

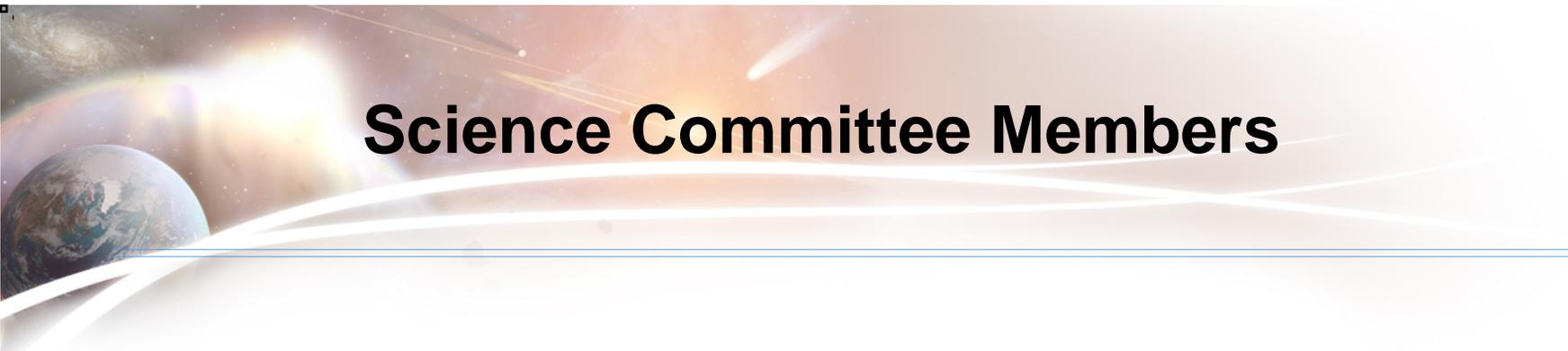
National Aeronautics and Space Administration



SCIENCE

# Science Committee Report

Dr. Wes Huntress, Chair



# Science Committee Members

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Wes Huntress, Chair

Byron Tapley, University of Texas-Austin (Vice Chair)

Jack Burns, University of Colorado

Ron Greeley, Arizona State University

Noel Hinners, Independent Consultant

\*Craig Hogan, Fermilab

Judith Lean, Naval Research Laboratory

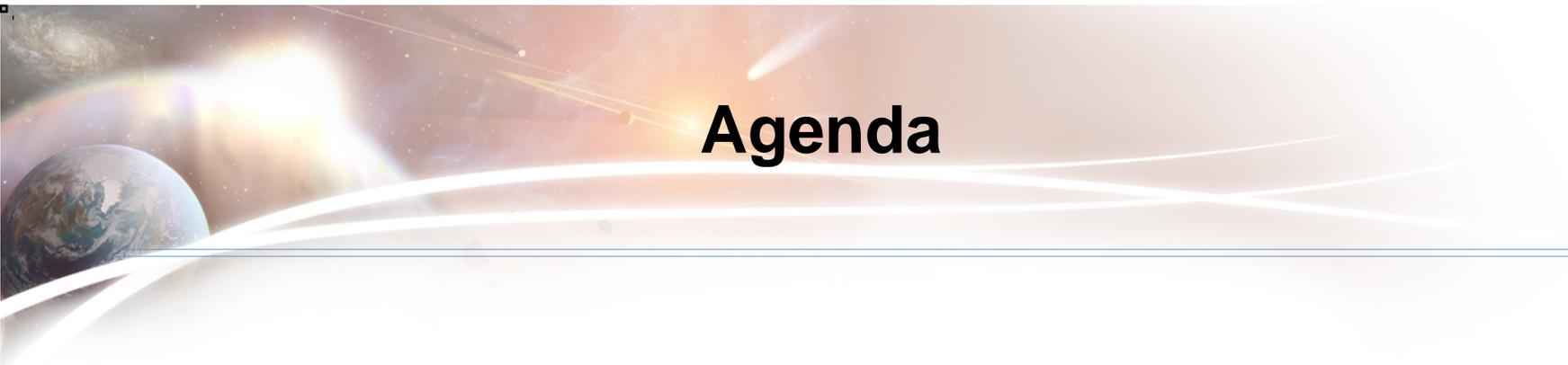
Gene Levy, Rice University

Roy Torbert, University of New Hampshire

Michael Turner, University of Chicago

Charlie Kennel, Space Studies Board (*ex officio* member)

\* = represented Astrophysics Subcommittee at February 2010 meeting of Science Committee

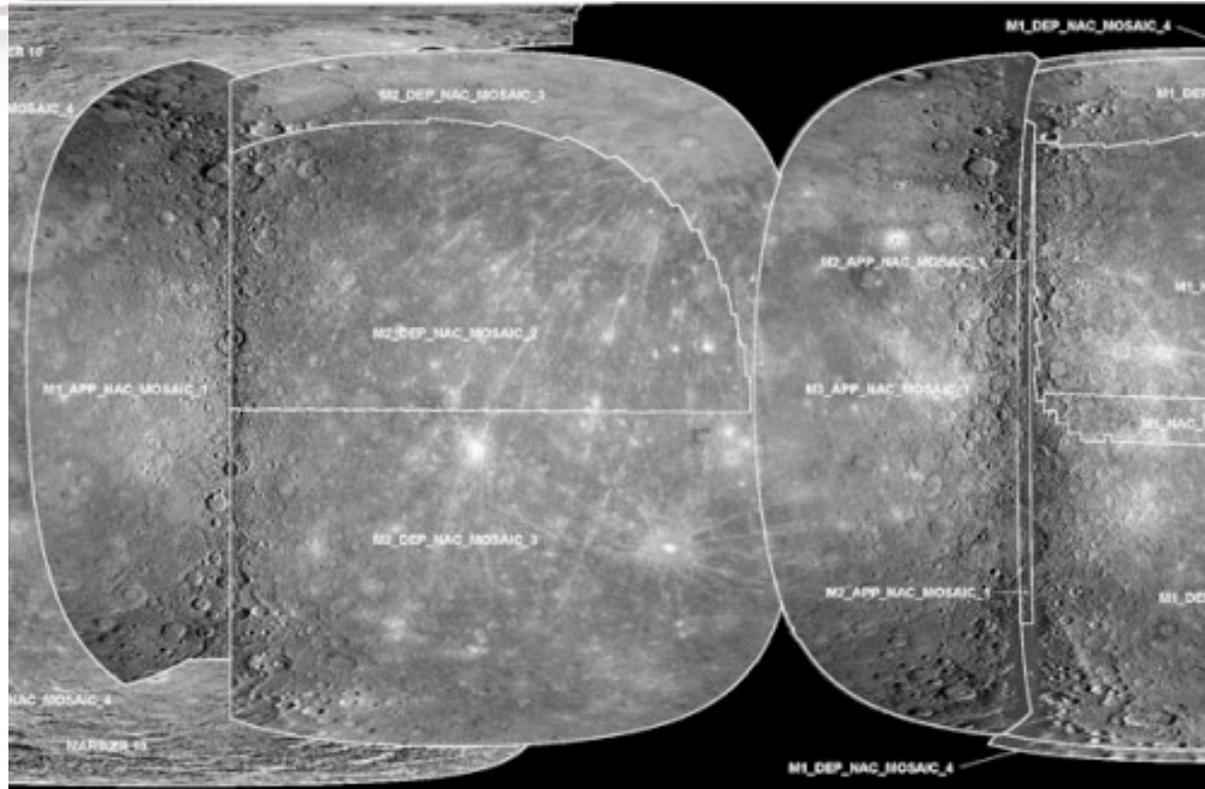


# Agenda

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- **Science Results**
- Programmatic Status
- FY11 Budget Request
- Findings & Recommendations

