NASA Heliophysics Update

Peg Luce
Acting Division Director
Heliophysics Division
Science Mission Directorate

November 29, 2017
Steve Clarke on detail to OSTP since July 2017
Peg Luce is Acting Director of Heliophysics

Heliophysics Division Director – IPA/Detailee Position, selection in process

New faces: Janet Kozyra (recently joined NASA as IPA after NSF IPA assignment from U of Michigan)
Jared Leisner (joined from NASA Planetary Science Division)
Terry Onsager on detail from NOAA/SWPC started, November 2017
Roshanak Hakimzadeh on detail from GRC started, November 2017
Jim Spann on detail from MSFC, started November 2017

Coming soon on detail:
Bill Atkinson from KSC starting January 2018

New Assignments:
Elsayed Talaat – Chief Scientist
Lika Guhathakurta on detail to Ames since May 2017
Jeff Morrill - LWS Program Scientist
Janet Kozyra - LWS Science Lead
### Alignment with Decadal Survey

The NASA FY17 Appropriation and the FY18 President’s Budget Request support the following:

<table>
<thead>
<tr>
<th>0.0 Complete the current program</th>
<th>Extended operations of current operating missions as recommended by the 2015 Senior Review; 5 missions currently in development (SET, ICON, GOLD, SOC and Parker)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Implement DRIVE (Diversify, Realize, Integrate, Venture, Educate)</td>
<td>Implemented DRIVE initiative wedge in FY15; fully funded in FY17 and onwards</td>
</tr>
<tr>
<td>2.0 Accelerate and expand Heliophysics Explorer program</td>
<td>Decadal recommendation of every 2-3 years; Explorer mission AO released in 2016; plan to release next Explorer AO in 2018. Notional mission cadence will continue to follow Decadal recommendation going forward.</td>
</tr>
<tr>
<td>3.0 Restructure STP as a moderate scale, PI-led flight program</td>
<td>STP-5 (IMAP) mission AO released with IMAP as a PI-led mission with a LRD ~2024</td>
</tr>
<tr>
<td>4.0 Implement a large LWS GDC-like mission</td>
<td>Start of mission formulation targeted for NET2019; RFI call for innovative ideas is out; inputs will feed into GDC STDT that will start in 2017.</td>
</tr>
</tbody>
</table>
Parker Solar Orbiter (ESA)

Parker Solar Probe

Stereo (2)

SOHO (ESA)

ACE

SDO

RHESSI

Hinode (JAXA)

IRIS

TIMED

AIM

IBEX

WIND

TWINS (2)

Geotail (JAXA)

THEMIS (3)

ARTEMIS (2)

Van Allen Probes (2)

SET

GOLD

MMS (4)

ICON

2018

Parker Solar Probe

July 2018

Solar Orbiter (ESA)

Solar Orbiter

Feb 2019

GOLD

Apr 2018

SOHO (ESA)

SET

Apr 2018

SET-1
The ICON launch, previously scheduled for 12/8/17, has been postponed. NASA and Orbital ATK are addressing an issue with the rocket’s spacecraft separation system. The satellite is in pristine condition, and will be stored and maintained at an Orbital ATK facility in Gilbert, AZ, until it is shipped for launch.

The GOLD Instrument is integrated with the SES-14 spacecraft and proceeding through environmental testing at the Airbus facility in Toulouse, France.

All instruments, including the Solar Probe Cup, are integrated with the observatory, which is proceeding through environmental testing. Outgassing of C103 Niobium at high temperature remains under investigation. In September, 3 of 6 separation nuts failed to separate during a test of the 3rd stage to spacecraft interface. An anomaly investigation team, including OSC, ULA, and LSP, recommended corrective actions and subsequent tests, including spacecraft shock/separation tests, have been successful. Qualification of the system is still required.

All Solar Orbiter instruments have been delivered to Airbus facility in Stevenage, UK. Overall observatory schedule continues to slip.

