National Aeronautics and Space Administration

SCIENCE MISSION DIRECTORATE

23rd Annual CQSDI

Gregory L. Robinson, Deputy Associate Administrator for Programs
March 2016

www.nasa.gov
Achieving Alignment for Pioneering Space

Commercial & International Partners • Other Government Agencies • Citizen Innovators
Science Objectives

• Understand the Sun and its interactions with Earth and the solar system, including space weather

• Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere

• Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars

• Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet
Science @ NASA executes:

- 100 missions
- 12 Balloon launches (FY 2015)
- 20 Sounding rockets (FY 2015)
- 4,200 Airborne hours (FY 2015)
- Over 10,000 U.S. scientists funded by 3,000 competitively selected research awards
- Partnerships with a dozen Federal agency and 60 other nations
Astrophysics Division/
James Webb Space Telescope
2015

ST-7/DRS Launched (LISA Pathfinder)

25th Anniversary of Hubble

EXOPLANETS 20/20

Super Pressure Balloon Capability Demonstrated

SOFIA Program Office Transition to Ames

JWST Mirror Installation Begun; Instrument Cryovac Testing Underway
NASA's Kepler Mission Discovers Bigger, Older Cousin of Earth
Astrophysics Division/
James Webb Space Telescope
2016

Senior Review
Hubble, Chandra, Fermi, Kepler/K2, NuSTAR, Spitzer, Swift, XMM

MIDEX AO Release and SMEX Down-select

JWST Observatory Assembly
Complete the three main components: instruments, telescope, and spacecraft
Planetary Science
Planetary Science Division
2015

MAVEN confirms fate of Mars atmosphere

Mars has flowing water!

Dawn arrives at Ceres

New Horizons flyby of Pluto
Dawn Survey of Ceres
Earth Science
Earth Science Instruments on ISS:
RapidScat, CATS, LIS, SAGE III (on ISS), TSIS-1, ECOSTRESS, GEDI, OCO-3, CLARREO-PF, TSIS-2
SAGE III (2016)
CLARREO PF (2019)

Earth Science Instruments

TSIS-1 (2017)
TSIS-2 (2020/22)

LIS (2016)

ELC-3

ELC-4

Columbus EF

ISERV (2012-2015)

RapidSCAT (2014-)

ISERV (2012-2015)

ECOSTRESS (2019)

External Logistics Carriers – ELC-1, ELC-2, ELC-3
External Stowage Platforms – ESP-3
Alpha Magnetic Spectrometer
Columbus External Payload Facility
Kibo External Payload Facility
Earth Science Division 2015

SMAP Soil Moisture + Sea-Surface Salinity, and GPM Precipitation

ICESat-2 ATLAS: 2 Lasers Integrated and Operating

NASA Products and Analyses Aided Nepal Earthquake Response

6 EVS-2 Projects Selected and Started

Joint ESD/NASA Launch Services Investment in Small Launch Vehicles
DSCOVR - EPIC

• Release of Epic Images

• First publically released picture of Earth from the first Lagrange point.

• The image showed the western hemisphere centered in the image with clouds covering the Mississippi Valley and the North East, brilliant blue waters around the Bahamas and the snow pack covering Greenland.

• Lunar transit images were released shortly thereafter.

• The images and related news stories were carried on social media and press articles around the world.
Heliophysics
SOHO Discovers its 3000th Comet

Voyager’s Magnetic Field Slowly Turning

MMS Launches & Delivers Promising Initial Results

NASA’s BARREL Team Return from Sweden

NASA-Funded Study Finds Two Solar Wind Jets in the Heliosphere

IBEX Sheds New Light on Solar System Boundary

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Heliophysics Division 2015
Solar Dynamics Observatory

- Mid-level CME captured by SDO on June 20, 2015
- M6.6-Class Flare
- CME arrived at Earth at 1:59 PM EDT on June 22, 2015
- NOAA Space Weather Prediction Center (SWPC) issued a G4 (Severe) Alert
- Aurora captured west of Philadelphia
Voyager 1's magnetic field slowly turning: Right after the crossing of the Heliopause, Voyager 1 saw unexpected magnetic field that was not aligned with the interstellar magnetic field direction as deduced from IBEX, SOHO and Ulysses. It now turns out that it was deflected and that it's slowly turning back with increasing distance - right into the expected direction by 2025.

2017: Launch of ICON and GOLD to study charged particles in Earth’s atmosphere.

August 2017: Total solar eclipse visible throughout North America.

2018: Launch of Solar Orbiter and Solar Probe Plus, which will fly right into the sun’s atmosphere.
Joint Agency Satellite Division
Jason-3 Launched on January 17, 2016
The Falcon 9 rocket successfully launches the Jason-3 spacecraft into orbit.

