Heliophysics Division
Heliophysics Advisory Committee (HPAC), Summer Meeting

Dr. Nicky Fox, Director, Heliophysics
June 30, 2020
Coronavirus (COVID-19) Response – Agency

- Agency leadership continues to monitor developments regarding coronavirus (COVID-19) around the nation, closely following the advice of health professionals and the White House Coronavirus Task Force to keep our workforce safe.
- Effective March 17, all centers and facilities elevated to Stage 3 of NASA's Response Framework. All employees and contractors moved to mandatory telework until further notice. Mission-essential personnel will continue to be granted access onsite.
- Some Centers have been elevated to Stage 4 of NASA's Response Framework:

See the NASA Response Framework to learn more about the stages of the agency's coronavirus response.
Coronavirus (COVID-19) Response – Science Mission Directorate (SMD)

• There will be impacts, and we don’t yet know the extent. We’re working with each mission and project in detail based on where they are in development process
• **Priority is everyone’s safety and protecting hardware and integrity of data for operating missions**
• Conducted status assessment of all 47 flight projects in the SMD Portfolio
• Most missions are in development phases early enough (phases A-B-early C) that bulk of the work can be done virtually
• Missions in integration and testing (I&T) will continue to the extent possible with small teams
• Will work with our domestic and international partners to refine the prioritization of our projects, especially those in I&T
• Have consulted with the NASA Chief Medical Officer and have protocols for working in clean rooms
Coronavirus (COVID-19) Response – ROSES 2020

• We know that progress on funded research may slow, and in some cases, even stop due to necessary telework and lack of access to facilities and labs, and other family obligations
• SMD understands this potential outcome and will work with the research community and its institutions to mitigate any impacts and to make plans, when possible, for a way forward
• NASA has instituted a number of grant administration flexibilities to ease the burden on grant recipients during the COVID-19 emergency
• SMD’s policy on late proposals will be applied leniently on a case-by-case basis
• Encouraging all to continue to pay graduate students, post-docs, and lab staff
• Watch the NSPIRES email lists for up-to-the-minute changes in due dates or policies
Heliophysics: COVID-19 Impacts

Missions

• Formulation: Minimal impacts so far but teams are concerned about inefficiencies related to telework and are tracking possible impacts if delays occur with ordering parts that require long lead times.

• Operational: Space Science Missions Operations (SSMO) management and HPD continue to monitor mission operations – many operations centers have reduced staffing and are working under mandatory telework. Multiple sounding rocket missions have been postponed.

Research

• Minimal impact so far. Many panels have been completed or went/will go virtual. Some Step-1 and Step-2 dates for ROSES-20 have been delayed by two weeks.

Other

• SMD and HPD continue to monitor the ability of SCaN to provide communications and navigation requirements for operating missions. To date, all missions are being supported as needed, and daily status updates are being provided.
Coronavirus (COVID-19) Response – R&A FAQs

- OMB has issued guidance in Memo M-20-17 (available at https://www.whitehouse.gov/wp-content/uploads/2020/03/M-20-17.pdf)
- Allows for paying soft-money researchers as well as graduate students, post-docs, and other lab staff during the COVID-19 epidemic, if the institution’s own policies allow for it
- Allows for institutions to charge restart costs to their grants
  - SMD will make use of this modification to allow other costs associated with resuming funded grant activities to be charged to currently active grants
  - SMD has not yet determined in detail its policy regarding augmentations to awards negatively impacted by the COVID-19 epidemic; it is likely that any policy on augmentations will not be issued until the full extent of the impacts of the epidemic are more clearly understood
Coronavirus (COVID-19) Response – Stay Updated

- This is a new and unprecedented situation
- We recognize everyone’s personal and professional challenges at this time
- As the situation evolves, we will continue to communicate with all of you, whether through Town Halls, NSPIRES notices, or other modes
- In the meantime, please continue to follow agency updates:
  - Web: nasa.gov and nasapeople.nasa.gov/coronavirus
  - Twitter: @NASA and @JimBidenstine
Thoughts on recent events…

• Now is the time to re-commit to and step up our efforts against racism. I ask that we all take a stand against the small injustices and the big injustices in our communities, in our classrooms and labs, in our Zoom and Teams meetings, and in our homes.

