

# SCIENCE

## **Science Committee Report** Dr. Wes Huntress, Chair

# Science Committee Members

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Wes Huntress, Chair

Alan Boss, Carnegie Institution, Chair of Astrophysics

Ron Greeley, Arizona State University, Chair of Planetary Science

Noel Hinners, Independent Consultant

\*Eugenia Kalnay, University of Maryland

Gene Levy, Rice University, Chair of Planetary Protection

\*Dave McComas, Southwest Research Institute

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

Roy Torbert, University of New Hampshire, Chair of Heliophysics

Michael Turner, University of Chicago

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

## Notes:

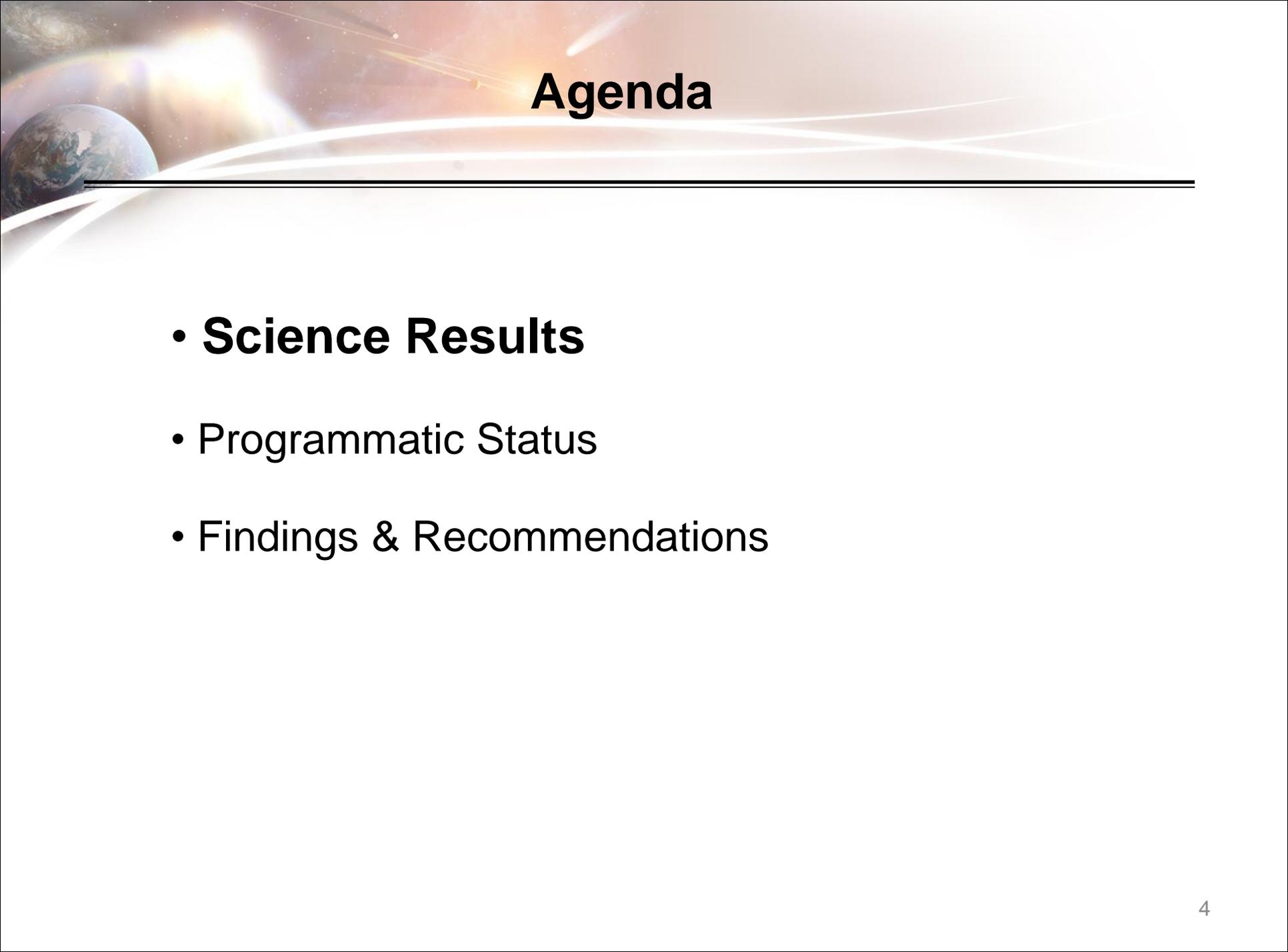
\* Drs. Kalnay and McComas were appointed since last meeting

- We expect one more appointment shortly (candidate has been identified)

# Task Group on Analysis Groups (TagAG)

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- Terms of Reference signed by Administrator Bolden on January 11
- Short-term study of how best to update Planetary Analysis Groups (AGs) to serve science needs of both SMD and ESMD
  - Goal to complete work and report back to the NAC Science and Exploration Committees by July 2011
- TagAG Membership being finalized and appointment letters in work
  - Will be chaired by the NASA Chief Scientist
  - Other members will be a combination of civil servants and NAC Committee members

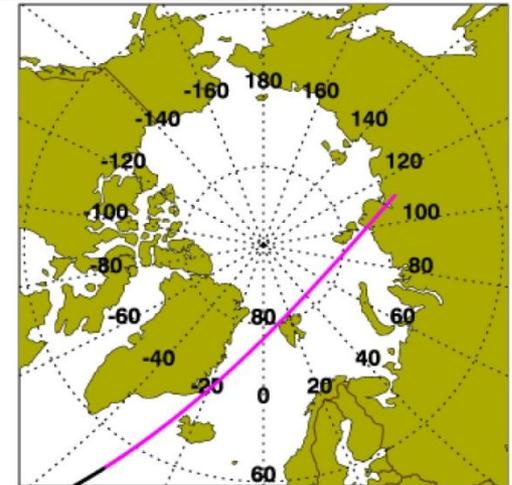
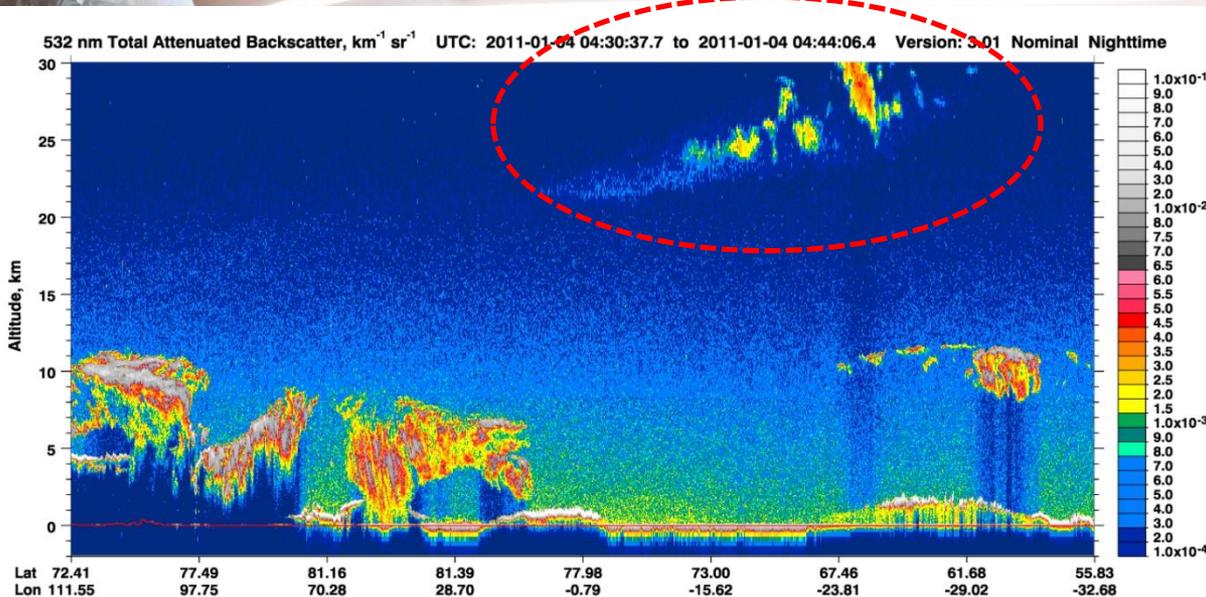


