Science Mission Directorate

Briefing to 5th IAA Symposium on Small Satellites for Earth Observation

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The NASA Vision

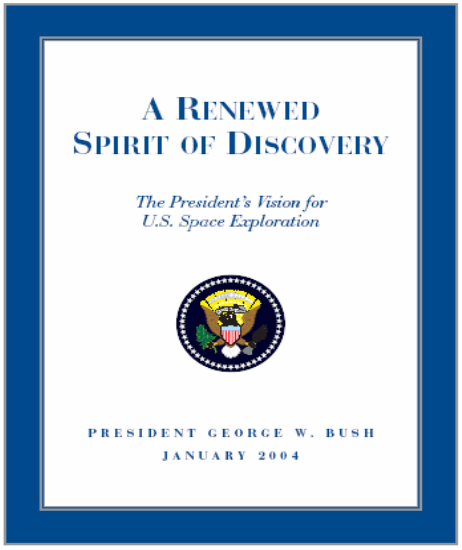
To improve life here,
To extend life to there,
To find life beyond.

The NASA Mission

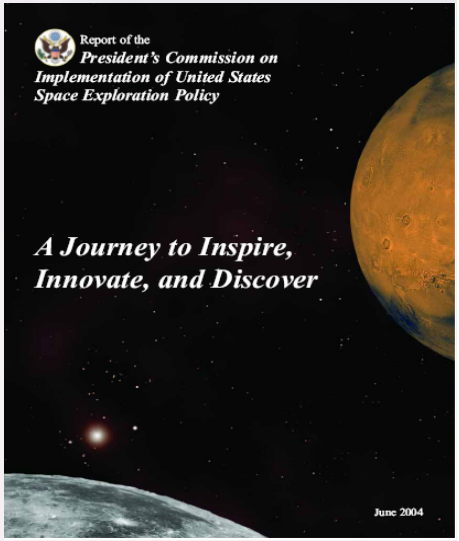
To understand and protect our home planet,
To explore the universe and search for life,
To inspire the next generation of explorers
... as only NASA can.

The Vision for U.S. Space Exploration is Well Underway

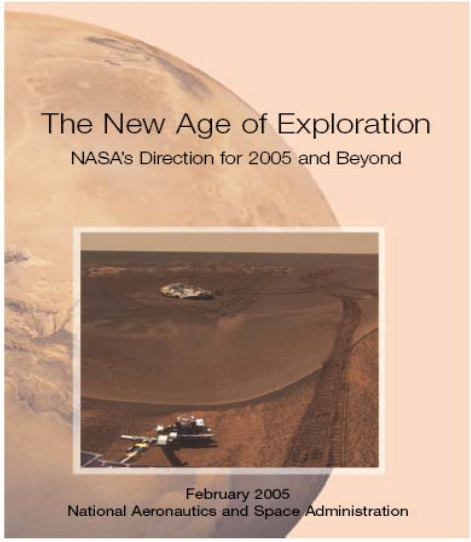
- The Vision provides an historic opportunity to focus NASA for the long-term
- The President has demonstrated his commitment to the Vision and the U.S. Congress supported with full funding for the first year of the Vision implementation
- The “Aldridge” Commission provided the blueprint for NASA transformation
- NASA strategic planning efforts are defining *The New Age of Exploration*
- The President’s FY 2006 Budget request identifies what is needed to continue transforming America’s civil space program



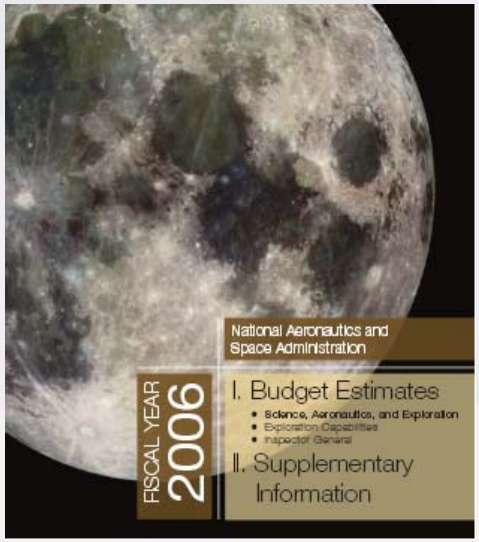
President's Policy Directive



Aldridge Report



NASA’s Direction for 2005 & Beyond

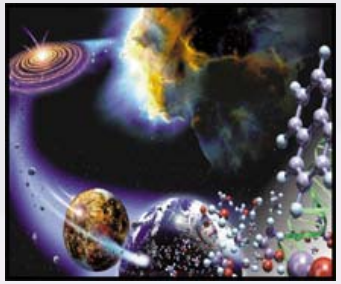


FY 2006 Congressional Budget

Science Mission Directorate Fully Supports NASA's Mission

Understand and Protect Our Home Planet by using our view from space to study the Earth system and improve prediction of Earth system change

