



# Earth Science Enterprise Technology Program

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## Strategy, Vision, and Implementation

Presentation to ARC Information Systems Staff

YF/Gran Paules

ESTO/George Komar

GSFC/Mike Ryschkewitsch

GSFC/Horace Mitchell

12/13 January 1999



# Agenda

- Overview of ESE Technology Strategy and Implementation Program
  - **HQ/G. Paules**
  - **ESTO/G. Komar ~ 1 hour**
- Future Vision and Architecture for Earth Science--  
technology focus
  - **Grand Challenges will be referenced at appropriate points**
  - **GSFC/M. Ryschkewitsch- ~ 1 \_ hour**
- Status of "Digital Earth" activities
  - **GSFC/H. Mitchell ~ \_ hour**



# Post-2002 Mission Scenario Planning

- **A Major Science/Applications Program Review**
  - June-August 1998
  - Ideas solicited through a RFI
- **Two-step process**
  - disciplined synthesis of concepts based on science and applications questions
    - » formulated a profile of nominal measurement scenarios with options
  - workshop review established consensus of results
    - » presented to an Interdisciplinary Panel of distinguished scholars
- **Mission Scenario 2002-2010 Profile released**
  - Measurement-driven rather than instrument-driven concepts



# Key Findings from RFI Process

- Three specialized categories of **science-based mission concepts**
  - EOS follow-on program and transition to operational systems for **key systematic measurements**, as appropriate
  - Earth Probe program for ground-breaking, **one-of-a-kind exploratory science missions**
  - New Millennium program for **innovative technology demonstration**
- **Applications mission concepts** were introduced for further investigation



# Science/Applications Measurement Sets

## **Atmospheric Chemistry**

- Stratospheric Chemistry
- Tropospheric Chemistry

## **Atmospheric Physics**

- Aerosol Properties
- Atmospheric Humidity
- Atmospheric Temperature
- Cloud Properties
- Radiative Energy Fluxes
- Total Solar Irradiance

## **Geodynamics, Geology & Applications**

- #Earth Surface Deformation Mapping
- #Gravity Field Mapping
- #Magnetic Field Mapping
- Volcanic Ash Cloud Tracking

## **Global Water Cycle and Weather**

- Cold Hydrologic Process
- Precipitation
- #Soil Moisture
- #Surface Flow
- #Tropospheric Wind

## **Land Cover and Terrestrial Ecosystems**

- Land Cover & Land Use Change
- Vegetation Disturbance Recovery

## **Natural Hazards**

- Lightning/Volcanic Ash Cloud/Fire Occurrence

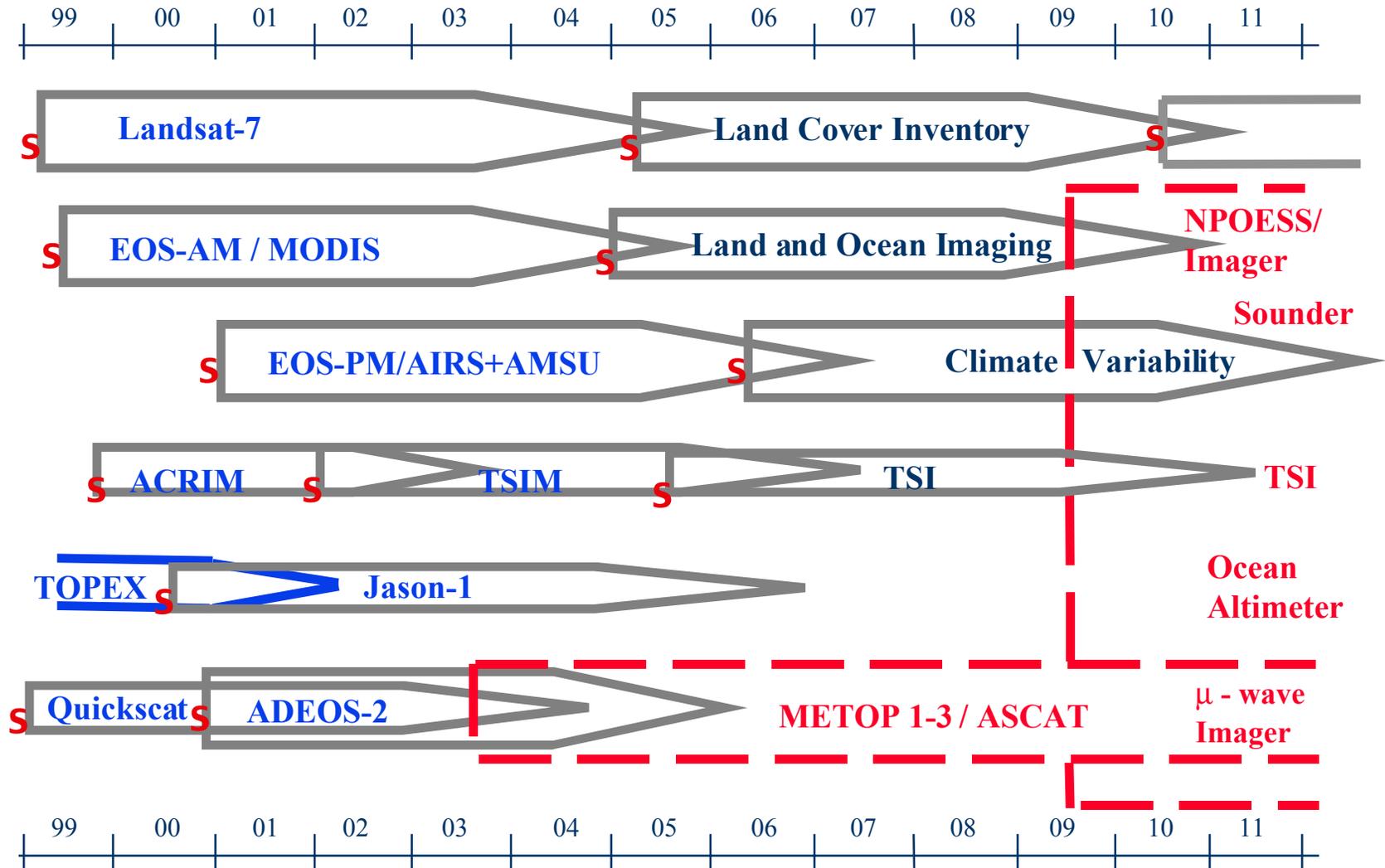
## **Ocean and Ice**

- Ice Sheet Mass Balance
- Ocean Color Mapping
- Ocean Surface Topography
- Ocean Surface Wind
- #Sea Surface Salinity