# Agenda

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

# CALIPSO Observes Mountain Wave PSC Above 30 km in the Arctic (1)

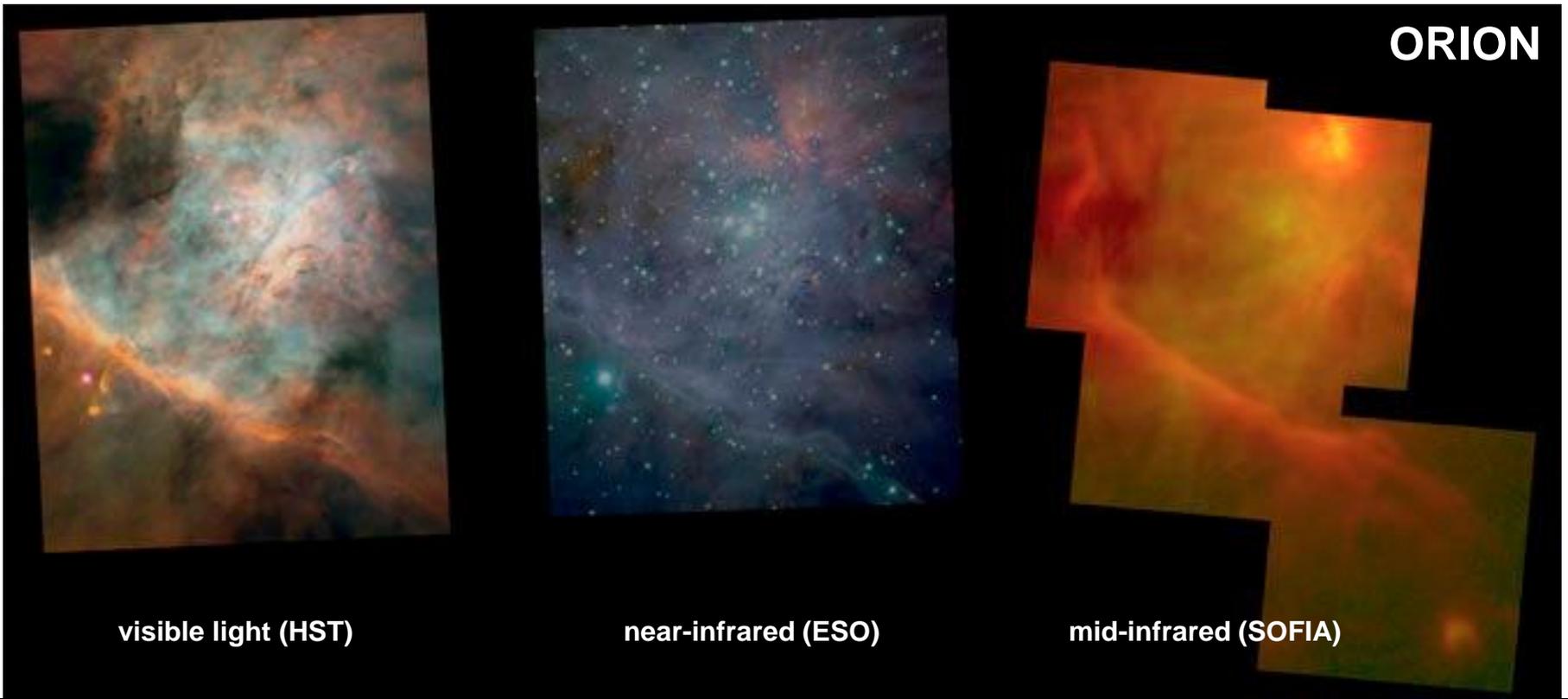


CALIPSO observed an unusual mountain wave polar stratospheric cloud (PSC) near the east coast of Greenland on 4 January 2011. Although orographically-induced wave ice PSCs are common in the Arctic (CALIPSO observes them every year), this event was remarkable because the cloud extended to altitudes above 30 km. **This is the highest wave ice PSC observed by CALIPSO in the Arctic during its five-year mission.** The propagation of mountain waves to such high altitudes is a rare phenomenon that occurs about once per winter. On this day the tropospheric jet stream was aligned with the edge of the polar vortex which produces ideal conditions for vertical mountain wave propagation.

Michael C. Pitts, NASA LaRC  
[Michael.C.Pitts@nasa.gov](mailto:Michael.C.Pitts@nasa.gov)

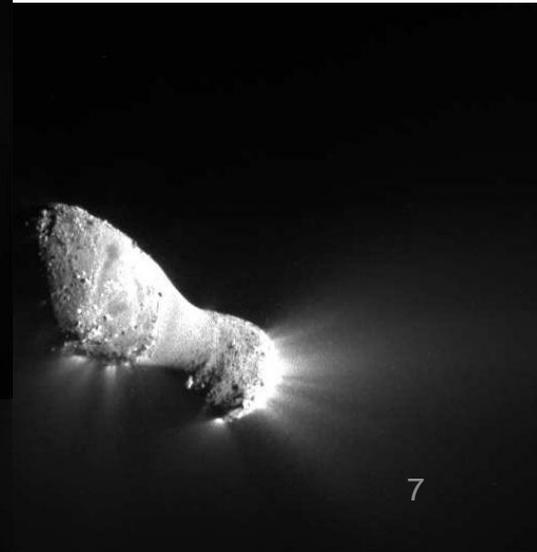
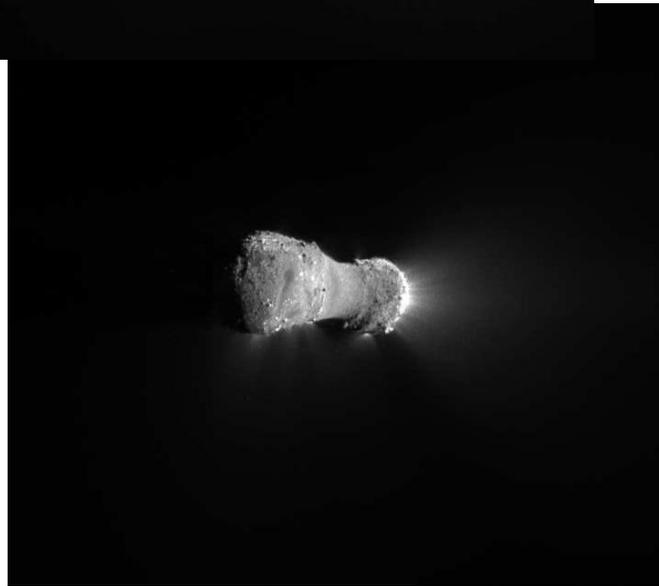
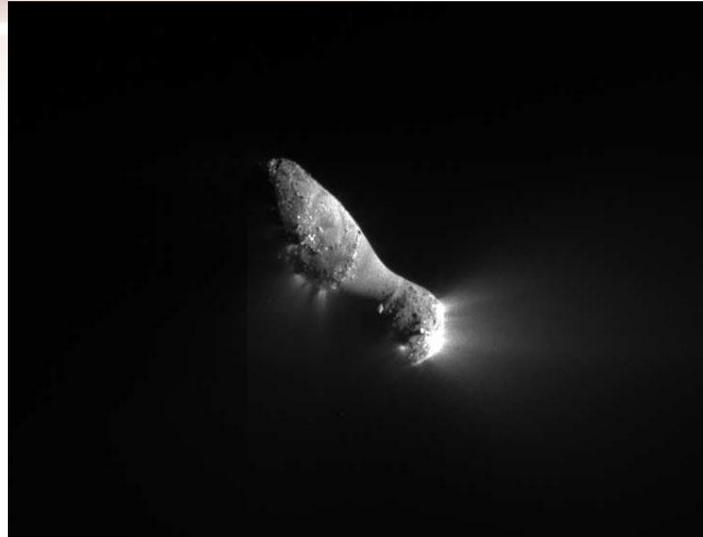
# SOFIA's First Science Flights

- Completed Short Science #1 Flight Series with FORCAST instrument. (see below)
- Released Draft AO for Second Generation Instruments on Dec. 15.
- Completed two nights of on-aircraft testing with GREAT instrument simulator on Dec. 16. Operational GREAT instrument flights planned to start in early April 2011.
- German State Secretary, Federal Ministry of Economics and Technology, Jochen Homann, visited SOFIA Science Project at ARC on Dec. 17.



