Technology Validation Needs for Earth Science

- Earth Science Implementation Plan
- Baseline Measurement Studies
- Earth Science Vision
- Technology Pipeline:
  - Advanced Technology Initiative
  - Instrument Incubator
  - Cross Enterprise Technology
  - Industry
  - Other Agencies

- Flight Validation Rationale
- Emerging Technology

- Earth Science Technology Validation Needs
Program Attributes

- **Technology - Focused Projects**
  - Phase A
  - Phase B
  - Ensures focus on technology needs of future science missions

- **Breakthrough Technologies Requiring Flight Validation**
  - Phase A
  - Open competitive technology calls
  - Strong rationale for flight validation

- **Multi-Mission Technology Benefits**
  - Broad user community

- **Partnership / Shared Launches**
  - Increases launch opportunity
  - Reduces “low tech” elements’ costs

- **System/Subsystem Approaches with Frequent Flights**
  - Maximizes cost effectiveness of validation approach
  - Balanced portfolio
  - Flexible / adaptive / resilient
Challenges to New Millennium Program

- Improve cost-effectiveness of technology flight validation
  - Focus NMP investments on breakthrough technologies/risk reduction
    ◦ Increased reliance on flights-of-opportunities
    ◦ Focus on technology “pieces” requiring flight validation

- Deliver benefits to broad set of Earth and Space Science measurements
  - Reduce cost/enable new capabilities
  - Align technology with science needs

- Enhance partnership for technology development/validation and accelerate technology infusion
Potential Technology Flight Validation Needs

- Microspacecraft
- Solar Sail
- Optical Communication
- Robotic Assembly
- Autonomy & On-board Processing
- Tethers
- Drag Free Inertial Sensors
- Gossamer Optics
- Thermal Control Precision Metrology
- Light Weight Deep Space Precision Structure
- Precision Formation Flying

Structure & Evolution of The Universe

Astronomical Search for Origins
Technology Subsystem Themes

- Preliminary assessment of technology validation needs
- Recurring technology subsystem validation "themes"
- Technology themes benefit a broad set of Earth Science measurements.
Sub-System Technology Validation

- Yearly flight opportunities for several sub-systems as stand-alone units on flights-of-opportunities or in a testbed (Space Truck)
  - NASA hosts one testbed flight every 3 years
  - Flights of opportunity (FOO)
  - Other NASA missions, Shuttle, DoD & commercial flights
Testbeds for Sub-system Technology Validations

- Definition: Common support hardware & software to validate several subsystems or components
  - Facilitates harvesting subsystems & components developed in & outside space science
  - Outside space science = Industry, other NASA technology development programs, other government agencies
Geostationary Imaging FTS (GIFTS)

Objectives:

Primary: Greatly improve weather forecasts by measuring the horizontal and vertical flux of water vapor. Observe temperature, water vapor, and tracer “wind” profiles with high vertical, horizontal, and temporal resolution.

Secondary: Demonstrate utility of geostationary satellites for atmospheric chemistry studies. Observe vertical profiles and transport of radiatively active trace gases including H₂O, CO, O₃, CH₄.

Technology Basis: Combine two measurement technologies. Large area format focal plane array (LFPA), Fourier transform spectrometer (FTS).

Measurement Capabilities: Imaging, Sounding, and Chemistry

Full Disk Imagery: IR (4 Km) / VIS (1 Km) imaging with 5 minute temporal frequency.

Full Disk Sounding: Hourly, low spatial resolution temperature, moisture, and winds for global forecasting.

Regional Sounding: (6000 x 6000 Km), Half-hourly, high spatial resolution temperature, moisture, and wind soundings for regional weather forecasting.

Mesoscale Sounding: (3000 x 3000 Km), Hourly, ultra-high vertical resolution soundings for chemistry, hazardous weather prediction applications, and self-validation of regional and full disk products.