# Added at  
Easton

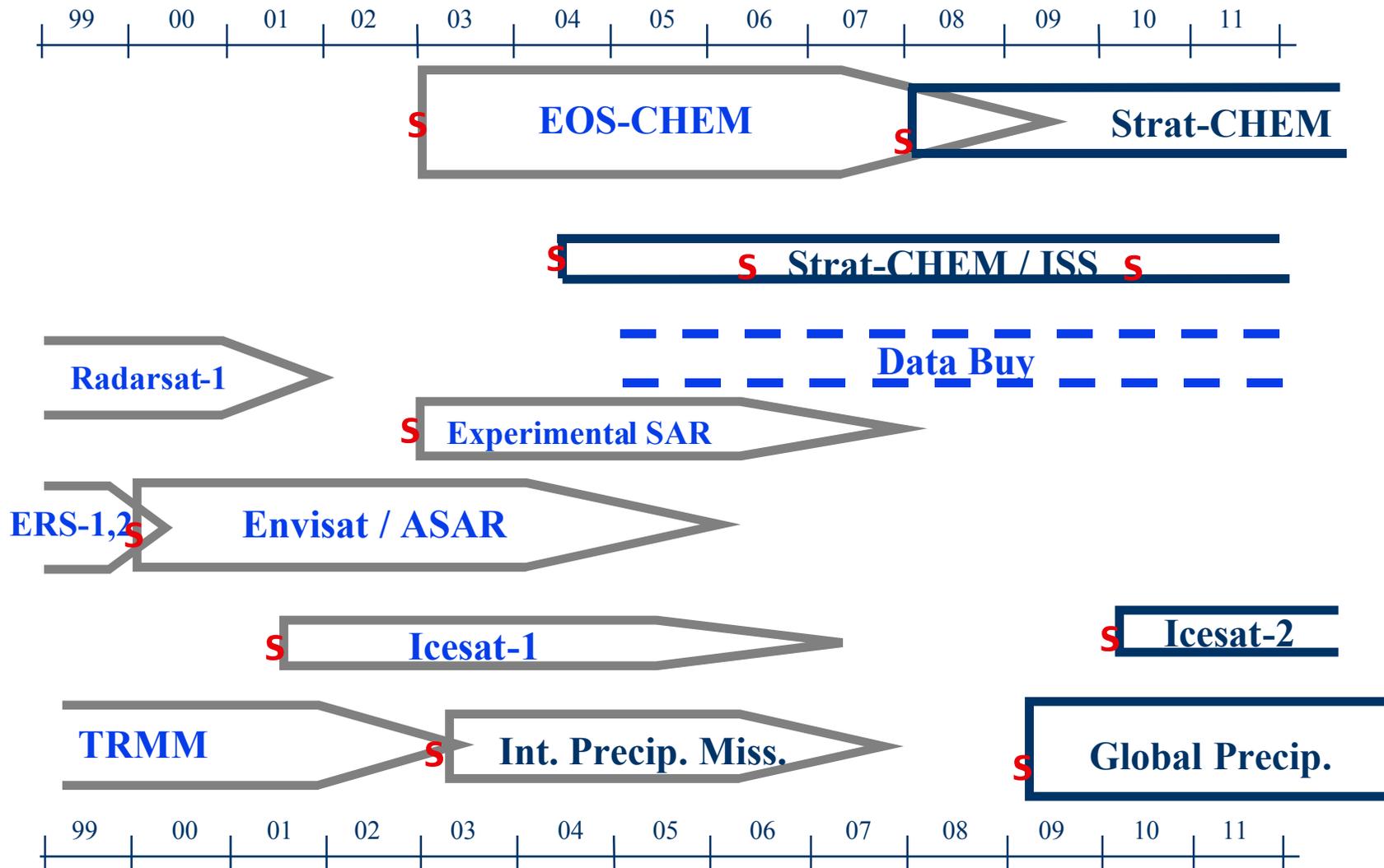


# Timeline for Systematic Measurements



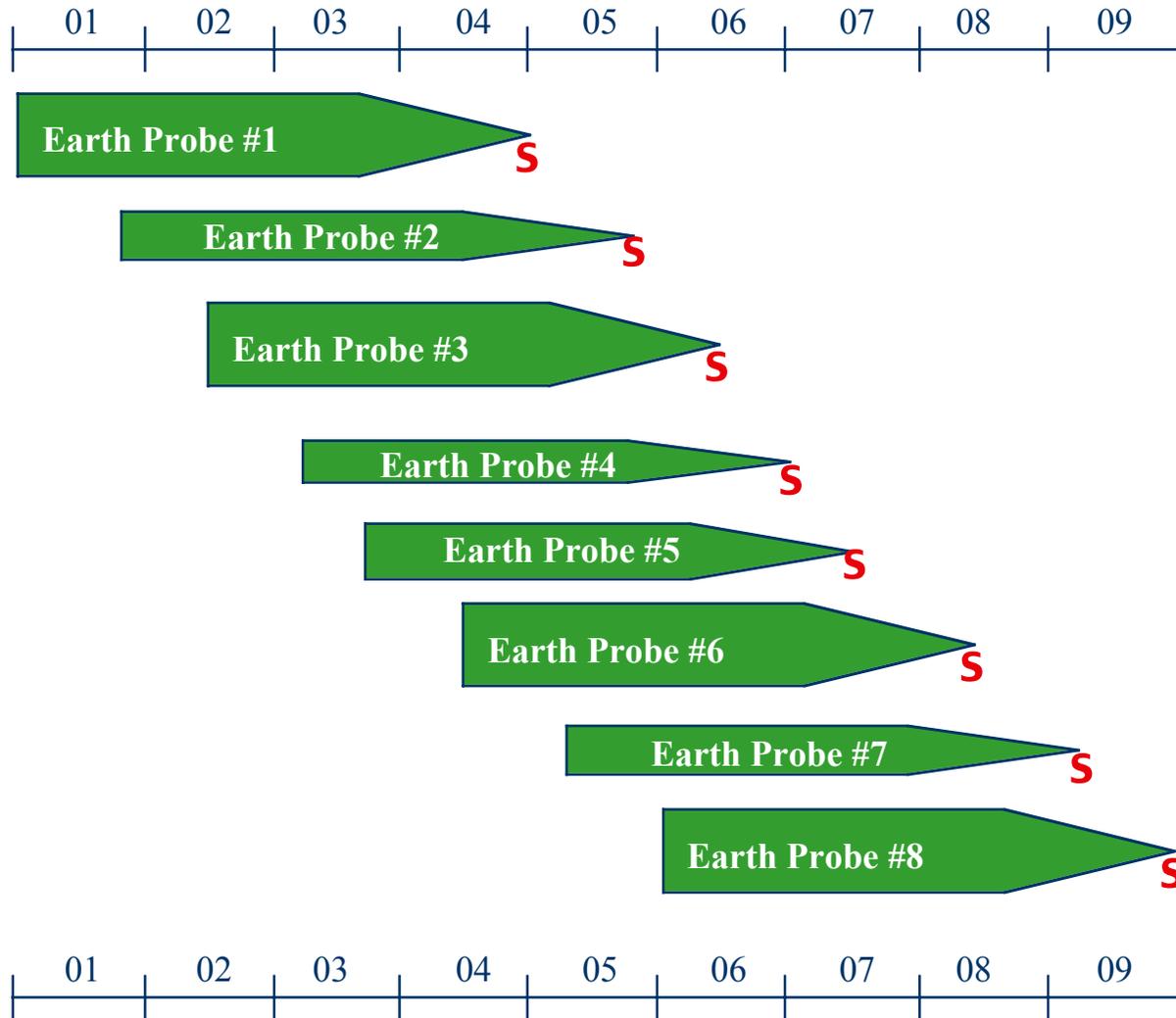


# Timeline for Systematic Measurements, con't



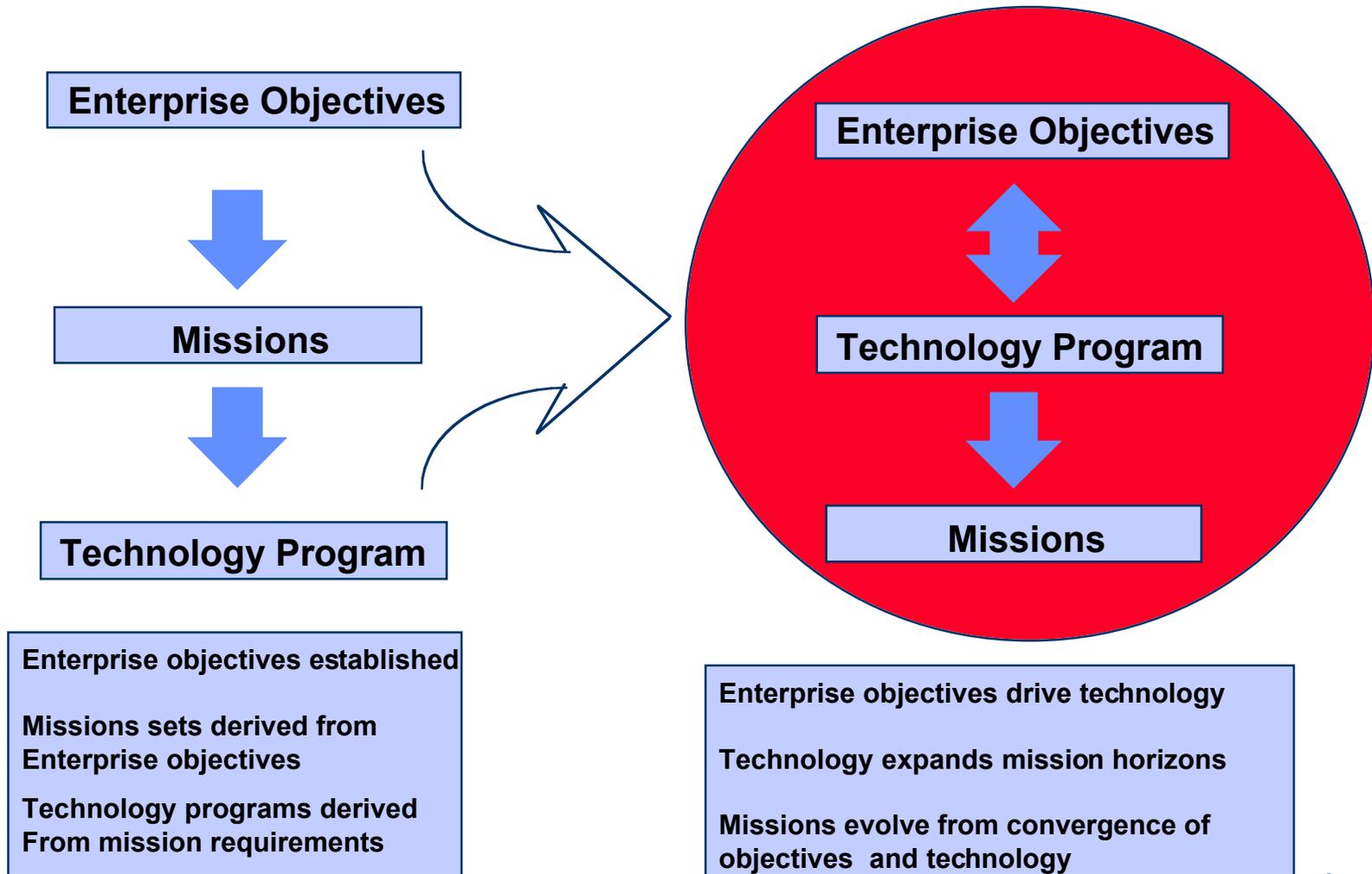


# Notional Earth Probe Mission Development Cycle





# Shift from Technology Derived from Missions to Missions Enabled by Technology



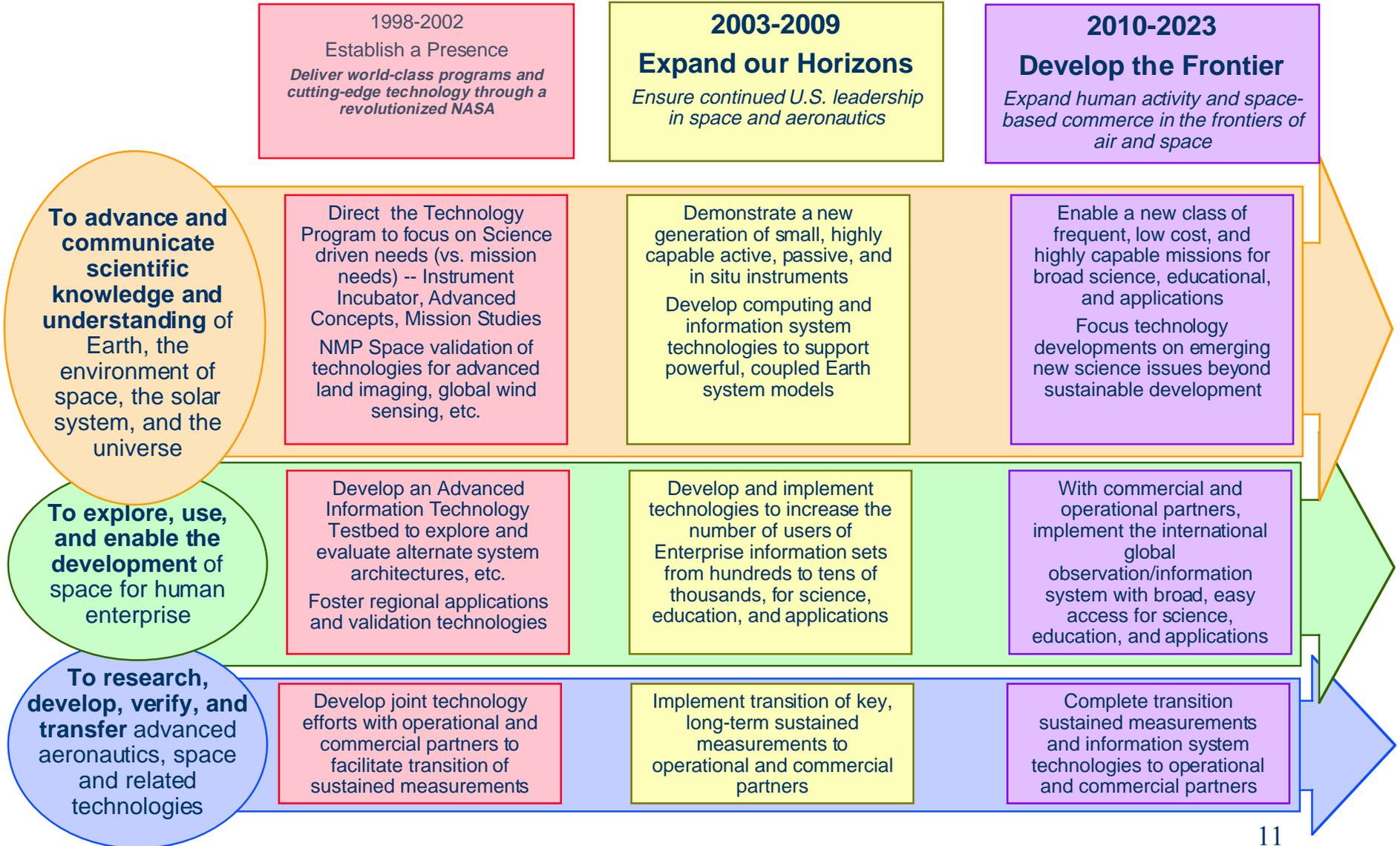


## OES Technology Program Objectives

- **Reduce science product life-cycle cost**
  - » **reduce instrument weight, power, volume**
- **Enable new Earth System Science measurements**
  - » **develop and validate breakthrough systems and subsystem technologies**
- **Enable new sensor-to-science knowledge information architectures**
  - » **allow for exploitation of emerging capabilities and widely distributed operations and research activities**
  - » **seek information handling efficiency and effectiveness**