# EPOXI Encounter with Hartley 2

- EPOXI spacecraft came through the encounter with Hartley 2 safely on November 4, 2010
- Closest approach was at a distance of 700km and traveling at 12.5km/s relative to the comet
- Hartley 2 is a very active comet with major jets of emissions with CO<sub>2</sub> ice that is believed to be driving the jets
- Hartley 2 has two rough regions, where the jets are emanating, separated by a long smooth region of redistributed material

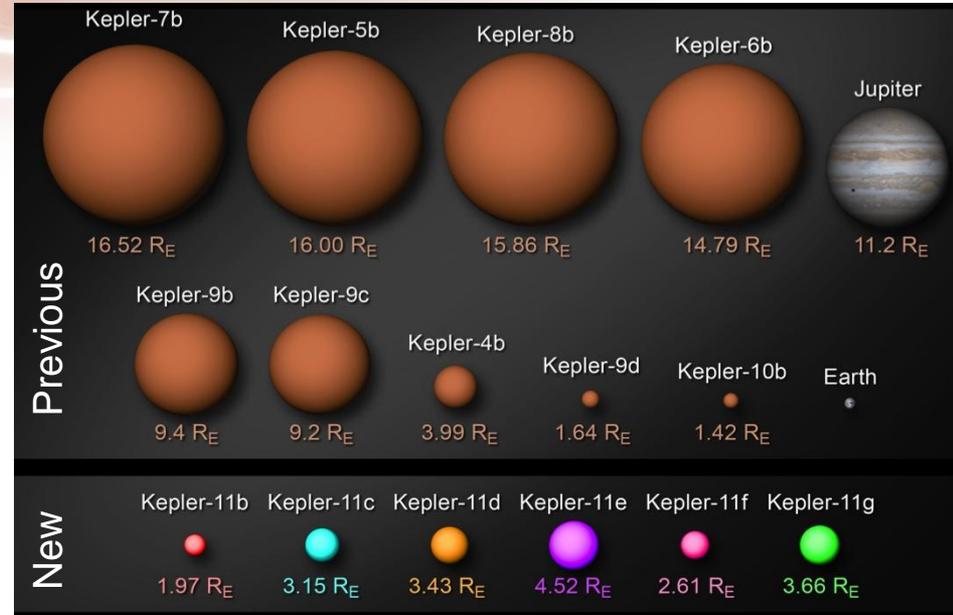
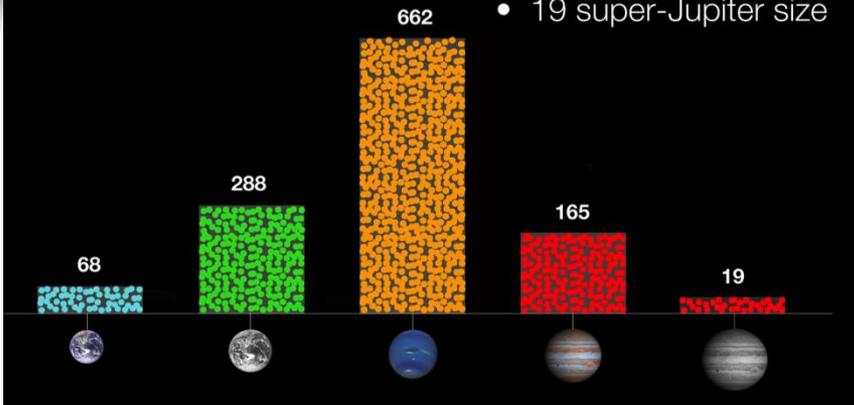


*Three images taken by the EPOXI spacecraft during its encounter with Comet Hartley 2. These images were taken during the closest approach and show the comet's interesting overall shape and various jets of material being released.*

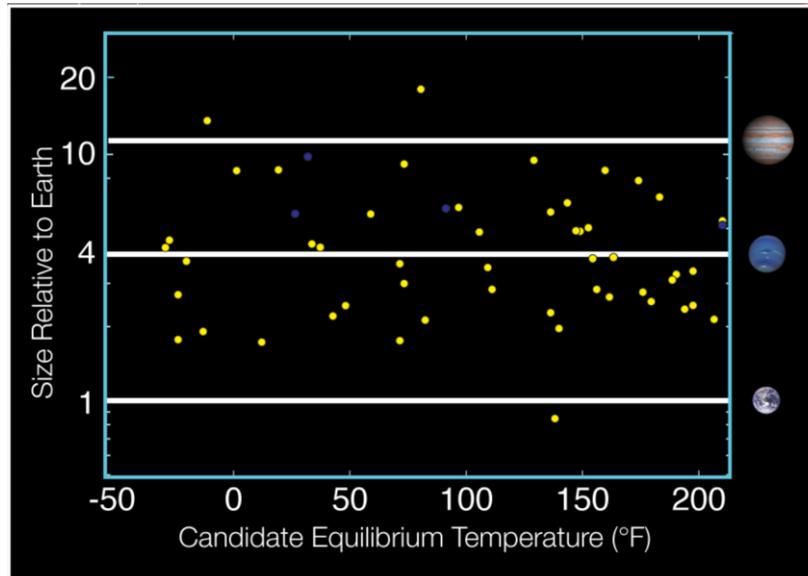
# Latest News from the Kepler Mission

## Numbers of Planet Candidates

- 68 Earth-size
- 288 super-Earth size
- 662 Neptune size
- 165 Jupiter size
- 19 super-Jupiter size

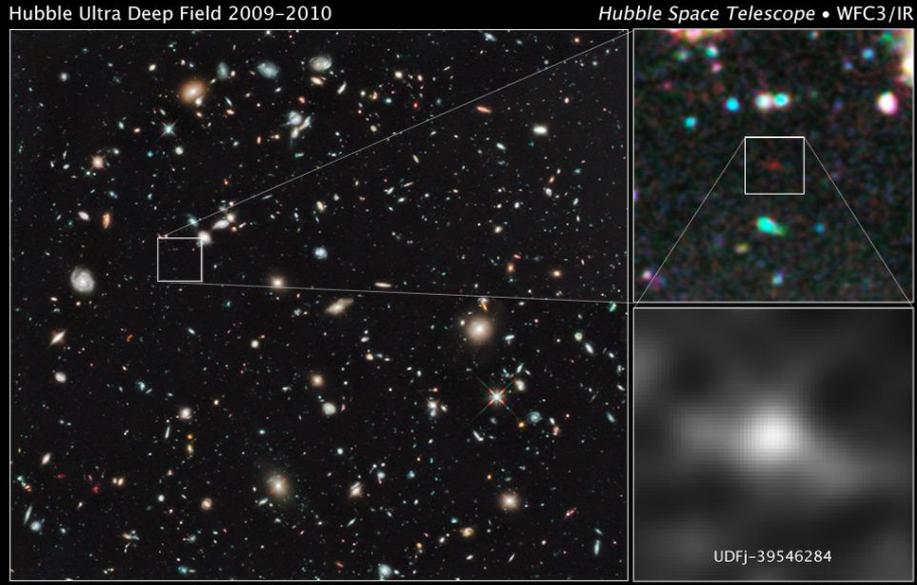


- Kepler has discovered 1,235 planetary candidates in first 4 months of science operations; 68 of Earth-size, 288 of super-Earth-size, 662 of Neptune-size, 165 of Jupiter-size, and 19 larger than Jupiter.
- 54 planetary candidates are in the habitable zone of their host stars, a region where liquid water could exist on a planet's surface; the 5 smallest of these range in size from 0.9 to twice the size of the Earth.