• I want to reaffirm that at NASA, we will continue to provide a model of unity—demonstrating the value of equal opportunity, diversity, and inclusion to our mission accomplishment.

• Thanks to those of you who have been thinking further about how to step up our diversity efforts across our communities.

• Let’s do more than have a conversation…

• The work is on us…
Mission Highlights
Solar Orbiter, an ESA-led mission with strong NASA participation, will provide the first views of the Sun’s uncharted polar regions, giving unprecedented insight into how our parent star works.

It will also investigate how intense radiation and energetic particles being blasted out from the Sun and carried by the solar wind through the Solar System impact our home planet, to better understand and predict periods of stormy ‘space weather.’

First perihelion: Jun. 15, 2020
Parker Solar Probe observed switchbacks — traveling disturbances in the solar wind that caused the magnetic field to bend back on itself — an as-yet unexplained phenomenon that might help scientists uncover more information about how the solar wind is accelerated from the Sun.

Credits: GSFC Conceptual Image Lab

New discoveries first published on Dec. 4, 2019, in the journal Nature

Solar Encounters #1-5 Complete:
Venus Flyby #3: July 11, 2020

Perihelion #4:
Jan 29, 2020

Perihelion #5:
Jun 13, 2020

Records:
11.6 million miles to the sun
244,225 miles per hour
Above: The ICON team calibrated the Extreme Ultraviolet instrument using the Moon. The bright line on the left is EUV emissions from ionized helium in the solar wind, which fills the solar system. The horizontal stripes are the result of EUV scanning over the Moon, which reflects solar radiation. Credits: NASA/ICON/Martin Sirk/Joy Ng

## HPD at a Glance: Operating Missions

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<thead>
<tr>
<th>Mission</th>
<th>Launch Date</th>
<th>Phase</th>
<th>Extension</th>
<th>M-3</th>
<th>M-2</th>
<th>M-1</th>
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<td>Prime</td>
<td>9/30/2025</td>
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<td>Parker Solar Probe sent a Beacon Tone 1 on 6/1 and 6/2 indicating nominal spacecraft performance during Solar Encounter #5. On 06/07, Parker passed the perihelion at the distance of 28 Rs (solar radius) from the Sun, and on 06/09, it sent a Beacon Tone 1 indicating a healthy status. Parker exited Encounter #5 on 06/13.</td>
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</table>

- **G**: Mission proceeding to meet science requirements
- **Y**: Area of concern - possible reduction in capability
- **R**: Significant problem – possible or probable loss of mission
- **B**: Mission Decommissioned
HELIOPHYSICS SYSTEM OBSERVATORY

- 20 Operating Missions with 27 Spacecraft
- 6 Missions in Formulation
Heliophysics Selects Sun Radio Interferometer Space Experiment (SunRISE)

- SunRISE will study how the Sun generates and releases giant space weather storms, known as solar particle storms, into planetary space. Not only will such information improve our understanding of how our solar system works, but it ultimately can help protect astronauts traveling to the Moon and Mars by better understanding how the Sun's radiation affects the space environment they must travel through.

- Array of six CubeSats operating as one very large radio telescope.


- Launch: no earlier than July 1, 2023.

- Principal Investigator: Justin Kasper at the University of Michigan in Ann Arbor
Atmospheric Waves Experiment (AWE)

2016 MO Selection

- Milestones
  - SRR/MDR, Feb. 5-6, 2020
  - Science Team Meeting, Mar. 10-12, 2020
  - PDR/CDR, September 2020
  - Launch Readiness Date no earlier than Aug. 2022

- Principal Investigator: Mike Taylor at Utah State University
Polarimeter to Unify the Corona and Heliosphere (PUNCH)

- Milestones
  - Successful System Requirements Review/Mission Definition Review (SRR/MDR) on April 2.
  - PDR, Fall 2020
  - KDP-C, Fall 2020
- Principal Investigator: Craig DeForest at Southwest Research Institute
Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS)

- Milestones
  - TRACERS and a Technology Demonstration Opportunity, MAGnetometers for Innovation and Capability (MAGIC) proceeded into Phase B Preliminary Design following the successful completion of an Extended Phase A study on April 24.
  - Principal Investigator: Craig Kletzing at University of Iowa
Interstellar Mapping and Acceleration Probe (IMAP)

- IMAP successfully completed its Key Decision Point B review on Jan. 28, 2020 which now allows the IMAP team to move forward with preliminary design work on the mission, spacecraft, and instruments.