# MESSENGER Maps Mercury



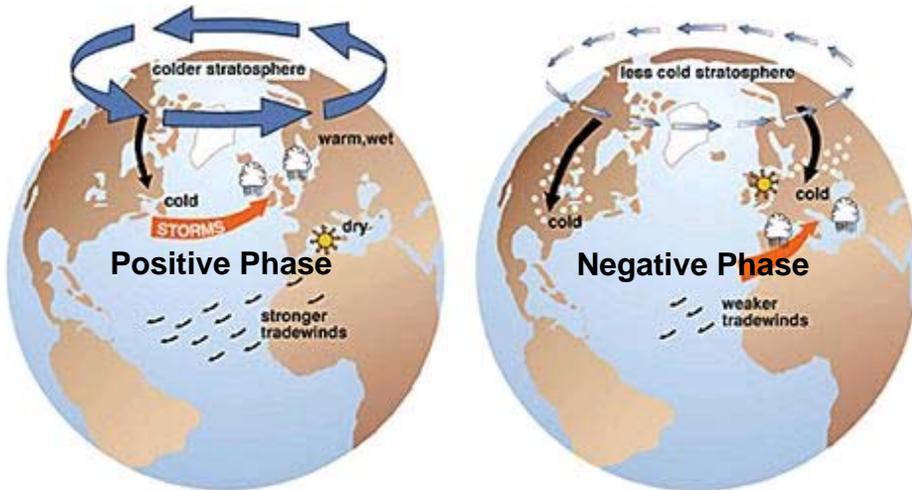
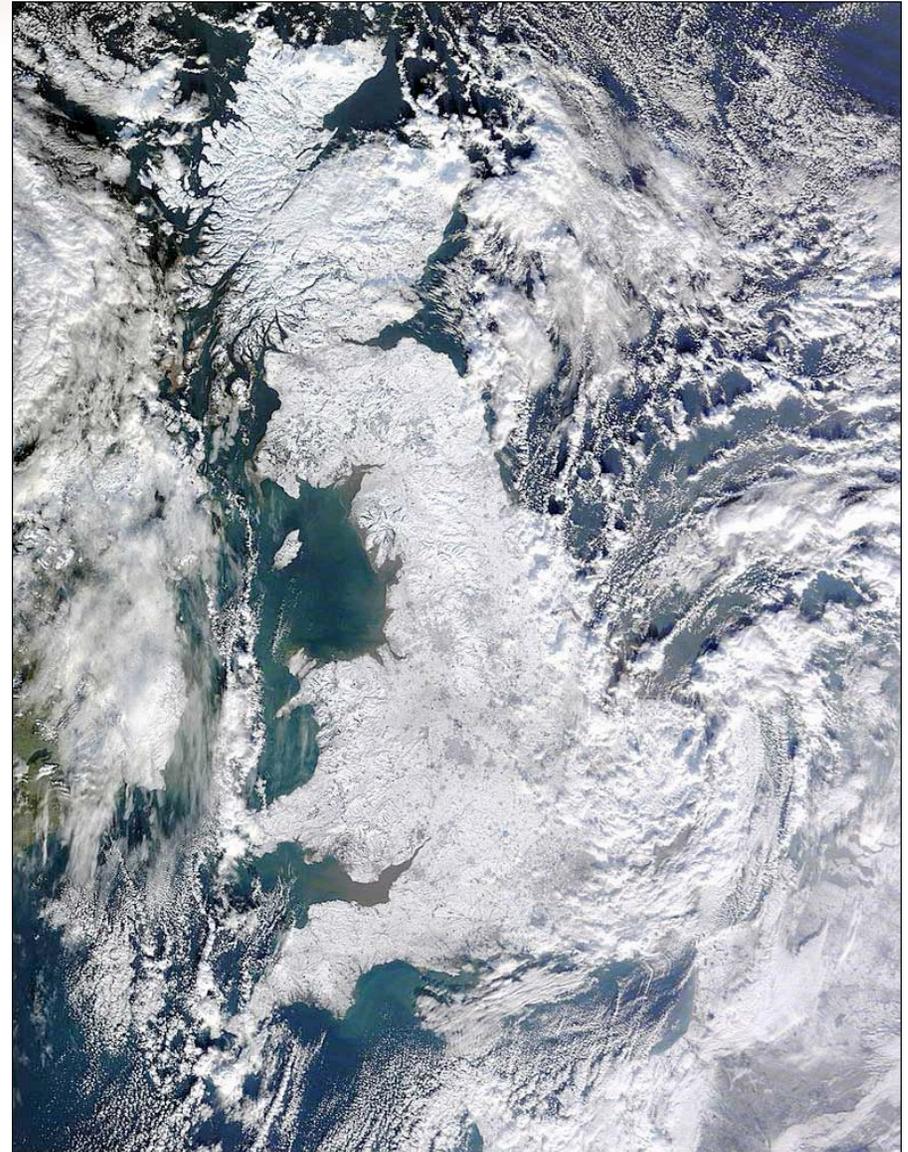
- The MESSENGER mission just released the first global map of Mercury
- In three flybys of the planet, MESSENGER has seen 90% of the planet
  - Mariner 10, the last mission to mercury, only captured 45%.
- Using all of the MESSENGER data and portions of the Mariner data to fill in holes, the MESSENGER team was able to create a global map of Mercury that covers 97.7% of the surface (missing only the polar regions)
- This map will help scientists with focus their scientific observations when MESSENGER enters orbit around Mercury in 2011

# BBC Report: “Frozen Britain seen from above”

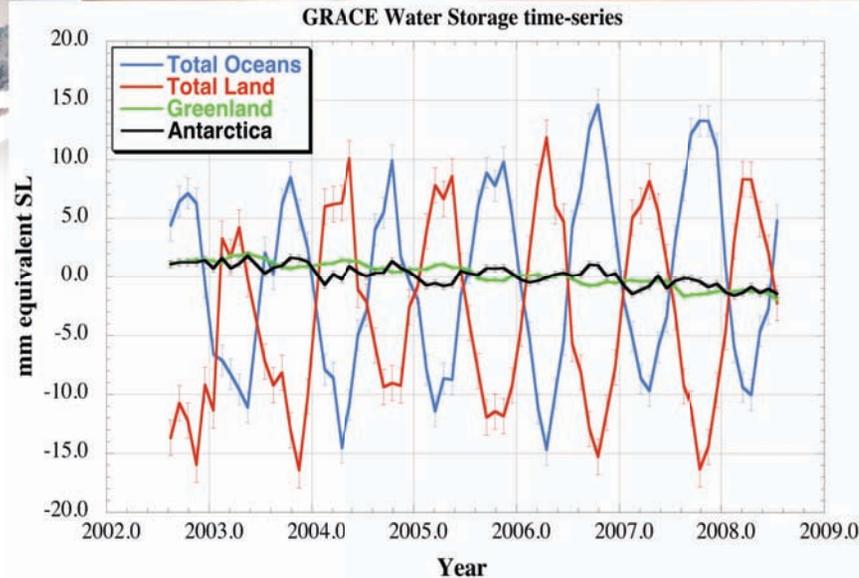
January 7, 2010

Icy conditions hit the UK after days of heavy snow

This striking image taken by NASA's Terra satellite on 7 January 2010 shows the UK deep in the clutches of a historic cold snap.



# GRACE Mass Estimate



Trends (mm/yr)