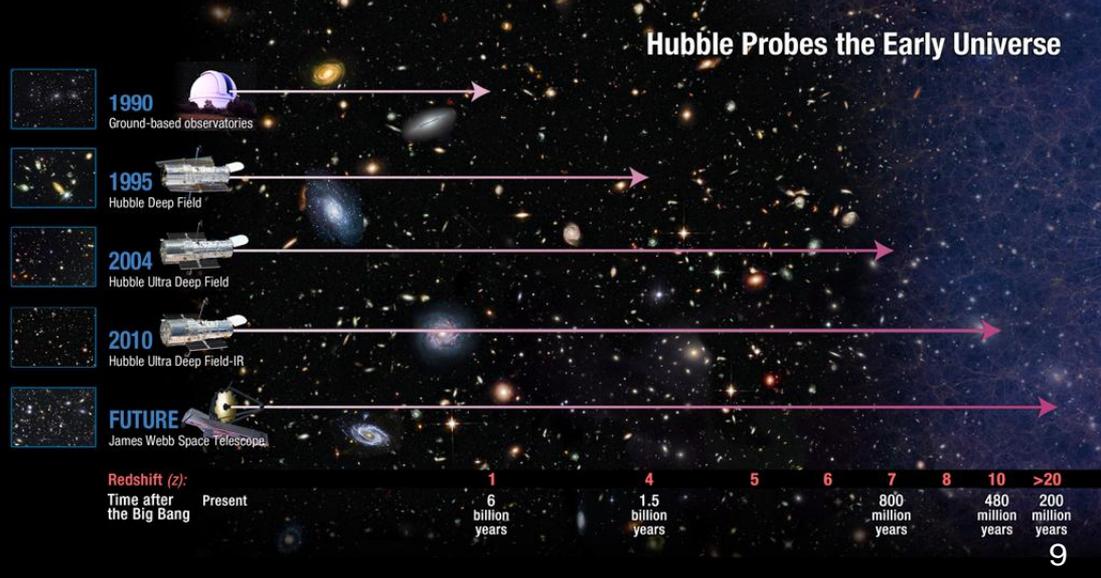
- Kepler has found six confirmed planets orbiting a sun-like star, Kepler-11, located ~2000 light years from Earth.
- This is the largest group of transiting planets orbiting a single star yet discovered outside our solar system.
- The five inner planets comprise the most closely-spaced planetary system known, with orbits smaller than Mercury's.

# Hubble Finds Most Distant Galaxy Candidate Ever Seen in Universe

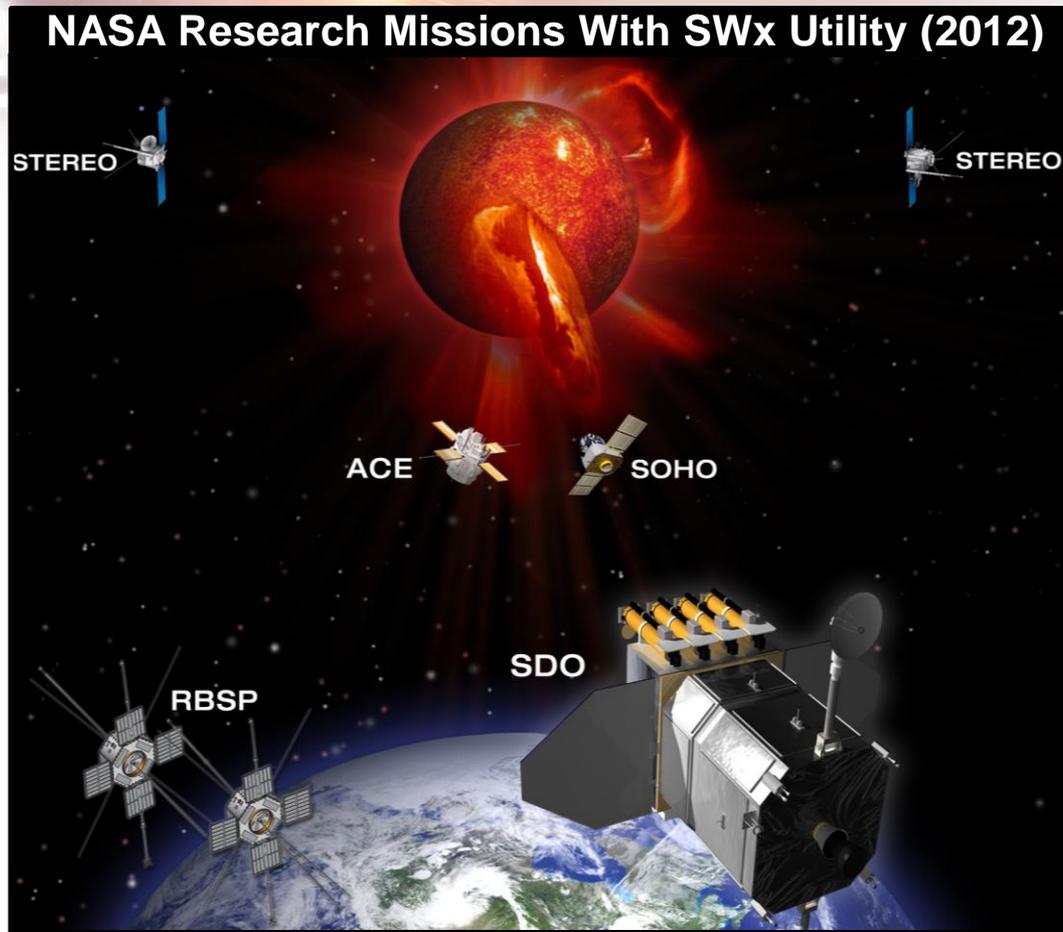


NASA, ESA, G. Illingworth (University of California, Santa Cruz),  
R. Bouwens (University of California, Santa Cruz, and Leiden University), and the HUDF09 Team  
STScI-PRC11-05

The farthest and one of the very earliest galaxies ever seen in the universe appears as a faint red blob in this ultra-deep-field exposure taken with NASA's Hubble Space Telescope. This is the deepest infrared image taken of the universe. Based on the object's color, astronomers believe it is 13.2 billion light-years away. The proto-galaxy is only visible at the farthest infrared wavelengths observable by Hubble. Observations of earlier times, when the first stars and galaxies were forming, will require Hubble's successor, the James Webb Space Telescope (JWST).

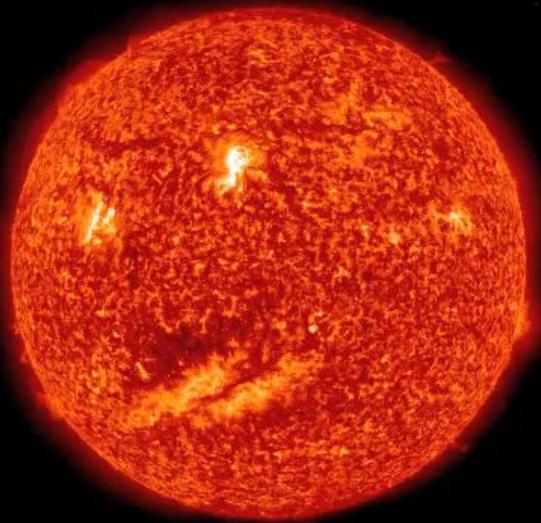


# Heliophysics: The Science of Space Weather (SWx)

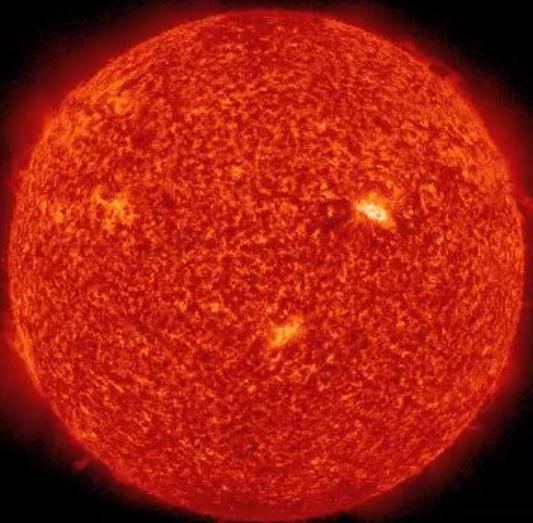


- Heliophysics research provides Theory, Data, and Modeling development at services to the national efforts in operational SWx.
- NOAA and USAF responsible for Civil and Military SWx operations.
- The five research missions most often utilized are ACE, SOHO, STEREO (ahead and behind spacecraft) and SDO. The RBSP mission will be ready for launch in 2012.