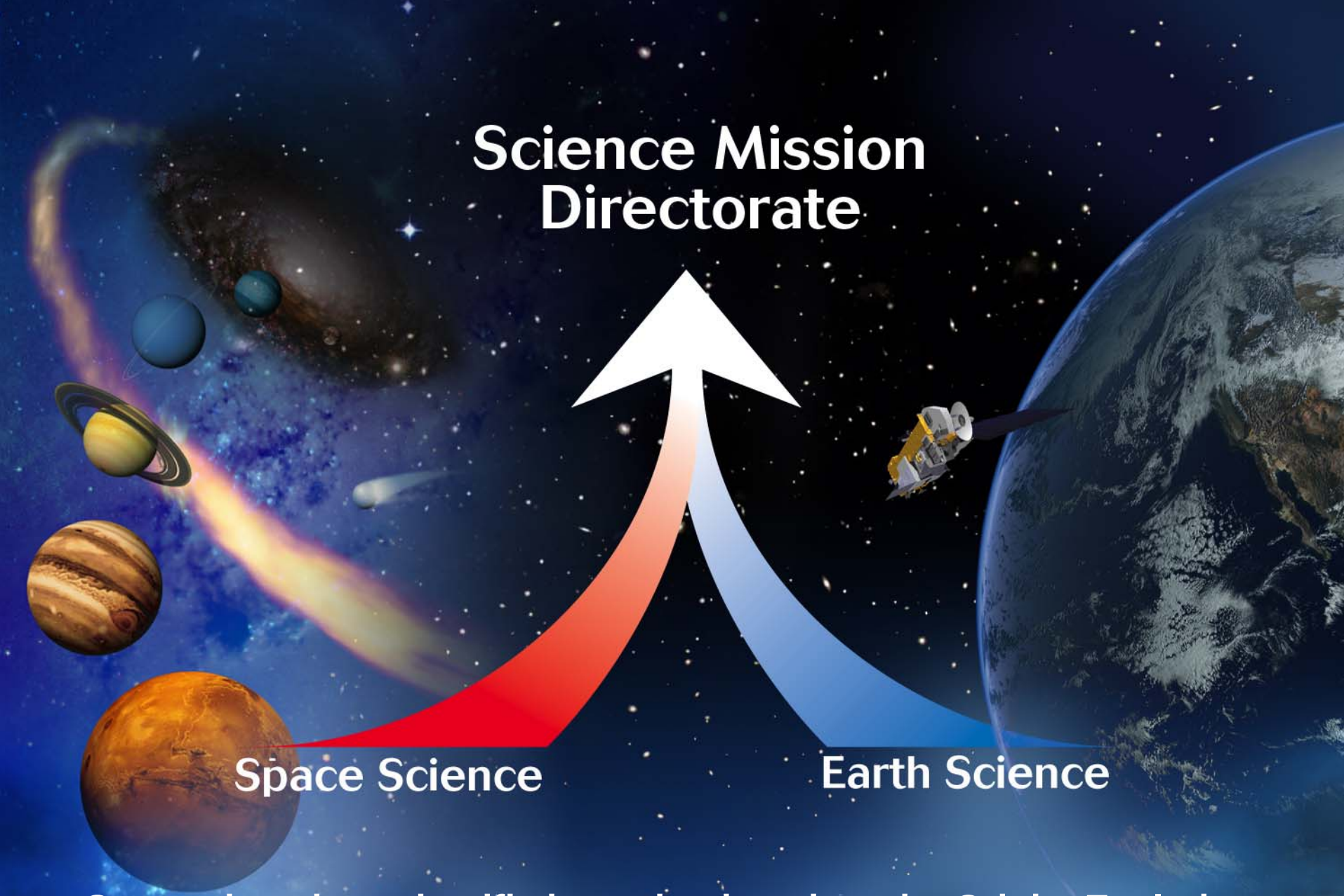
Explore the Universe and Search for Life by continuing scientific investigations into the origin, evolution, and destiny of the universe and our solar system, and by applying our scientific understanding of the Earth system to the identification and study of Earth-like planets around other stars



Inspire the Next Generation of Explorers by providing Earth and Space science content and training to educators, and by sponsoring the education and early careers of Earth scientists, astronomers, physicists…