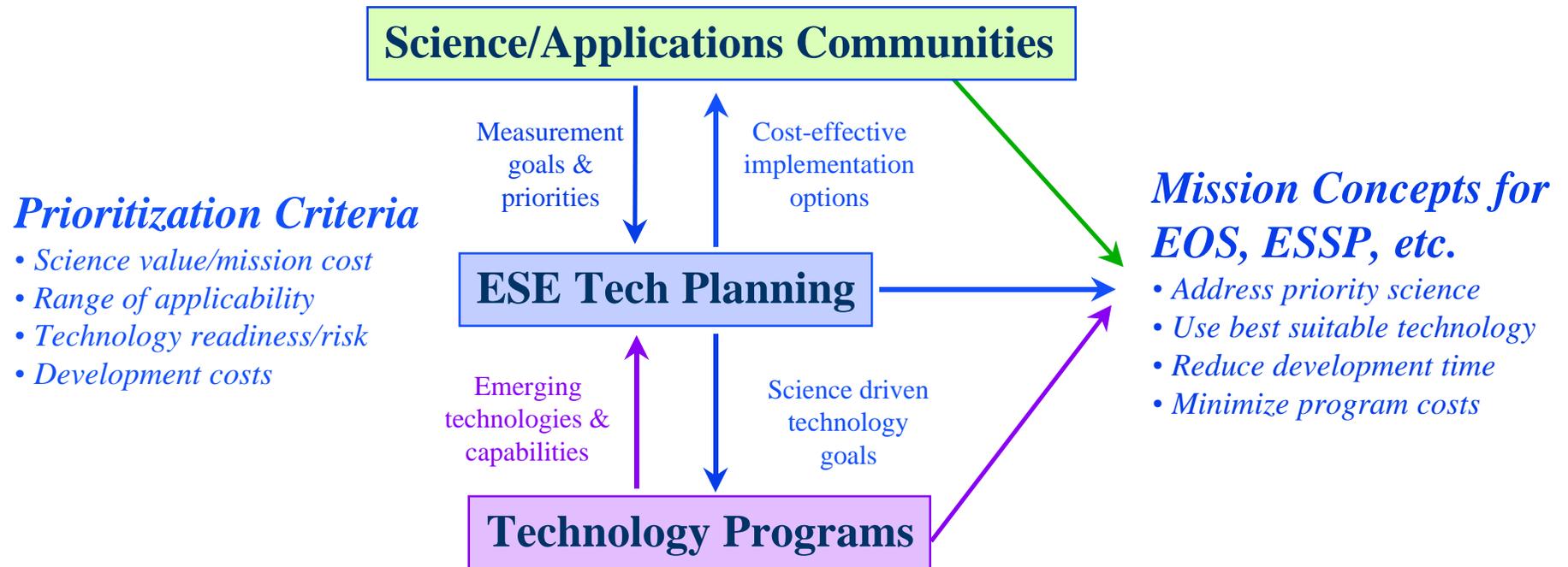


# Earth Science Enterprise Strategic Technology Roadmap



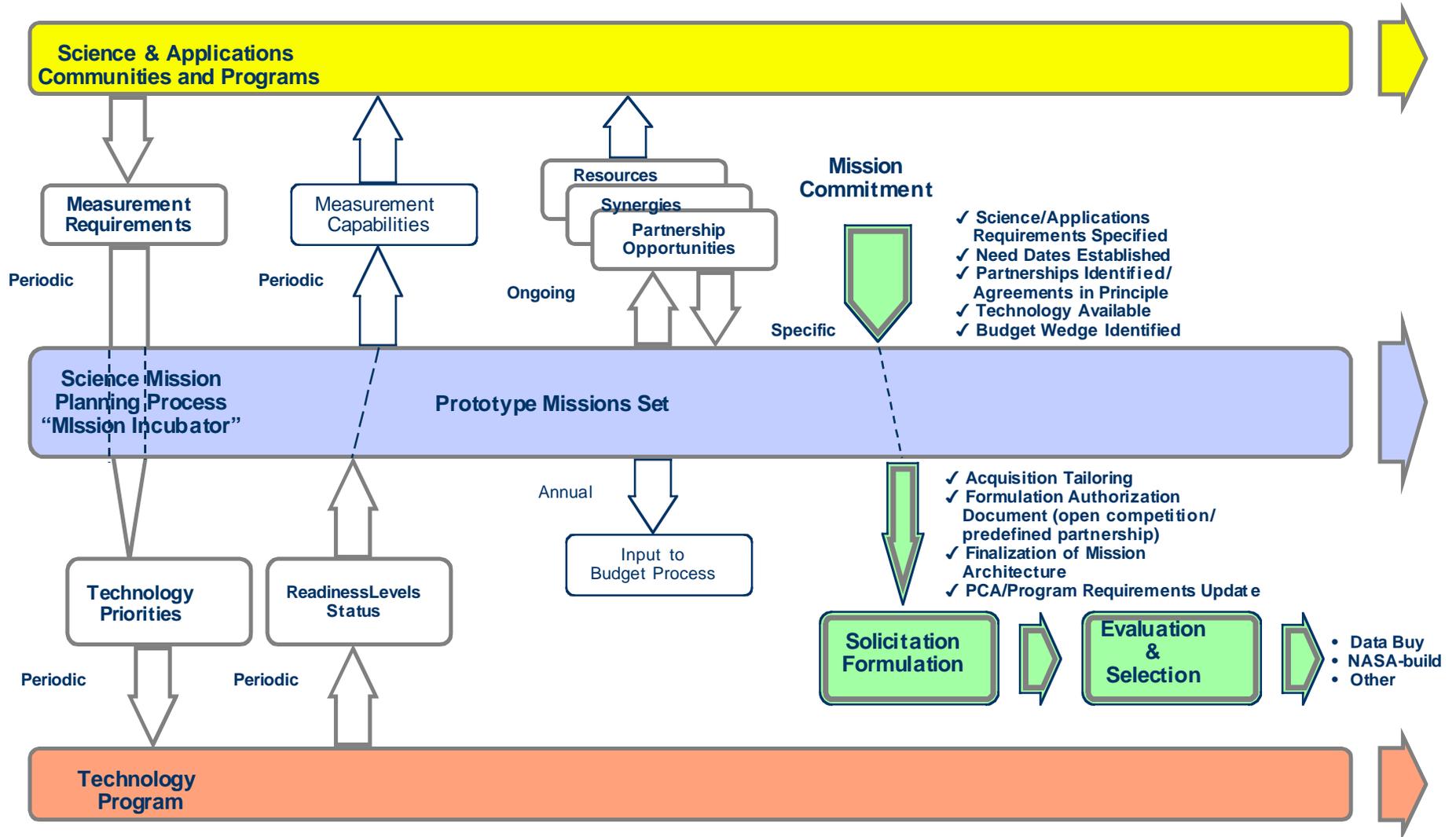


