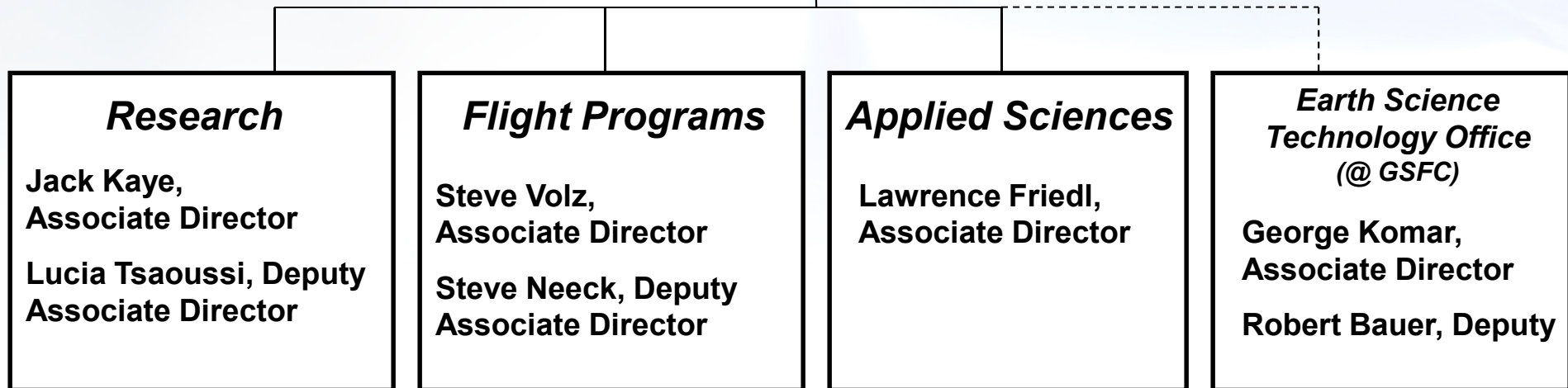
**Oceans**



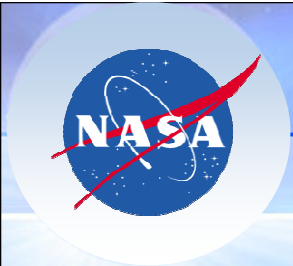
# Earth Science Division

## Organization Chart

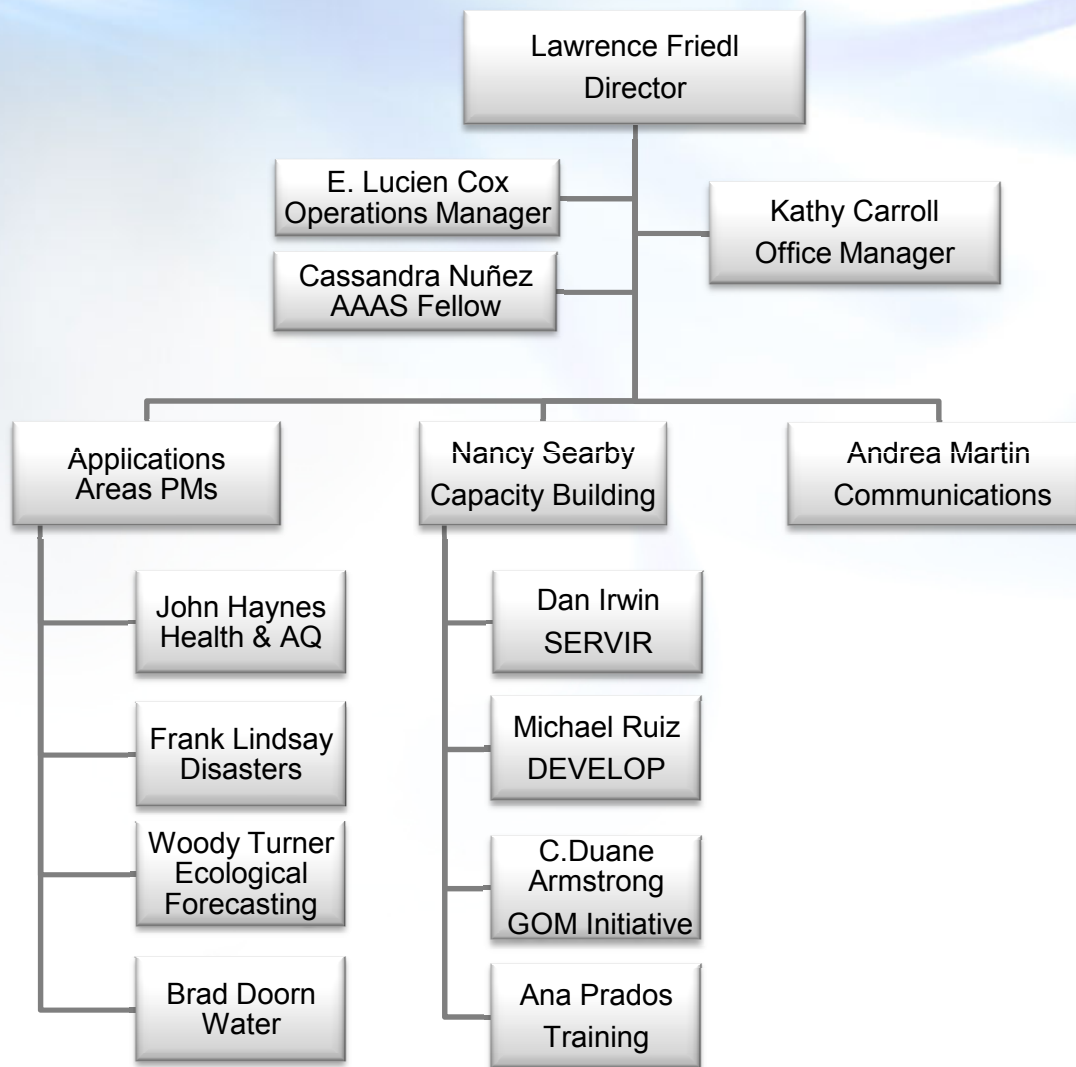
**Michael Freilich, Director**  
**Peg Luce, Deputy Director**  
**Pat Jacobberger-Jellison,**  
**Inter-organizational Coord.**