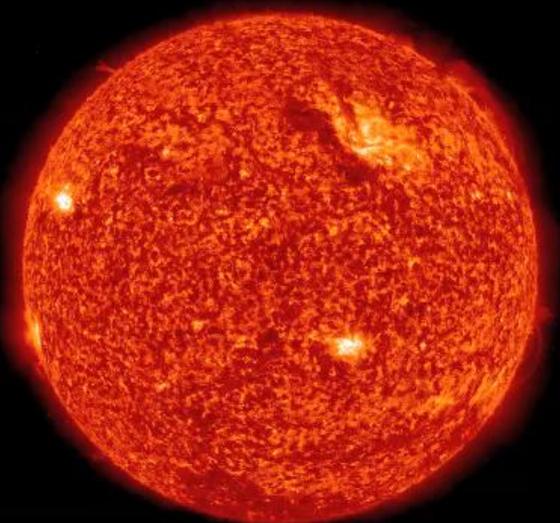
# STEREO & SDO allow for continuous observations of entire Sun



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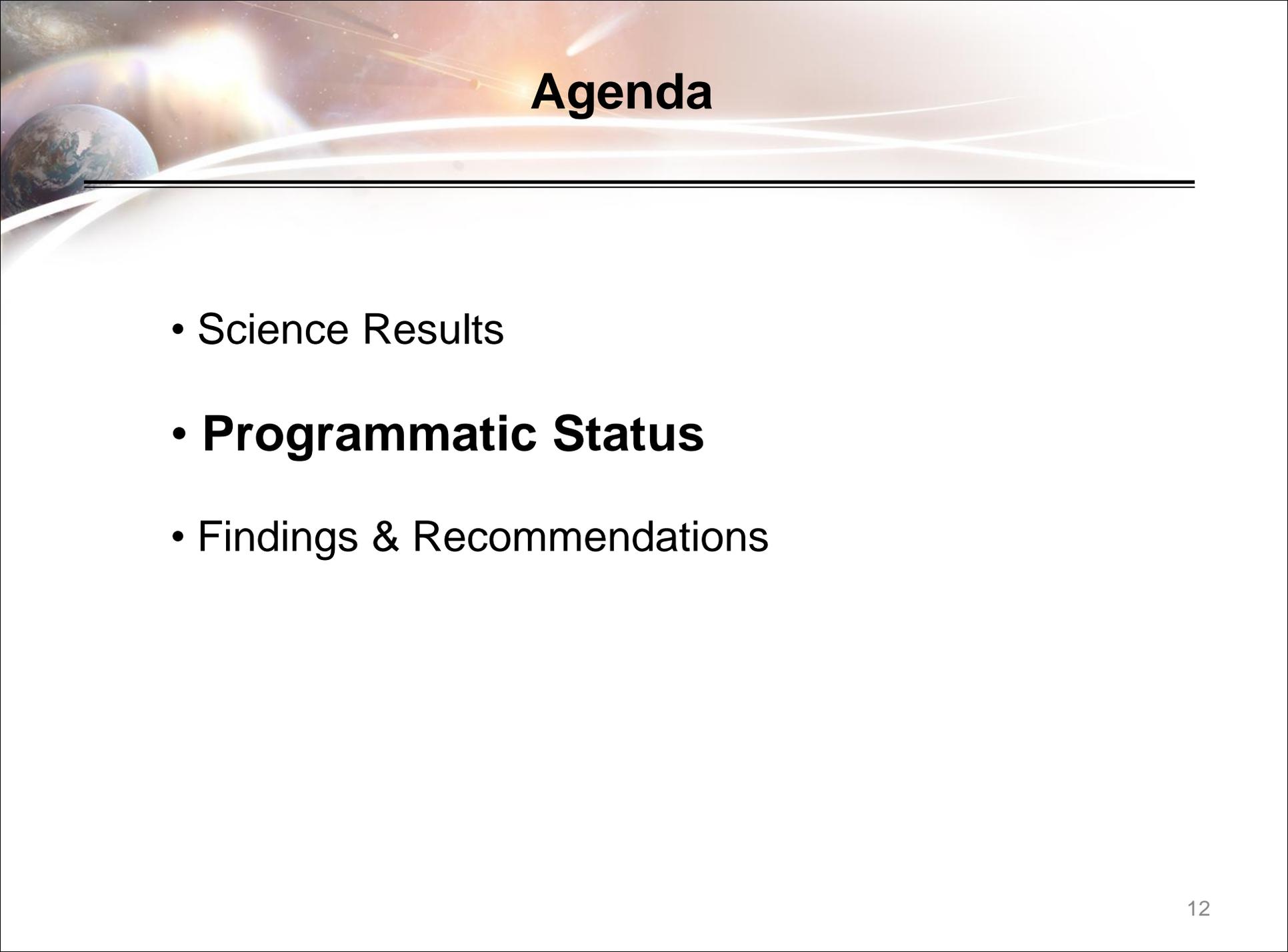


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*The combination of the STEREO-B (left), Solar Dynamics Observatory (center), and STEREO-A (right) spacecraft allow us to constantly monitor and study all sides of the Sun simultaneously for the first time.*



# Agenda

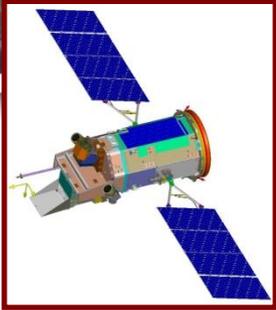
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- Science Results
- **Programmatic Status**
- Findings & Recommendations

# Some SMD-Wide Programmatic Issues

- Launch Vehicle costs are rising and guaranteed performance (payload mass to specific orbit) is being reduced under NASA Launch Services II (NLS II) contract
  - Changes for Atlas V will have greatest adverse affect on SMD portfolio
  - Impacts unevenly distributed among 4 science themes based on launch vehicle needs
  - Descoping of missions may be needed to accommodate cost increases and performance reductions
  - Impacts on mission frequency are expected; may reduce the number of mission studies as well
- Effects of Continuing Resolution (CR) which runs through March 4
  - Spending rate capped at FY10 levels; incremental funding for duration of CR
  - Can't begin New Starts, including Pu-238 restart and some instruments
- FY11 possible options:
  - A full year CR at FY10 levels would most directly impact Earth Science and Planetary Science
  - Congress considering going back to FY08 or FY06 levels
    - NASA direction: "With the possibility of reductions below current CR (FY10) levels being considered by the new Congress, care should be given to limit spending before the resolution of FY11 appropriations."
  - Anticipatory actions have been taken, including delaying final selection decisions for some R&A proposals until FY11 budget levels are resolved; proposers have been informed whether they are 'selectable' and are given periodic updates

# Missions in Formulation and Implementation – 2/2011



**GLORY**

2/23/2011

Aerosols, TSI



**AQUARIUS**

6/2011

w/CONAE; SSS

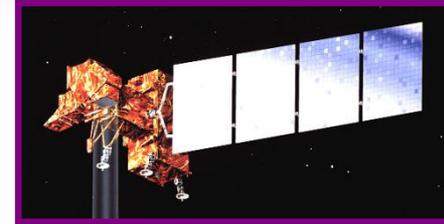


**NPP**

10/2011

w/NOAA

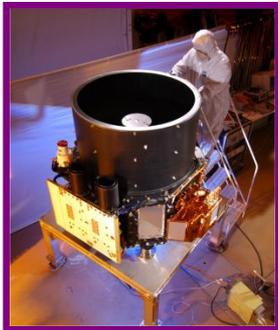
EOS cont., Op Met.