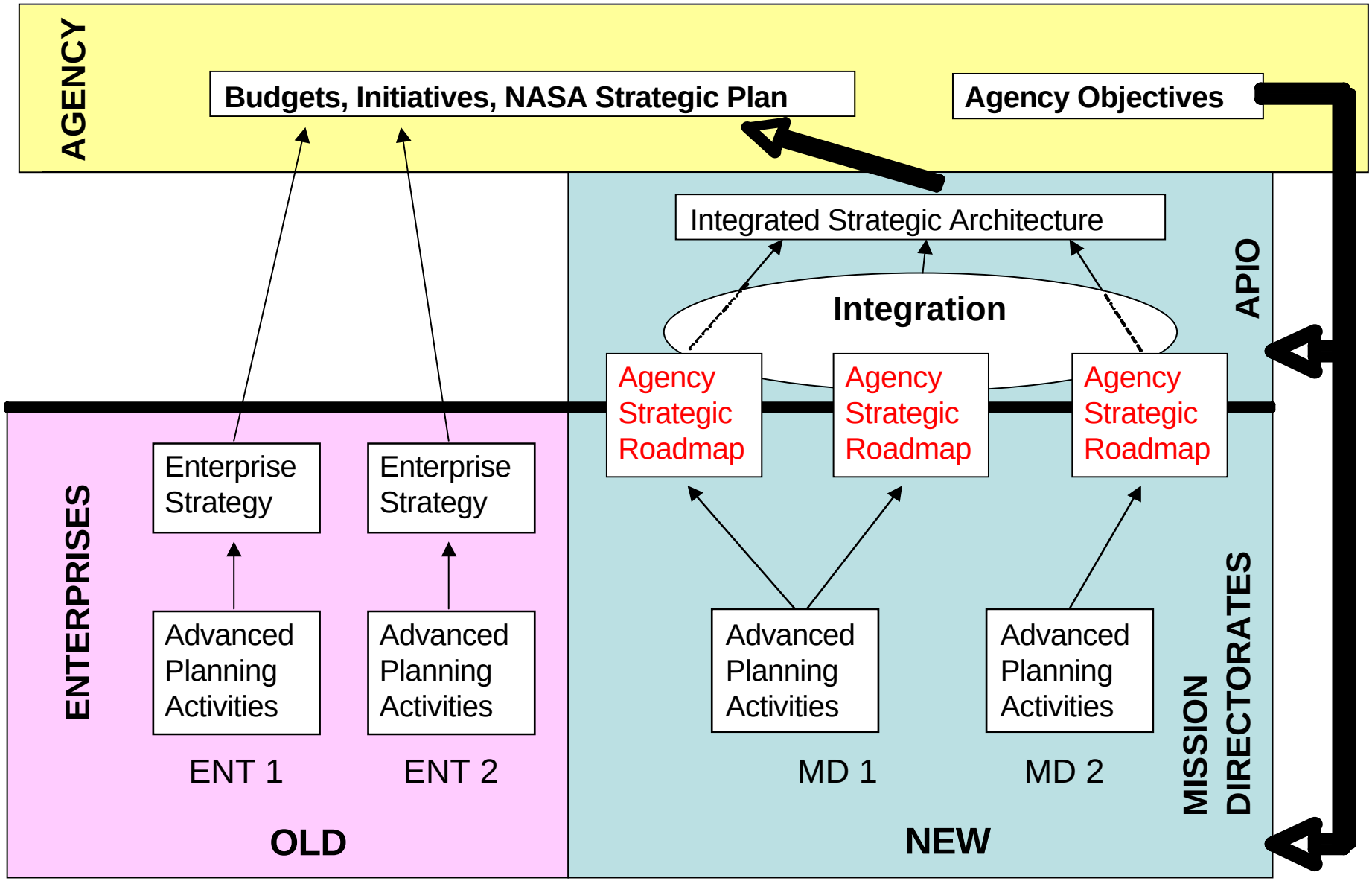
The Advance of

Science at NASA

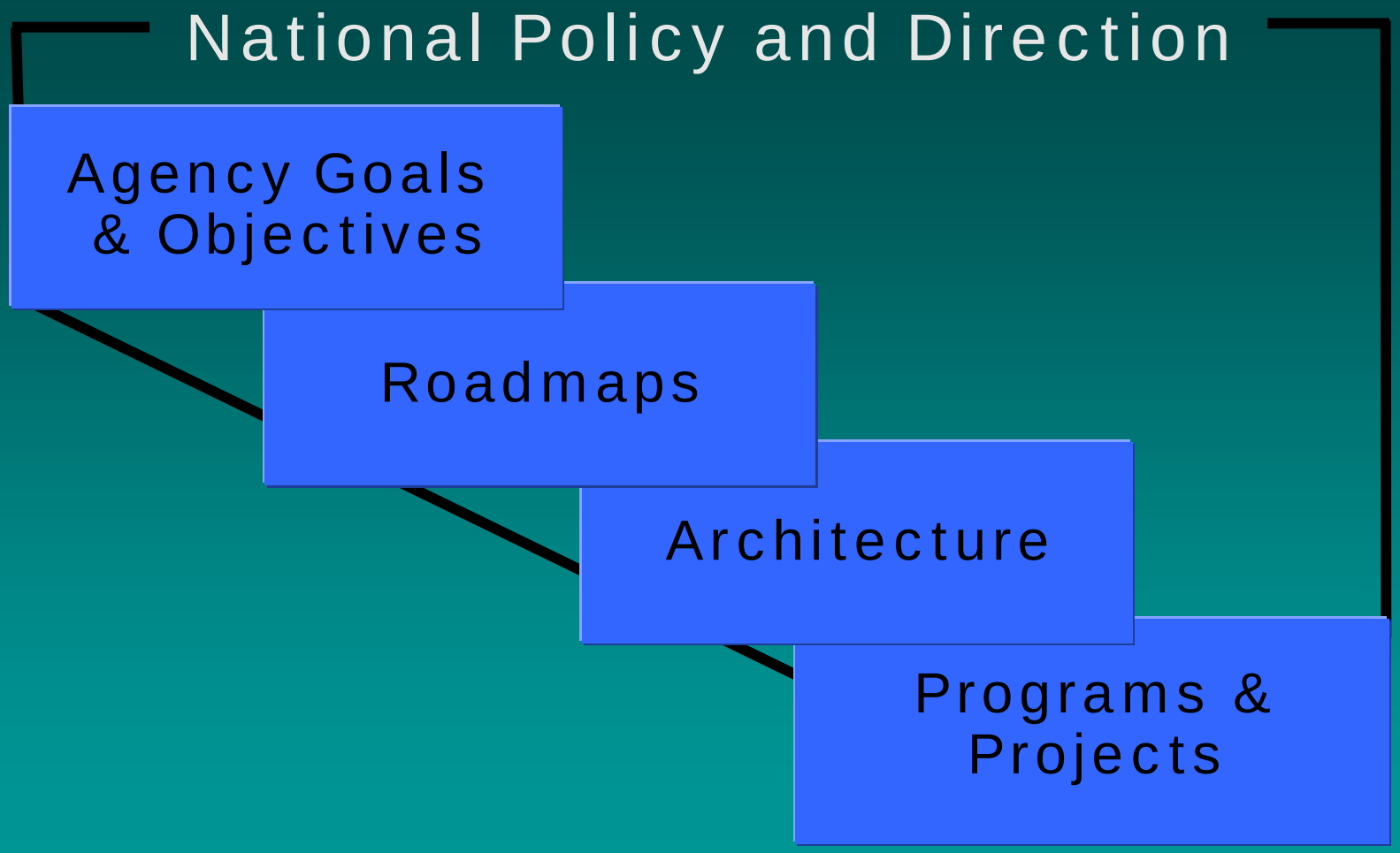


Comprehensive scientific investigations into the Origin, Evolution, and Destiny of the Earth, the Solar System, and the Universe

Strategic Planning - Old vs. New



Strategic Planning Framework



Pursuing National Objectives for Space Exploration

NASA's Guiding National Objectives:

1. Implement a sustained and affordable human and robotic program to explore the solar system and beyond.
2. Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations.
3. Develop innovative technologies, knowledge, and infrastructure both to explore and to support decisions about the destinations for human exploration.
4. Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.
5. Study the Earth system from space and develop new space-based and related capabilities for this purpose.

Enhanced Long Range Planning: Achieving the NASA Objectives

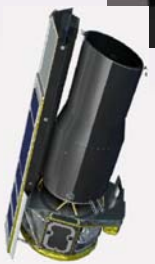
Strategic Roadmap: A coordinated and comprehensive longitudinal strategy, with key achievements, options, and decision points identified, that provides a foundation for NASA's long-term priorities and investments.

Develop roadmaps as strategies to guide achievement of the Strategic Objectives:

- Foundation for mission/program architectures
- Emphasize national/community input, with NASA guidance
- Involve industry, academia, other government agencies
- Enlist the aid of the National Academies of Science, Engineering and Institute of Medicine through reviews by the National Research Council

NASA's Strategic Roadmaps

A coordinated and comprehensive longitudinal strategy, with key decision points identified, that provides a foundation for investment decisions and priorities.