as of Jan. 2012



# Applied Sciences Program Organization Chart



as of Jan. 2012

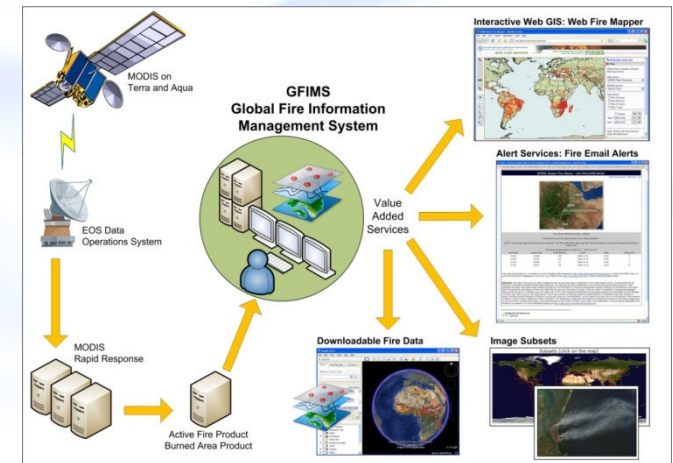


# Applied Sciences Program

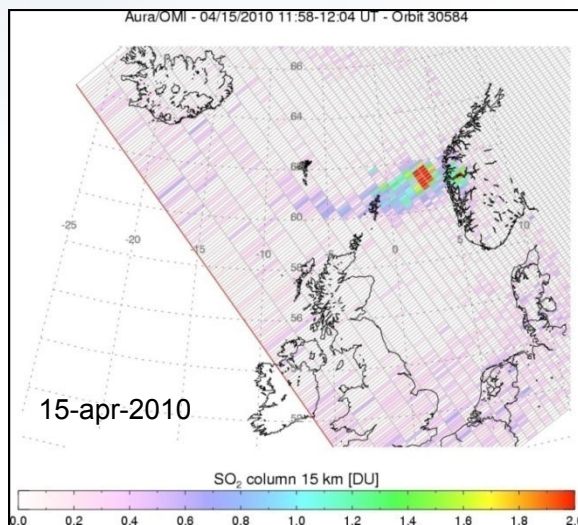
## Project Examples

Global active fire locations from MODIS Fire/Thermal Anomalies product are processed in rapid response. SMS/text messages sent out to emails & cell phones with key info (fire coordinates, time, distance to reference point). For example, park managers use alerts to reduce illegal clearing and respond to wildfires.

August 2010: Transitioned to UN FAO for on-going operational support.



System Configuration

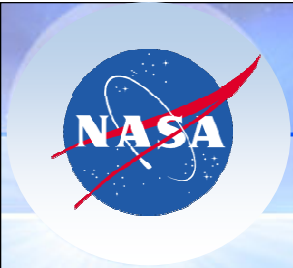


OMI SO<sub>2</sub> – Iceland Volcano

Projects developed and demonstrated reliable detection of volcanic ash clouds using Aura/OMI SO<sub>2</sub> data and other NASA Earth science satellite sensors. Proven utility led to its operational use by NOAA to formulate Volcanic Ash Advisories. Products used extensively in Iceland volcano eruption in April 2010.

February 2011: The NASA satellite data were used to produce volcanic ash advisories for aviators across the Gulf of Mexico due to the Feb. 1 eruption of the Popocatepetl volcano in Mexico.





# Applied Sciences Program

## Applications Readiness Levels

### Applications Readiness Levels (ARL)

9. **Approved, Operational Deployment and Use in Decision Making**
8. **Application Completed and Qualified**
7. **Application Prototype in Partners' Decision Making**
6. **Demonstrate in Relevant Environment**
5. **Validation in Relevant Environment**
4. **Initial Integration and Verification**
3. **Proof of Application Concept**
2. **Application Concept**
1. **Basic Research**

*Partner  
Demonstration  
and Transition*

*Development,  
Test, and  
Validation*

*Discovery and  
Feasibility*

ARL 9

–

ARL 8

–

ARL 7

–

ARL 6

–

ARL 5

–

ARL 4

–

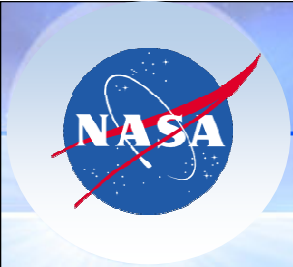
ARL 3

–

ARL 2

–

ARL 1



# Applied Sciences Program

## *Feasibility-to-Decisions Projects*

### **Feasibility-to-Decisions Projects (F2DS)**

#### **Objective:**

**Identify, prioritize, and implement high-reward applications ideas with committed partners**

These solicitations will initially support feasibility studies of potential applications; NASA will select and continue support of a subset of these applications in subsequent projects to develop and transition the application fully.