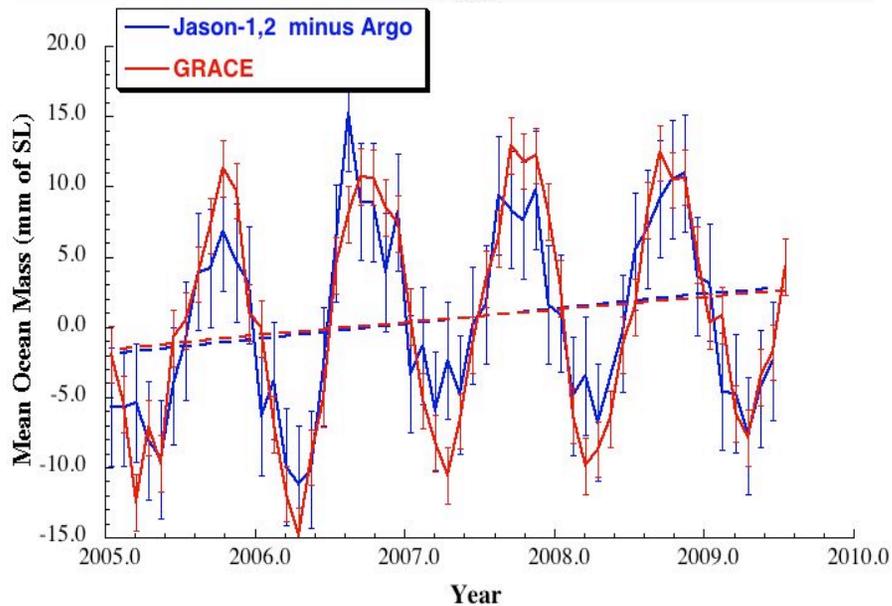
Ocean =  $1.2 \pm 0.3$

Land =  $0.3 \pm 0.5$

Greenland =  $-0.60 \pm 0.1$

Antarctica =  $-0.40 \pm 0.2$

Famiglietti, 2009

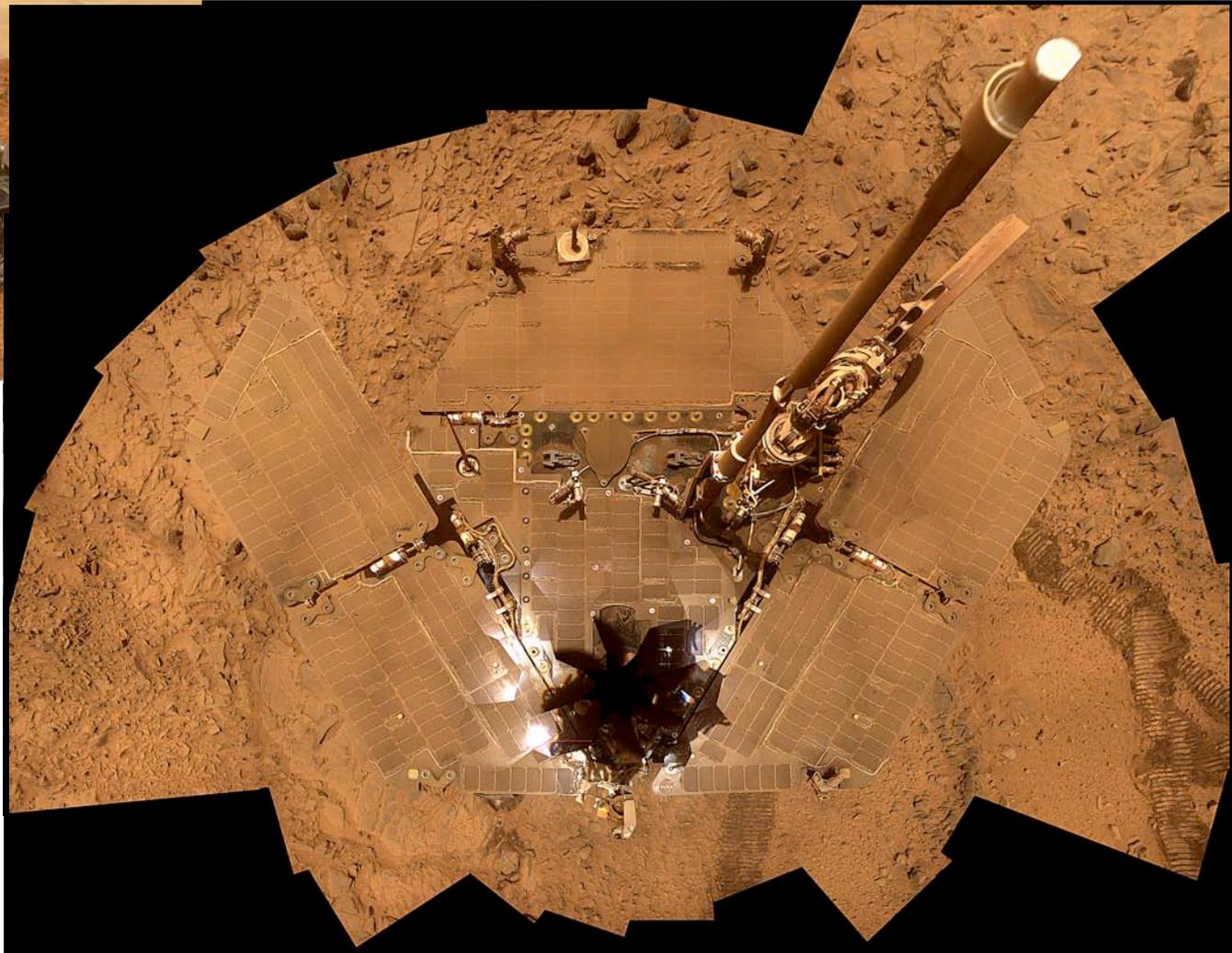


GRACE/Jason/Argo Closure

Grace Trend(2003-2009.5) =  $1.3 \pm 0.8$  mm/yr

Chambers, 2009

# Status of Spirit

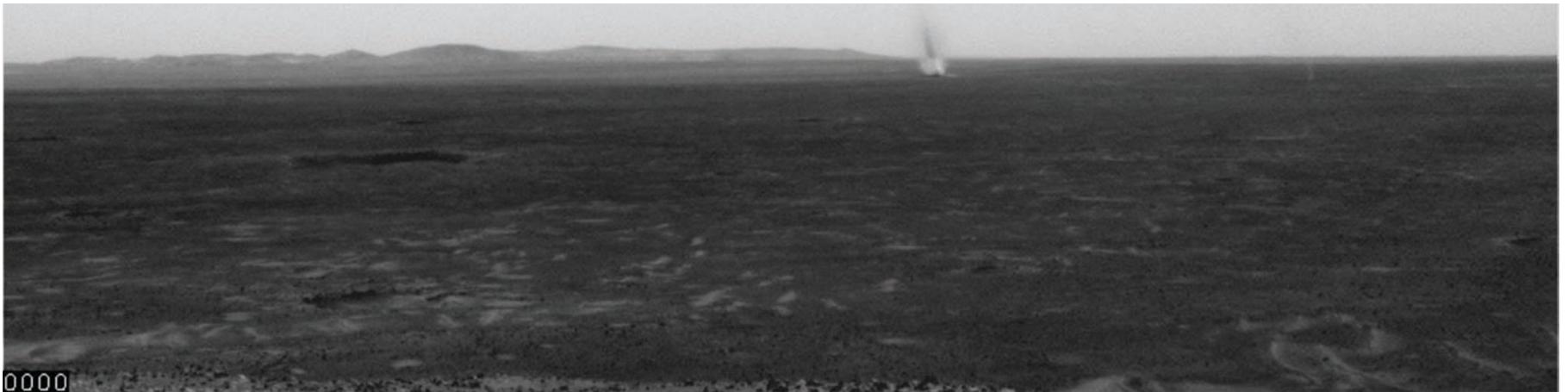


***The Wind Giveth and the Wind Taketh Away!***

# Dust Devils in Spirit Crater

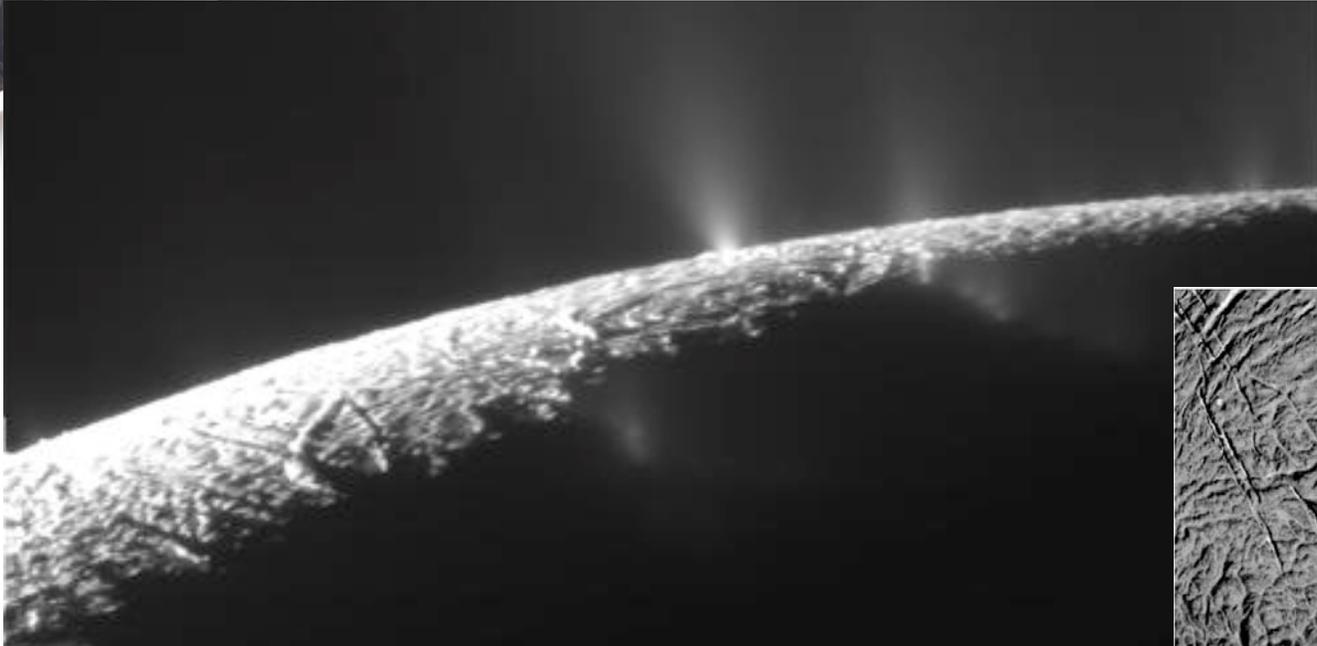
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*Unprecedented data set !*

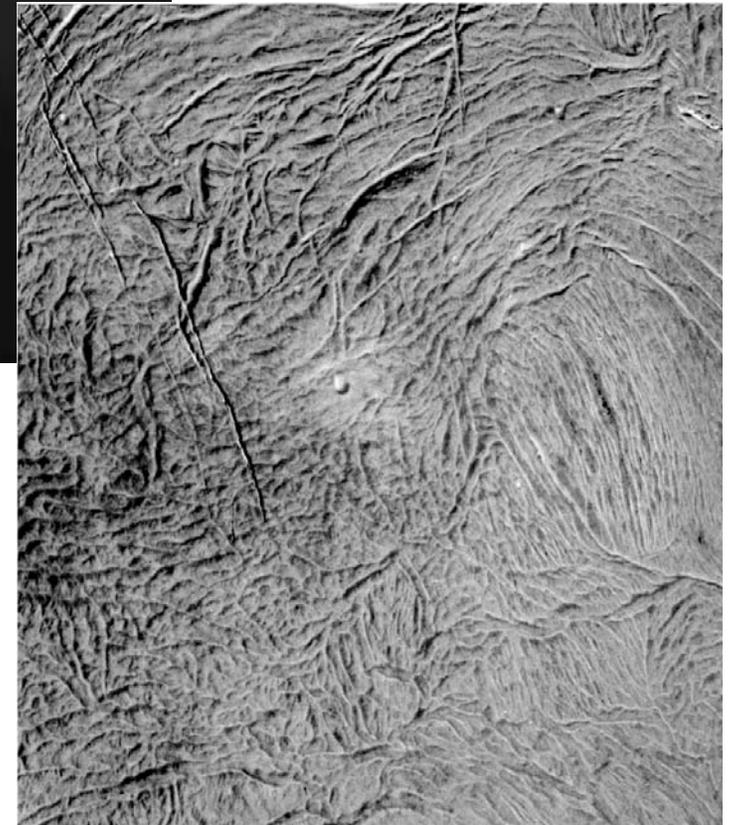


*More than 750 seen, representing three complete “seasons”*

# **New Views of Enceladus: Images from Cassini's E8 Fly-by, Nov. 21, 2009**

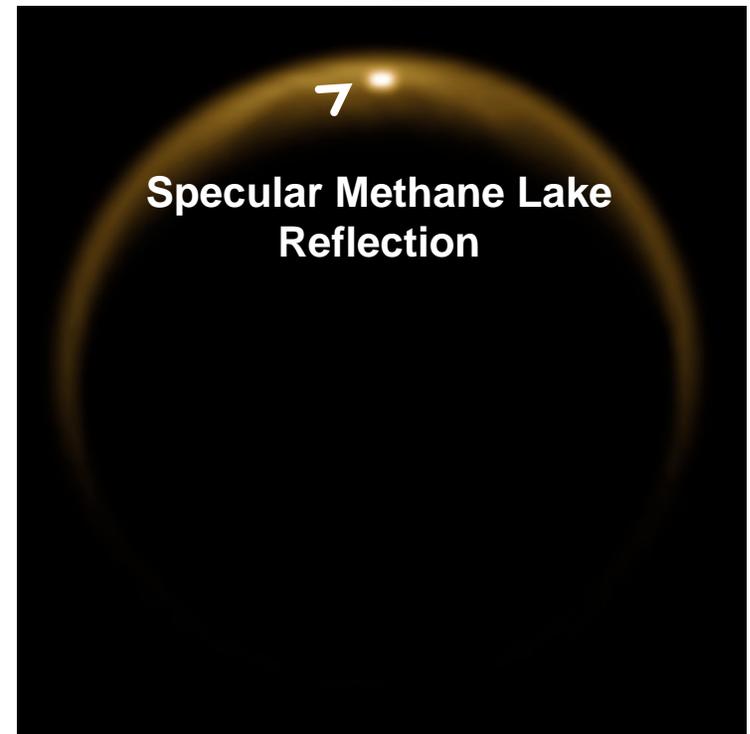


- **High phase, high resolution images reveal possible new small jets, or that previously known jets are composed of smaller jets**
- **First views of the southern leading hemisphere (~170 m/pixel) fill hole in previous coverage and show severely deformed terrain**
- **Much more is still to come from the IR, UV, and fields & particles instruments!**