# Earth Science Enterprise Technology Planning Strategy





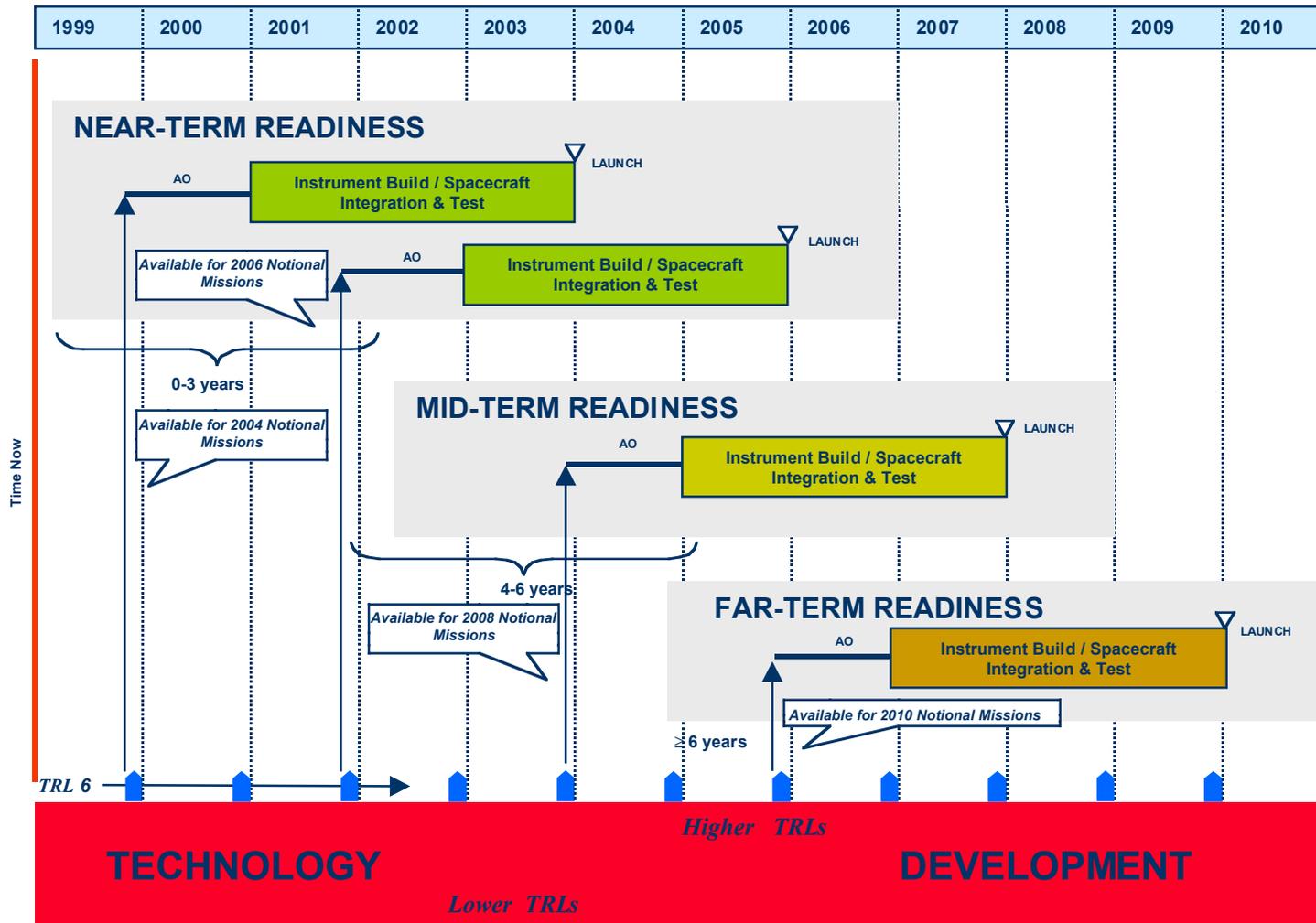
# Science and Applications Mission Development Roadmap