Initial awards are one-year in duration (Stage 1-Feasibility Study).

*Based on an evaluation at the end of year one, the grantee MAY be selected to continue work in years two through four (Stage 2-Decision Support Project).*

An assessment of Stage 1 results, partner commitment, and in-person presentations will be used to assess Stage 2 award continuations.



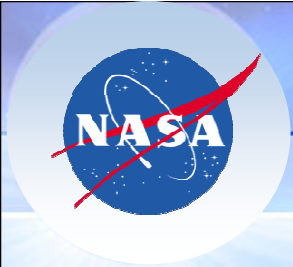
# Applied Sciences Program

## Feasibility-to-Decisions Projects

### Feasibility-to-Decisions Projects

Project	Stage	Activity	NASA Share	Partner Share
Year 1	Feasibility	Prove out application potential	100%	Optional
Year 2	Decision Support	Develop application	~80%	~20%
Year 3	Decision Support	Continue development	~60-70%	~30-40%
Year 4	Decision Support	Complete application and transition	~30-40%	~60-70%
Subsequent Years	<p>Following the Stage-2 project phase, the partner organization(s) is responsible for the operational costs to run their decision support system using the Earth observations. If additional activities are needed to assist in the sustained use of the Earth observations, NASA will support additional efforts with in-kind support. NASA will continue to provide appropriate Earth observations through the NASA data centers and near real time data distribution systems for use by the partner organization(s).</p>			

The on-going costs to incorporate and maintain the application of the Earth observations in the decision-making activities will likely be much less than the costs to develop, test, and transition the application.



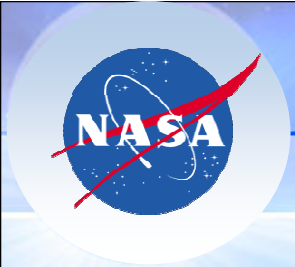
# Earth Science & Applications

## *Program Applications leads for Missions*

### **Missions: Program Applications leads (PA)**

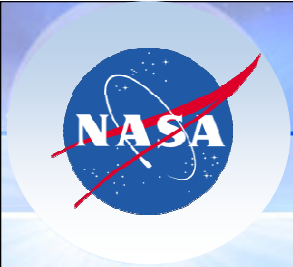
#### Key Responsibilities

- » Represent Applications perspectives in the mission development and planning; help in support to Mission PE, PS, Technologist, etc.
- » Engage with the mission project and SDT/ST, with an emphasis on the applications and scientific aspects of the mission.
- » Support Mission Project team to develop the applications dimension of the mission.
- » Organize the relevant applications communities on behalf of the mission they represent. Support and facilitate organizations' and communities' efforts to imagine, articulate, and anticipate possible applications.
- » Identify studies and organize sufficient meetings/events/workshops to support the apps. communities' input to inform trade-offs in mission concept & design
- » Enhance the applications value of mission and alert management to situations in which the applications value of the mission might increase/decrease



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

- ICESat-2 Level 1  
Requirements Document



# Earth Science & Applications

## *ESD-Wide Study*

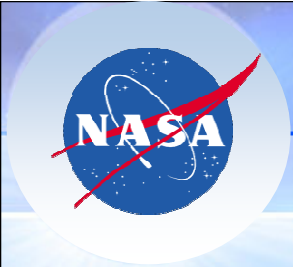
### **Study on Latency**

Issue: 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. Overall, the Earth Science community seeks to assess options for meeting latency desires on the missions without unduly driving-up the mission costs.

Study (led by Brad Doorn):

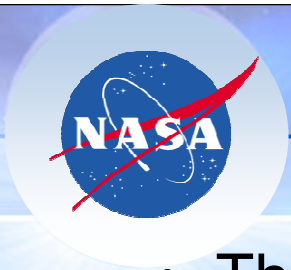
*Latency & User Needs*. Assess the probable data latency targets for the suite of ESD planned missions through 2020 including Tier 1 missions.

*Latency & Technical Capabilities*. Examine possible methods and mechanisms for delivering data that meets data latency targets



# Challenges in Disaster Risk Management

- Improving coordination across all NASA assets for disasters research to disaster applications
- Balance of resources for disasters to lessen disparate demand between/across disaster hot spots and lulls
- Maintain a strategic balance between national and international events
- Improved data sharing between countries with greater access to data prior to some disaster events
- Overall better and more timely response to disasters enabled by technology and coordinated systems



# ROSES 2011 Disaster Solicitation A33

- The objective of this solicitation is to select applied research and applications projects to improve disaster forecasting, response, and mitigation.
- Successful projects will advance organizations' use and application of Earth science observations and models in decision-making associated with disasters.
- The projects are to include relevant NASA satellite mission and/or airborne observations. Foreign satellites and commercial products, as long as they are used in conjunction with some NASA capabilities.
- Projects were encouraged to include modeling and prediction, data fusion and interoperability techniques, visualizations, near real time data and/or other Earth science products to complement an array of Earth obs.