# Titan's "hydrological" cycle

- Cassini now supports the long-held hypothesis that Titan has a hydrologic cycle like Earth but based on methane rather than water
- Cassini data confirmed three parts of this cycle:
  - The dark areas on Titan are lakes filled with liquid methane and ethane
  - Storm clouds create methane rain that fills these lakes
  - Methane evaporation occurs and partially empties the lakes
- The change of seasons is creating new lakes and drying up others
- Cassini is tracking the lakes and storms as Titan moves through seasons

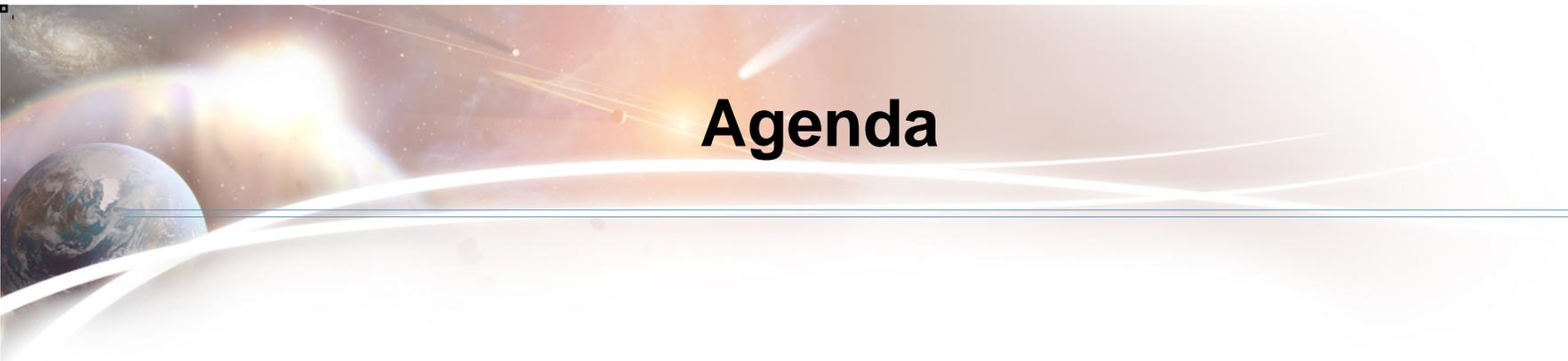


# FIRST Robotics Program

The FIRST Robotics Competition is a national contest where high school students team with engineers from government, industry and universities to get a hands-on, realistic exposure to the engineering and technical professions



- NASA has been participant since 1995 (sponsoring 1 team that year)
- NASA is now the largest single organization participating in the program, sponsoring nearly 300 of the 1800 teams competing in 2010
- Student participants are the engineers of the future
  - 30% of the incoming freshman class for the Virginia Commonwealth University School of Engineering are FIRST program alumni
  - 10% of last year's freshman class at MIT were FIRST program alumni



# Agenda

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- Science Results
- **Programmatic Status**
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HST  
SM-4



White House Star Party: Oct 7

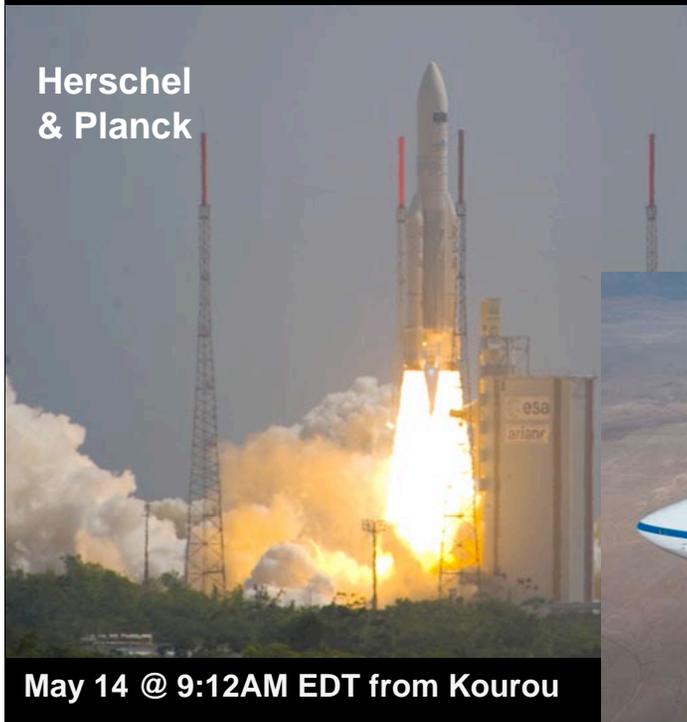


WISE

Dec 14 @ 6:09 AM PST from VAFB

# 2009: Year in Review

SOFIA open door flight: Dec 18



Herschel  
& Planck

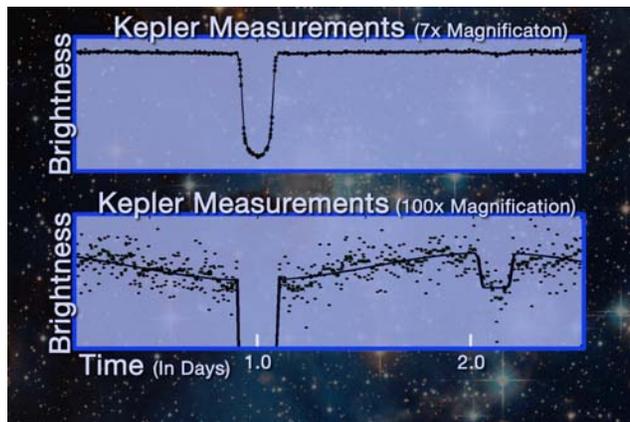
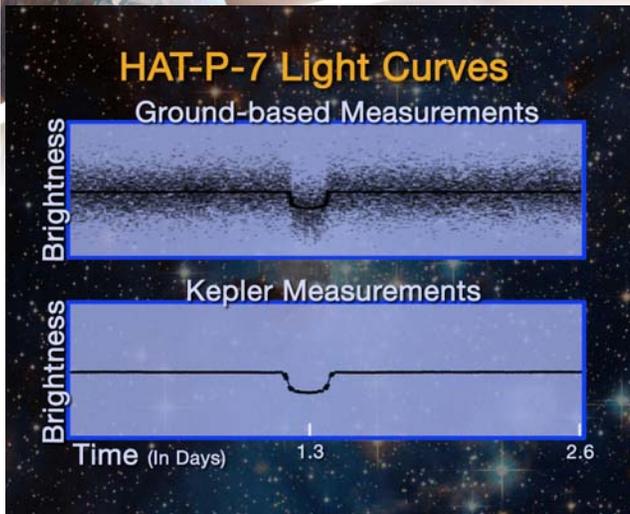
May 14 @ 9:12AM EDT from Kourou