- **Milestones**
  - Preliminary Design Review, Feb. 2021
  - Confirmation Review, Mar. 2021
  - Launch Readiness Date, Fall 2024

- IMAP will simultaneously investigate the acceleration of energetic particles and interaction of the solar wind with the interstellar medium.
  - **PI:** David McComas of Princeton University
LWS Missions Update

Recent/Future LWS Missions and their impact on Heliophysics

- SDO
- Van Allen / BARREL
- HERSCHEL/Sub-Orbital Payload
- Space Environments Testbed
- Parker Solar Probe
- Solar Orbiter
- GDC

Recent/Future Missions that will support upcoming LWS Science opportunities

- GOLD
- ICON
- AWE
- DYNAMIC
LWS Science

- ROSES opportunities – Focus Science Topics (FSTs)
  - ROSES 2019 - Reviews complete, Sections underway, Announcements by ~mid-July
  - ROSES 2020 - Due dates: Step-1 (Aug. 27) & Step-2 (Nov. 12)

- ROSES opportunities – Strategic Capabilities (2020) - Develop a model:
  - to specify the global ion and neutral density in the thermosphere, ionosphere and plasmasphere and its variation in time & geomagnetic conditions;
  - of the magnetosphere that extends beyond single-fluid MHD;
  - of CME eruption & propagation, SEP acceleration & transport.

- Revised Strategic Science Areas (SSAs) – used as guidelines for FSTs, etc.

- LWS Program Analysis Group (LPAG) – replaces the LWS Steering Committee
  - Recent LPAG Virtual Workshop: Explain LWS FST website for community input
  - Currently, 18 topics with 31 comments; inputs for FSTs for ROSES 2021 and beyond
Expanding the Heliophysics Community

- Recent activities sponsored by the LWS Program
  - Frontier Development Laboratory (FDL) – AI/ML programs to provide an innovation forum to address and accelerate solutions to Heliophysics Scientific Problems
  - High End Computing (HEC) resources to support Strategic Capability modeling
  - Heliophysics Summer Schools – training the next generation interdisciplinary scientists
  - Jack Eddy Post Doctoral Fellowships, 34 in total, the next generation heliophysicists
  - LWS Institutes –bridging the gap between science and application

- These programs provide resources necessary to train the next generation of Heliophysicists and sponsor specific topical focus of relevance to science and society to current members of the Heliophysics Community

- All these LWS activities, Missions, Science and Community support, provide direction to new missions

- The next LWS mission is GDC (LWS-7) …
Geospace Dynamics Constellation

- Recommended by 2013 Solar and Space Physics Decadal Survey, next mission for Living With a Star (LWS) program (LWS-7)
- GDC is a science mission to dramatically improve our understanding of the upper atmosphere and its strong variability in response to energy inputs from the Sun, from near-Earth space, and from the lower atmosphere.
  - Will inform space weather studies (e.g. radiation effects, navigation/communication disturbances) and Agency exploration goals (e.g. sustained human presence at Mars)
- Following HPAC October 2019 recommendation on conducting an implementation study based on the STDT report, HPD stood up a GSFC Pre-Project Office.
- The Pre-Project Office is planning for a Mission Concept Review (July 2020). In preparation, the office activities have included:
  - Refining science requirements
  - Supporting HPD inter-agency/international collaboration discussions
  - Market survey of s/c and associated engineering services provider(s), make/buy process
- Pending Agency support of project initiation, expect final solicitation NET Dec. 2020

In-depth briefing to follow.
Other SMD and Division Activities
Suborbital & CubeSats Highlights
Providing Low Cost Access to Cutting Edge Research

Sounding Rocket Updates
- **Cusp Heating Investigation (CHI)** launched from Svalbard, Norway on Dec. 10, 2019.
  - Measured neutral upwelling and high-resolution electric fields over an extended region in the Cusp.
- **PolarNOx** launched from Poker Flat Research Range, Alaska on Jan. 27, 2020.
  - Designed to measure the intensity of nitric oxide in the mesosphere and lower thermosphere in the polar region by observing starlight with a high spectral resolution UV spectrograph operating near 215 nm.