Robotic and Human Lunar Expeditions

Mars Exploration

Solar System Exploration

Advanced Telescope Searches for Earth-like Planets

Exploration Transportation System

International Space Station Assembly and Used

Shuttle Transition to New Exploration Launch Systems

Origin, Evolution, Structure and Destiny of the Universe

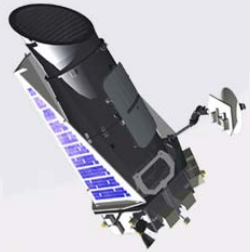
Dynamic Earth System

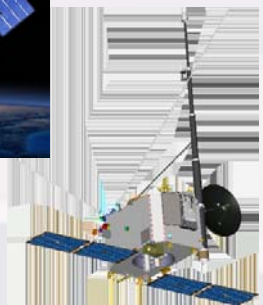
Sun-Solar System Connection

Transform Air Transportation

Educate Students and Public

National Plan for Nuclear Systems





Enhanced Long Range Planning: Implementation of the Strategy

Capability Roadmap: A description of the developments (including alternate paths and options) required to achieve the capability.

Develop capabilities to implement the strategies

- Assess the state of the art
- Engage broad community in the effort to project capability needs forward

"Successful development of identified enabling technologies will be critical to attainment of objectives within reasonable schedules and affordable costs."

Report of the President's Commission on Implementation of US Space Exploration Policy
A Journey to Inspire, Innovate, and Discover
June 2004.

NASA Capability Roadmaps

High-energy Power and Propulsion

In-space Transportation

Advanced Telescopes and Observatories

Communication and Navigation

Robotic Access to Planetary Surfaces

Human Planetary Landing Systems

Human Health and Support Systems

Human Exploration Systems and Mobility

Autonomous Systems and Robotics

Transformational Spaceport/Range

Scientific Instruments/Sensors

In-Situ Resource Utilization

Advanced Modeling, Simulation, Analysis

Systems Engineering Cost/risk Analysis

Nanotechnology

Advance scientific knowledge of the Earth system through space-based observation, assimilation of new observations, and development and deployment of enabling technologies, systems, and capabilities including those with the potential to improve future operational systems.

Earth-Sun System

Study the Earth system from space and develop new space-based and related capabilities for this purpose.

Explore the Sun-Earth system to understand the Sun and its effects on the Earth, the solar system, and the space environmental conditions that will be experienced by human explorers.

Earth Science & Applications from Space Strategic Roadmap Challenges

Explorations on the Frontiers of Science:

- Places we've never seen
- Processes we don't understand
- Phenomena we can't yet sample
- Perspectives we have not yet used

Continuous Awareness:

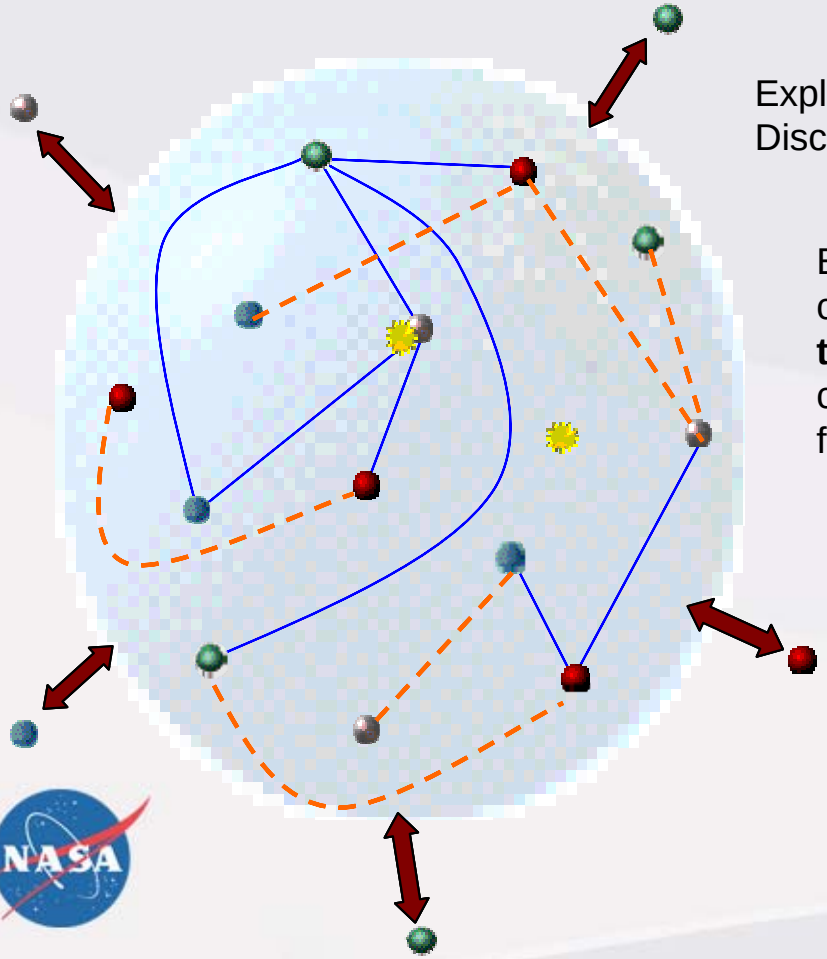
- Getting the data you need when, where and how you need it
- 4-D measurement/model integration - sensorweb/ modelweb
- Transient events (e.g., fire, flood) with lasting impacts
- Partnerships for decision support & societal benefits
- Application for operations on other planets

Maintain Perspectives:

- Challenging long-term measurements -- calibration, validation, inter-comparison
- Data stewardship -- archiving for the researchers of the 22nd century
- Modeling on planetary/geologic timescales
- Transition from research to operations

Earth System Strategic Roadmap Framework

- The Earth system:
  - Consists of several internal elements (e.g. oceans, cryosphere, atmosphere, etc.)
  - Interacts with several external elements (e.g. Solar Variability, Human activity, etc.)
  - Elements have sub-elements (e.g. troposphere, stratosphere, ionosphere, etc.)
- In the past, we have focused on individual elements and have identified connections between them.



Discovery and Exploration

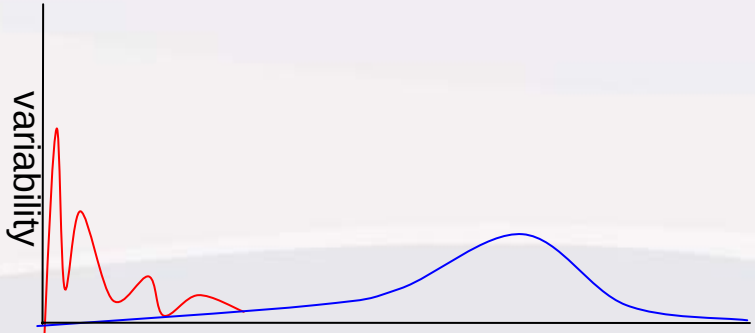
Explore new aspects of the Earth System.
Discover new connections between elements of the Earth system.