## Applied Sciences Program

Discovering Innovative & Practical Applications of NASA Earth Science

- Home
- About Applied Sciences
- Applications Areas
- Capacity Building
- Solicitations
- Missions
- Performance
- Documents & Reports
- Results & Highlights
- Community Library & Links
- e-Books
- Provide Feedback

Coming Soon

Search the Applications Portfolio

Visit the

Applied Sciences Calendar



Group On Earth Observations



Federation of Earth Science Information Partners



earthzine

NASA Earth Science Division



### NASA Partnership Sends Earth Science Data to Africa

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[More Info](#)

◀ NASA Partnership Sends Earth Science Data to Africa ▶

### Earth Science Serves Society

The Applied Sciences Program promotes and funds activities to discover and demonstrate innovative uses and practical benefits of NASA Earth science data, scientific knowledge, and technology. The Program's portfolio of projects deliver results in applying NASA Earth science to support improvements in aviation safety, malaria early warning, agricultural productivity, water management, earthquake response, and many other important topics.

The Applied Sciences Program partners with public and private organizations on ways to apply data from NASA's environmental satellites and scientific findings in their decision-making activities and services, helping to improve the quality of life and strengthen the economy.

### Applied Sciences Program

News & Events

Applications Areas

Capacity Building

### Applications Areas



The Program focuses on economic, health, natural resources, and other themes to support both applied research and targeted, decision-support projects in 8 areas of national priority.

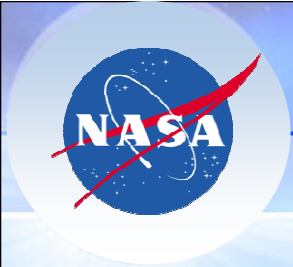
- [Agriculture](#)
- [Air Quality](#)
- [Climate](#)
- [Natural Disasters](#)
- [Ecological Forecasting](#)
- [Public Health](#)
- [Water Resources](#)
- [Weather](#)

# NASA Science Mission Directorate Earth Science Division



*Back-up*



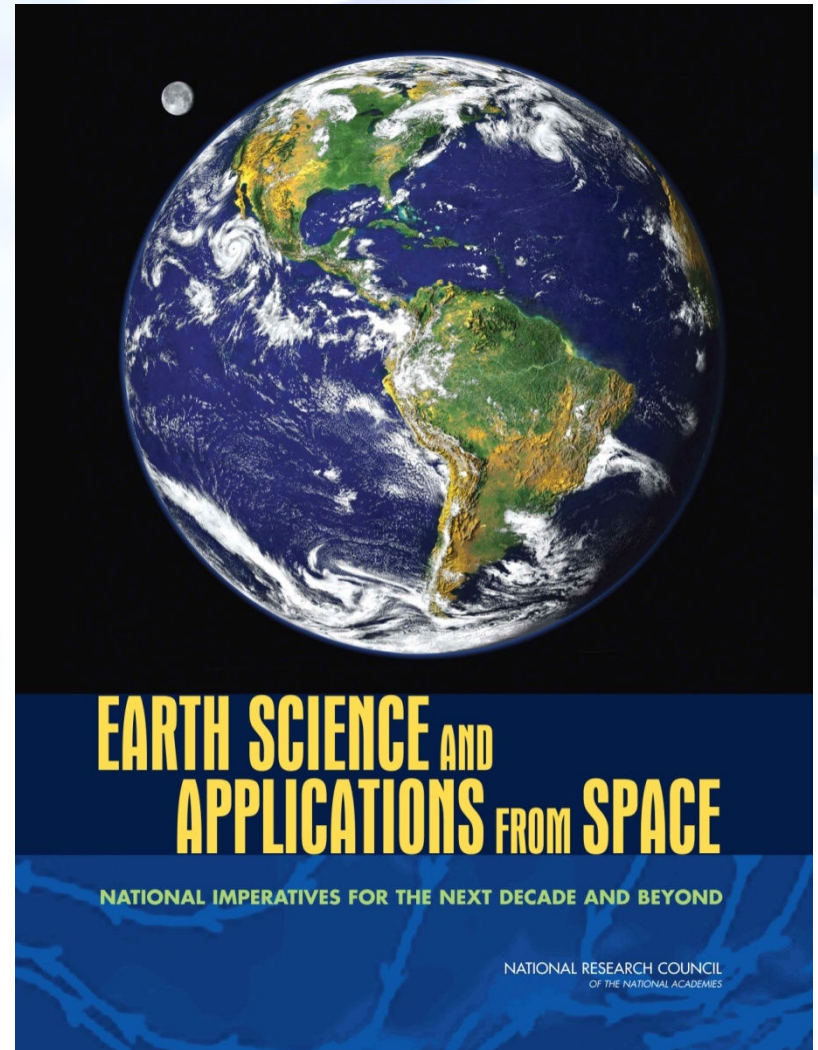


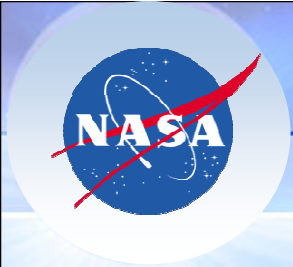
# Earth Science & Applications

## *Decadal Survey*

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*





# NASA and Earth Science

## *Earth Science Division*

The NASA Earth Science Division supports basic and applied research on the Earth system and its processes.

Primary efforts are to characterize, understand, and improve predictions of the Earth system.

In the course the research, NASA pursues innovative and practical applications of Earth observations and new scientific knowledge to improve public and private organizations' decision-making activities.