**LDCM**

12/2012

w/USGS; TIRS



**ICESat-II**

2015-2016

Ice Dynamics



**SMAP**

11/2014

w/CSA  
Soil Moist., Frz/Thaw



**GPM**

7/2013, 11/2014

w/ JAXA; Precip



**OCO-2**

2/2013

Global CO<sub>2</sub>

# Year of the Solar System

(October 2010 until August 2012)

## **2010**

- \* September 16 - LRO transfer to SMD
- \* November 4 - EPOXI encounters Comet Hartley 2
- \* November 19 - Launch of O/OREOS
- \* December 7- Venus Climate Orbiter (JAXA) arrives at Venus

## **2011**

- \* January – NEO-WISE completes mission
- February 14 - Stardust NExT encounters comet Tempel 1
- Early March - Planetary Decadal Survey
- March 18 - MESSENGER orbit insertion at Mercury
- July 13 - Dawn orbit insertion at asteroid Vesta
- August 5 - Juno launch to Jupiter
- September 8 - GRAIL launch to the Moon
- November 25 - MSL launch to Mars

## **2012**

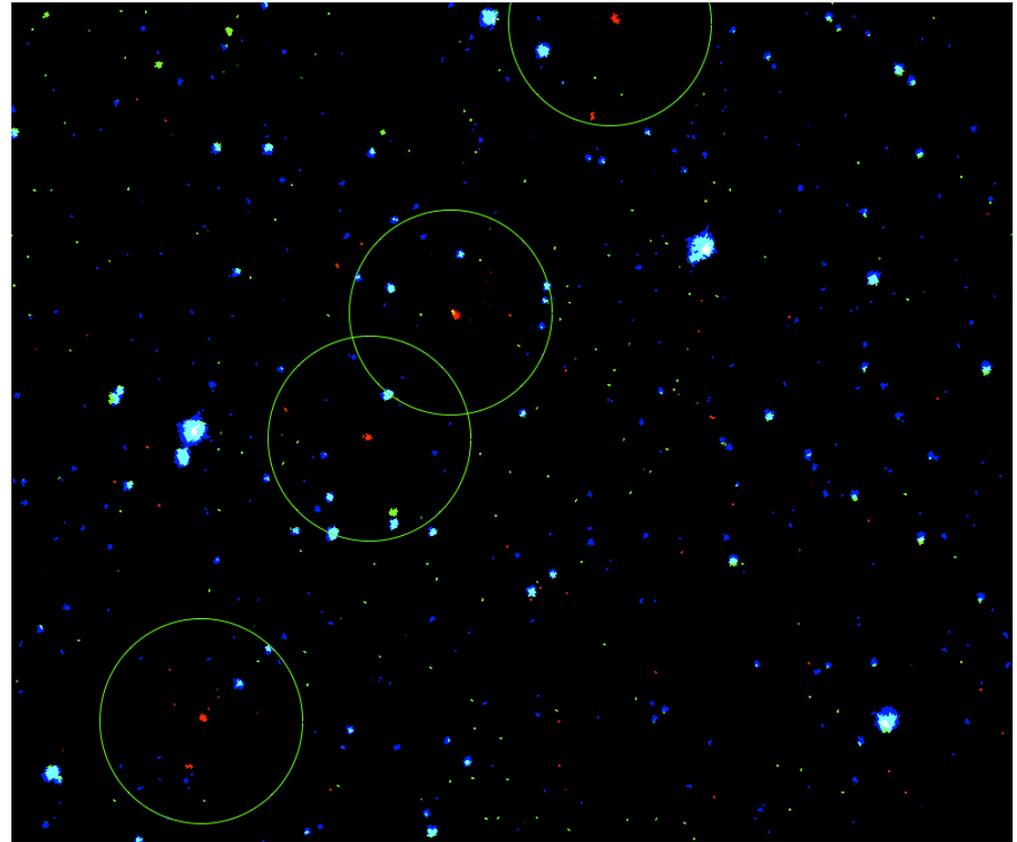
- Mid 2012 - Mars Opportunity Rover gets to Endeavour Crater
- July - Dawn leaves Vesta starts on its journey to Ceres
- August - MSL lands on Mars

\* **Completed**

# NEO-WISE Mission draws to a Close

Credited with discovering 133 Near Earth Asteroids to date

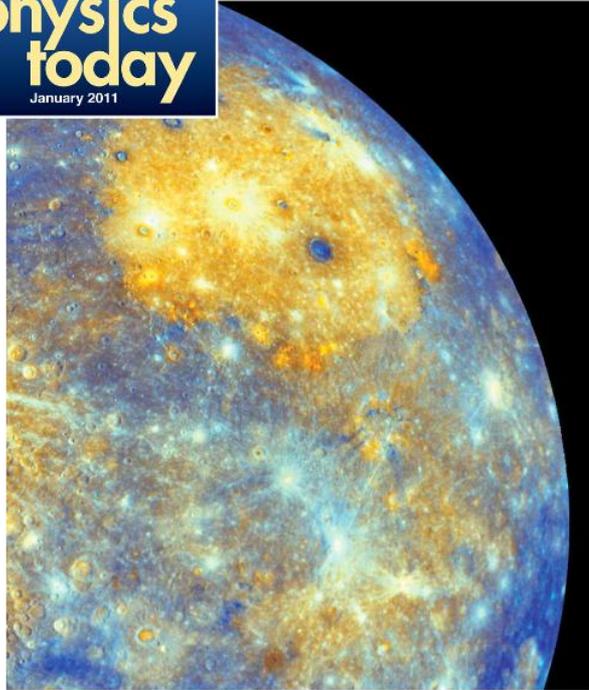
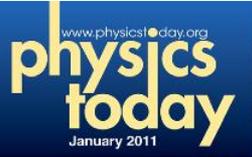
- Largest ~2.0 km
- Smallest ~40m
- 21 are Potentially Hazardous to Earth
- Also found over 33,000 main belt asteroids and 20 comets
- Near Earth Object search phase completed; WISE spacecraft decommissioning expected by end of month



*First Near Earth Object discovered by WISE was 2010 AB78,  
Which is about 600 meters in size*

# MESSENGER

## Mission to Mercury – The Last Frontier of the Terrestrial Planets



Revisiting Mercury

A portion of Mercury's surface (above) as seen by MESSENGER following the spacecraft's first flyby of the planet in January 2008. The colors are enhanced to convey information about different rock types. The Caloris basin, visible as a large, bright yellow-orange circular area, dominates the northern region. (Cover: January 2011 Physics Today)

MESSENGER (MERcury Surface, Space ENvironment, GEOchemistry, and Ranging) was launched in 2004 and has flown by Mercury three times, and is scheduled for orbit insertion on **March 17, 2011 (8:45 p.m. ET)**.

MESSENGER's science objectives are designed to answer six broad questions:

- 1) Why is Mercury so dense?
- 2) What is the geologic history of Mercury?
- 3) What is the nature of Mercury's magnetic field?
- 4) What is the structure of Mercury's core?
- 5) What are the unusual materials at Mercury's poles?
- 6) What volatiles are important at Mercury?



A commemorative U.S. Postal Service stamp (left), scheduled to go on sale May 4, 2011, highlights NASA's Planetary Science MESSENGER mission. The stamp depicts the MESSENGER spacecraft in orbit around Mercury.