Maintain Perspective

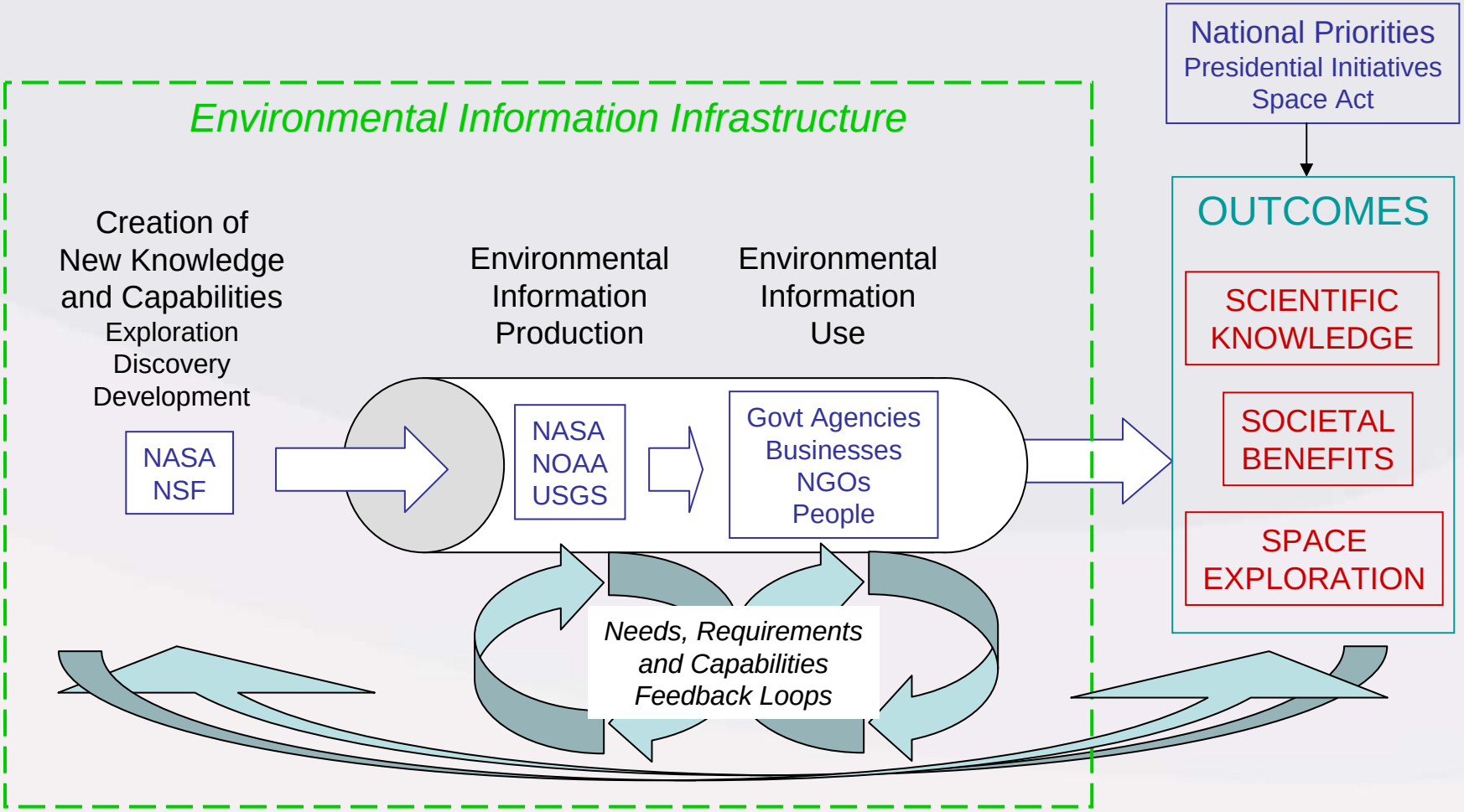
Establish a flexible framework for identifying, initiating, and continuing key space-based observations required for **long-term Earth system studies**, and ensuring their quality, consistency and preservation, over very long time periods, for science research and operational usability.

Continuous Awareness

Transform discovery and decisions in Earth Science through **continuous awareness of our environment.**