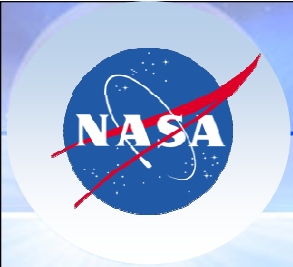
***Technology***

***Missions***

***Research***

***Data Systems***

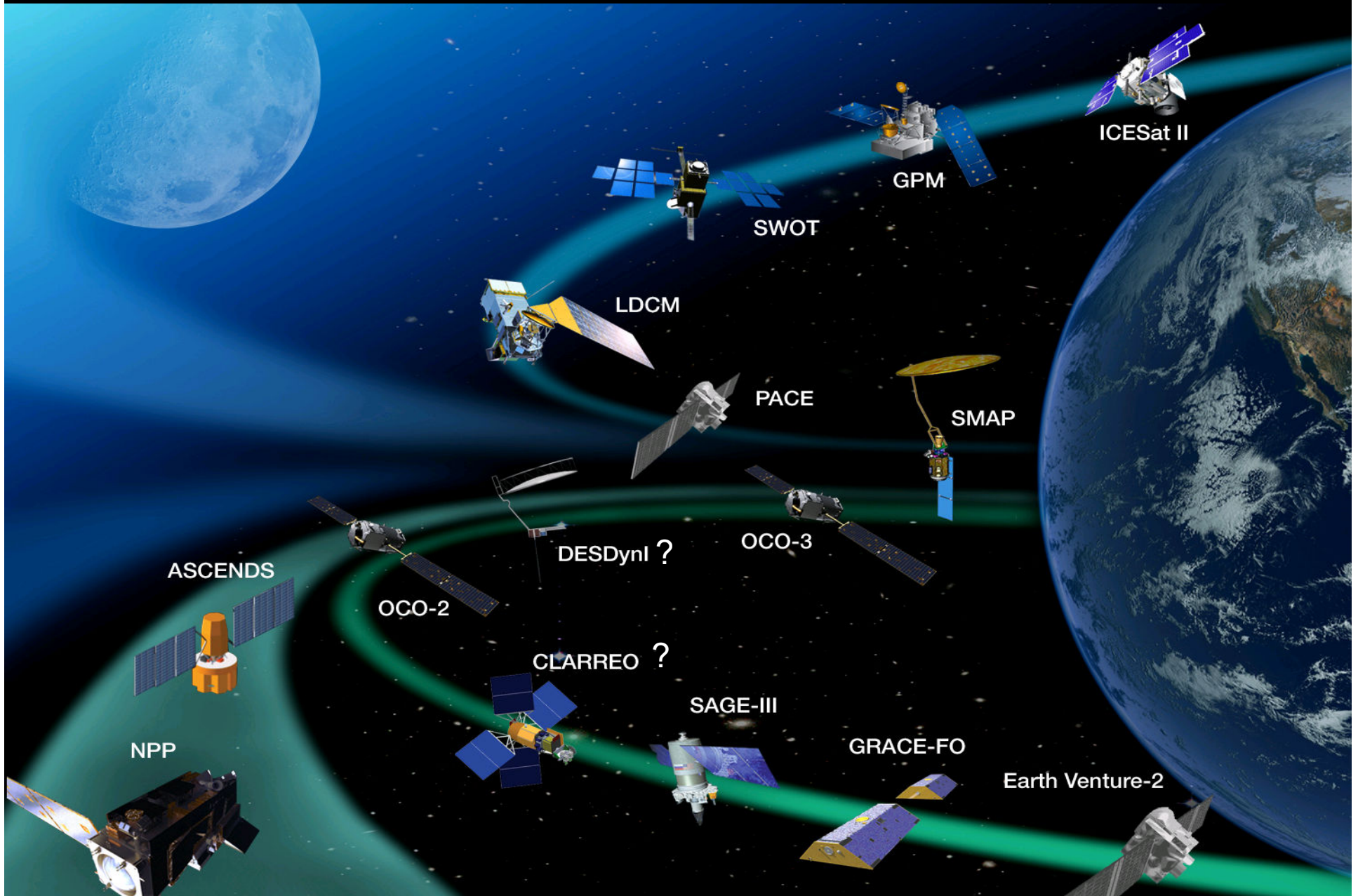
***Applications***

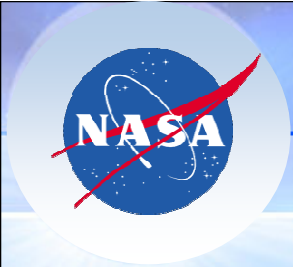


**The mind may, as it appears to me, divide science into three parts. The first comprises the most theoretical principles, and those more abstract notions whose application is either unknown or very remote. The second is composed of those general truths which still belong to pure theory, but lead nevertheless by a straight and short road to practical results. Methods of application and means of execution make up the third. Each of these different portions of science may be separately cultivated, although reason and experience show that none of them can prosper long, if it be absolutely cut off from the other two.**

**- Alexis DeTocqueville  
*Democracy in America, 1835***

# Planned Earth Science Missions (2011-2022)



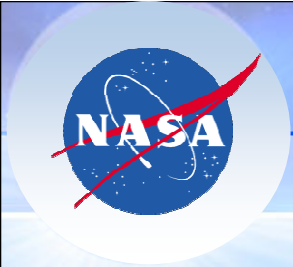


# Earth Science & Applications

## *Guidelines for Mission Planning*

### **BOX 5.1 GUIDELINES FOR MISSION PLANNING TO BALANCE SCIENCE AND APPLICATIONS**

- Processes to move from observations to information should be identified in the initial planning of new missions.
- Mission planning should consider performance requirements for applications, such as timeliness of and capacity for data integration.
- Planning should consider the need for ancillary data and should ensure that ancillary data are available when needed.
- Planning and implementation priorities should include the need to link the data to models and decision-support tools and processes.
- Planning should provide effective lines of communication between decision makers and data gatherers.