# Stardust NExT encounters comet Tempel 1 on Feb 14th



Tempel 1

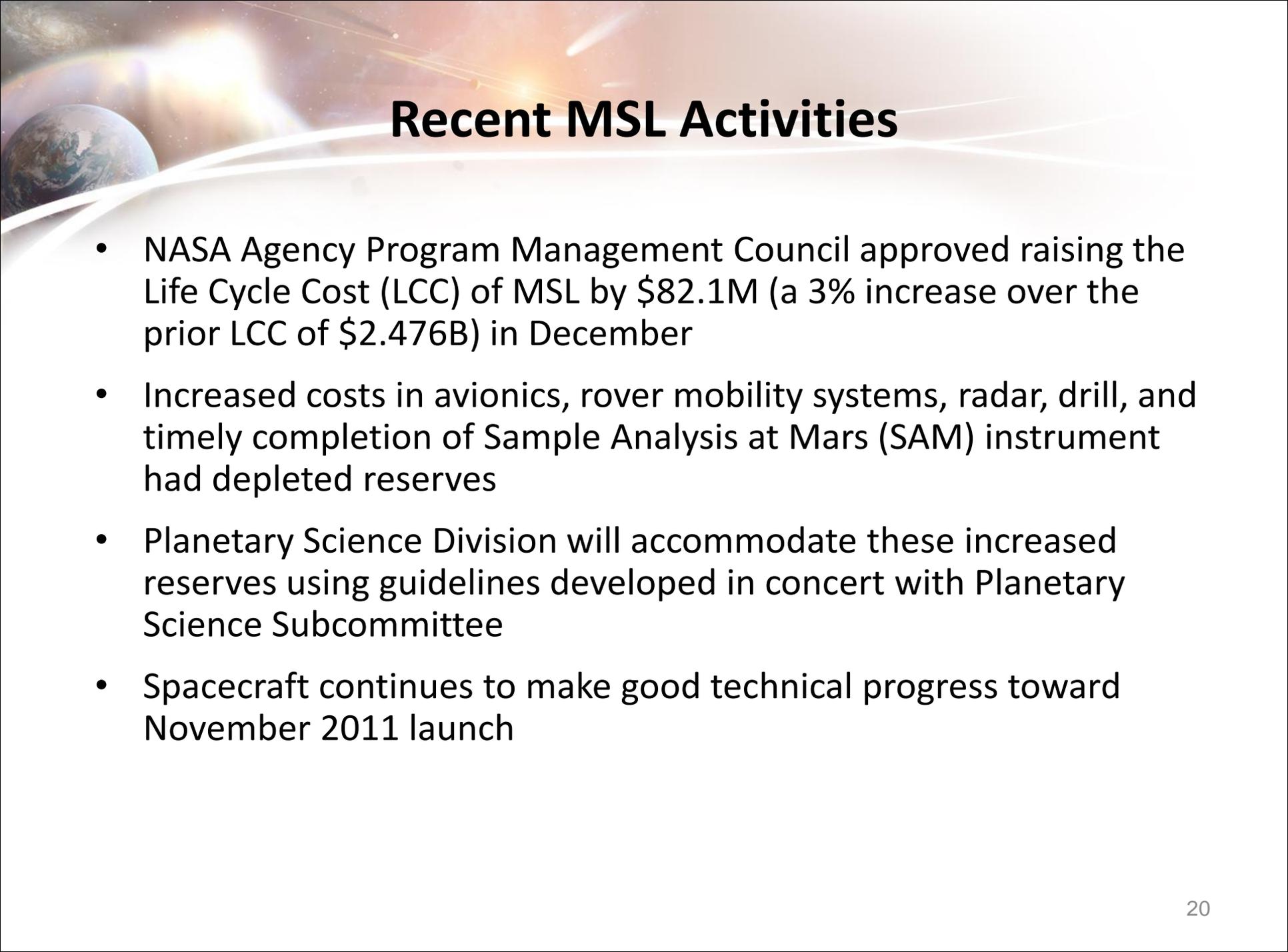
Hartley 2

*This composite image shows the approximate length of Comet Tempel 1 (7.6 km) in relation to Comet Hartley 2 (2.0 km). Stardust-NExT will encounter Tempel 1 on February 14, about 5 years after the Deep Impact encounter. Tempel 1 will be the first comet ever visited twice and will provide important data on how comets change over time*



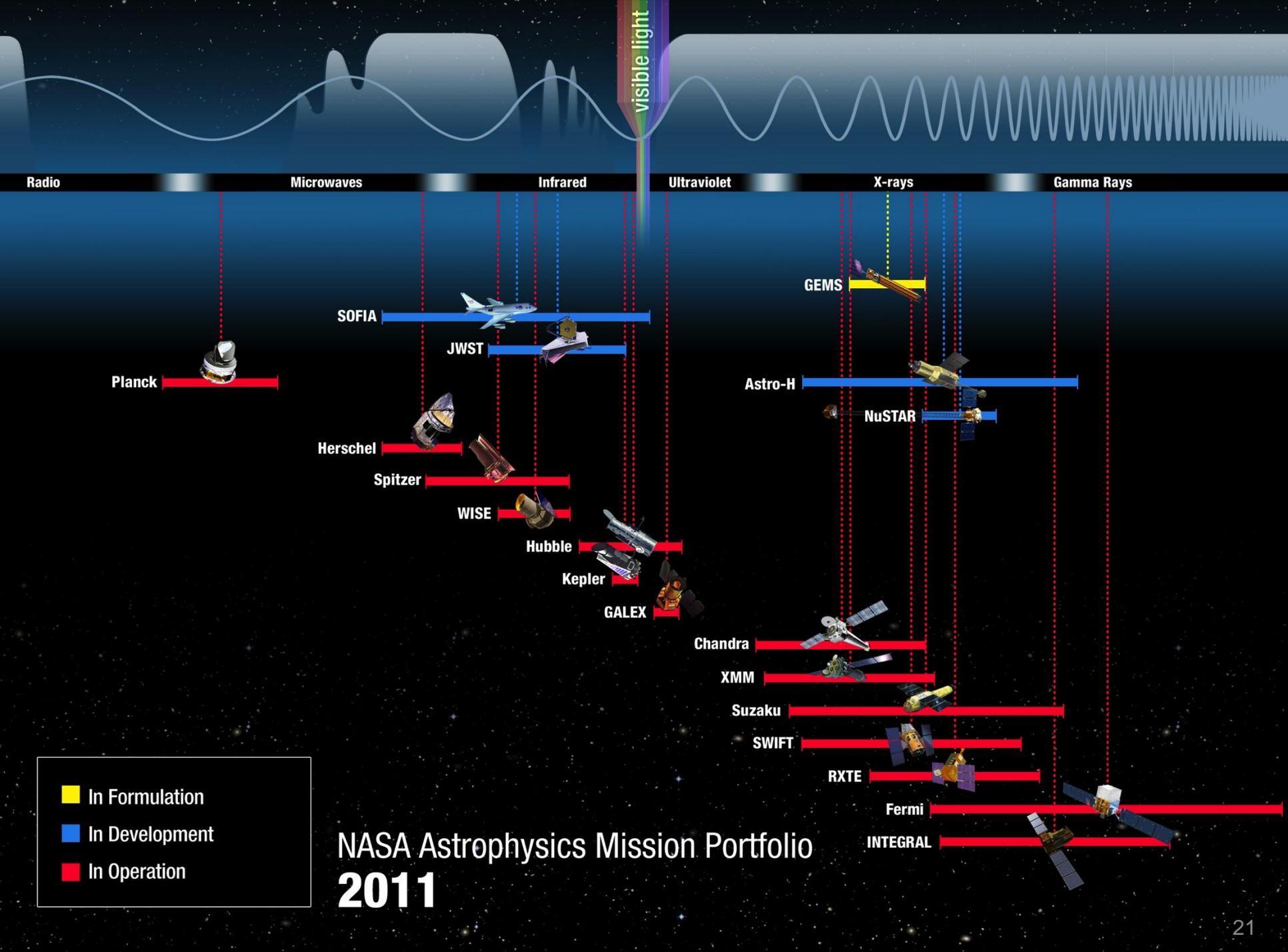
# Planetary Missions nearing Launch

- All missions are on track for a successful launch
  - Cash flow to these missions is also on track
  - Must continue to plan for the unexpected
- Juno – Launch on an Atlas V in August
  - Projected to stay within its external commitment (\$1107M)
  - Ships to KSC in April
- GRAIL – Launch on a Delta II in September
  - Projected to stay within its external commitment (\$496M)
  - Ships to KSC in May
- Mars Science Laboratory – Launch on Atlas V in November
  - Had virtually no unencumbered reserves left
  - A mission with a nuclear power system that ships to KSC in June



# Recent MSL Activities

- NASA Agency Program Management Council approved raising the Life Cycle Cost (LCC) of MSL by \$82.1M (a 3% increase over the prior LCC of \$2.476B) in December
- Increased costs in avionics, rover mobility systems, radar, drill, and timely completion of Sample Analysis at Mars (SAM) instrument had depleted reserves
- Planetary Science Division will accommodate these increased reserves using guidelines developed in concert with Planetary Science Subcommittee
- Spacecraft continues to make good technical progress toward November 2011 launch