CubeSat Updates
- **Scintillation Observations and Response of the Ionosphere to Electrodynamics (SORTIE)**
  - Designed to discover the sources of wave-like plasma perturbations in the F-region ionosphere, and determine the relative role of dynamo action versus direct mechanical forcing in the formation of wave-like plasma perturbations.
  - The spacecraft was released from the International Space Station (ISS) on Feb. 19, 2020.
  - As of late June, the SORTIE mission is well underway, the spacecraft operations are nominal, and the instruments are both working and collecting science data.
**Heliophysics Suborbital & CubeSats (2018-2021)**

### Sounding Rockets
- **DXL**
  - 1/19/2018
- **WRX-R**
  - 4/4/2018
- **Micro-X**
  - 7/22/2018
- **Visions 2**
  - 2 Rockets
  - 12/7/2018
- **CAPER-2**
  - GCI
  - 4/1/2019
- **CLASP-2**
  - 4/11/2019
- **SUBTEC-8**
  - 10/24/2019

### CubeSats
- **ELFIN-STAR**
  - 12/3/2018
- **ELFIN-STAR**
  - 6/25/2019
- **CeReS**
  - 12/16/2018
- **MinXSS**
  - 12/3/2018
- **CeReS**
  - 12/16/2018
- **E-TBEx**
  - 6/25/2019
- **SORTIE**
  - 12/20/2019
- **CuPID**
  - 2021
- **MinXSS-3**
  - 7/2020
- **LLITED**
  - Late 2020
- **SPORT**
  - 2021
- **CuSP**
  - 2021

### Balloons
- **HiWIND**
  - 6/24/2018
- **PMC Turbo**
  - 7/8/2018
- **BARREL**
  - 12/9/2018
- **BITSE**
  - 9/18/2019
- **BARREL**
  - 12/20/2019
- **BARREL**
  - 2020

*Launches resuming in August through end of year; multiple launches pushed to 2021 due to COVID-19 impacts.*
Gateway: HERMES

NASA selects first two scientific investigations to fly on Gateway in support of Artemis

• The NASA space weather instrument suite, led by HPD, will observe solar particles and the solar wind. The second scientific investigation is a radiation instrument package, built by the European Space Agency.
  • HERMES (NASA - Heliophysics Environmental and Radiation Measurement Experiment Suite)

• Program Office: Living With a Start (LWS) Program, Explorers and Heliophysics Projects Division (EHPD), Goddard Space Flight Center (GSFC)

• This payload will enable meaningful science, support Artemis, and be forward looking to crewed missions to Mars.

Space Weather Instrument RFI

• HPD will be releasing a Request for Information in the coming weeks to seek community inputs on space weather instruments and spacecraft to populate a pipeline for future opportunities.

In-depth briefing to follow.
Strategic Working Groups

To drive innovation within the upcoming Heliophysics Division’s (HPD) Decadal Survey strategy, HPD formed 8 strategic working groups (SWG). Across the working groups, three key themes emerged as priorities for HPD: maximize the impact of HPD missions and research, ensure the sustainable management and innovative expansion of HPD science, and diversify the future of the science community.

Space Weather

• Define overarching strategy for the Heliophysics Space Weather Science Application program expansion of HPD science, and diversify the future of the science community.

Archives

• Assess, restructure, and modernize the HPD Archives.

Technology

• Define technology strategy to enable advances in Heliophysics science.
Senior Review 2020

• 13 participating missions: AIM, Geotail, GOLD, Hinode, IBEX, IRIS, MMS, SDO, STEREO, THEMIS, TIMED, Voyager, and Wind
  - Received both science and infrastructure proposals
• Changes to Senior Review briefed to HPAC on October 2, 2019 are being implemented
  - Missions may propose either a science investigation or to move into HSO infrastructure
  - Project Data Management Plan vs. Mission Archive Plan
  - Proposals must present plans to move to open source code
  - In-depth evaluation of proposer data archives in Space Physics Data Facility (SPDF) and Solar Data Analysis Center (SDAC)
  - No longer use non-NASA data archives
Decadal Activities