# Applied Sciences Program

## Program Assessment

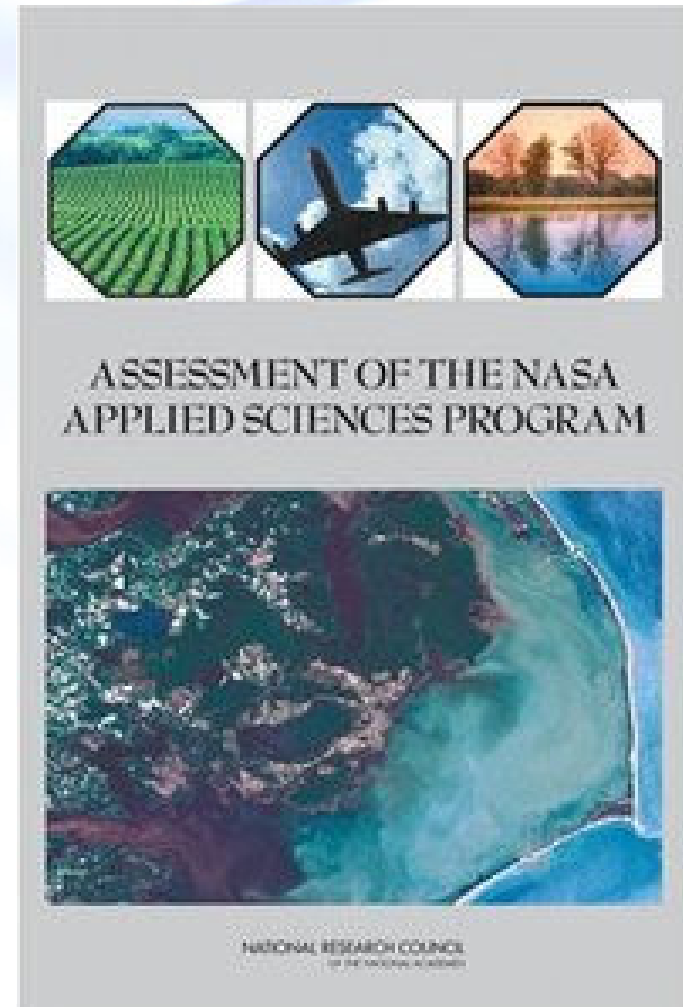
### Conclusion (one of several)

The current U.S. government-wide emphasis on ensuring societal benefits from Earth observing systems is unprecedented, and presents a special opportunity for NASA to enhance its focus on achieving such benefits.

...

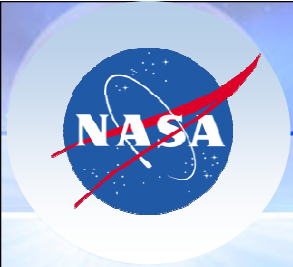
However, NASA does not involve ASP in the initial stages of mission planning in cases when societal benefits are anticipated. ...

Including ASP as a participant in the initial stages of mission planning and selection would enhance the program's ability to perform its central role in advancing and improving NASA's cooperation with users.