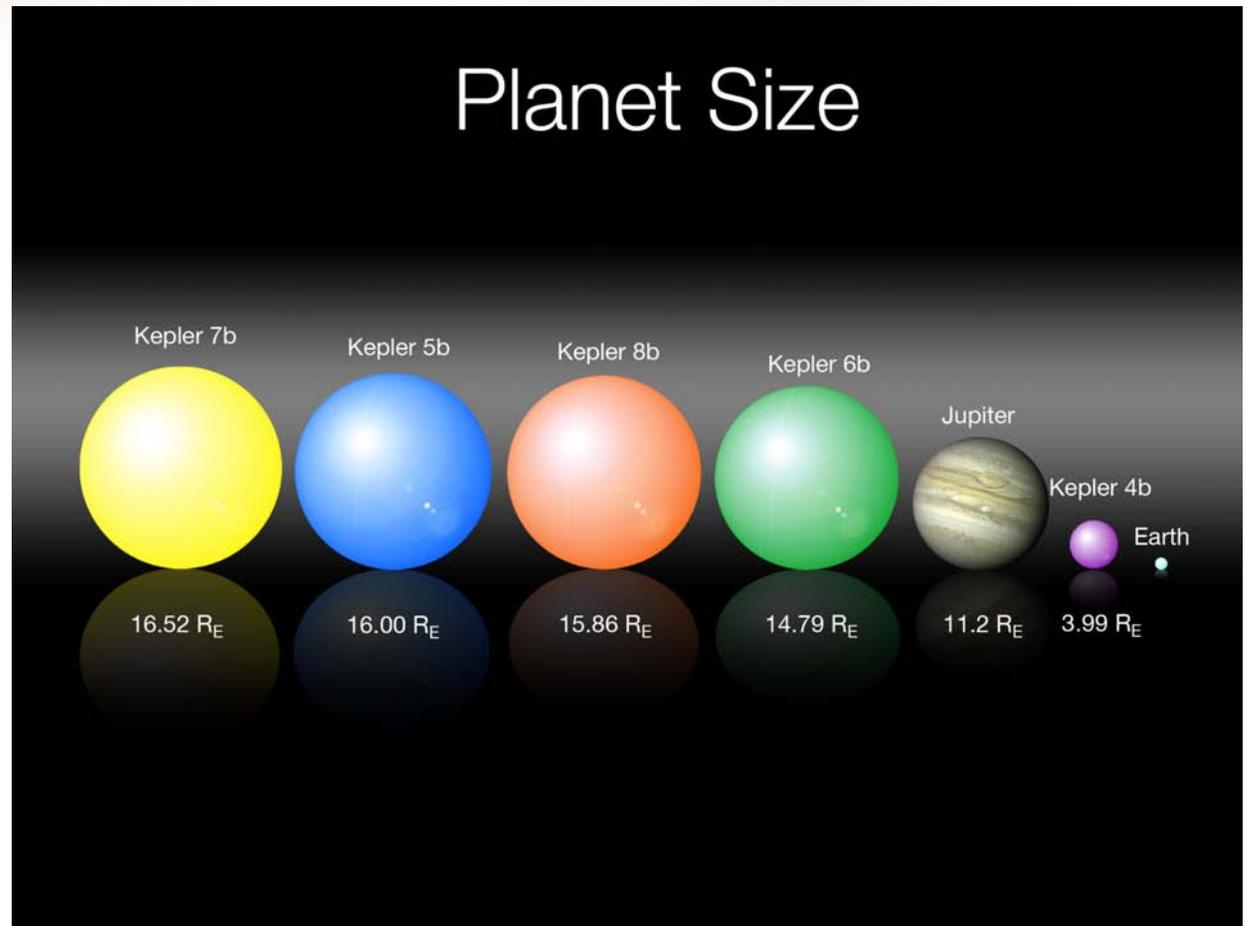
Kepler

Mar 6 @ 10:48PM EDT from KSC<sup>13</sup>

# Kepler: First 5 Exoplanets discovered!



6 August 2009  
Press Conference



4 January 2010 Press Conference

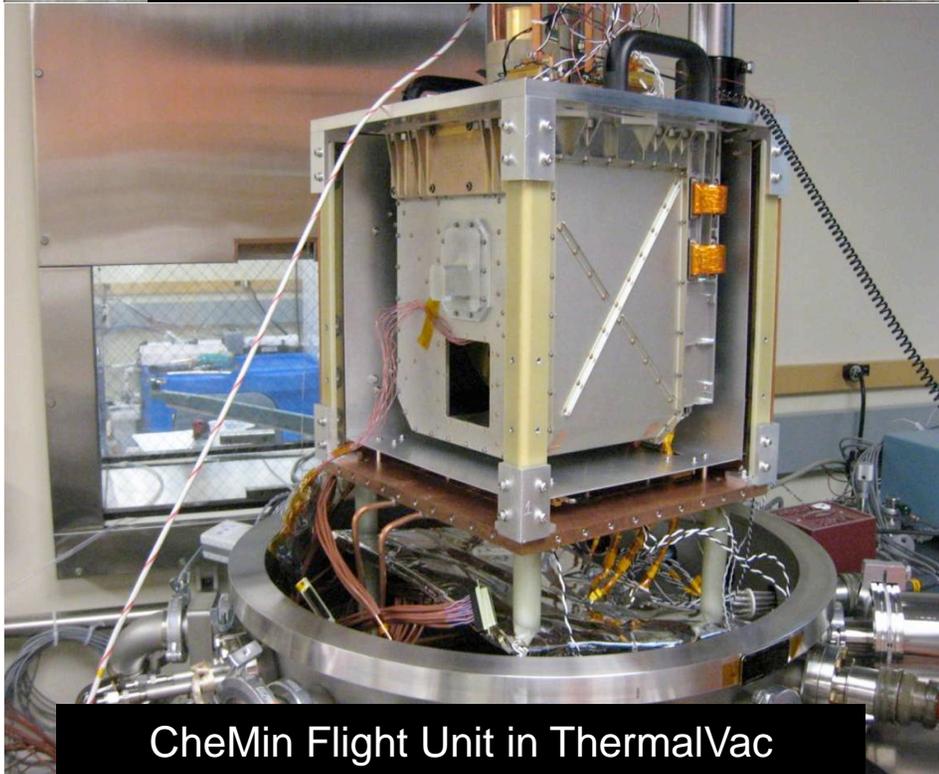
# Mars Science Laboratory (MSL) Hardware



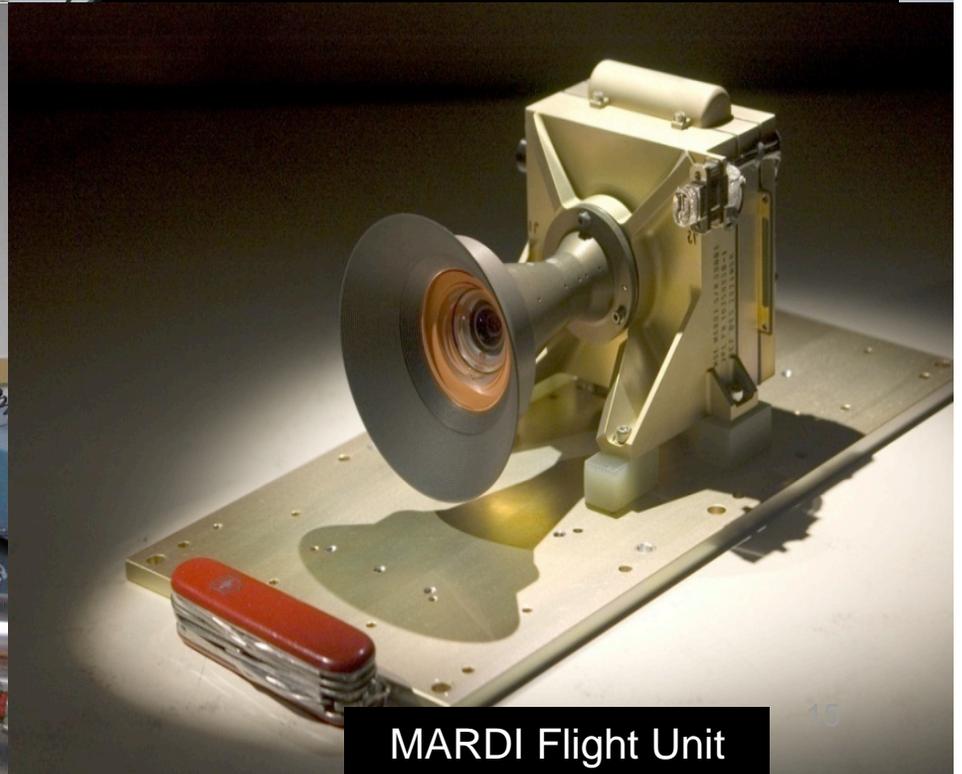
Flight Actuators at JPL



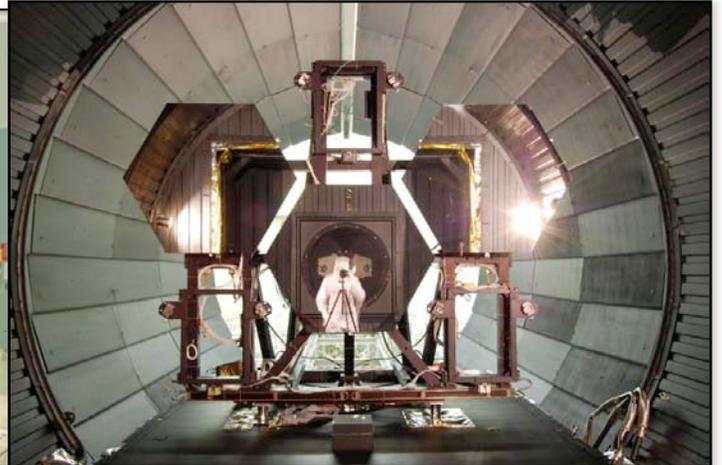
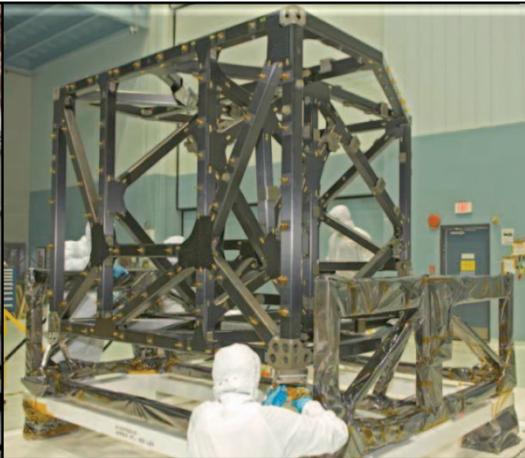
SAM Flight Unit Vibration Test