2013 Decadal Midterm Assessment
• Delivered to HPD in Feb. 2020
• Responses provided to NASEM Apr. 2020

Planning for the next Decadal
• Heliophysics 2050 Workshop
  - NASA- and NSF-enabled, community-led workshop
  - Develop short-, medium-, and long-term science objectives, including capability needs
• Discussions between sponsoring agencies underway, including NOAA and NSF
• Conversations with NAS, CSSP underway

In-depth briefing to follow.
Collaborations on Missions with International Partners

- NASA establishes partnerships with international space agencies to advance its strategic objectives in science.
- PI proposed partnerships have not been an effective manner of establishing NASA contributions to partner-led missions.
  - These are “Partner Mission of Opportunity” (PMO) proposals.
  - We have concluded that the PMO process is not a successful or efficient process for establishing partnerships.
- SMD will no longer solicit PMO proposals.
  - SMD will still allow PI-led Explorers missions to be proposed that include a partner contribution, generally limited to be <1/3 of the mission per the AO.
- SMD will continue to seek community input on potential partnerships.
NASA Science Plan Released


• Through close collaboration with the entire Science Mission Directorate leadership team and NASA Center Directors, laid out ambitious program over next five years to build on current activities and drive change in high-priority areas where we can have the greatest impact

• Demonstrated commitment to excellence across SMD portfolio through leadership and strategic engagement with partners

• Consulted with the NAC Science Committee and Space Studies Board ad hoc committee to validate approach
  • Thank you to Jeff Dozier (Chair), Victoria Hamilton (Vice Chair), and members of the ad hoc committee

• Will continually assess progress for transparency and accountability
The DRIVE initiative is now part of the Heliophysics R&A baseline.

**DRIVE Elements include:**

- **HTIDs:**
  - Instrument Technology Development (ITD) and LNAP
- **HFORT:**
  - Low Cost Access to Space (LCAS): Sub-orbital and CubeSats
- **Guest Investigator**
  - Open and mission focused
- **Supporting Research**
- **Heliophysics Science Centers**
- **Theory, Modeling and Simulation**
- **Early Career Investigator Program & FINESST**
- **Living With a Star (LWS) Science**
- **Space Weather O2R**
- **Data Environment Emphasis**
### Heliophysics DRIVE Science Center Selections – Phase 1

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<td>SH</td>
<td>James Drake/UMD</td>
<td>Solar Flare Energy Release</td>
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<td>FP</td>
<td>David Brain/UC Boulder</td>
<td>Do Habitable Worlds Require Magnetic Fields?</td>
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<td>SH</td>
<td>Todd Hoeksema/SU</td>
<td>Consequences of Flows and Fields in the Interior and Exterior of the Sun (COFFIES)</td>
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<td>FP</td>
<td>Merav Opher/BU</td>
<td>Our Heliospheric Shield</td>
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<td>ITM</td>
<td>Daniel Welling/UTA</td>
<td>The Center for the Unified Study of Interhemispheric Asymmetries (CUSIA)</td>
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<tr>
<td>FP</td>
<td>Marco Velli/UCLA</td>
<td>HERMES: HEliospheRic Magnetic Energy Storage and conversion</td>
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*In-depth briefing to follow.*
ROSES Updates

**High Risk/High Impact**

- PIs are being asked to self-certify whether or not their 2020 proposals are high risk/high impact.

**Dual Anonymous**

- First test of dual anonymous will be in HGIO 2020. Proposals must be anonymized (guidelines on NSPIRES with this solicitation) and reviewers will not know the identity of the team during the merit evaluation. There will be a reveal at the end for proposals at the top end and reviewers can comment on team qualifications (not expected to change outcome).

**Mock Panel**

- Heliophysics conducted a mock ROSES Panel to train new Program Scientists and share best practices for ROSES Panel facilitation.

Volunteer for a Proposal Review Panel!