NAS, 2007



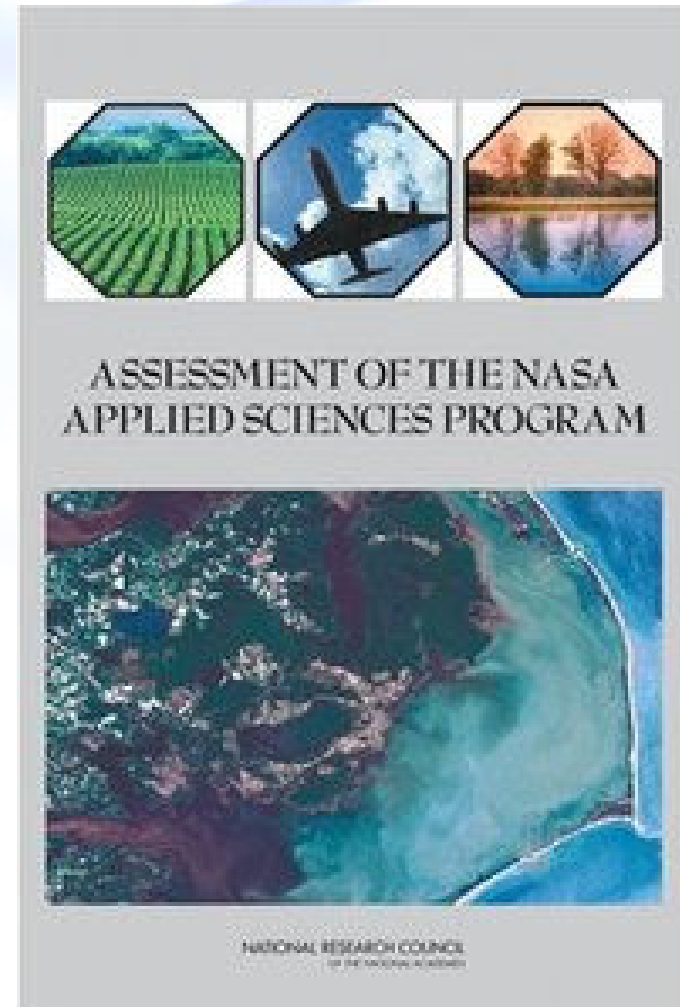


# Applied Sciences Program

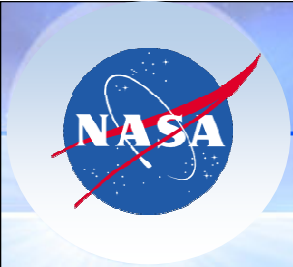
## Program Assessment

### Recommendation (one of five)

RECOMMENDATION 1: ASP should be assigned the responsibility within NASA to review and help establish the requirements and guidelines offered in Chapter 5 of the Decadal Study for effective extension of data and research to applications that meet societal needs. As part of this action, the committee recommends incorporating an ASP representative on NASA mission design and selection teams to aid ASP in increasing the use and impact of NASA products in the user community.



NAS, 2007



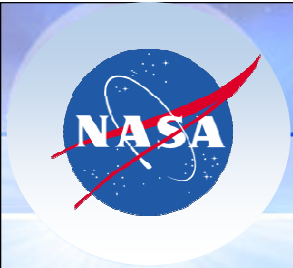
# Earth Science & Applications

## *Guidance to NASA*

One of the principal recommendations of the Decadal Survey was the inclusion of applications scientists on mission planning teams. As an example of applied science research furthering NASA's primary mission, the ASAG has urged ASP to continue and even strengthen its efforts to work with mission teams.

*- Earth Science Subcommittee  
Applied Sciences Advisory Group (ASAG)*

*Letter to NASA Administrator  
November 2009*



# SMD Earth Science Division

**Michael Freilich, Director**  
**Peg Luce, Deputy Director**  
**Pat Jacobberger-Jellison,**  
**Inter-organizational Coord.**

## ***Research***

**Jack Kaye,**  
**Associate Director**  
**Lucia Tsaoussi, Deputy**  
**Associate Director**

## ***Flight Programs***

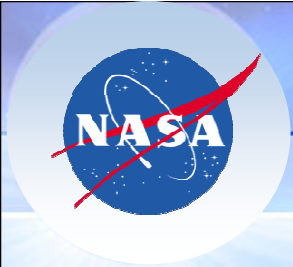
**Steve Volz,**  
**Associate Director**  
**Steve Neeck, Deputy**  
**Associate Director**

## ***Applied Sciences***

**Lawrence Friedl,**  
**Associate Director**

## ***Earth Science Technology Office (@ GSFC)***

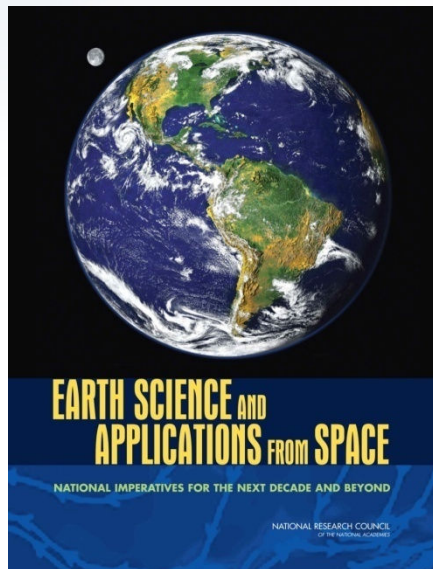
**George Komar,**  
**Associate Director**



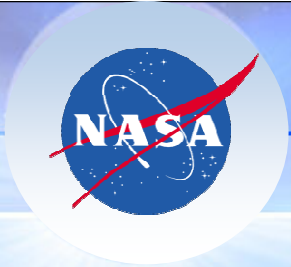
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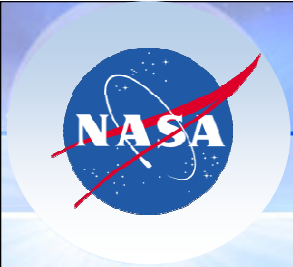