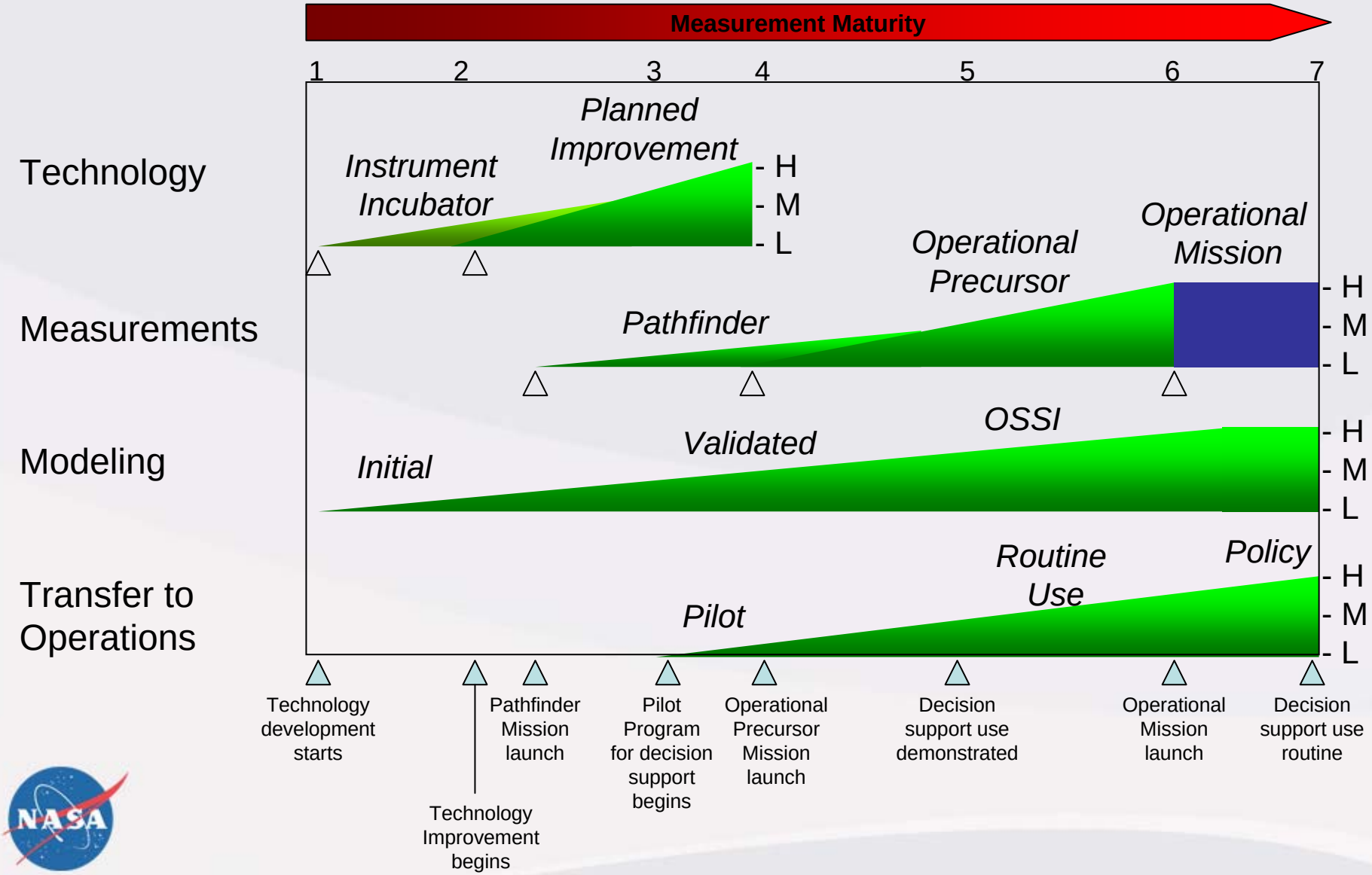


From Discovery to Outcomes*

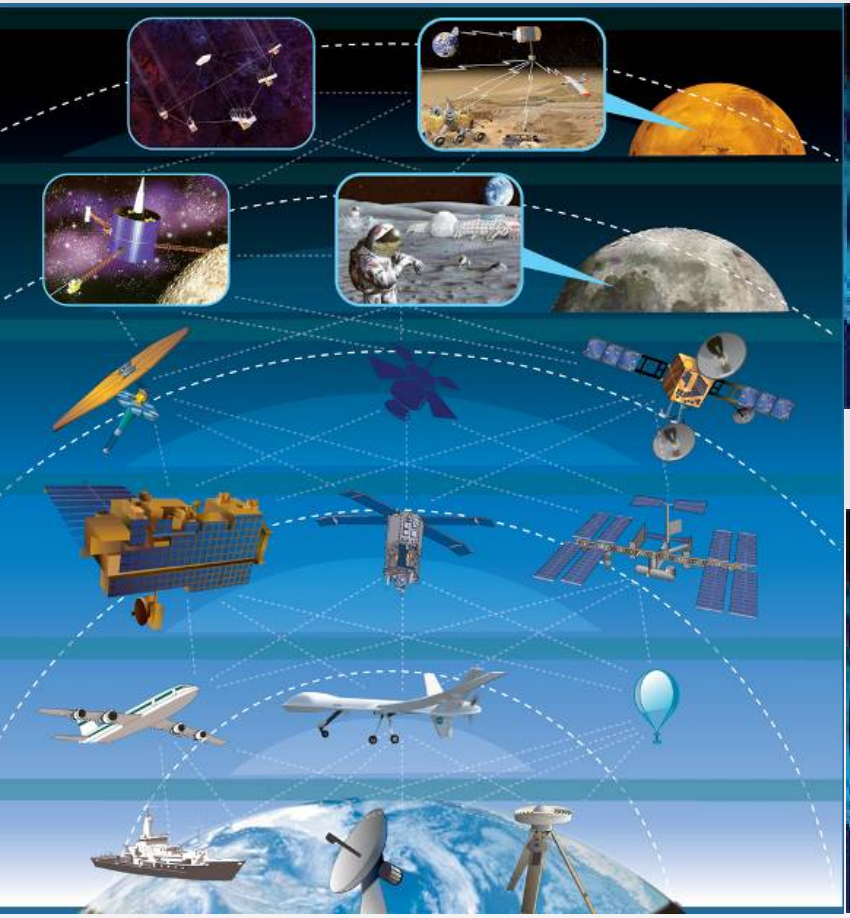


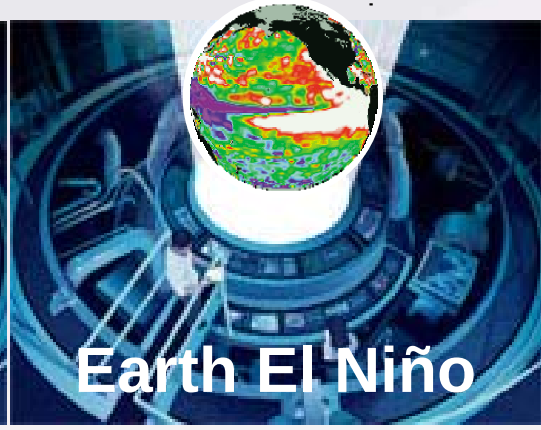
***GEOSS makes this possible world-wide**