[https://science.nasa.gov/researchers/volunteer-review-panels](https://science.nasa.gov/researchers/volunteer-review-panels)
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<td>HSODS Heliophysics System Observatory Data Support</td>
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<td>9/30/2019</td>
<td>46</td>
<td>6</td>
<td>4</td>
<td>67%</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>HTIDS Technology and Instrument Development for Science</td>
<td>8/28/2019</td>
<td>4/2/2020</td>
<td>218</td>
<td>31</td>
<td>12</td>
<td>39%</td>
<td>4</td>
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<tr>
<td>HSR Supporting Research</td>
<td>10/18/2019</td>
<td>6/16/2020</td>
<td>242</td>
<td>122</td>
<td>30</td>
<td>25%</td>
<td>19</td>
<td>63%</td>
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<tr>
<td>HFORT Flight Opportunities for Research and Technology</td>
<td>11/8/2019</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>42</td>
<td>42%</td>
<td>42</td>
<td>100%</td>
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<tr>
<td>TMS Theory, Modeling, Simulation</td>
<td>12/3/2019</td>
<td>6/19/2020</td>
<td>199</td>
<td>54</td>
<td>14</td>
<td>25%</td>
<td>10</td>
<td>71%</td>
</tr>
<tr>
<td>OHGI Outer Heliosphere Guest Investigator</td>
<td>12/10/2019</td>
<td>3/5/2020</td>
<td>86</td>
<td>16</td>
<td>5</td>
<td>31%</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td>SWO2R Space Weather Applications Operations 2 Research</td>
<td>2/13/2020</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>48</td>
<td>48%</td>
<td>48</td>
<td>100%</td>
</tr>
<tr>
<td>LWS Science Living With a Star Science</td>
<td>2/27/2020</td>
<td>^</td>
<td>^</td>
<td>^</td>
<td>65</td>
<td>65%</td>
<td>65</td>
<td>100%</td>
</tr>
<tr>
<td>HSO Connect Heliophysics System Observatory Connect</td>
<td>3/13/2020</td>
<td>6/23/2020</td>
<td>102</td>
<td>14</td>
<td>4</td>
<td>29%</td>
<td>4</td>
<td>100%</td>
</tr>
</tbody>
</table>
Welcome Amy Winebarger!

• Detail in place Apr. 2020 – Nov. 2020

• Mission Unstoppable: Sounding Rockets with Amy Winebarger
  • The CBS show Mission Unstoppable recently featured the ESIS rocket launch with Amy Winebarger, a solar astrophysicist based in NASA’s Marshall Space Flight Center in Huntsville.

This week on @CBSUnstoppable, witness a rocket launch that will help this @NASA #scientist study the sun. #SheCanSTEM @AmyRWinebarger @WSMissileRange
Headquarters Updates

Program Executives
• 3 new PEs hired – welcome Jamie Favors, Heather Futrell, and David Cheney!
• 1 new PE to be hired via direct hire authority
• 2 new PEs to be brought on via detail

Program Scientists
• 3-4 new PSs to be brought on via Intergovernmental Personnel Act (IPA)
• 3 new PSs to be hired via direct hire authority Summer 2020
  • Job announcement released 6/29
It is a Great Time to be a Heliophysicist!

**Heliophysics Division is poised like never before to:**

- Capitalize on our unique opportunity to study the Sun and its effects throughout the Heliosphere
- Augment the Heliophysics fleet with new, innovative missions, a robust suborbital program, and an enhanced ride share program
- Make research and technology investments to enable science, e.g. interstellar probe, solar sails
- Develop the next generation of Heliophysicists and engage the public with science knowledge
- Fulfill our responsibility for the Nation enabling advances in space weather
- Play a critical role in Exploration supporting the Artemis mission
- Lean forward for success in the next decade
BACKUP
Highlights

- **Interstellar Mapping and Acceleration Probe**
  - Successfully completed its Key Decision Point B review on Jan. 28.

- **Geospace Dynamics Constellation**
  - The Pre-Project Office at GSFC is planning for a Mission Concept Review (July 2020).

- **Parker Solar Probe**
  - Perihelion #4: Jan. 29, 2020, Perihelion #5: Jun. 13, 2020
  - Records: 11.6 million miles to the sun, 244,225 miles per hour

- **Solar Orbiter**
  - Launched Feb. 9, 2020

- **Sun Radio Interferometer Space Experiment (SunRISE)**
  - Selected on Mar. 27, project kick-off held June 2020.

- **Polarimeter to Unify the Corona and Heliosphere (PUNCH)**
  - Successful System Requirements Review/Mission Definition Review (SRR/MDR) on Apr. 2.