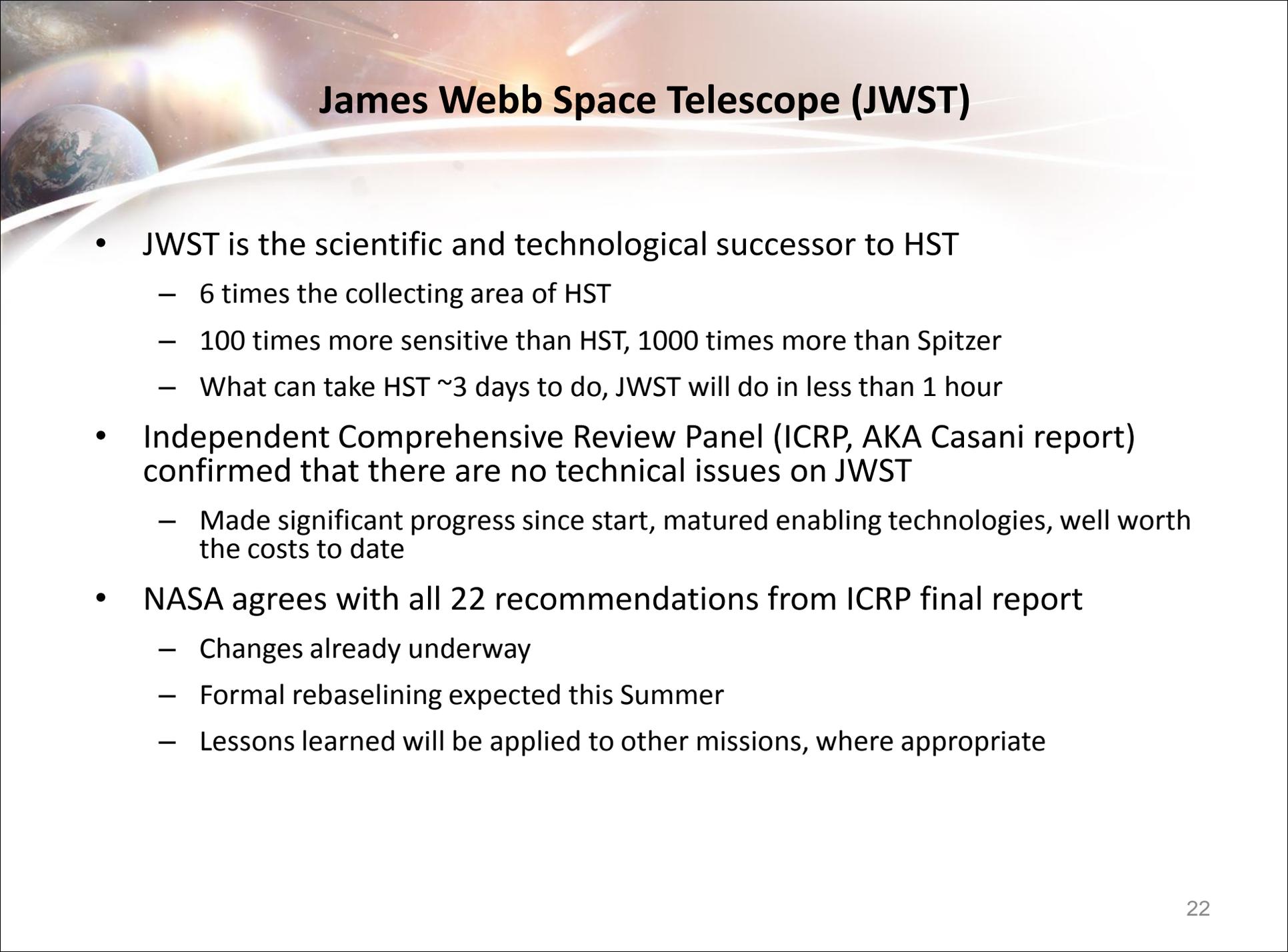


visible light

Radio      Microwaves      Infrared      Ultraviolet      X-rays      Gamma Rays

■ In Formulation  
■ In Development  
■ In Operation

# NASA Astrophysics Mission Portfolio 2011

The background of the slide features a vibrant space scene. On the left, a portion of the Earth is visible, showing blue oceans and white clouds. The rest of the background is a deep orange and red, suggesting a sunset or sunrise in space, with a bright light source on the left creating a lens flare effect. Several white, curved lines sweep across the scene, adding a sense of motion and depth.

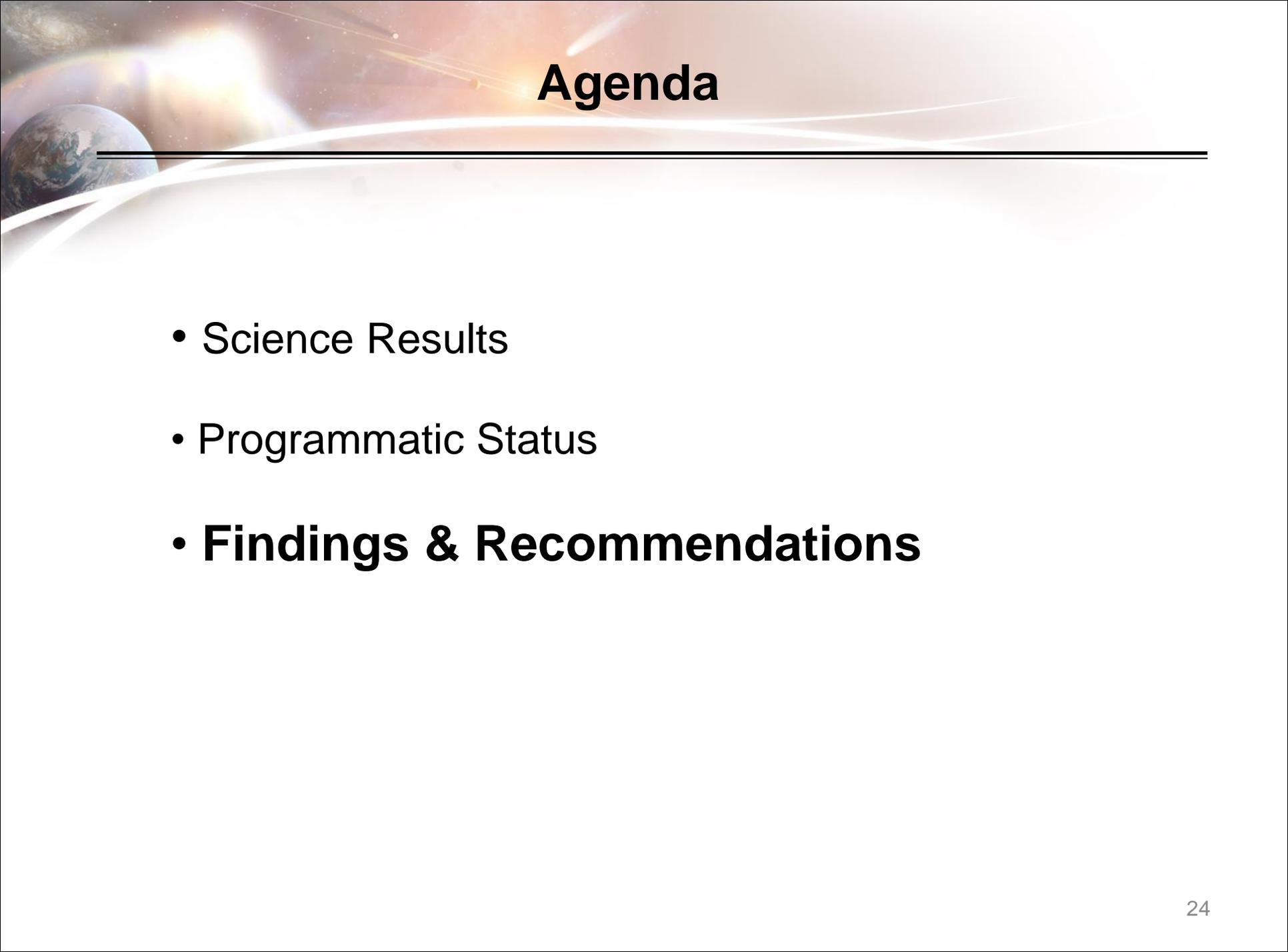
# James Webb Space Telescope (JWST)

- JWST is the scientific and technological successor to HST
  - 6 times the collecting area of HST
  - 100 times more sensitive than HST, 1000 times more than Spitzer
  - What can take HST ~3 days to do, JWST will do in less than 1 hour
- Independent Comprehensive Review Panel (ICRP, AKA Casani report) confirmed that there are no technical issues on JWST
  - Made significant progress since start, matured enabling technologies, well worth the costs to date
- NASA agrees with all 22 recommendations from ICRP final report
  - Changes already underway
  - Formal rebaselining expected this Summer
  - Lessons learned will be applied to other missions, where appropriate



# JWST Management Changes made at GSFC and Headquarters

- At GSFC:
  - New Project Manager (Bill Ochs) and Business Manager (Rich Ryan) in place
  - Resource analyst dedicated to the Integrated Science Instrument Module (ISIM) has been added to the team
  - JWST Project reports to Center Director
- At Headquarters:
  - JWST Program reports directly to the SMD AA (Ed Weiler) and NASA AA (Chris Scolese)
  - JWST Program Office created and staffing in process
    - Program Director (Rick Howard) in place in SMD
    - Program Manager selected
    - Program Deputy Director selected
- Initiated quarterly senior-level meetings among Headquarters, GSFC, and JWST contractors



# Agenda

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