Maintaining Perspective

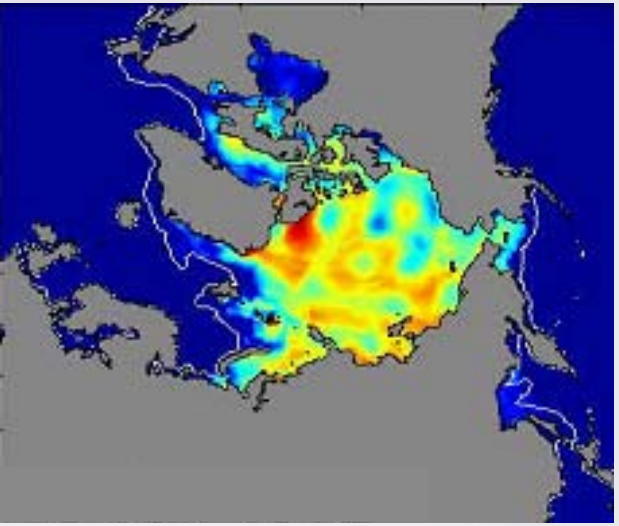


Continuous Awareness:
An Observation and Modelling Framework

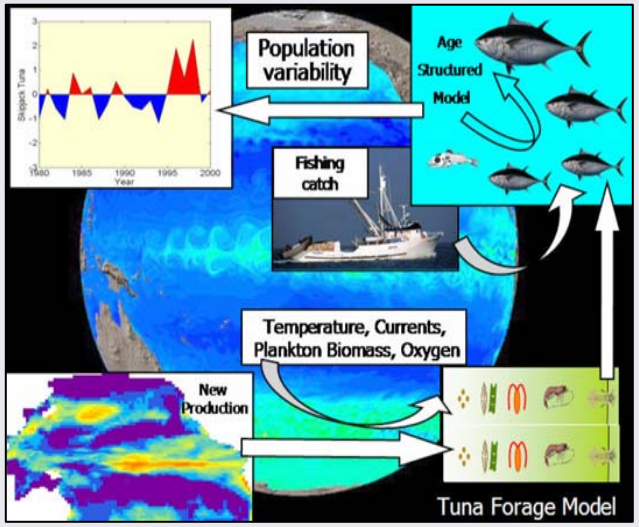




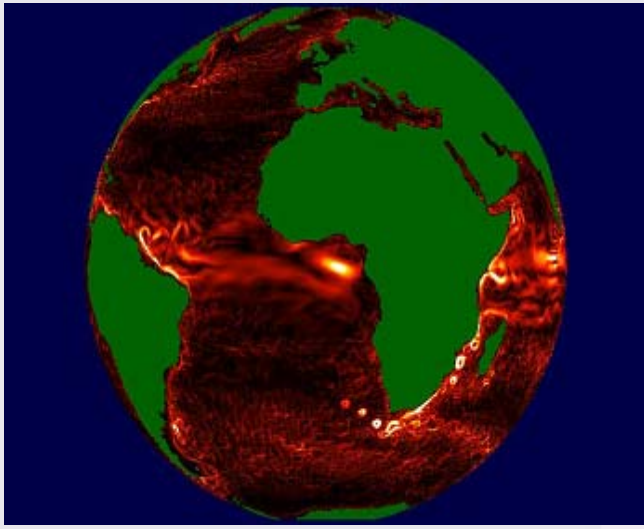
We Are Beginning to Understand the Complex Nature of Our Home Planet