- **Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS)**
  - TRACERS and a Technology Demonstration Opportunity, MAGnetometers for Innovation and Capability (MAGIC) proceeded into Phase B Preliminary Design following the successful completion of an Extended Phase A study on April 24.
Global-scale Observations of the Limb and Disk (GOLD)

- Making observations of the American hemisphere ~18 hours per day with essentially no interruption since October 2018
- First simultaneous upper-atmosphere global-scale temperatures and composition measurements from GEO orbit.
  - Separation of spatial and temporal variability
  - Development & evolution of geomagnetic storms, upwardly propagating waves, and effects of solar radiation
- During this time of rapid commercialization of space, it is important to understand the region in which critical space-based resources will operate. Assimilation of GOLD data into a thermospheric model can:
  - Reduce the bias in model temperatures (ensemble mean) by 70% under quiet & disturbed conditions.
  - Reduce model uncertainty (ensemble spread) by 50%

*Data available through the SPDF & GOLD Science Data Center

Measurements:
On the disk, temperature and composition during the day, and electron densities at night.
On the limb, exospheric temperatures and O2 density profiles.

Unique Features:
First mission to study the weather of the thermosphere-ionosphere rather than its climate
First NASA mission to fly as a hosted payload on a commercial communications satellite
GOLD Highlights

First Observations Linking Thermospheric Composition Changes to Polar Vortex

- GOLD’s global-scale images captured a dramatic change in the thermospheric composition (decrease of O/N₂) at ~100 km resulting from a sudden stratospheric warming (SSW) in the north [Oberheide et al., GRL, 2020].

First Gravity Wave Campaign with GOLD

- GOLD resolved atmospheric gravity waves in the airglow as periodic variation moving northward, possibly away from the southern aurora. [England et al., 2020 – JGR Special Collection].
- Future campaigns to focus on gravity waves from hurricanes, convective storms, orography
Observations of the equatorial ionization anomaly (EIA) at night have far exceeded expectations.

GOLD has the ability to observe both the northern & southern crests over a wide range of longitudes from South American to North Africa. GOLD can:

- Follow the temporal and spatial development of individual bubbles
- Compare drifts in longitude at the two EIA crests and at the equator
- Observe the development and evolution of asymmetries in the EIA crests
- Increase knowledge of triggers for bubble onsets
ICON Updates

ICON team released scientific data collected during the spacecraft’s first eight months in orbit to the public on 6/22/2020.

• The data release features observations from ICON’s four instruments — MIGHTI, FUV, EUV, and IVM

• ICON science payload is working exceptionally well
  • Challenging MIGHTI observations of airglow down to 90 km in the daytime working perfectly.
  • EUV observations by ICON EUV as sensitive as expected and producing daytime ionospheric data
  • FUV observations by ICON FUV also extremely sensitive and producing outstanding day and night airglow images.
  • ICON IVM producing remarkable measurements of local plasma environment including high precision velocities.
Rideshare

- CSSP Short report on rideshare delivered to HPD, Feb. 2020
  - Briefed to Science Committee, NASA Advisory Council
- Agile Access 2 Space Workshop, Feb. 2020
  - Splinter groups focused on:
    - Science that Drives the Pipeline Based on Destination
    - Instrument Types and Configurations that Drive the Pipeline Based on Science
    - Launch Vehicle Barriers and Issues that Hinder the Pipeline
    - Small Spacecraft Technology Challenges that Hinder the Pipeline
    - Programmatic Challenges that Hinder the Pipeline
- All Rideshare opportunities on IMAP ESPA Grande identified
- Supporting accommodation of rideshare payloads selected under the SIMPLEX call

Rideshare Office

- SMD has established a full-time Rideshare office housed within the Heliophysics Division that will be staffed with a permanent lead and support team.
- Teams are advised to consult with this office for questions on deliverables and deadlines, policies and processes.
2020 Science Plan Backup
NASA Science Strategic Approach

VISION
Lead a globally interconnected program of scientific discovery that encourages innovation, positively impacts people’s lives, and is a source of inspiration

MISSION
Discover the secrets of the universe
Search for life elsewhere
Protect and improve life on Earth

VALUES
Excellence
Leadership
Integrity
Teamwork
Safety

FOCUS
Exploration and Scientific Discovery
Innovation
Interconnectivity and Partnerships
Inspiration
Exploration and Scientific Discovery

Seeking to discover the secrets of the universe, search for life, and protect and improve life on Earth. We utilize a balanced portfolio approach that is informed by Decadal Surveys and is responsive to Administration priorities and direction from Congress to make progress and enhance opportunities for cross-disciplinary science.