CheMin Flight Unit in ThermalVac

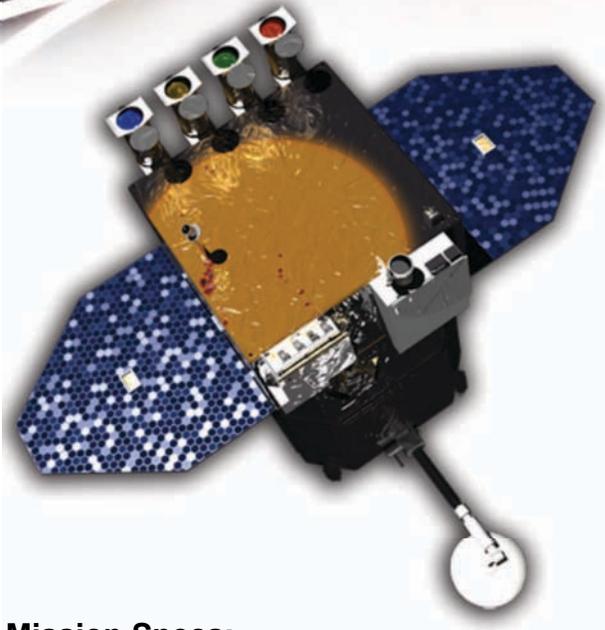


MARDI Flight Unit



# Solar Dynamics Observatory

## The First Mission in NASA's Living With A Star Program



### Mission Specs:

- February 2010 launch
- Inclined Geosynchronous Orbit
- Continuous 150 Mbps Ka-Band downlink
- Dedicated ground station
- Developed and managed at GSFC

### Mission Science Objectives

SDO's goal is to understand, driving towards a predictive capability, the solar variations that influence life on Earth and humanity's technological systems by determining

- *How the Sun's magnetic field is generated and structured*
- *How this stored magnetic energy is converted and released into the heliosphere and geospace in the form of solar wind, energetic particles, and variations in the solar irradiance.*

### Science Investigations

#### Helioseismic and Magnetic Imager (HMI)

PI Institution: Stanford University

*Images the Sun's helioseismic, longitudinal and vector magnetic fields to understand the Sun's interior and magnetic activity*

#### EUV Variability Experiment (EVE)

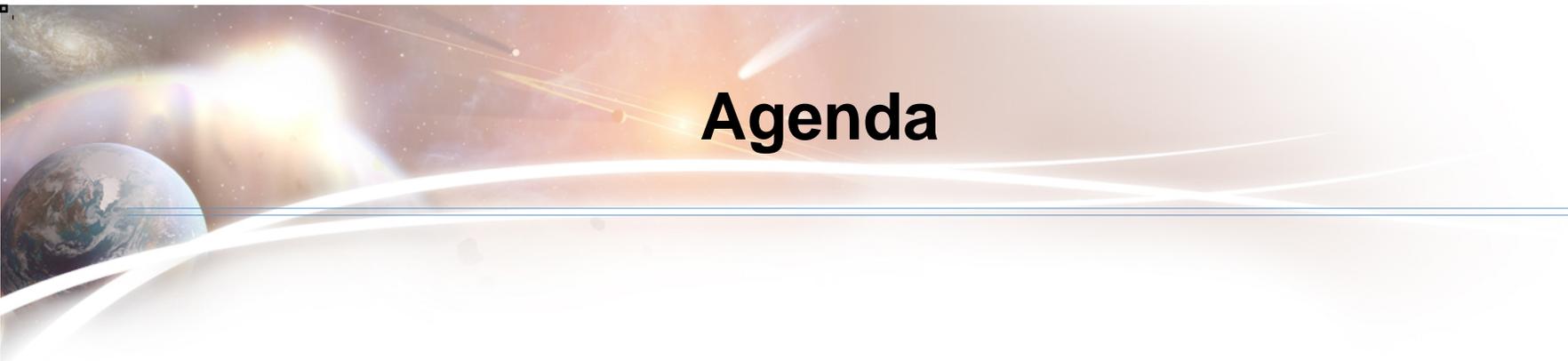
PI Institution: University of Colorado

*Measures the solar extreme ultraviolet (EUV) spectral irradiance to understand variations on the timescales which influence Earth's climate and near-Earth space*

#### Atmospheric Imaging Assembly (AIA)

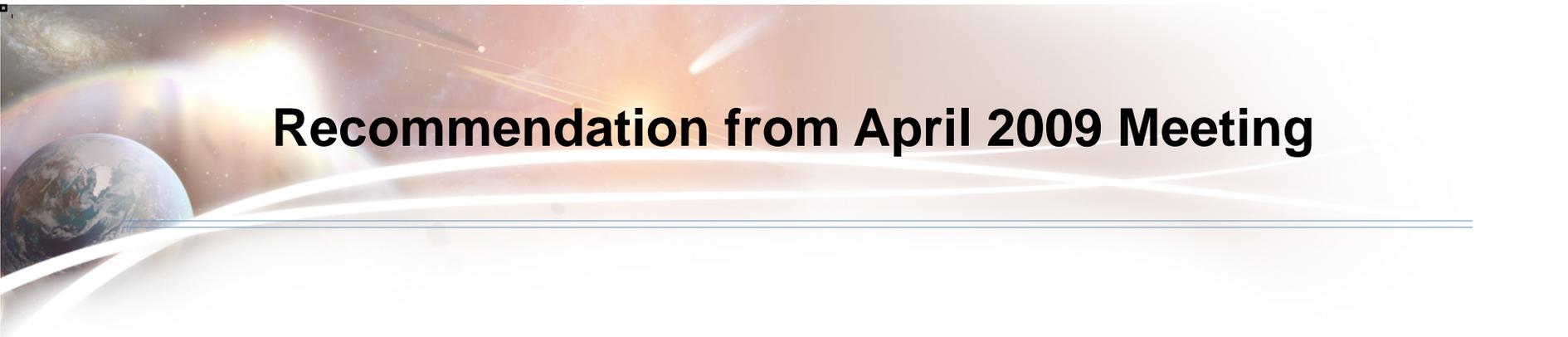
PI Institution: Lockheed Martin Solar Astrophysics Laboratory

*Images the solar atmosphere in multiple wavelengths to link changes to surface & interior changes*



# Agenda

- Science Results
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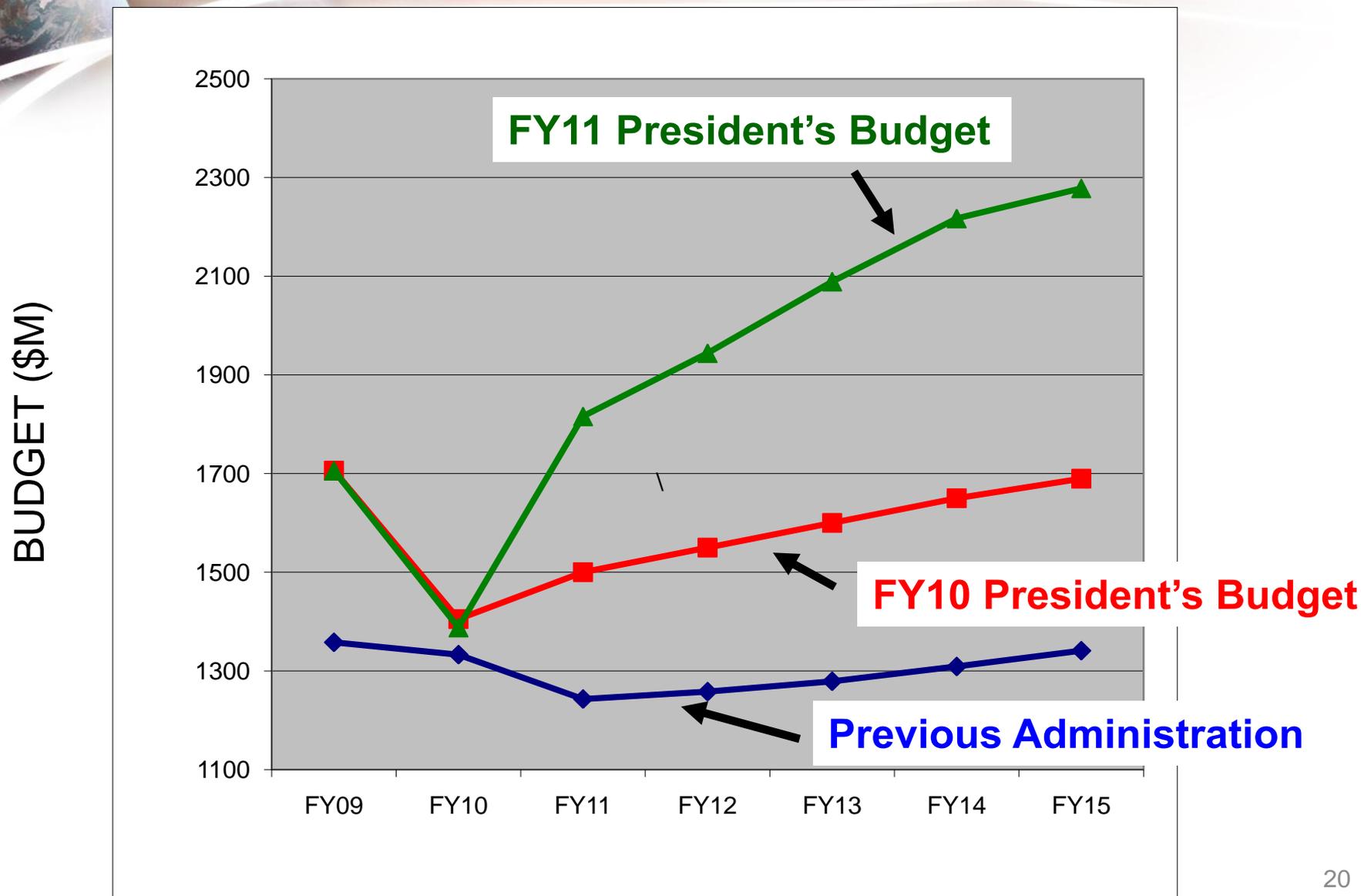


## Recommendation from April 2009 Meeting

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**Process for identifying non-science requirements and funding for Earth observations:** NASA is encouraged to work with OSTP and other agencies at the highest levels to define responsibilities and secure funding for Earth observations beyond those recommended by the NRC Decadal Survey to advance Earth System Science.