The Heliophysics Senior Review Subcommittee (now a subordinate group of a FACAG-chartered Committee) met in October and will report to the Heliophysics Advisory Committee this week.
Mission Highlights

ICON Observatory Prior to Close-Out for Shipment to VAFB

Parker Solar Probe Installation of the Flight Thermal Protection System at APL, Sep 21
Upcoming Mission Updates

• SMEX 16 AO:
  – Five missions selected for Phase A competition
  – Three Missions of Opportunity (MO) selected for further competition
  – One Cat 3 MO selected for technology development

• IMAP proposals are in review

• GDC RFI responses due November 30

• GDC STDT on track for formation in 2017

• Mission study teams for DYNAMIC and MEDICI (STP-6, STP-7) will be sequenced after GDC STDT
• Five SMEX missions in Phase A competition, LRD ~2022
  – MEME-X, FOXSI, MUSE, TRACERS, PUNCH
Three MOs selected to proceed:
- Two MOs (SunRISE, AWE) in Phase A competition, LRD varies
- One partner MoO: THOR-US, contingent on selection of ESA M5 mission

Tech development funding for Cat-3 MO: COSIE

Several selections use multiple CubeSats/SmallSats
- Technology development that can be leveraged for future Decadal Survey missions
Interagency, Intra-agency and International efforts

• NASA–NSF (NASA-NSF MOU)
  – Co-funding CCMC facility
  – Co-funding Living With a Star Strategic Capabilities
  – New opportunity focused on “Computational Aspects of Space Weather”
  – Coordinating ICON & GOLD opportunities (NASA mission GI, NSF CEDAR, joint opp.)

• NASA-NOAA (NASA-NOAA MOU)
  – Collaboration between CCMC and NOAA/SWPC on space weather modeling capability

• NASA-NSF-NOAA
  – Pilot O2R research activity

• Heliophysics-Planetary
  – Co-funding selected Living With a Star grants
  – Joint Juno Participating Scientist Program

• Heliophysics-Astrophysics
  – Joint “Impact of Stellar Properties on the Habitability of Exoplanets” research opportunity

• NASA-ESA
  – Solar Orbiter
  – THOR-US contingent on selection of ESA M5 mission

• NASA-KASI
  – Development towards prototype coronagraph for balloon flight in 2019; agreement signed October 2017
<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>STEP 1 PROPOSALS (Due Date)</th>
<th>STEP 2 PROPOSALS (Due Date)</th>
<th>AWARDS (Expected)</th>
<th>YEAR 1 ($M)</th>
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</thead>
<tbody>
<tr>
<td>B.2 H-SR</td>
<td>194</td>
<td>177</td>
<td>(25-30)</td>
<td>($6.0M)</td>
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<tr>
<td>B.3 H-TIDeS</td>
<td>101</td>
<td>88</td>
<td>(12)</td>
<td>($4.0M-$6.0M)</td>
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<tr>
<td>B.4 H-GI Open</td>
<td>193</td>
<td>175</td>
<td>(25-30)</td>
<td>($4.7M)</td>
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<tr>
<td>B.5 H-GCR TMS</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>B.6 H-LWS</td>
<td>(12/5)</td>
<td>(2/6/2018)</td>
<td>(15-20)</td>
<td>($3.75M)</td>
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<tr>
<td>B.7 H-DEE</td>
<td>15</td>
<td>9</td>
<td>(&lt;=9)</td>
<td>($0.5M)</td>
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<tr>
<td>B.8 H-GI MMS</td>
<td>54</td>
<td>(1/11/18)</td>
<td>(8-10)</td>
<td>($1.3M)</td>
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<td>B.9 H-GCR SC</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
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<tr>
<td></td>
<td>FY16</td>
<td>FY17</td>
<td>FY18</td>
<td>FY19</td>
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<td>Sounding Rocket Program Office</td>
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<tr>
<td>FY15 PBR</td>
<td>48.3</td>
<td>53.0</td>
<td>53.0</td>
<td>53.0</td>
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<tr>
<td>FY18 PBR</td>
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<td>53.3</td>
<td>59.0</td>
<td>61.1</td>
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<td>Guest Investigator</td>
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<tr>
<td>FY15 PBR</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
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<tr>
<td>FY18 PBR</td>
<td>10.5</td>
<td>11.6</td>
<td>15.2</td>
<td>20.0</td>
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<td>Research &amp; Analysis (HSR, H-TIDeS, H-GCR)</td>
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<tr>
<td>FY15 PBR</td>
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<td><strong>33.9</strong></td>
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<tr>
<td>FY18 PBR</td>
<td>36.3</td>
<td>39.4</td>
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<td>LWS Science</td>
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<tr>
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<tr>
<td>FY18 PBR</td>
<td>18.4</td>
<td><strong>21.9</strong></td>
<td>29.0</td>
<td>35.5</td>
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**DRIVE implemented in FY18 President’s Budget**
On May 31, the Solar Probe Plus was renamed the Parker Solar Probe in honor of the discovery of the solar wind by Eugene Parker. During the ceremony he received the NASA Distinguished Public Service Award.
40th Anniversary of Voyager
Smithsonian Air & Space Museum, Sept 5