Innovation

Fostering a culture that recognizes innovation and measured risk-taking as the cornerstones of a forward-looking program of scientific discovery. We encourage innovation, entrepreneurship, and collaboration in pursuit of common goals and to capitalize on the rapid evolution of commercial capabilities.

Interconnectivity and Partnerships

Forming strategic partnerships that leverage each contributor’s strengths to yield advances for mutual benefit. We recognize and support the important role NASA Centers, Federal agencies, private industry, academia, non-profits, community-based organizations, and international partners play in helping make our scientific vision a reality.

Inspiration

Building opportunities to encourage as wide an audience as possible to engage in our work. We seek to reduce barriers to entry, in order to allow people of all ages and backgrounds to join us for the benefit of the entire scientific and engineering community, as well as the world.
<table>
<thead>
<tr>
<th>PRIORITY 1: Exploration and Scientific Discovery</th>
<th>PRIORITY 2: Innovation</th>
<th>PRIORITY 3: Interconnectivity and Partnerships</th>
<th>PRIORITY 4: Inspiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRATEGY 1.1: Execute a balanced science program based on discipline-specific guidance from NASEM, Administration priorities, and direction from Congress</td>
<td>STRATEGY 2.1: Foster a culture that encourages innovation and entrepreneurship across all elements of the SMD portfolio.</td>
<td>STRATEGY 3.1: Actively engage with the NASA Centers to make more informed strategic decisions that further NASA’s scientific goals and are aligned with each Center’s unique capabilities.</td>
<td>STRATEGY 4.1: Increase the diversity of thought and backgrounds represented across the entire SMD portfolio through a more inclusive environment.</td>
</tr>
<tr>
<td>STRATEGY 1.2: Participate as a key partner in the agency’s exploration initiative, focusing on scientific research of and from the Moon, lunar orbit, Mars, and beyond.</td>
<td>STRATEGY 2.2: Foster a culture that encourages collaboration in pursuit of common goals.</td>
<td>STRATEGY 3.2: Actively seek collaborations with international partners based on their unique capabilities and mutual scientific goals.</td>
<td>STRATEGY 4.2: Purposefully and actively engage with audiences and learners of all ages to share the story of NASA’s integrated science program.</td>
</tr>
<tr>
<td>STRATEGY 1.3: Advance discovery in emerging fields by identifying and exploiting cross-disciplinary opportunities between traditional science disciplines</td>
<td>STRATEGY 2.3: Enhance our focus on high intellectual risk/high impact research investments.</td>
<td>STRATEGY 3.3: Actively engage with other federal agencies to make more informed decisions, cooperate in scientific research, and pursue partnerships that further national interests.</td>
<td></td>
</tr>
<tr>
<td>STRATEGY 1.4: Develop a Directorate-wide, target-user focused approach to applied programs, including Earth Science Applications, Space Weather, Planetary Defense, and Space Situational Awareness</td>
<td>STRATEGY 2.4: Drive innovation in focused technology areas to capitalize on the rapid evolution of commercial capabilities</td>
<td>STRATEGY 3.4: Provide increasing opportunities for research institutions, including academia and non-profits, to contribute to SMD’s mission.</td>
<td></td>
</tr>
<tr>
<td>STRATEGY 3.5: Pursue public-private partnerships in support of shared interests with industry.</td>
<td></td>
<td></td>
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</tbody>
</table>
2024 Future State

- Implement recommendations of Decadal Surveys in concert with national priorities and needs through creative partnership models that go beyond traditional ways of developing and executing missions
- Challenge assumptions about what is technically feasible and enable revolutionary scientific discovery through a deliberate focus on innovation, experimentation, and cross-disciplinary research
- Create a more collaborative culture within SMD and across science community, encouraging diversity of thought, sharing best practices, and informed risk-taking to improve operations
- Develop future leaders and inspire learners of all ages through new opportunities and hands-on experiences
- Read the full document at science.nasa.gov/about-us/science-strategy to understand our priorities and how we will continue to interact with the community