*- Earth Science Subcommittee  
Applied Sciences Advisory Group  
Letter to NASA Administrator  
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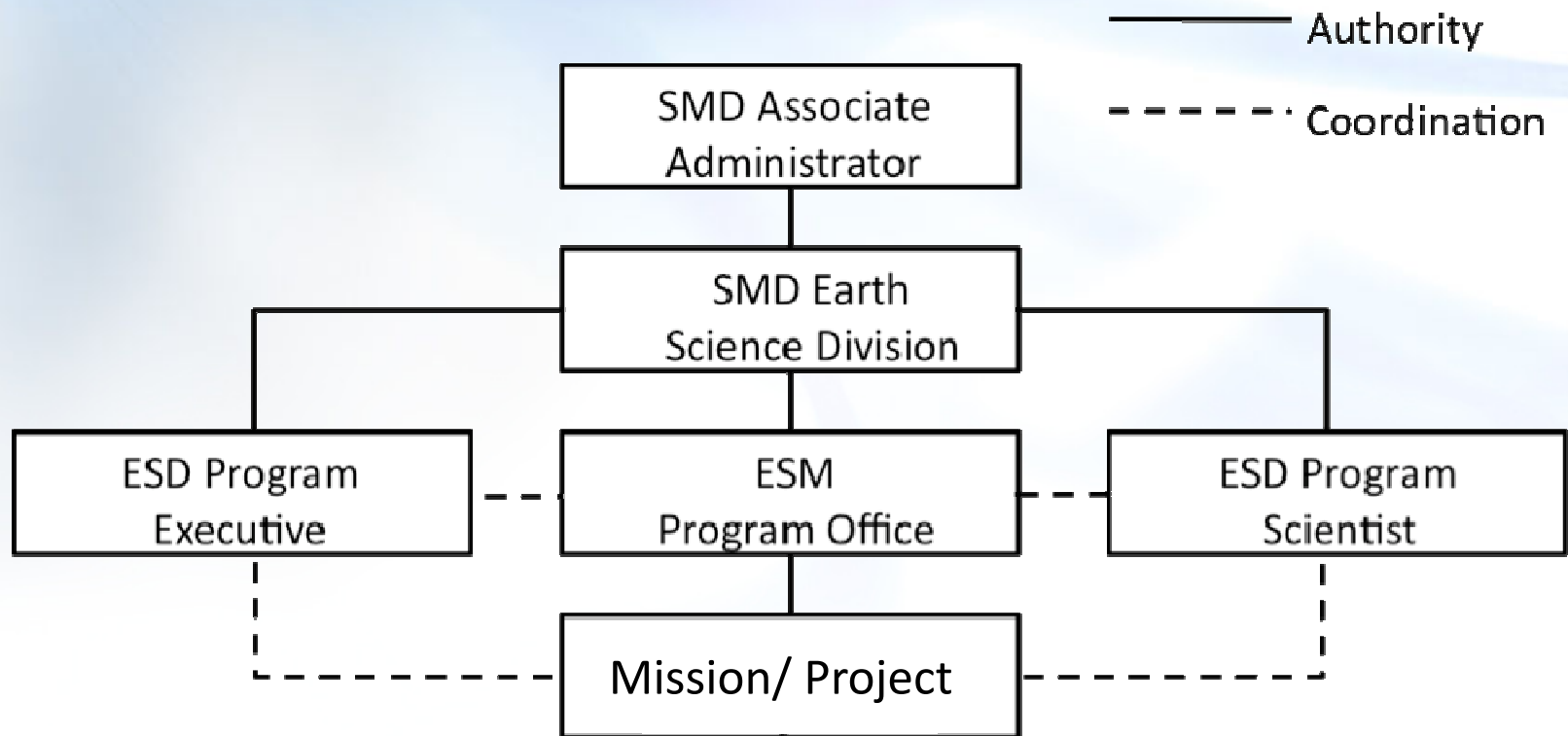
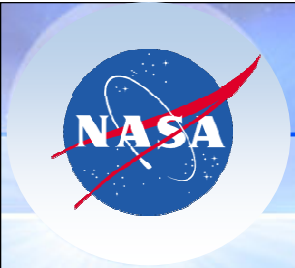
The ICESat-2 Project is aided in the development phase by the ICESat-2 Science Definition Team (SDT), which is succeeded in the execution phase by an ICESat-2 Science Team (ST).

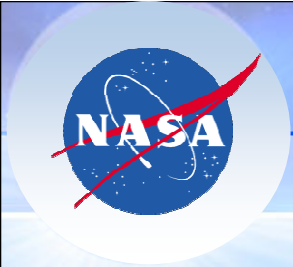
The teams are composed of competitively selected scientists with expertise spanning the disciplines of laser altimetry; geodesy; glaciology; sea ice science; ecosystem structure science; atmospheric sciences, especially cloud science; and relevant aspects of land, ocean, hydrologic, and applied sciences.



The SDT and ST tasks are to:

- Develop and prioritize the scientific goals for the mission;
- Derive and identify the required measurements and measurement accuracies necessary to meet the science goals;
- Provide guidance for the development of calibration and validation plans for the mission;
- Define the geophysical products and data sets to be provided by the mission, and identify algorithm work required to create these products and data sets;
- Identify and perform the necessary prelaunch studies to meet the science objectives, and evaluate such studies when completed;
- Identify the ground system necessary to support the mission scientific goals;
- Consider the scientific impacts of project de-scoped capabilities taken during development;
- Consider the scientific impacts of changes in mission operations that occur during implementation; and
- Provide liaison with the broader science and applications communities.





# Earth Science & Applications

## *Program Applications Reps.*

### **Center Mission Applications Representatives (*Program level*)**

#### Key Responsibilities:

- Work with the HQ Program Manager to represent Applications perspectives in the mission development and planning; help in support to PE & PS
- Participate in regular telecons and team meetings for the mission.
- Engage with the mission project and SDT/ST, with an emphasis on the applications and scientific aspects of the mission.
- Support Mission Project team to develop the applications dimension of mission
- Organize the relevant applications communities on behalf of the mission they represent. Support and facilitate organizations' and communities' efforts to imagine, articulate, and anticipate possible applications. Organize sufficient meetings/events/workshops to support and organize the applications communities for the mission
- Enhance the applications value of mission and alert management to situations in which the applications value of the mission might increase/decrease

NOTE: These reps are not the Applications Lead at the Project-level.