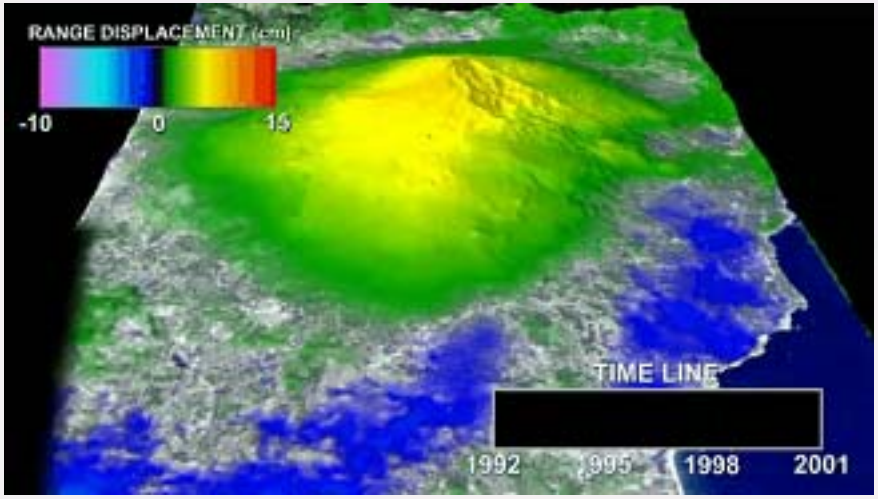
Arctic ice research



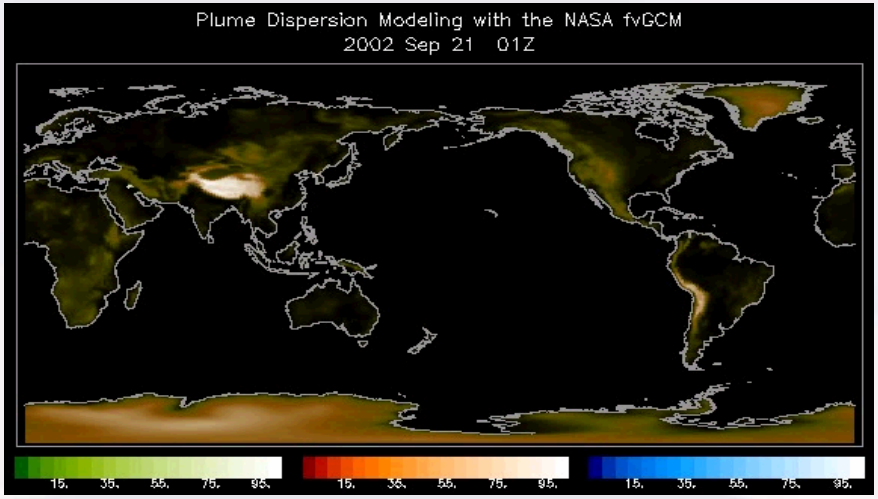
Marine ecology



Ocean circulation



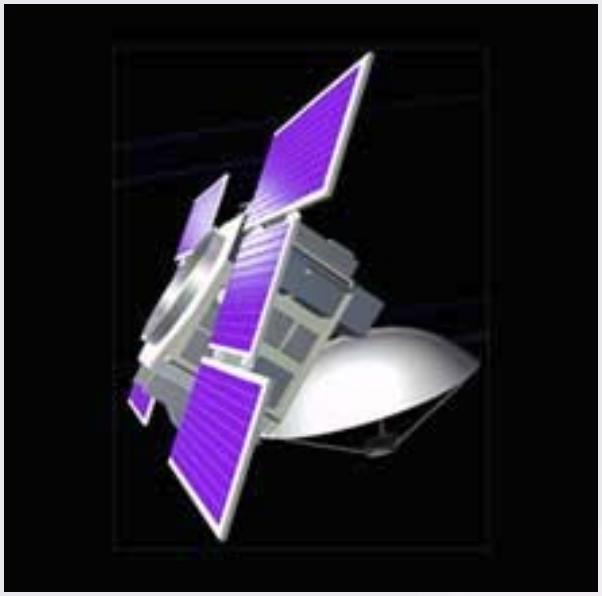
Volcanic stress modeling

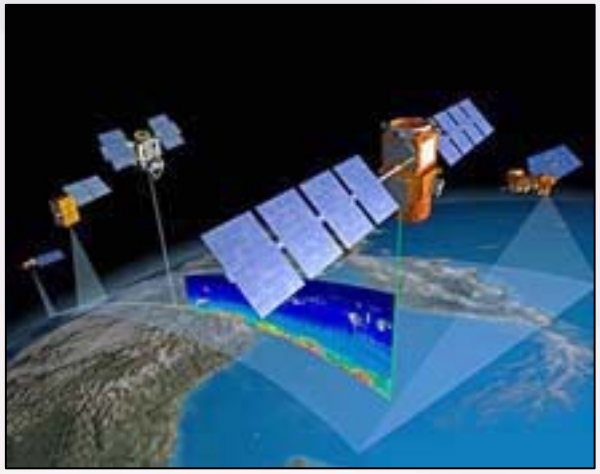
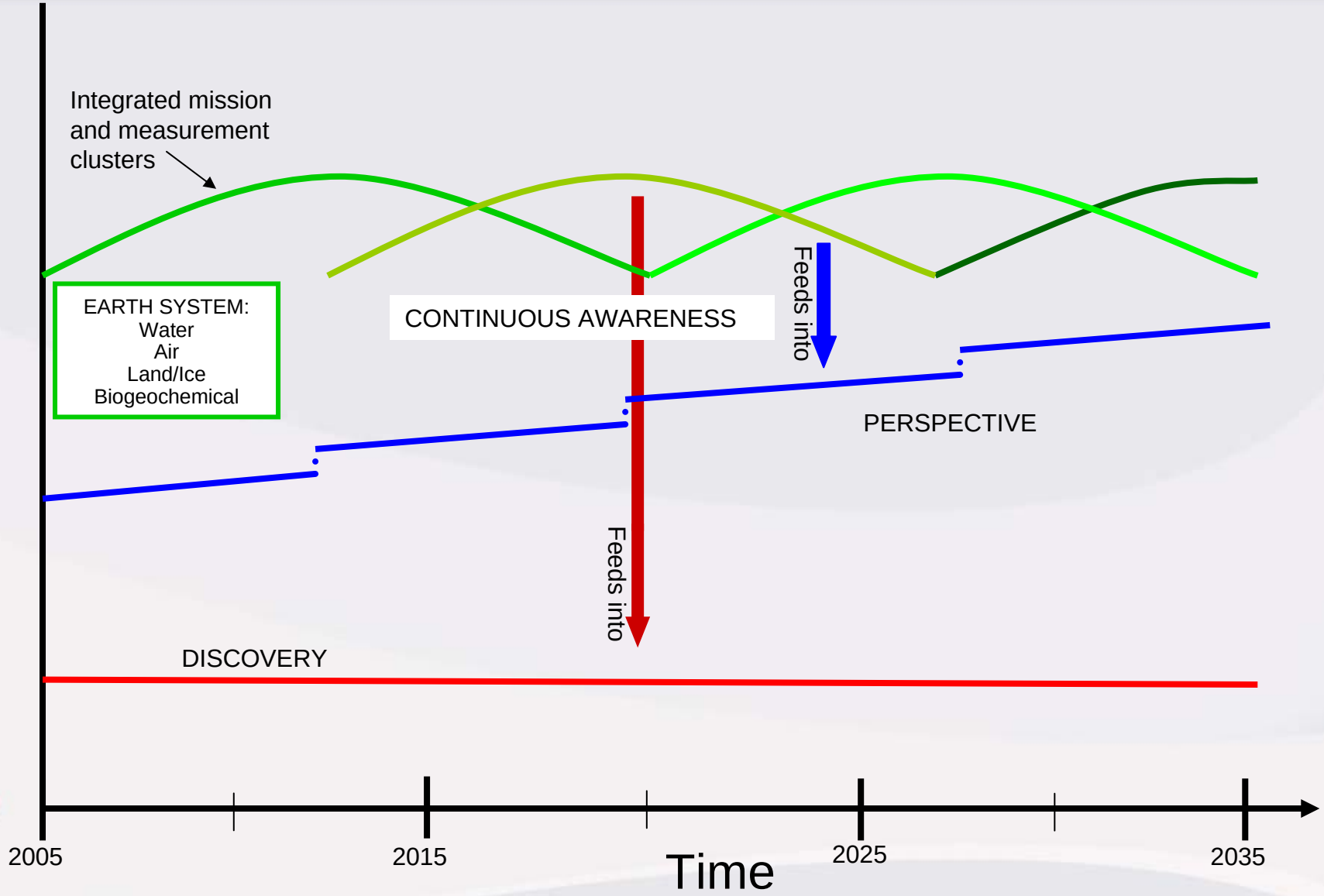


Plume dispersion modeling

Upcoming Launches:
CloudSat/CALIPSO

- Launch is scheduled for this summer from the Vandenberg Air Force Base, CA.
- CloudSat will use radar technology to “slice” through clouds to see their vertical structure. CloudSat will study clouds on a global basis, looking their their structure, composition, and effects.
- The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations mission will provide a global set of data on aerosol and cloud properties, radiative fluxes, and atmospheric state to better represent highly uncertain aerosol and cloud processes in climate models.
- CloudSat, CALIPSO, Aqua, Aura, PARASOL, and Orbiting Carbon Observatory (OCO) will make up a constellation (A-Train) focused on the atmospheres.





Notional Concept for Program Implementation