# Technology Infusion into the Notional Missions

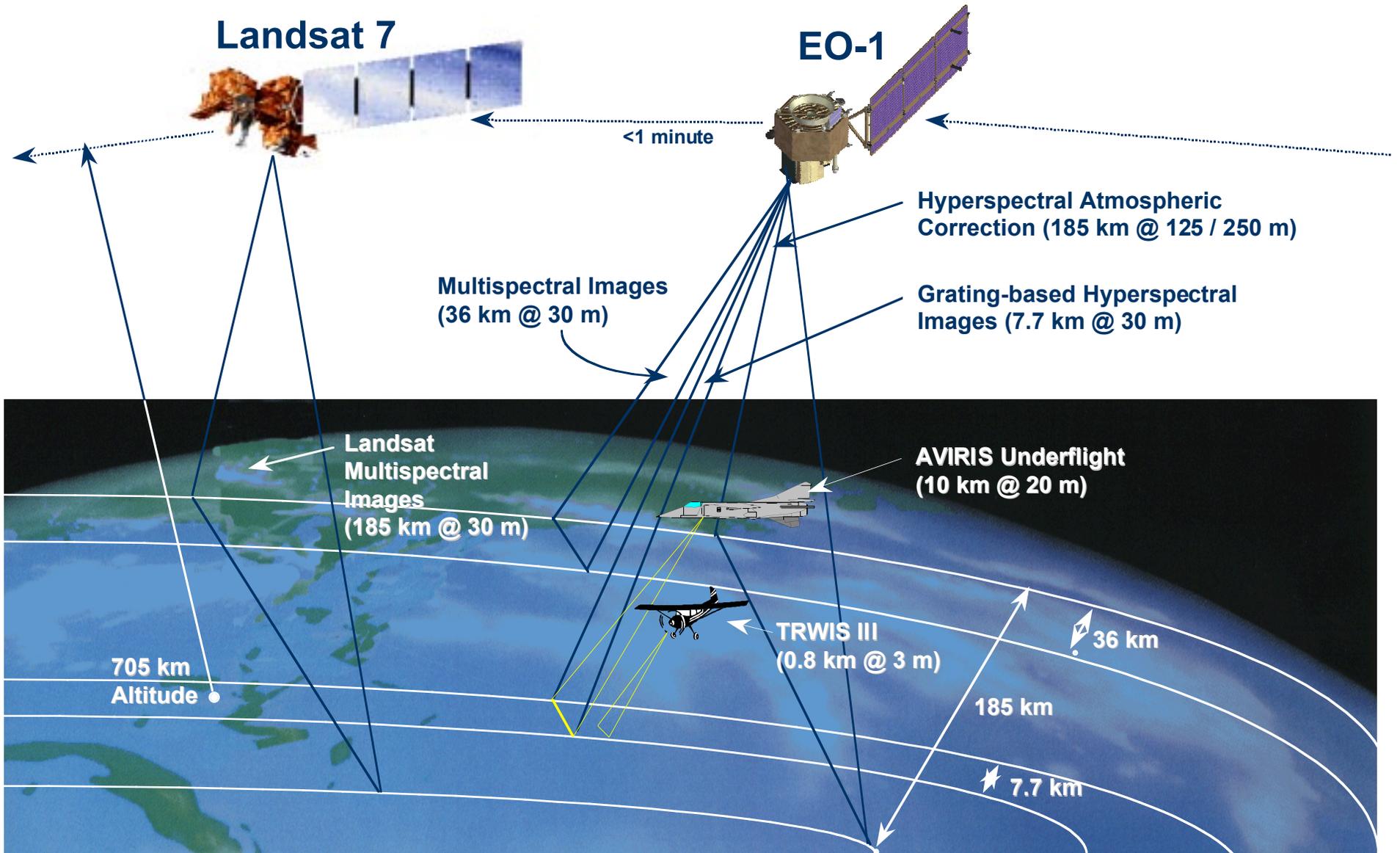
- using a biennial AO model -





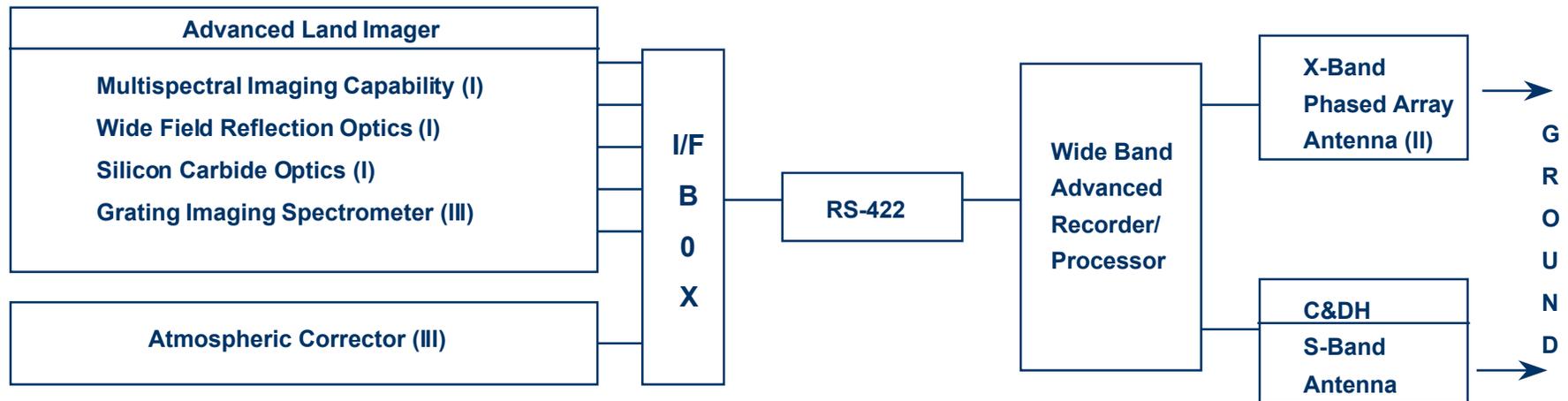
# OES Near-and Mid-Term Technology Development Thrusts

- **Instrument and Measurement Technologies Development**
  - Active Sensor Systems (Lidar and LightSAR)
  - Passive Miniature Atmospheric sensors and Earth surface imaging sensors
    - EO-1 Land Imager Alternatives (hyper- and multi-spectral)
    - EOS Follow-on Instrument Development
  - Airborne and In Situ Sensor Technology (R&A, co-investment with Core Technology)
- **Information Systems Technologies**
  - Advanced on-orbit data processing/compression techniques
    - EO-1 Fiber Optic Databus, Cloud Editing
    - EO-1 application of formation flying concepts and data synthesis
  - Advanced information systems architectures
    - EOSDIS Alternate Architecture Studies and testbeds
    - EOSDIS Federation Approach --highly distributed, advanced INTERNET interfaces