GOES-R – October 2016
GOES-R is the next generation of geostationary weather satellites.
## Cost and Schedule Performance

<table>
<thead>
<tr>
<th>Original Baseline</th>
<th>Revised Baseline</th>
<th>Q1 FY16 Actual/Current</th>
<th>Change From Latest Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estab. LRD Dev $</td>
<td>Estab. LRD Dev $</td>
<td>LRD Dev $</td>
<td>LRD Dev Cost</td>
</tr>
<tr>
<td>Juno</td>
<td>Aug-08 Aug-11 742</td>
<td>8/5/11 709</td>
<td>-- -4%</td>
</tr>
<tr>
<td>GRAIL</td>
<td>Jan-09 Sep-11 427</td>
<td>9/10/11 398</td>
<td>-- -7%</td>
</tr>
<tr>
<td>Suomi NPP</td>
<td>Feb-06 Apr-08 593</td>
<td>10/25/11 765</td>
<td>- 4 mos -6%</td>
</tr>
<tr>
<td>Curiosity</td>
<td>Aug-06 Sep-09 1069</td>
<td>11/26/11 1769</td>
<td>-- 3%</td>
</tr>
<tr>
<td>NuSTAR</td>
<td>Aug-09 Jan-12 110</td>
<td>6/13/12 116</td>
<td>+ 5 mos 5%</td>
</tr>
<tr>
<td>Van Allen</td>
<td>Dec-09 May-12 534</td>
<td>8/30/12 504</td>
<td>+ 3 mos -6%</td>
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<tr>
<td>Landsat 8</td>
<td>Dec-09 Jun-13 583</td>
<td>2/11/13 503</td>
<td>- 4 mos -14%</td>
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<tr>
<td>IRIS</td>
<td>Oct-10 Jun-13 141</td>
<td>6/27/13 143</td>
<td>-- 1%</td>
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<tr>
<td>LADEE</td>
<td>Aug-10 Nov-13 168</td>
<td>9/6/13 191</td>
<td>- 2 mos 14%</td>
</tr>
<tr>
<td>MAVEN</td>
<td>Oct-10 Nov-13 567</td>
<td>11/18/13 472</td>
<td>-- -17%</td>
</tr>
<tr>
<td>GPM</td>
<td>Dec-09 Jul-13 555</td>
<td>Oct-11 Jun-14 519</td>
<td>- 4 mos -7%</td>
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<tr>
<td>OCO-2</td>
<td>Sep-10 Feb-13 249</td>
<td>Jan-13 Feb-15 372</td>
<td>- 7 mos -14%</td>
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<tr>
<td>SMAP</td>
<td>Jun-12 Mar-15 486</td>
<td>1/31/15 454</td>
<td>- 2 mos -6%</td>
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<tr>
<td>MMS</td>
<td>Jun-09 Mar-15 857</td>
<td>4/1/15 875</td>
<td>-- 2%</td>
</tr>
<tr>
<td>Astro-H</td>
<td>Nov-13 Mar-16 81</td>
<td>Mar-16 78</td>
<td>-- -4%</td>
</tr>
<tr>
<td>InSight</td>
<td>Dec-13 Mar-16 542</td>
<td>Mar-16 542</td>
<td>-- 0%</td>
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<tr>
<td>SAGE-III</td>
<td>Jul-13 Mar-16 81</td>
<td>Jun-16 92</td>
<td>+ 3 mos 13.3%</td>
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<tr>
<td>OSIRIS-REx</td>
<td>May-13 Oct-16 779</td>
<td>Oct-16 700</td>
<td>-- -10%</td>
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<tr>
<td>CYGNSS</td>
<td>Feb-14 May-17 151</td>
<td>May-17 147</td>
<td>-- -3%</td>
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<tr>
<td>ICON</td>
<td>Oct-14 Oct-17 196</td>
<td>Oct-17 196</td>
<td>-- 0%</td>
</tr>
<tr>
<td>GRACE-FO</td>
<td>Feb-14 Feb-18 264</td>
<td>Feb-18 263</td>
<td>-- 0%</td>
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<tr>
<td>ICESat-2</td>
<td>Dec-12 May-17 559</td>
<td>May-14 Jun-18 764</td>
<td>-- 0%</td>
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<tr>
<td>TESS</td>
<td>Oct-14 Jun-18 323</td>
<td>Jun-18 296</td>
<td>-- -8%</td>
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<tr>
<td>SPP</td>
<td>Mar-14 Aug-18 1056</td>
<td>Aug-18 1050</td>
<td>-- -1%</td>
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<tr>
<td>SOC</td>
<td>Mar-13 Oct-18 377</td>
<td>Oct-18 320</td>
<td>-- -15%</td>
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<tr>
<td>JWST</td>
<td>Aug-09 Jun-14 2581</td>
<td>Oct-18 6198</td>
<td>-- 0%</td>
</tr>
<tr>
<td>Euclid</td>
<td>Sep-13 Mar-20 77</td>
<td>Jun-20 92</td>
<td>+ 3 mos 20%</td>
</tr>
<tr>
<td>TEMPO</td>
<td>Apr-15 Dec-21 161</td>
<td>Dec-21 161</td>
<td>-- 0%</td>
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</tbody>
</table>
Mission Success

• Producible Designs
• Manufacturing problems and Rework
• Test Failures
• Mistakes (bad procedures, not following procedure)
• Acquisition Strategy (types of subcontracts and management)
• Supply Chain (EEE Parts)
Advancing Industries
More Science Opportunities

• Commercial Satellite market
• Commercial Launch Vehicle market
• Emerging Small Launch Vehicles
• Smaller Satellites
• CubeSats
• Numerous International Partnerships
• Principal Investigator teams (NASA, OGAs, Industry, Academia)