# Earth Science: FY11 Budget Request



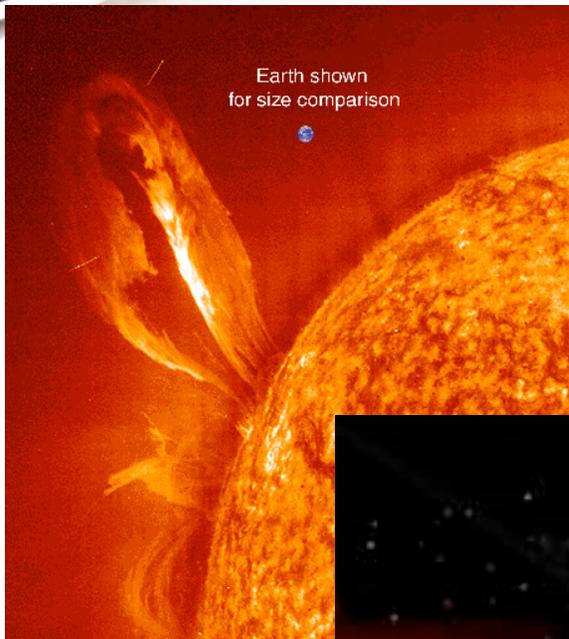


# President's FY11 Budget Request: Mission Launch Cadence

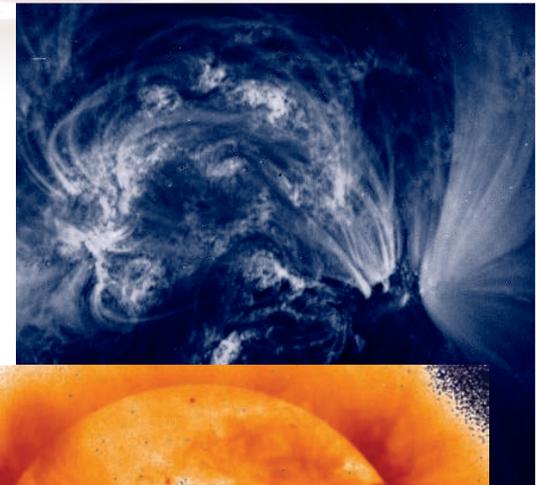
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- GLORY (11/2010)
- Aquarius (12/2010) (with CONAE)
- NPP (NET 9/2011) (with Interagency partners)
- LDCM (12/2012) (agency external commitment 6/2013) (with USGS, TIRS capability)
- **OCO-2 (2/2013)**
- GPM Core (7/2013) (with JAXA)
- **SAGE-III on ISS (11/2013) (launch required and not in budget, includes hexapod)**
- **SMAP (11/2014) (date set by LV selection issues, SRB's recommendation for Phase C-D)**
- **ICESAT-2 (10/2015) (date constrained by technical development)**
- **GRACE-C (12/2015) (likely with DLR; budgeted for well over grass-roots estimate)**
- **CLARREO-1 (10/2017) (cost-constrained mission)**
- **DESDynI RADAR+LIDAR (10/2017) (possibly with DLR, partnership not essential)**
- **Additional missions possible for launch prior to 2020, identified in concert with USGCRP**
  - **SCOPING EXAMPLE ONLY: OCO-3 instrument + ASCENDS + ACE-1 + SWOT**
  
- Annual Venture major instrument solicitations starting in FY12
- First small-sat Venture mission call, possibly in FY12

# SOLAR PROBE PLUS: Solar and Interplanetary Consequences



- **ACTIVE CORONA**
- **SOLAR WIND**
- **GEOMAGNETIC ACTIVITY**



# NASA's NEO Search Program

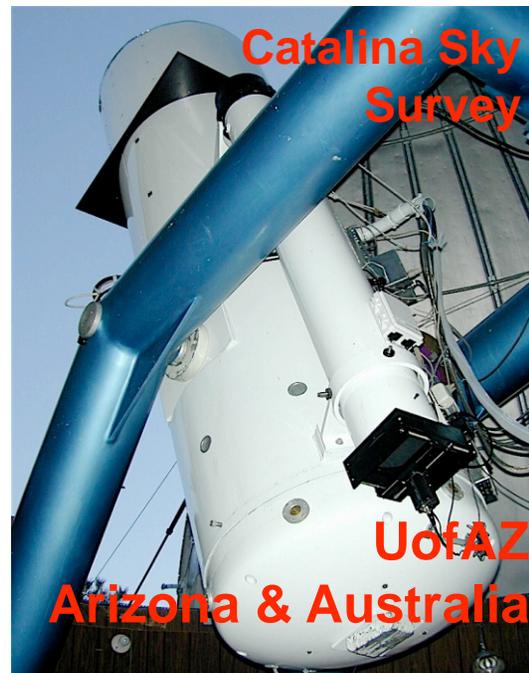
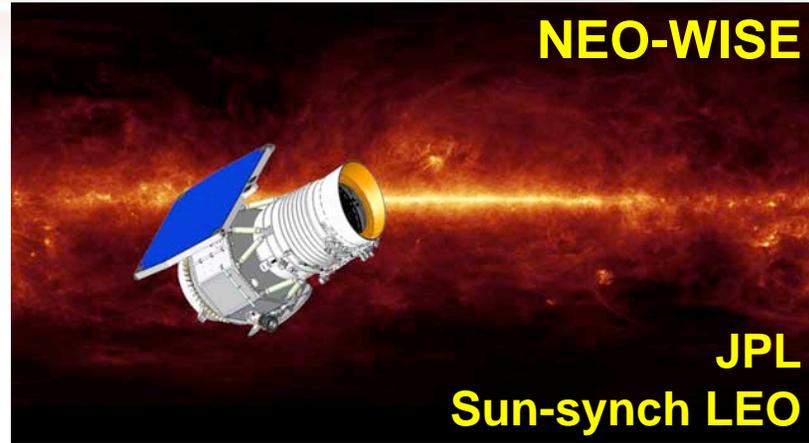
## (Current Systems)

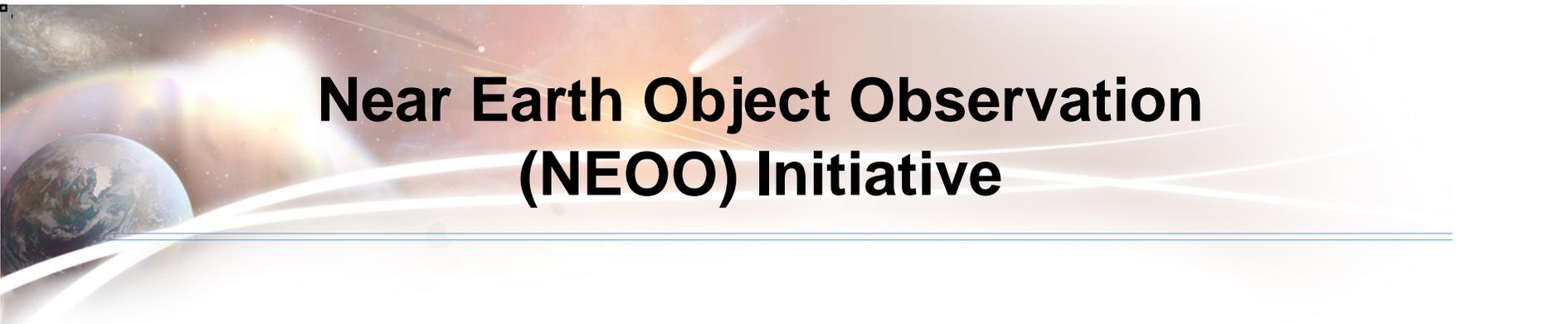
### NEO Program Office @ JPL

- Program coordination
- Automated SENTRY

### Minor Planet Center (MPC)

- IAU sanctioned
- Discovery Clearinghouse
- Initial Orbit Determination



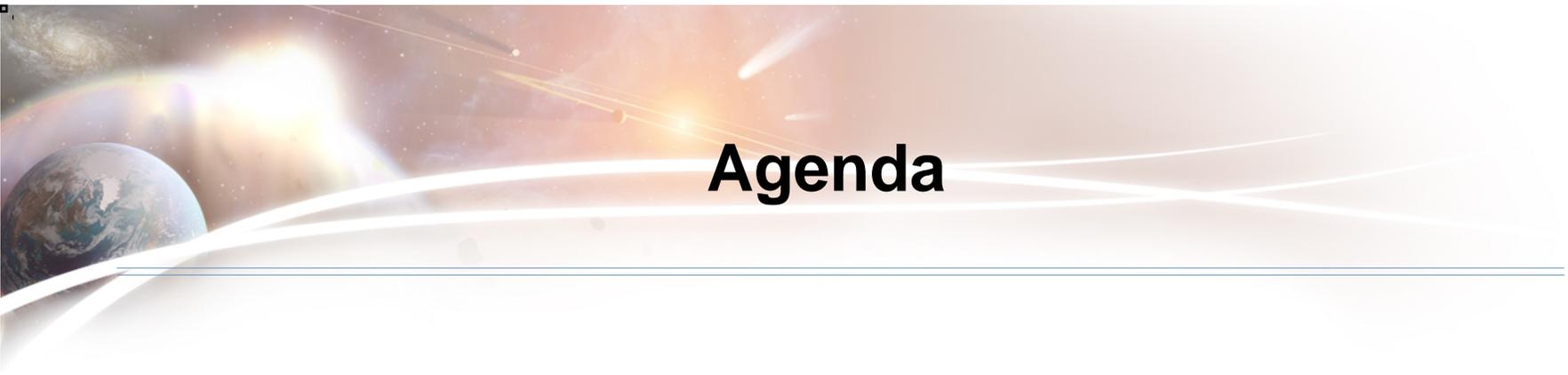


# Near Earth Object Observation (NEOO) Initiative

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With the additional funding of \$16M, the NEOO Program will:

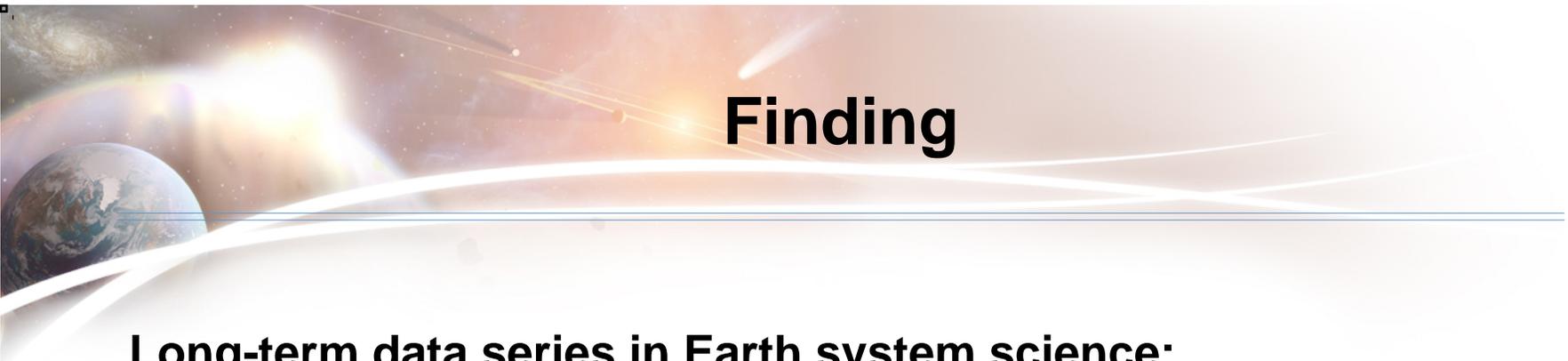
- Extend the collection, archive, and analysis of WISE NEO data
- Enable collection of NEO data by the USAF's Pan-STARRS project
- Support the continued operation of planetary radar capabilities at the NSF's Arecibo and NASA's own Goldstone facilities
- Investigate use of both ground and space-based assets for Potentially Hazardous Objects (PHOs) 140 meters and below
- Determine what characteristics of PHOs are needed to assess possible mitigation actions



# Agenda

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- Science Results
- Programmatic Status
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- **Findings and Recommendations**

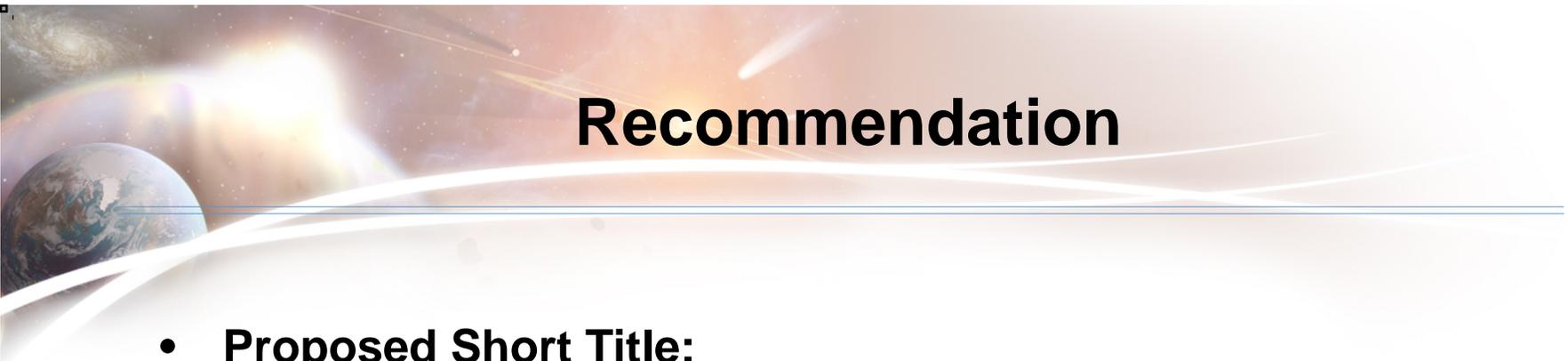


# Finding

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## **Long-term data series in Earth system science:**

- The Administration's 2011 budget explicitly allows NASA to undertake missions that enable the continuation of long-term data series in Earth system science. This profound decision recognizes NASA's technical leadership and permits NASA to play a stronger role in the provision of measurements that the Nation needs. It recognizes the fact that understanding many complex issues in Earth system science requires long-term data. The assurance of long-term access to high quality data will encourage a broad range of users to develop new research and applications products.



# Recommendation

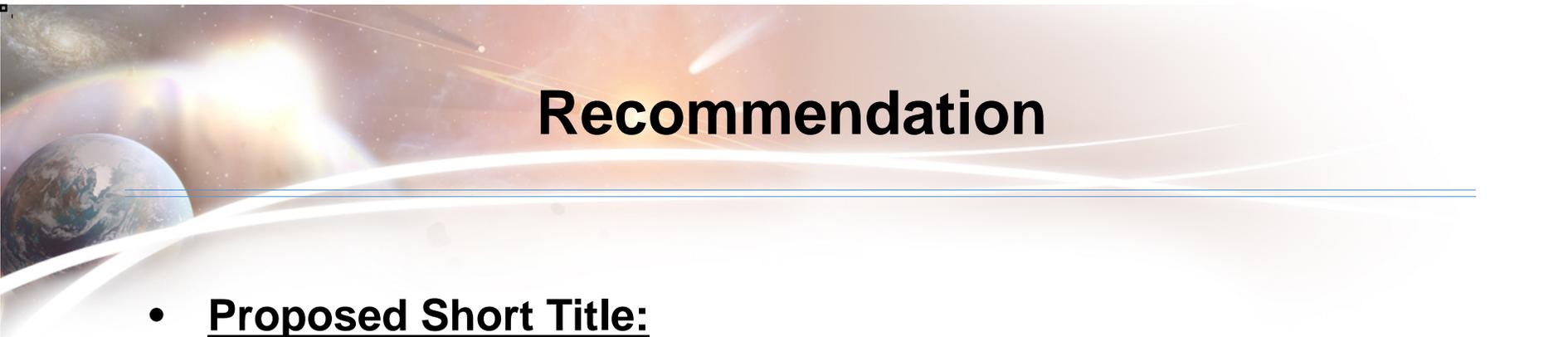
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- **Proposed Short Title:**

Restart of Domestic Pu-238 Production

- **Short Description of Proposed Recommendation:**

The Science Committee urges NASA to work with DOE to seek an equitable solution for the restart of domestic production of Pu-238, and for the development and testing of advanced Radioisotope Power Systems (RPSs). The Science Committee requests to be kept informed of developments on this issue at the next meeting.



# Recommendation

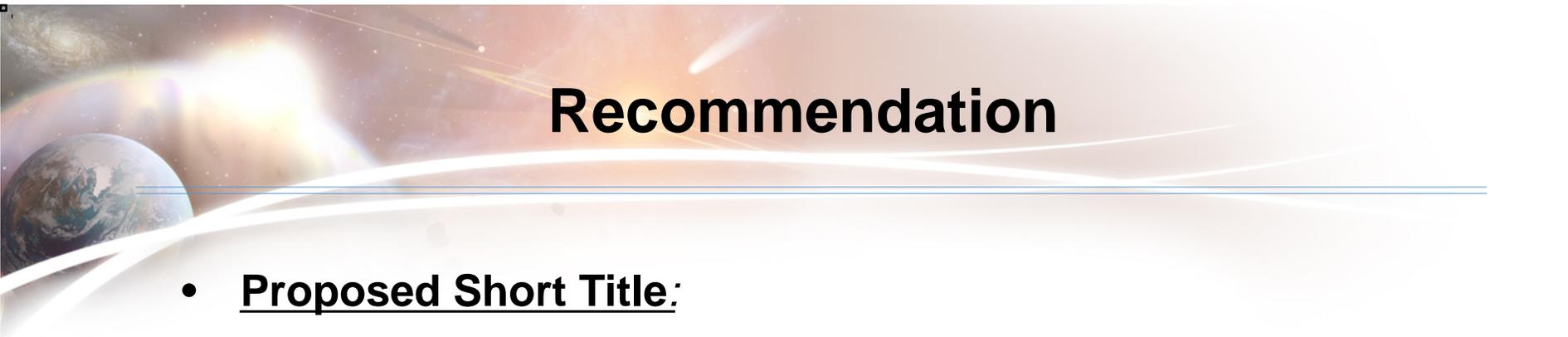
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- **Proposed Short Title:**

Technology space flight test program

- **Short Description of Proposed Recommendation:**

The Science Committee urges that NASA institute a technology space flight test program to close the “mid-TRL gap” between Earth-based tests and flight readiness. This program would take balloon and sounding rocket testing of new technologies and flight instruments to the next level, bridging a critical gap to keeping the technology pipeline open and sustaining a robust technology development community.



# Recommendation

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- **Proposed Short Title:**

Establish Program Analysis Groups (PAGs) in Astrophysics

- **Short Description of Proposed Recommendation:**

Science Committee recommends establishing PAGs for two other themes in Astrophysics (Physics of the Cosmos and Cosmic Origins)