  - Supercomputing initiatives in large-scale modeling and image visualization
- **Spacecraft Technologies**
  - OES Reliance on Industry for Spacecraft and Spacecraft Technology (IDIQ)
  - Linkage to NASA intragency Developments
    - Core Program, SBIR, X-2000 Advanced Miniaturization
- **Autonomous Operations**
  - End-to-end communications, constellation architectures, intelligent systems

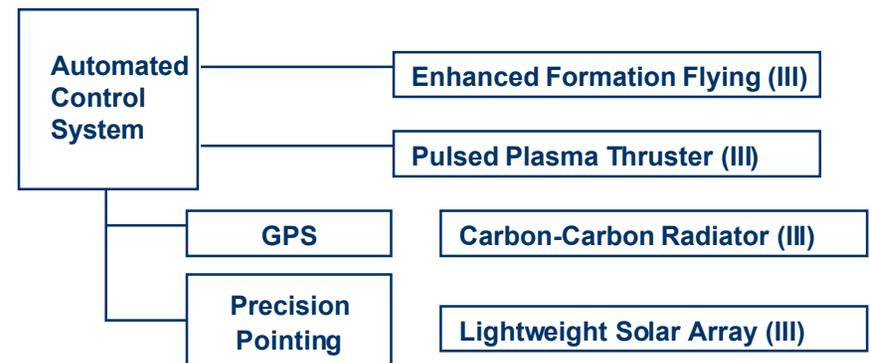




# EO-1 Technologies



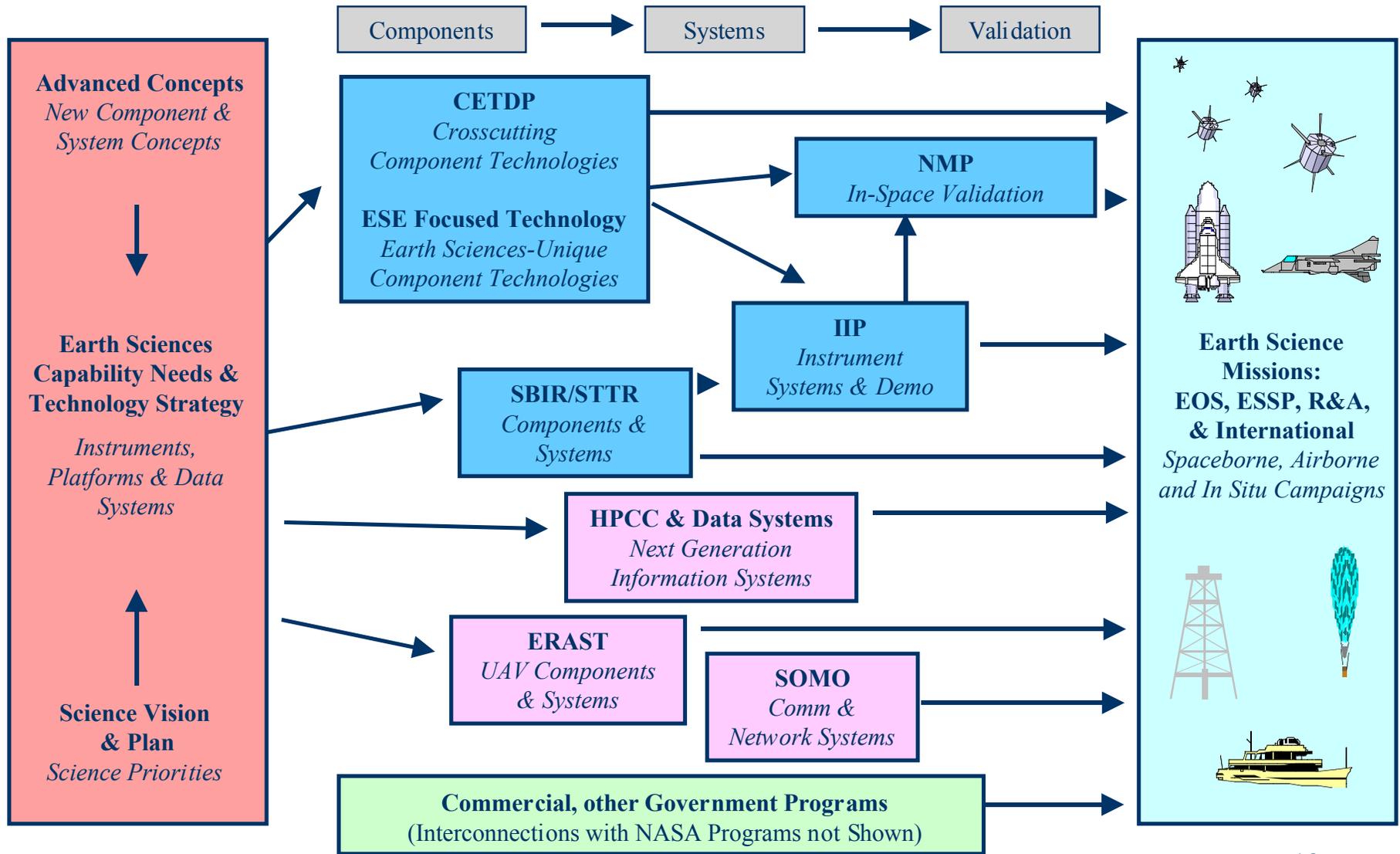
Technology	Developer
Multispectral Imaging Capability (I) Wide Field, High Resolution, Reflective Optics (I) Silicon Carbide Optics (I)	Lincoln Lincoln Lincoln
X-Band Phased Array Antenna (II)	Boeing
WARP GPS Precision Pointing Subtotal	GSFC Loral Litton
Grating Imaging Spectrometer (III) Atmospheric Corrector (III) Enhanced Formation Flying (III) Carbon-Carbon Radiator (III) Lightweight Solar Array (III) Pulsed Plasma Thruster (III)	TRW GSFC GSFC CSRP L-M Primex