Voyager launched into a severe but poorly characterized energetic particle environment, just 20 years into the space age. Its longevity is a testament to the designers and engineers who developed Voyager.

William Shatner sent message to Voyager

We offer friendship across the stars. You are not alone. #MessageToVoyager
On October 14, 2014, the NASA/ESA SOHO spacecraft observed a powerful coronal mass ejection (CME) associated with an M1.1 solar flare and tracked it through space.

An international team of scientists from Europe and the United States, including two NASA centers, used data from 10 NASA and ESA spacecraft to track the CME from the Sun out to the edge of the heliosphere.

<table>
<thead>
<tr>
<th>Date</th>
<th>Detected By</th>
<th>Location in Space</th>
<th>Distance from the Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 16, 2014</td>
<td>Venus Express (indirect data)</td>
<td>Venus</td>
<td>0.72 AU</td>
</tr>
<tr>
<td>Oct. 16, 2014</td>
<td>STEREO-A</td>
<td>The Far Side of the Sun</td>
<td>0.96 AU</td>
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<tr>
<td>Oct. 17, 2014</td>
<td>Curiosity</td>
<td>Mars</td>
<td>1.41 AU</td>
</tr>
<tr>
<td></td>
<td>MAVEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mars Express</td>
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<tr>
<td></td>
<td>Mars Odyssey</td>
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<tr>
<td>Nov. 12, 2014</td>
<td>Cassini</td>
<td>Saturn</td>
<td>9.94 AU</td>
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<tr>
<td>Jan. 18 – Feb. 14, 2015</td>
<td>New Horizons (possible detection)</td>
<td>En Route to Pluto</td>
<td>31.49 AU</td>
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<tr>
<td>Late March 2016</td>
<td>Voyager 2 (possible detection)</td>
<td>The Heliosheath</td>
<td>111.06 AU</td>
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</tbody>
</table>

CCMC models were used to simulate the CME passage throughout the solar system and to help identify the October 2014 event as it traveled past NASA and ESA spacecraft.
Moon’s shadow moving across North America as seen by EPIC on DISCOVR.

Credit: NASA EPIC Team

Credits: Innermost image: NASA/SDO.
Ground-based eclipse image: Jay Pasachoff, Ron Dantowitz, Christian Lockwood and the Williams College Eclipse Expedition/NSF/National Geographic
Outer image: ESA/NASA/SOHO
Solar Eclipse Research: Temperature and Flow Speed in the Solar Corona

Principal Investigator: Nat Gopalswamy

Polarization Camera Images in 3850 Å
THANK YOU