\*Precision Pointing driven by WIS Validation Requirements

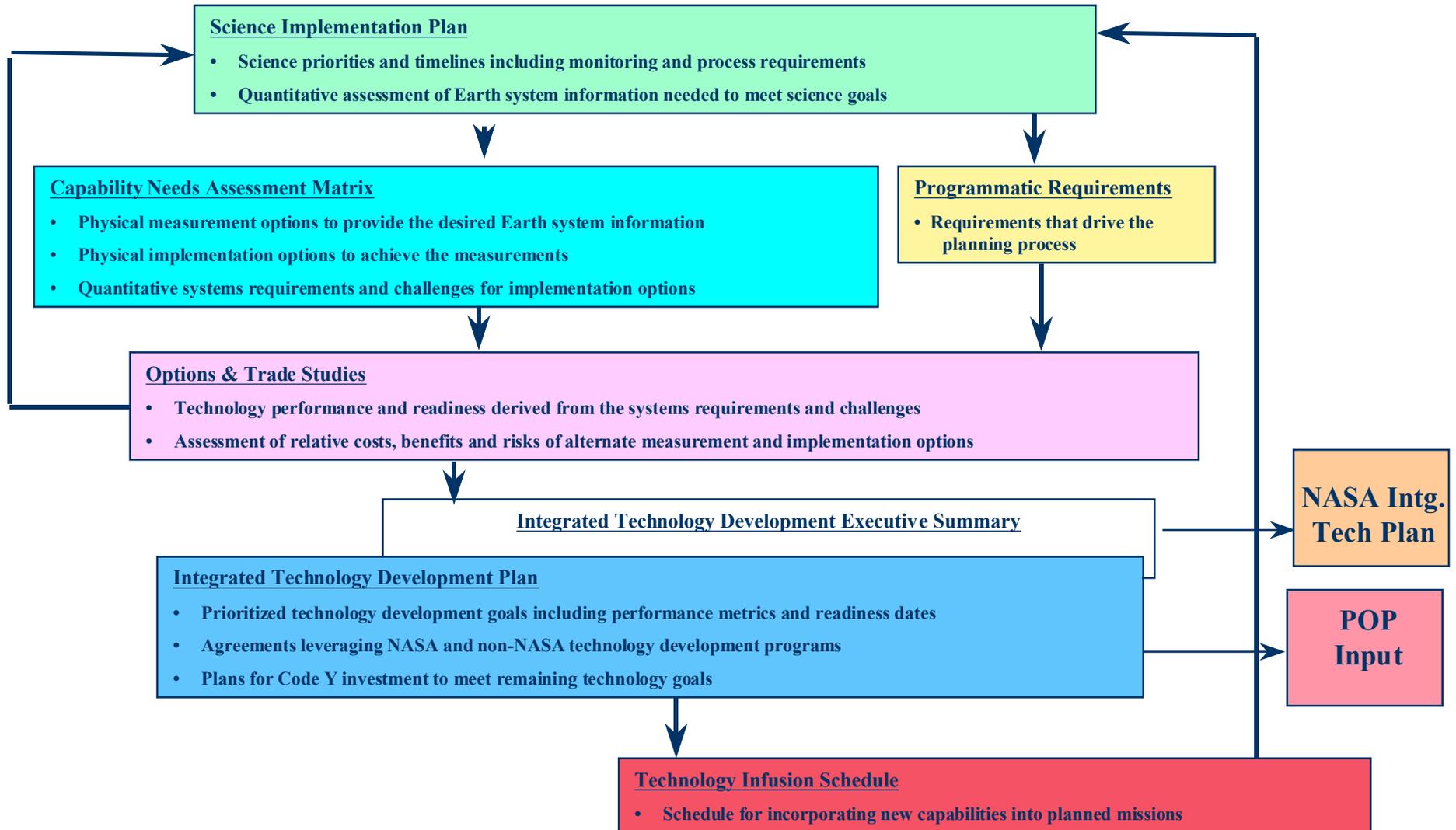


# Technology Development Program Elements





# Near Term Technology Planning Activities





## Next Steps

- **Review of actions from ESE Senior Management Council 4 December**
- **Initial thoughts on related Technology Program implementation**
- **Organization of a follow-on Working Group**
- **Assignment of actions and personnel**



# **Actions From ESE Senior Management Council**

- **(To be provided)**